## SPECIAL STUDY

ACCIDENTS INVOLVING ENGINE FAILURE/MALFUNCTION U.S. GENERAL AVIATION 1965 -1969

ADOPTED: NOVEMBER 29, 1972

NATIONAL TRANSPORTATION SAFETY BOARD Washington, D. C. 20591

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### 16.Abstract

This report presents the record of engine failure/malfunction accidents for fixed-wing aircraft which occurred in all operations of U. S. General Aviation during the period 1965-1969. It includes a comparison of the engine-failure accident rates for single-engine and multi-engine aircraft. Analyses are included concerning causes and related factors of engine-failure accidents by selected makes and models of aircraft and engines. Injury tables, analytic tables, and cause/factor tables are presented for all fixed-wing aircraft along with single-engine and multiengine fixed-wing aircraft.

| 17. Key Words  Engine  Engine failure/malfunction accidents, single-engine aircraft, multiengine aircraft, pilot causes(s)/ factor(s), powerplant cause(s)/factor(s), fuel ex- haustion, fuel starvation, maintenance and inspection. |  |                                 |
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This special study, Accidents Involving Engine Failure/Malfunction, is based on data describing 4,310 U. S. general aviation accidents which occurred during the 5-year period 1965-1969. Each accident involved a fixed-wing aircraft and was precipitated by engine failure or malfunction.

The statistical base for this study was provided by the automated aircraft-accident data bank of the National Transportation Safety Board. The period 1965 - 1969 was the most recent complete 5-year period of data contained in the bank at the time of the study. The data concerning aircraft-hours flown by aircraft make and model were obtained from the Federal Aviation Administration.

For ease of reference, this study has been divided into three sections. Section I provides a comparative analysis of engine-failure accident rates by aircraft make and model. Section II analyzes the causes of and related factors in engine-failure accidents by selected aircraft and engine makes and models. Section III displays graphically the relative severity of accident types which follow an engine failure or malfunction.

Appendices A, B, and C present supporting data in the form of injury tables, analytic tables, and cause/factor tables. Appendix A includes data for all 4,310 accidents. These data are then segregated into two separate groupings, one for

single-engine aircraft and the other for multiengine aircraft (Appendix B and Appendix C, respectively).

The various ways in which different makes and models of aircraft are used may alter operating conditions to an extent that is reflected in the engine-failure accident rates. For example, the Boeing A-75 is used most often for aerial application and associated crop-control activities. The Cessna 150, on the other hand, is used for instructional flying and personal transportation. Thus, in evaluating the accident rates shown for the various makes and models, care should be taken to consider all factors involved.

All aircraft and engine makes and models contained in this study were certificated in accordance with airworthiness requirements. Although the study includes comparative analyses which serve to highlight specific pilot and powerplant cause/factor involvement, these analyses are not intended to be an evaluation of the overall safety of a specific aircraft or powerplant, or as a criticism of any manufacturer. The comparative studies were made to identify the differences (between these aircraft and engines) of specific cause/factor citations which seemed to be statistically significant. To properly measure the importance of these differences in terms of defining specific remedial solutions in most cases will require additional engineering, operational, and design study.

### TABLE OF CONTENTS

|            |                                |  | Page |
|------------|--------------------------------|--|------|
|            | FOREWORD                       | · , • • • • • • • • • • • • • • • • • •  | iii  |
|            | LIST OF TAI                    | BLES   | vi   |
|            | EXPLANATO                      | DRY NOTES  | vļi  |
|            | INTRODUCT                      | TION   | 1    |
| [ <b>.</b> | Comparison of and Model .      | of Engine-Failure Accidents by Aircraft Make                                     | 7    |
| I.         | Comparison o<br>Selected Aircr | f Engine-Failure Accident Cause(s)/Factor(s) By raft and Engine Makes and Models | 25   |
| II.        | Nature and Se<br>Involved      | eriousness of the Second Accident Type   | 101  |
|            | APPENDICES                     | 3  |      |
|            | Appendix A:                    | Fixed-Wing Aircraft, U. S. General   |      |
|            | Appendix B:                    | Aviation   | 109  |
|            |                                | U. S. General Aviation   | 147  |
|            | Appendix C:                    | Multiengine Fixed-Wing Aircraft, U. S. General Aviation                          | 183  |

### LIST OF TABLES

| TABLE | TITLE  | PAGE  |
|-------|--|-------|
| 1     | Accidents, Rates, Hours Flown  | 3     |
| 2     | Total, Fatal, and Engine-Failure Accidents and Rates by Kind of Flying                         | 4     |
| 3     | Engines Installed in Various Single-Engine Aircraft Makes and Models                           | 10    |
| 4     | Engines Installed in Various Multiengine Aircraft Makes and Models                             | 14    |
| 5     | Engine-Failure Accidents, Rates for Selected Make and Model of Single-Engine Aircraft          | 16    |
| 6     | Engine-Failure Accidents, Rates for Selected Make and Model of Multiengine Aircraft            | 19    |
| 7     | Comparison of Engine-Failure Accidents for Selected Make and Model of Single-Engine Aircraft   | 20    |
| 8     | Comparison of Engine-Failure Accidents for Selected Make and Model of Multiengine Aircraft     | 23    |
| 9     | Eligible Aircraft by Selected Make and Model   | 37    |
| 10    | Engine-Failure Accidents for Selected Aircraft<br>Makes and Models and Engine Makes and Models | 39    |
| 11-36 | Accidents Involving Engine Failure or Malfunction by Aircraft Make and Model                   | 40-65 |
| 37    | Cause/Factor Table All Engines   | 69    |
| 38-57 | Accidents Involving Engine Failure or Malfunction by Engine Make and Model                     | 77-96 |
| 58    | Selected Cause/Factor Matrix   | 98    |

### **EXPLANATORY NOTES**

### **GENERAL AVIATION**

General Aviation refers to the operation of aircraft owned and operated by persons, corporations, etc., other than those aircraft engaged in air carrier operations authorized by a Certificate of Public Convenience and Necessity, issued by the Civil Aeronautics Board.

### AIRCRAFT ACCIDENT

The accidents included herein are occurrences incident to flight in which, as a result of the operation of an aircraft, any person (occupant or nonoccupant) receives fatal or serious injury or any aircraft receives substantial damage. Comparisons of annual totals of engine-failure accidents or total accidents should be made with care because of the effect of an amendment to Section 430.2 of the National Transportation Safety Board's Regulations. The change helped to decrease the number of accidents by redefining "substantial damage" to aircraft of 12,500 pounds maximum certificated takeoff weight or less.

Prior to January 1, 1968, the definition of substantial damage was as follows:

(1) Except as provided in subparagraph (2) of this paragraph:

(i) Substantial damage in aircraft of 12,500 pounds maximum certificated takeoff weight or less means damage or structural failure reasonably estimated to cost \$300 or more to repair.

(ii) Substantial damage in aircraft of more than 12,500 pounds maximum certificated takeoff weight means damage or structural failure which adversely affects the structural strength, performance, or flight characteristics of the aircraft, and which would normally require major repairs or

replacement of the affected component.

(2) Engine failure, damage limited to an engine, bent fairings or cowling, dented skin, small punctured holes in the skin or fabric, taxiing damage to propeller blades, damage to tires, engine accessories, brakes or wingtips are not considered "substantial damage" for the purpose of this part.

The amendment, effective January 1, 1968, changed the definition of substantial damage as follows:

- (1) Except as provided in subparagraph (2) of this paragraph, substantial damage means damage or structural failure which adversely affects the structural strength, performance, or flight characteristics of the aircraft, and which would normally require major repair or replacement of the affected component.
- (2) Engine failure, damage limited to an engine, bent fairings or cowling, dented skin, small punctured holes in the skin or fabric, ground damage to rotor or propeller blades, damage to landing gear, wheels, tires, flaps, engine accessories, brakes or wingtips are not considered "substantial damage" for this part.

### **INJURY INDEX**

Injury index describes the highest degree of personal injury sustained as a result of the accident.

### TYPE OF ACCIDENT

The type of accident relates to the immediate circumstances of the occurrence. Many accidents involve a series of circumstances and

therefore require a second type to more fully describe the sequence of events. Some examples of types of accidents are gear collapsed, gear retracted, airframe failure, and engine failure or malfunction. Engine failure or malfunction includes engine stoppage, power interruption, or power loss for any reason. For an engine failure to be classified as an accident, the occurrence must be in combination with another accident type, unless serious or fatal injuries or structural damage resulted from flying parts.

### PHASE OF OPERATION

The phase of operation relates to the particular segment of the flight or operation during which the accident occurred.

### KIND OF FLYING

Kind of flying describes the purpose for which the aircraft was being operated at the time of the accident. There are four broad categories of kind of flying:

- Instructional Flying
   Flying accomplished with supervised
   training under the direction of an ac credited instructor.
- 2. Noncommercial Flying
  Use of an aircraft for pleasure, personal transportation, private business, corporate/executive operations, and other operations for which no direct monetary fee is charged. Categories of noncommercial flying are defined as follows:

Pleasure

Flying by individuals in their own or rented aircraft for pleasure or personal transportation not in furtherance of their occupation or company business. Business

The use of aircraft by pilots (not receiving direct salary or compensation for piloting) in connection with their occupation or in the furtherance of private business.

Corporate/Executive Operations
The use of owned or leased aircraft, operated by a corporation
or business firm for the transportation of personnel or cargo in
furtherance of the corporation's
or firm's business, and flown by
professional pilots receiving a
direct salary or compensation for
piloting.

3. Commercial Flying

All general aviation flying normally conducted for direct financial return except instructional flying. This includes air taxi operations, aerial application, fire control, aerial mapping or photography, aerial advertising, power/pipelines patrol and fish spotting.

4. Miscellaneous Flying
Other kinds of flying not covered
under the other three broad categories.

### CAUSE AND RELATED FACTORS

In determining probable cause(s) of an accident, all facts, conditions, and circumstances are considered. The objective is to ascertain those cause-effect relationships in the accident sequence about which something can be done to prevent recurrence of the type of accident under consideration. For statistical purposes, where two or more causes exist in an accident, each is recorded and no attempt is made to establish a primary cause. Therefore, in the cause/related factor tables, the figures shown in the columns dealing with cause will exceed the total number

of accidents. The term "factor" is used, in general, to denote those elements of an accident which further explain or supplement the probable cause(s). This provision was incorporated into the coding system to increase its flexibility and to provide a means for collecting essential items of information which could not be readily categorized elsewhere in the system.

Several specific cause/factor citations and the broad cause/factor category, powerplant, are defined below:

- Inadequate Preflight Preparation and/ or Planning.

  Refers to ground preparation for flight. The preflight check of the aircraft and its equipment, the planning of the flight, weather briefing, fuel reserve, etc., are examples of actions which could be improperly performed or omitted.
- 2. Mismanagement of Fuel
  Any act of omission or commission by
  the pilot with reference to fuel or the
  fuel system considered causative in
  the accident.
- 3. Improper Operation of Powerplant and Powerplant Controls
  Improper operation of the powerplant from a mechanical standpoint,

through improper use of throttles. super-charger, cowl flaps, carburetor heat, mixture controls, propeller controls, etc., under the conditions and circumstances involved. Causes used in conjunction with the misuse of powerplant controls include "anti-icing/ deicing equipment - improper operation of/or failed to use" and "conditions conducive to carburetor/ induction system icing" together with "ice-carburetor" or "ice-engine" when engine failure or malfunction is determined to have been the result of such ice and the weather conditions are reported as such.

- 4. Fuel Starvation and Fuel Exhaustion
  Fuel starvation occurs when ample
  fuel is aboard the aircraft but for
  some reason the flow of fuel to the
  engine is interrupted, reduced, or
  completely stopped, while fuel exhaustion means that there is no useable fuel aboard the aircraft.
- 5. Powerplant
  Refers to any malfunction of the engine, the fuel system, lubricating system, propeller and accessories, exhaust system, etc.

### NATIONAL TRANSPORTATION SAFETY BOARD Washington, D. C. 20591

### SPECIAL STUDY

Adopted: November 29, 1972

### Accidents Involving Engine Failure/Malfunction, U.S. General Aviation, 1965 – 1969

#### I. INTRODUCTION

During the 5-year period 1965 – 1969, 4,310 fixed-wing general aviation aircraft were involved in accidents precipitated by engine failure or malfunction, i.e., occurrences in which engine failure or malfunction (hereinafter called engine failure) was cited as the first type of accident. In order for an engine failure to be considered as a first accident type, it must be followed by a second type of accident which results in substantial damage to the aircraft or in serious injury to an individual.

Engine failure was the most frequently cited first type of accident in general aviation from 1965 through 1969. The purposes of the study described in this report were:

(1) To compare these 4,310 accidents by make and model of aircraft,

(2) To compare the causes/factors of these accidents by selected makes and models of aircraft as well as by selected makes and models of engines,

(3) To examine the nature and severity of the second accident types which followed these engine failures, and

(4) To determine findings that could help to reduce the frequency of enginefailure accidents.

#### Overview

Of the 4,310 aircraft involved in these ccidents, 841 (19.5%) were destroyed, and the

remainder were substantially damaged. The pilot-in-command was cited as a probable cause or related factor in 51.81% of the engine-failure accidents, while the powerplant was cited in 44.62%. Although these two categories do not account for all of the engine-failure accidents, they do comprise the majority of them. Particularly frequent cause/factor citations found in accidents involving pilot error and/or powerplant failure were:

### DETAILED CAUSE/FACTORS FREQUENCY

### Pilot-In-Command Involvement

| Inadequate preflight preparation or  |     |
|--------------------------------------|-----|
| planning                             | 934 |
| Mismanagement of fuel                | 615 |
| Improper operation of powerplant and |     |
| powerplant controls                  | 504 |
| Improper in-flight decisions or      |     |
| planning                             | 127 |
| Became lost/<br>disoriented          | 101 |
| alsoriented                          | 101 |

### DETAILED CAUSE/FACTORS FREQUENCY

### Powerplant Involvement

| Valve assemblies           | 130 |
|----------------------------|-----|
| Carburetor                 | 102 |
| Master and connecting rods | 86  |
| Cylinder assembly          | 72  |
| Piston, piston rings       | 70  |
| Magnetos                   | 64  |
| Crankshaft                 | 57  |
| Spark plug                 | 53  |

Table 1 presents engine-failure accident rates per 100,000 aircraft-hours flown for single-engine and multiengine aircraft. The rate for multiengine aircraft was consistently lower than that for single-engine aircraft in each of the five years studied. Overall, the average engine-failure accident rate was 2.3 per 100,000 aircraft-hours flown for multiengine aircraft compared with 4.6 for single-engine aircraft.

A lower rate for the multiengine aircraft does not necessarily indicate a lesser degree of hazard. In Table 1, the ratio of fatal to total accidents was 2,426/22,352 (10.9%) for singleengine aircraft compared with 473/2,884 (16.4%) for multiengine aircraft. Furthermore, of the 3,855 engine-failure accidents involving single-engine aircraft, 208 (5.4%) were fatal accidents, which resulted in 375 fatalities or 5.2% of the 7,169 people aboard all the aircraft (Table 1, Appendix B). In comparison, multiengine aircraft were involved in 455 enginefailure accidents, of which 104 (22.9%) were fatal and resulted in the deaths of 264 people, 18.1% of the 1,461 people aboard all the aircraft (Table 1, Appendix C.)

The number of total, fatal, and engine-failure accidents along with corresponding rates by kind of flying for the 5-year period 1965-69 are displayed in Table 2. Aerial applications as a kind of flying had the highest engine-failure accident rate per 100,000 hours flown, followed by pleasure, instructional, business/corporate, and air taxi.

### **Findings**

- 1. The average engine-failure accident rate for multiengine aircraft was 2.3 accidents per 100,000 aircraft-hours flown compared with 4.6 for single-engine aircraft.
- 2. The percentage of fatal to total engine-failure accidents was 22.9 for multiengine aircraft compared with 5.4 for single-engine aircraft.
- 3. Over 18% of the occupants were fatally injured aboard multiengine aircraft involved in engine-failure accidents compared with 5.2% for single-engine aircraft.
- 4. The incidence of severe injury-producing accidents (such as stall, stall/spin, stall/spiral, and collision with the ground/water controlled and uncontrolled) that follow engine-failure accidents was 24.6% for multiengine aircraft compared to 7.3% for single-engine aircraft.
- 5. The pilot was cited as a probable cause/related factor in over 51% of the engine-failure accidents. The predominant pilot cause/factor citations were:
  - a. inadequate preflight preparation and/or planning
  - b. mismanagement of fuel
  - improper operation of powerplant and powerplant controls
  - d. improper in-flight decisions
  - e. became lost/disoriented

# ACCIDENTS, RATES, HOURS FLOWN U. S. GENERAL AVIATION 1965 - 1969

| YEAR .     | TOTAL   |         | DENTS           | AIRCRAFT-<br>HOURS FLOWN | 100,00 | O AIRCR | RATES PER<br>AFT-HOURS FLOWN<br>ENGINE FAILURE |
|------------|---------|---------|-----------------|--------------------------|--------|---------|--|
| SINGLE     | ENGIN   | E, FIXE | D-WING AIRCRAFT |                          |        |         |  |
| 1965       | 4365    | 440     | 686             | 12,031,200               | 36.3   | 3.7     | 5.7  |
| 1966       | 4774    | 464     | 750             | 16,148,000               | 29.6   | 2 • 9   | 4.6  |
| ¥*<br>1967 | 5133    | 471     | 827             | 17,526,000               | 29.3   | 2.7     | 4.7  |
| 1968       | 4165*   | 555*    | 765             | 18,987,950               | 21.9   | 2.9     | 4.0  |
| 1969       | 3918    | 499     | 827             | 19,547,915               | 20.0   | 2.6     | 4 • 2  |
| TOTAL      | 22355*  | 2429*   | 3855            | 84,241,065               | 26.5   | 2.9     | 4.6  |
| MULTII     | ENGINE, | FIXED-  | WING AIRCRAFT   | ·                        |        |         |  |
| 1965       | 564     | 80      | 80              | 3,185,800                | 17.7   | 2.5     | 2.5  |
| 1966       | 599     | 76      | 79              | 4,315,000                | 13.9   | 1.8     | 1.8  |
| 1967       | 687     | 103     | 98              | 3,450,000                | 19.9   | 3.0     | 2.8  |
| 1968       | 498     | 100     | 94              | 4,326,982                | 11.5   | 2.3     | 2.2  |
| 1969       | 536     | 114     | 104             | 4,892,626                | 11.0   | 2.3     | 2.1  |
| TOTAL      | 2884    | 473     | 455             | 20,170,408               | 14.3   | 2.4     | 2.3  |

<sup>\*</sup> THREE SUICIDE/SABOTAGE ACCIDENTS INCLUDED IN ALL COMPUTATIONS EXCEPT RATES.

TOTAL, FATAL, AND ENGINE FAILURE ACCIDENTS AND RATES BY KIND OF FLYING U. S. GENERAL AVIATION 1965 - 1969

1

KIND OF FLYING

|                                  | 1      | H H H H H H H H H H H H H H H H H H H |               |   | 11 11 11 11 11 11 11 11 11 11 11 11 11 | 10<br>11<br>15<br>10<br>11<br>11<br>11<br>11<br>11<br>11 | 11<br>11<br>11<br>11<br>11<br>11            | # # D D D # B :     | # |
|----------------------------------|--------|---------------------------------------|---------------|---|--|--|---|---------------------|---|
|                                  | 1 1 1  | Z !!                                  | NONCOMMERCIAL | A L   | 1                                      |  | COMMERCIAL                                  | 1                   | MISC                                    |
|                                  | INSTR  | PLEASURE                              | BUSINESS      | ALL INSTR PLEASURE BUSINESS CORPORATE OTHER | ALL<br>OTHER                           | AERIAL<br>APPLIC*  | AERIAL ALL APLIC* ALL APLIC* AIR TAXI OTHER | ALL<br>OTHER        |   |
| ACCIDENTS<br>========            |        |                                       |               |   |  |  |   |                     |   |
| TOTAL                            | 4,653  | 4,653 0 11,840                        | 3,576         | 446   | 1,548                                  | 1,548 7,834  | 7 1,025                                     | 1,025 7 486 2 1,494 | 1,494                                   |
| FATAL                            | 242    | 1,651                                 | 384           | 59  | 74                                     | 198  | 157   | 81                  | 239                                     |
| ENGINE FAILURE                   | 602    | 1,998                                 | 534           | 45  | 218                                    | 419  | 168   | 45                  | 284                                     |
| 4                                |        |                                       |               |   |  |  |   |                     |   |
| HOURS FLOWN(000)                 | 27,784 | 32,122                                | 26,927        | *   | N                                      | 6,019  | 9,549                                       | V<br>V              | <<br>Z                                  |
|                                  |        |                                       |               |   |  |  |   |                     |   |
| ACCIDENT RATES PER 100,000 HOURS |        |                                       |               |   |  |  |   |                     |   |
| TOTAL ACCIDENTS                  | 1.6.75 | 36.86                                 | 14.94         | *<br>*                                      | NA                                     | 30.47  | 10.73                                       | AN                  | N<br>A                                  |
| FATAL ACCIDENTS                  | 0.87   | 5.14                                  | 1.64          | *   | N                                      | 3.29   | 1.64  | NA                  | A                                       |
| ENGINE FAILURE ACCIDENTS         | 2.17   | 6.22                                  | 2.15          | it<br>it                                    | N                                      | 96*9   | 1.76  | A                   | A<br>A                                  |

4

<sup>\*</sup> INCLUDES ASSOCIATED CROP COMTROL ACTIVITIES.

<sup>\*\*</sup> RUSINESS AME CORPORATE FIGURES ARE COMBINED.

- 6. The powerplant was cited as a probable cause/related factor in over 44% of the engine-failure accidents. The predominant powerplant cause/factor citations were:
  - a. valve assemblies
  - b. carburetor
  - c. master and connecting rods
  - d. cylinder assembly
  - e. piston and piston rings
  - f. magnetos
  - g. crankshaft
  - h. spark plugs
- 7. Fuel starvation was recorded as a probable cause/related factor in 833 (19.3%) of the 4,310 engine-failure accidents. The following aircraft had a statistically higher-than-average incidence of fuel starvation:
  - a. Beech 23 (Table 13)
  - b. Beech 35 (Table 14)
  - c. Callair A-9 (Table 16)
  - d. Piper PA-22 (Table 30)
  - e. Piper PA-28 (Table 34)
  - f. Piper PA-32 (Table 35)

Fuel starvation was commonly associated with error on the part of the pilot-in-command, such as:

- a. mismanagement of fuel
- b. inadequate preflight preparation and/or planning
- c. inattentive to fuel supply
- d. improper operation of powerplant and powerplant controls
- B. Fuel exhaustion was cited as a probable cause/related factor in 811 (18.8%) of the engine-failure accidents. Pilot-in-command cause/factor citations most commonly associated with fuel exhaustion were:
  - a. inadequate preflight preparation and/or planning
  - b. mismanagement of the fuel
  - c. improper inflight decisions or planning
  - d. became lost/disoriented

- e. inattentive to fuel supply
- f. miscalculated fuel consumption
- 9. Maintenance, servicing, and inspection personnel were cited as a probable cause/related factor in 425 (9.9%) of the engine-failure accidents. The predominant cause/factor citations were:
  - a. inadequate maintenance and inspection
  - b. improper maintenance (maintenance personnel)
  - c. improperly serviced aircraft (owner-pilot)
  - d. improper maintenance (owner personnel)
- 10. Specific engine makes and models which had significantly higher-than-expected involvement in individual powerplant cause/factor citations were:
  - a. Avco/Lycoming O-235: fuel system vents, drains, tank caps
     (Table 38)
  - b. Avco/Lycoming O-290: exhaust system mufflers (Table 39)
  - c. Avco/Lycoming O-320: engine structure valve assemblies; lubicating system lines, hoses, fittings (Table 40)
  - d. Avco/Lycoming IO-360: engine structure — master and connecting rods (Table 42)
  - e. Avco/Lycoming O-540: fuel system vents, drains, tank caps; fuel system tanks; exhaust system mufflers (Table 43)
  - f. Continental A-65: engine controls throttle power lever assemblies (Table 45)
  - g. Continental C-75 and C-85: engine controls throttle power lever assemblies (Table 46)
  - h. Continental E-225: fuel system pumps (Table 51)

- i. Continental O-470: fuel system – carburetor (Table 53)
- j. Continental IO-470: engine structure – cylinder assemblies, master and connecting rods, crankshaft; fuel system – lines and fittings (Table 54)
- k. Continental IO-520: engine structure – piston, piston rings, crankshaft (Table 55)
- l. Franklin 6A4 and 6AG4; engine structure valve assemblies; ignition system magnetos (Table 56)
- m. Pratt and Whitney Military R-985: engine structure – cylinder assembly, master and connecting rods, blower impeller assembly (Table 57)

### SECTION I

COMPARISON OF ENGINE-FAILURE ACCIDENTS BY AIRCRAFT MAKE AND MODEL

Individual makes and models of single-engine and multiengine aircraft are considered in this section. The engine makes and models installed in the various aircraft are shown in Tables 3 and 4. Engine-failure accident rates (per 100,000 aircraft-hours flown) by aircraft make and model are presented in Tables 5 and 6 for those aircraft for which exposure data (aircraft-hours flown) were available. Comparisons of engine-failure accidents by make and model of aircraft are given in Tables 7 and 8. No attempt has been made to analyze the aircraft according to kind of flying because doing so would create subcell sample sizes and expected values too small for meaningful statistical comparisons.

The qualitative ratings of Tables 7 and 8 were derived from numerical values which were calculated using a single degree of freedom chisquare analysis. The formula for the numerical rating is

$$X^2 = \frac{(F_o - F_e)^2}{F_e}$$

where F<sub>o</sub> is the observed number of the enginefailure accidents for a given make and model and F<sub>e</sub> is the expected number of engine-failure accidents.

To calculate the expected number of ingine-failure accidents for a particular make ind model, it was assumed that the ratio of total ingine-failure accidents to total aircraft hours has proportional to the ratio of engine-failure ceidents by make and model to aircraft hours y make and model, i.e.,

total engine failures total aircraft hours

engine failures by make and model aircraft hours by make and model

Hence,

engine failures by make and model

total engine failures total aircraft hours by make and model

When the result of the chi-square equation was above 3.84 but equal to or less than 10.8, a qualitative rating of low (L) or high (H) was recorded, depending on whether the sign of the difference Fo - Fe was negative or positive. When the numerical rating fell above 10.8, a qualitative rating of very low (VL) or very high (VH) was given. When the numerical rating was less than or equal to 3.84, a qualitative rating of average (a) was assigned. A rating of L or H means that the statistical difference between Fo and Fe would have a probability between 0.05 and 0.001 of occurring by chance alone if there really were no difference between the given make and model and other makes and models. A rating of VL or VH means that the difference would have a probability of less than 0.001 of occurring by chance.

Example. For the Aeronca 11 aircraft shown in Table 7, the observed number of engine-failure accidents was 24, the expected number was 8, and the numerical rating was 32.0. A qualitative rating of VH was therefore assigned to this make and model. The expected number of engine failures was found as follows: total engine failures for single-engine aircraft = 3,855; total aircraft hours for single-engine aircraft = 84,241,065; and the aircraft hours flown for the Aeronca 11 = 175,762; hence, Expected engine failures, Aeronca 11 = (3,855/84,241,065) x 175,762 = 8.

man, Acheson J., "Report on the Differential Accident mance of Single Engine Non-Air Carriers, 1949-51."

### TABLE 3

Callair A-9

## ENGINES INSTALLED IN VARIOUS SINGLE-ENGINE AIRCRAFT MAKES AND MODELS

| Aircraft Make and Model | Engine Make and Model   |
|-------------------------|---|
| Aeronca 11              | Continental A-65 series, C-75 and C-85 series, C-145 series   |
| Aeronca 15              | Continental C-145 series  |
| Aeronca 7               | Avco/Lycoming O-235 series, O-290 series, O-320 series, Continental A-65 series, C-75 and C-85 series, C-90 series, O-200 series  |
| Beech 35                | Continental E-165 and E-185 series, E-225 series, IO-470-A, -C; IO-470-D, -E, -F, -G, -H, -J, -K, -L, -M, -N, -P, -R, -S, -T, -U; LIO – 470-A, IO-520-A, -B, -C, -D, -E, -F, -J, -K, -L; TSIO – 520 series  |
| Beech 23                | Avco/Lycoming O-320 series, O-360 series, LTC1B-1, IO-360 series, AIO-360 series  |
| Beech A45, T34          | Continental E-225 series; O-470-4, -11, -13, -13A, -15, -11CI; O-470-A, -B, -E, -G, -H, -J, -K, -L, -M, -N, -P, -R  |
| Bellanca 14-13          | Avco/Lycoming O-435 series,<br>Franklin 4AC-150 series 40, 50, A; 6A4 and 6AG4 series   |
| Bellanca 14-19          | Avco/Lycoming O-435 series,<br>Continental O-470-A, -B, -E, -G, -H, -J, -K, -L, -M, -N, -P, -R;<br>IO-470 -A, -C; IO-470 -D, -E, -F, -G, -H, -J, -K, -L, -M, -N, -P, -R,<br>-S, -T, -U; LIO-470 -A, IO-520 -A, -B, -C, -D, -E, -F, -J, -K, -L   |
| Boeing A-75             | Avco/Lycoming R-680, R-680-B4 series, R-680-4, R-680-E series, Continental R-670-A, -C, -E, -G; R-670-B, -D, -F, -H; W-670 -6A, -6N, -K, -M Jacobs L-6 series, Pratt and Whitney Wasp Jr. T1B2, T1B3, Military R-985 series, Military R-1340 series, Curtiss-Wright R-975, A, B, D, E |

series

Avco/Lycoming O-320 series, O-360 series, O-540 series, IO-540

### TABLE 3 (continued)

| ircraft Make and Model | Engine Make and Model   |
|------------------------|---|
| essna 120/140          | Continental C-75 and C-85 series, C-90 series   |
| Cessna 150             | Continental C-90 series, O-200 series   |
| essna 170              | Avco/Lycoming O-360 series, O-435 series,<br>Continental C-145 series, O-300 series,<br>Franklin 6A4 and 6AG4 series  |
| Cessna 172             | Avco/Lycoming O-320 series, O-360 series, Continental C-145 series, O-200 series, GO-300-A, -B, -C, -D, -E, -F; O-300 series, O-470-A, -B, -E, -G, -H, -J, -K, -L, -M, -N, -P, -R   |
| Cessna 175             | Continental GO-300-A, -B, -C, -D, -E, -F; O-300 series  |
| Cessna 180             | Continental O-470 -A, -B, -E, -G, -H, -J, -K, -L, -M, -N, -P, -R; IO-520-A, -B, -C, -D, -E, -F, -J, -K, -L  |
| lessna 182             | Continental O-470-A, -B, -E, -G, -H, -J, -K, -L, -M, -N, -P, -R; IO-470-A, -C; IO-520 -A, -B, -C, -D, -E, -F, -J, -K, -L  |
| Cessna 195             | Continental A-65 series, W-670-16, -23, -24; O-470-A, -B, -E, -G, -H, -J, -K, -L, -M, -N, -P, -R; Jacobs L-4 series, L-6 series, R-755 series   |
| Cessna 210             | Continental IO-470-A, -C; IO-470-D, -E, -F, -G, -H, -J, -K, -L, -M, -N, -P, -R, -S, -T, -U; LIO-470-A, TSIO-470-B, -C, -D; IO-360-A, -B, -C, -D, -E; IO-520-A, -B, -C, -D, -E, -F, -J, -K, -L; GTSIO-520-C, -D, -E; TSIO-520 series |
| Cessna 206             | Continental IO-520-A, -B, -C, -D, -E, -F, -J, -K, -L; TSIO-520 series   |
| Cossna 188             | Continental O-470-4, -11, -13, -13A, -15, -11CI; O-470-A, -B, -E, -G, -H, -J, -K, -L, -M, -N, -P, -R; IO-520-A, -B, -C, -D, -E, -F, -J, -K, -L  |
| esana 177              | Avco/Lycoming O-320 series, O-360 series  |
| orney 415              | Continental A-65 series, A-75 series, C-75 and C-85 series, C-90 series, E-165 and E-185 series   |
| umman G-164            | Avco/Lycoming R-680-E series,<br>Continental W-670-6A, 6N, -K, -M; W-670-16, -23, -24;  |

### TABLE 3 (continued)

| Aircraft Make and Model | Engine Make and Model   |  |  |  |
|-------------------------|---|--|--|--|
| Grumman G-164 (cont)    | Jacobs L-4 series, R-755 series, Military R-755-7,<br>Pratt and Whitney Military R-985 series,<br>Military R-1340 series  |  |  |  |
| Luscombe 8              | Avco/Lycoming O-290 series,<br>Continental A-65 series, C-75 and C-85 series, C-90 series   |  |  |  |
| Mooney M20              | Avco/Lycoming O-320 series, O-360 series, IO-360 series, AIO-360 series   |  |  |  |
| Navion L-17             | Avco/Lycoming O-320 series, GO-435 and Military O-435-6, -17; Continental E-165 and E-185 series and Military O-470-7, -7A, -7B; E-225 series, O-470-4, -11, -13, -13A, -15, -11CI; IO-470-D, -E, -F, -G, -H, -J, -K, -L, -M, -N, -P, -R, -S, -T, -U; LIO-470-A; IO-520-A, -B, -C, -D, -E, -F, -J, -K, -L |  |  |  |
| Piper J-3               | Avco/Lycoming O-145-A series, O-235 series, O-290 series, O-320 series, Continental A-65 series, A-75 series, C-75 and C-85 series, C-90 series   |  |  |  |
| Piper PA-12             | Avco/Lycoming O-235 series, O-290 series, O-320 series  |  |  |  |
| Piper PA-16             | Avco/Lycoming O-235 series  |  |  |  |
| Piper PA-18             | Avco/Lycoming O-235 series, O-290 series, O-320 series<br>Continental A-65 series, C-90 series  |  |  |  |
| Piper PA-20             | Avco/Lycoming O-290 series, O-320 series  |  |  |  |
| Piper PA-22             | Avco/Lycoming O-235 series, O-290 series, O-320 series  |  |  |  |
| Piper PA-24             | Avco/Lycoming O-320 series, O-360 series, O-540 series, IO-540 series, IO-720-A1A   |  |  |  |
| Piper PA-25             | Avco/Lycoming O-290 series, O-320 series, O-540 series, IO-540 series   |  |  |  |
| Piper PA-28             | Avco/Lycoming O-235 series, O-320 series, O-360 series, O-540 series, IO-360 series, AIO-360 series, IO-540 series  |  |  |  |

### TABLE 3 (continued)

Aircraft Make and Model

Engine Make and Model

Piper PA-32

Avco/Lycoming O-540 series, IO-540 series

Globe GC-1A, 1B

Avco/Lycoming O-320 series,

Continental A-65 series, C-115 and C-125 series, O-300 series

Stinson 108

Avco/Lycoming O-145-B, -C; GO-145 series; O-435 series;

Continental A-40, -2, -3, -4; Franklin 6A4 and 6AG4 series

Taylorcraft BC

Avco/Lycoming O-235 series, O-320 series, Continental A-65 series, C-75 and C-85 series

#### **TABLE 4**

## ENGINES INSTALLED IN VARIOUS MULTIENGINE AIRCRAFT MAKES AND MODELS

| Aircraft | Make | and | Model |
|----------|------|-----|-------|
|----------|------|-----|-------|

### Engine Make and Model

| Aero | Comn | nander | 500, |
|------|------|--------|------|
| 520, | 560, | 500S   |      |

Avco/Lycoming GO-435, GO-480 series, O-540 series, IO-540 series, Continental IO-470-D, -E, -F, -G, -H, -J, -K, -L, -M, -N, -P, -R, -S,

-T; LIO-470-A

Aero Commander 560F, 680, 680T

Avco/Lycoming GO-480 series, GSO-480 series, IGSO-480,

Airesearch TPE, 331 series

Beech 18, C-45

Pratt and Whitney Military R-985 series,

Airesearch TPE 331 series

Beech 50

Avco/Lycoming GO-435, GO-480 series, GSO-480 series, IGSO-480

Beech 65

Avco/Lycoming GSO-480 series, IGSO-480, IO-540 series

Beech 95

Avco/Lycoming O-360 series, IO-360 series, AIO-360 series, IO-540

series.

Continental IO-470-D, -E, -F, -G, -H, -J, -K, -L, -M, -N, -P, -R, -S,

-T, -U; LIO-470-A; IO-520-A, -B, -C, -D, -E, -F, -J, -K, -L; United Aircraft PT6A-6, -6A, -6B, -20, -27, -28, -29, PT6B-9

Cessna 310

Avco/Lycoming IO-540 series,

Continental O-470-A, -B, -E, -G, -H, -J, -K, -L, -M, -N, -P, -R; IO-470-D, -E, -F, -G, -H, -J -K, -L, -M, -N, -P, -R, -S, -T, -U;

LIO-470-A, TSIO-470-B, -C, -D; TSIO-520 series

Cessna 320

Avco/Lycoming IO-540 series;

Continental TSIO-470-B, -C, -D; IO-520-A, -B, -C, -D, -E, -F, -J, -K,

-L; TSIO-520 series

Cessna 336, 337

Continental IO-360-A, -B, -C, -D, -E; TSIO-360 series

Cessna 401, 402, 411,

Continental GTSIO-520-C, -D, -E; TSIO-520 series

421

DeHavilland DH104,

DH114

Avco/Lycoming IO-720-A1A;

DeHavilland Gypsy Queen 30MK.2; Gypsy Queen 70-4, 70MK2, 70MK3

### TABLE 4 (continued)

### Aircraft Make and Model

### Engine Make and Model

Piper PA-23

Avco/Lycoming O-320 series, O-340 series, O-360 series, O-540

series, IO-360 series, AIO-360 series, IO-540 series,

Franklin 6V-350-A, -B; GA-350-D, -D1, -C1, C2

Piper PA-30

Avco/Lycoming LTC1B-1, IO-320 series

Piper 31

Avco/Lycoming IO-540 series, TIO-540-A1A, -A1B, -A2A, -A2B,

C1A

Lear

General Electric CJ-610-1, -4, -5, -6, -8, -9

TABLE 5

### ENGINE-FAILURE ACCIDENTS, RATES FOR SELECTED MAKE AND MODEL OF AIRCRAFT SINGLE-ENGINE AIRCRAFT 1965 – 1969

| Make and Model | Engine-Failure<br>Accidents | Aircraft-Hours<br>Flown | Engine-Failure<br>Accidents Per 100,000<br>Aircraft-Hours Flown |
|----------------|-----------------------------|-------------------------|---|
| Aeronca 11     | 24                          | 175,762                 | 13.65   |
| Aeronca 15     | 17                          | 61,055                  | 27.84   |
| Aeronca 7      | 112                         | 2,075,159               | 5.40  |
| Beech 35       | 194                         | 5,278,580               | 3.68  |
| Beech 23       | 64                          | 1,392,673               | 4.60  |
| Beech A45, T34 | 13                          | 231,842                 | 5.61  |
| Bellanca 14-13 | 15                          | 27,802                  | 53.95   |
| Bellanca 14-19 | 18                          | 118,619                 | 15.17   |
| Boeing A-75    | 138                         | 1,475,846               | 9.35  |
| Callair A-9    | 50                          | 164,482                 | 30.40   |
| Cessna 120/140 | 99                          | 1,723,086               | 5.74  |
| Cessna 150     | 390                         | 15,137,844              | 2.58  |
| Cessna 170     | 57                          | 1,281,719               | 4.45  |
| Cessna 172     | 232                         | 10,013,792              | 2.32  |
| Cessna 175     | 32                          | 773,806                 | 4.14  |
| Cessna 180     | 47                          | 1,793,611               | 2.62  |
| Cessna 182     | 136                         | 5,295,105               | 2.57  |
| Cessna 185     | 11                          | 426,909                 | 2.58  |
|                |                             |                         |   |

### TABLE 5 (continued)

| Make and Model | Engine-Failure<br>Accidents | Aircraft-Hours<br>Flown | Engine-Failure<br>Accidents Per 100,000<br>Aircraft-Hours Flown |
|----------------|-----------------------------|-------------------------|---|
| Cessna 195     | 14                          | 219,355                 | 6.38  |
| Cessna 210     | 72                          | 1,353,610               | 5.32  |
| Cessna 206     | 30                          | 713,938                 | 4.20  |
| Cessna 188     | 14                          | 123,747                 | 11.31   |
| Cessna 177     | 51                          | 445,007                 | 11.46   |
| Forney 415     | 78                          | 827,488                 | 9.43  |
| Grumman G-164  | 48                          | 594,448                 | 8.07  |
| Luscombe 8     | 87                          | 681,268                 | 12.77   |
| Mooney M20     | 133                         | 3,082,733               | 4.31  |
| Navion L-17    | 62                          | 586,882                 | 10.56   |
| Piper J-3      | 99                          | 1,157,927               | 8.55  |
| Piper PA-12    | 44                          | 567,934                 | 7.75  |
| Piper PA-16    | 8                           | 116,006                 | . 6.90  |
| Piper PA-18    | 93                          | 2,068,290               | 4.50  |
| Piper PA-20    | 12                          | 183,352                 | 6.54  |
| iper PA-22     | 275                         | 3,848,707               | 7.14  |
| per PA-24      | 137                         | 2,823,300               | 4.85  |
| per PA-25      | 116                         | 1,665,856               | 6.96  |
| ber PA-28      | 322                         | 10,262,616              | 3.14  |
| er PA-32       | 53                          | 700,336                 | 7.57  |

### TABLE 5 (continued)

| Make and Model  | Engine-Failure<br>Accidents | Aircraft-Hours<br>Flown | Engine-Failure<br>Accidents Per 100,000<br>Aircraft-Hours Flown |
|-----------------|-----------------------------|-------------------------|---|
| Globe GC-1A, 1B | 35                          | 184,456                 | 18.97   |
| Stinson 108     | 71                          | 603,908                 | 11.76   |
| Taylorcraft BC  | 30                          | 514,106                 | 5.84  |
| All Others      | 322                         | 3,468,103               | 9.28  |
| то              | TAL 3855                    | 84,241,065              |   |

TABLE 6

### ENGINE-FAILURE ACCIDENTS, RATES FOR SELECTED MAKE AND MODEL OF AIRCRAFT MULTIENGINE AIRCRAFT 1965 – 1969

| Make and Model                        | Engine-Failure<br>Accidents | Aircraft-Hours<br>Flown | Engine-Failure<br>Accidents Per 100,000<br>Aircraft-Hours Flown |
|---------------------------------------|-----------------------------|-------------------------|---|
| Aero Commander 500,<br>520, 560, 500S | 31                          | 727,664                 | 4.26  |
| Aero Commander 560F,<br>680, 680T     | 22                          | 720,714                 | 3.05  |
| Beech, 18, C-45                       | 53                          | 2,178,848               | 2.43  |
| Beech 50                              | 7                           | 621,980                 | 1.12  |
| Beech 65                              | 14                          | 1,083,477               | 1.29  |
| ₩.<br><b>Be</b> ech 95                | 45                          | 935,668                 | 4.81  |
| Cessna 310                            | 42                          | 2,060,138               | 2.04  |
| Cessna 320                            | 11                          | 474,226                 | 2.32  |
| Cessna 336, 337                       | 22                          | 614,553                 | 3.58  |
| Cessna 401, 402, 411, 421             | 7                           | 574,370                 | 1.22  |
| DeHavilland DH104, DH114              | 7                           | 100,385                 | 6.97  |
| Piper PA-23                           | 103                         | 3,328,122               | 3.09  |
| Piper PA-30                           | 28                          | 1,259,670               | 2.22  |
| riper PA-31                           | 2                           | 165,628                 | 1.21  |
| eat                                   | 2                           | 194,920                 | 1.03  |
| Il Öthers                             | 59                          | 5,130,045               | 1.15  |
| TOTAL                                 | 455                         | 20,170,408              |   |

TABLE 7

### COMPARISON OF ENGINE-FAILURE ACCIDENTS FOR SELECTED MAKE AND MODEL OF AIRCRAFT SINGLE-ENGINE AIRCRAFT

### **ENGINE-FAILURE ACCIDENTS**

| Make and Model | Observed | Expected | $(F_o - F_e)^2/F_e$ |
|----------------|----------|----------|---------------------|
| Aeronca 11     | 24       | 8        | 32.0 VH             |
| Aeronca 15     | 17       | 3        | 65.3 VH             |
| Aeronca 7      | 112      | 95       | 3.0 a               |
| Beech 35       | 194      | 242      | 9.5 L               |
| Beech 23       | 64       | 64       | 0 a                 |
| Beech A45, T34 | 13       | 11       | 0.4 a               |
| Bellanca 14-13 | 15       | 1        | 196.0 No test       |
| Bellanca 14-19 | 18       | 5        | 33.8 VH             |
| Boeing A-75    | 138      | 68       | 72.1 VH             |
| Callair A-9    | 50       | 8        | 220.5 VH            |
| Cessna 120/140 | 99       | 79       | 5.1 H               |
| Cessna 150     | 390      | 693      | 132.5 VL            |
| Cessna 170     | 57       | 59       | 0.1 a               |
| Cessna 172     | 232      | 458      | 111.5 VL            |
| Cessna 175     | 32       | 35       | 0.2 a               |
| Cessna 180     | 47       | 82       | 14.9 VL             |
| Cessna 182     | 136      | 242      | 46.4 VL             |
| Cessna 185     | 11       | 20       | 4.0 L               |

## TABLE 7 (continued)

| ENGINE-FAILURE ACCIDENTS |         |           |                              |
|--------------------------|---------|-----------|------------------------------|
| Make and Model           | Observe | d Expecte | $d \qquad (F_o - F_e)^2/F_e$ |
| Cessna 195               | 14      | 10        | 1.6 a                        |
| Cessna 210               | 72      | 62        | 1.6 a                        |
| Cessna 206               | 30      | 33        | 0.3 a                        |
| Cessna 188               | 14      | 6         | 10.7 H                       |
| Cessna 177               | 51      | 20        | 48.0 VH                      |
| Forney 415-C             | 78      | 38        | 42.1 VH                      |
| Grumman G-164            | 48      | 27        | 16.3 VH                      |
| Luscombe 8               | 87      | 31        | 101.2 VH                     |
| Mooney M20               | 133     | 141       | 0.4 a                        |
| Navion L-17              | 62      | 27        | 45.4 VH                      |
| Piper J-3                | 99      | 53        | 39.9 VH                      |
| Piper PA-12              | 44      | 26        | 12.5 VH                      |
| Piper PA-16              | 8       | 5         | 1.8 a                        |
| Piper PA-18              | 93      | 95        | 0.04 a                       |
| Piper PA-20              | 12      | 8         | 2.0 a                        |
| Piper PA-22              | 275     | 176       | 55.7 VH                      |
| Piper PA-24              | 137     | 129       | 0.5 a                        |
| Piper PA-25              | 116     | 76        | 21.0 VH                      |
| Piper PA-28              | 322     | 470       | 46.6 VL                      |
| Piper PA-32              | 53      | 32        | 13.8 VH                      |
| Globe GC-1A, 1B          | 35      | 8         | 91.1 VH                      |

## TABLE 7 (continued)

|                | ENGINE-FAILURE ACCIDENTS |          |  |  |
|----------------|--------------------------|----------|--|--|
| Make and Model | Observed                 | Expected | $(\mathbf{F_o} - \mathbf{F_e})^2/\mathbf{F_e}$ |  |
| Stinson 108    | 71                       | 28       | 66.0 VH  |  |
| Taylorcraft BC | 30                       | 24       | 1.5 a  |  |

TABLE 8

### COMPARISON OF ENGINE-FAILURE ACCIDENTS FOR SELECTED MAKE AND MODEL OF AIRCRAFT MULTIENGINE AIRCRAFT

| Make and Model                        | Observed | Expected | $(F_o - F_e)^2/F_e$ |
|---------------------------------------|----------|----------|---------------------|
| Aero Commander 500,<br>520, 560, 500S | 31       | 16       | 14.1 VH             |
| Aero Commander 560F,<br>680, 680T     | 22       | 16       | 2.2 a               |
| Beech 18, C-45                        | 53       | 49       | 0.3 a               |
| Beech 50                              | 7        | 14       | 3.5 a               |
| Seech 65                              | 14       | 24       | 4.2 L               |
| eech 95                               | 45       | 21       | 27.4 VH             |
| esma 310                              | 42       | 46       | 0.3 a               |
| asana 320                             | 11       | 11       | 0 a                 |
| sana 336, 337                         | 22       | 14       | 4.6 Н               |
| sena 401, 402, 411, 421               | 7        | 13       | 2.8 a               |
| havilland DH 104, DH114               | 7        | 2        | 12.5 No test        |
| E.PA-23                               | 103      | 75       | 10.4 H              |
| r <b>₽</b> A-30                       | 28       | 28       | 0 a                 |
| <b>P</b> A-31                         | 2        | 4        | 1.0 a               |
|                                       | 2        | 4        | 1.0 a               |

### SECTION II

COMPARISON OF ENGINE-FAILURE ACCIDENT CAUSES(S)/FACTOR(S)
BY SELECTED AIRCRAFT
AND ENGINE MAKES AND MODELS

The purpose of Section II is to analyze the causes and related factors of engine-failure accidents by selected aircraft and engine makes and models. Four broad cause/factor categories were studied: (1) pilot-in-command, (2) maintenance, servicing, and inspection personnel, (3) powerplant, and (4) fuel exhaustion and fuel starvation.

Each cause/factor table included in Section II presents only those citations which fall within these four categories and thus does not represent the total causes/factors recorded. Also, the individual cause/factor citations refer only to the first type of accident (the engine failure or malfunction).

Several kinds of engine-failure accidents were excluded from the statistical base used in Section II. These are: (1) accidents which involved either homebuilt or experimental aircraft, (2) accidents which were caused by simulated engine failures, and (3) accidents in which the cause/factor citation was either "undetermined" or "powerplant failure for undetermined reasons."

Because these restrictions had to be imposed after the selection of a particular make and model, only those makes and models involved in at least 50 engine-failure accidents could be considered. Although arbitrary, this selection criterion was necessary in order to obtain adequate frequency distribution of the cause/factor citations.

A listing of aircraft makes and models selected for study in this section is given in Table 9, along with the number of eligible aircraft by make and model as of December 31, 1969.

Table 10 presents a summary of the number of engine-failure accidents by both aircraft makes and models and engine makes and models.

### Aircraft Make and Model Causes/Factors

In Tables 11 through 36, detailed causes/ factors for a particular aircraft make and model

were compared with those of all other aircraft. To make the comparisons, the two-sample case of the normal approximation to the binomial technique was used.2 The technique tested the hypothesis that  $P_1 = P_2 = P$  where  $P_1$  and  $P_2$ represent the parameters of two binomial populations. The parameter P<sub>1</sub> was estimated by the sample proportion  $X_1/N_1$ , where  $X_1$  represents the number of times a cause/factor (such as valve assemblies) was cited for a particular aircraft make and model involved in N<sub>1</sub> enginefailure accidents. P2 was estimated by the sample proportion  $X_2/N_2$  (the expected proportion), where X2 represents the number of times the same cause/factor was cited for all aircraft involved in N2 accidents, excluding the particular make and model in question. The hypothesis was tested on the basis of the statistic

$$Z = \frac{X_1/N_1 - X_2/N_2}{[\hat{P}(1-\hat{P})(1/N_1 + 1/N_2)]^{\frac{1}{2}}}$$

where  $\hat{P} = (X_1 + X_2)/(N_1 + N_2)$ .

Whenever the calculated Z value fell outside the range -1.96 to +1.96 it was concluded that P<sub>1</sub> was significantly different from P<sub>2</sub> at the 0.05 level of significance. This means that there is a 95-percent probability that P<sub>1</sub> and P<sub>2</sub> were genuinely different, and that the observed difference was not due to chance alone.

In Tables 11 through 36, an asterisk (\*) denotes that the percent of total accidents involving a specific cause/factor citation was significantly greater than the expected percent at the 0.05 level of significance. A number sign (#) denotes the opposite of the asterisk. The absence of a symbol indicates that no significant difference was detected from the samples.

It should be noted that statistical significance does not necessarily imply practical significance. Taking for example the Cessna 150 aircraft (Table 18), even though the cause/factor, "operated carelessly," was cited only

<sup>&</sup>lt;sup>2</sup>Freund, John E. *Mathematical Statistics*, Prentice-Hall, Inc., Englewood Cliffs, N. J., 1962.

once, the observed percentage was significantly higher than the expected percent. The practical significance of "operated carelessly" as a cause/factor is therefore questionable in Cessna 150 engine-failure accidents. In such a case, a subjective judgment or an engineering judgment has to be made.

Example. There were a total of 3,015 engine-failure accidents involving single-engine aircraft excluding undetermined causes/factors, homebuilt and experimental aircraft, and accidents involving simulated engine failures. Improper operation of powerplant and powerplant controls was cited as a cause/factor in 436 (14.5%) of these accidents. The Cessna 150 was involved in 280 engine-failure accidents, in 94 (33.6%) of which improper operation of powerplant and powerplant controls was cited as a cause/factor. The expected percent was the percentage of times in which improper operation of powerplant and powerplant controls was cited as a cause/factor for the set of all remaining makes models, i.e.,  $(X_2/N_2) \times 100 =$  $[(436-94)/(3015-280)] \times 100 = 12.5$ . Calculation of the Z statistic yields

Z= 
$$\frac{33.6-12.5}{[(14.5)(85.5)(1/280+1/2735)]^{\frac{1}{2}}}$$
 =9.6

which is larger than 1.96. Therefore, at the 0.05 level of significance, improper operation of powerplant and powerplant controls in the Cessna 150 was cited as a cause/factor of engine-failure accidents a significantly higher percentage of times than that of the remaining set of makes and models.

Summary of the comparisons. The causes and related factors involving human error which were significantly higher (\*) or lower (#) than expected in percentage involvement by aircraft makes and models are summarized below.

With few exceptions, whenever mismanagement of fuel was significantly higher than expected for a particular aircraft, fuel starvation was also significantly higher than expected. The same was true when mismanagement of fuel was significantly lower than expected for a particular

aircraft. More than 53% of the 167 engine-failure accidents involving the Beech 35 aircraft were associated with fuel starvation. The Piper PA-32, Callair A-9, Beech 23, Piper PA-28, and Piper PA-22 aircraft all had over 35% of their engine-failure accidents associated with fuel starvation. For these aircraft, a high percentage of the engine-failure accidents (more than 35%) were a result of the pilot mismanaging the fuel, which led to fuel starvation and an engine-failure accident.<sup>3</sup>

With few exceptions, whenever inadequate preflight preparation and/or planning for a particular aircraft was higher (lower) than expected, fuel exhaustion was also higher (lower) than expected for the same aircraft. The Cessna 177, Cessna 172, Piper PA-25, Cessna 182, Piper PA-24, Cessna 150, and Beech 18, C-45 aircraft had from 34.4% to 63.9% of their engine-failure accidents associated with fuel exhaustion. A high percentage of these engine-failure accidents (over 34%) also involved the pilot not making adequate preflight preparation or planning, perhaps becoming lost and disoriented, and exhausting the fuel which ended in an engine-failure accident.

Review of Tables 11 through 36 reveals that most of the engine-failure accidents for each aircraft make and model were caused by pilot-in-command error, such as inadequate preflight preparation and/or planning, mismanagement of fuel, and improper operation of powerplant controls. These same causal citations were found to be significant in engine-failure accidents which preceded stall/spins. Increased emphasis to overcome these errors along with increased awareness of fuel starvation and fuel exhaustion could reduce the occurrence of

<sup>&</sup>lt;sup>3</sup>The Bureau of Aviation Safety while under the Civil Aeronautics Board published a more detailed examination of fuel mismanagement as a cause/factor of engine-failure accidents. See study entitled "Aircraft Design - Induced Pilot Error," Civil Aeronautics Board, Report Number: PB 175-629, July 1967.

<sup>&</sup>lt;sup>4</sup>National Transportation Safety Board, "General Aviation Stall/Spin Accidents," NTSB-AAS-72-8.

| Aircraft    | Percent of Total Engine-Failure Accidents              | Expected<br>Percent |
|-------------|--|---------------------|
|             | Pilot-In-Command                                       |                     |
|             | Improper Inflight Decisions or Planning                |                     |
| Cessna 172  | 11.7*  | 3.0                 |
| Mooney M20  | 11.2*  | 3.2                 |
| Piper PA-24 | 7.0*   | 3.4                 |
|             | Became Lost/Disoriented                                |                     |
| Cessna 172  | 9.0*   | 2.8                 |
| Cessna 150  | 8.2*   | 2.6                 |
|             | Lack of Familiarity With Aircraft                      |                     |
| Beech 35    | 6.6*   | 1.5                 |
|             | Inadequate Supervision of Flight                       |                     |
| Piper PA-28 | 4.0*   | 1.1                 |
| Cessna 150  | 3.2*   | 1.2                 |
|             | Spontaneous Improper Action                            |                     |
| Cessna 150  | 2.5*   | .2                  |
|             | Continued VFR Flight Into Adverse Weather Conditions   |                     |
| Mooney M20  | 4.3*   | 1.2                 |
| Cessna 172  | 3.2*   | 1.2                 |
|             | Failed to Follow Approved Procedures, Directives, etc. |                     |
| Luscombe 8  | 8.4*   | .4                  |

| Aircraft    | Percent of Total Engine-Failure Accidents                | Expected<br>Percent |
|-------------|--|---------------------|
|             | Improper Operation of Powerplant and Powerplant Controls |                     |
| Cessna 150  | 33.6*  | 12.5                |
| Piper PA-18 | 23.9*  | 14.2                |
| Piper PA-22 | 9.5#   | 14.9                |
| Beech 35    | 4.8#   | 15.0                |
| Boeing A-75 | 3.7#   | 14.9                |
| Navion L-17 | 3.6#   | 14.7                |
|             | Inadequate Preflight Preparation and/or Planning         |                     |
| Cessna 177  | 61.1*  | 27.8                |
| Piper PA-25 | 46.4*  | 27.7                |
| Cessna 172  | 38.3*  | 27.5                |
| Piper PA-18 | 16.2#  | 28.5                |
| Beech 35    | 12.0#  | 29.1                |
| Beech 23    | 10.0#  | 28.4                |
|             | Mismanagement of Fuel                                    |                     |
| Beech 35    | 45.5*  | 16.3                |
| Callair A-9 | 36.1*  | 17.7                |
| Piper PA-32 | 31.7*  | 17.8                |
| Piper PA-28 | 30.2*  | 17.0                |
| Beech 23    | 30.0*  | 17.8                |
| Piper PA-18 | 27.0*  | 17.7                |
| Piper PA-22 | 25.9*  | 17.3                |

| Aircraft     | Percent of Total Engine-Failure Accidents | Expected<br>Percent |
|--------------|---|---------------------|
|              | Mismanagement of Fuel (continued)         |                     |
| Cessna 150   | 10.4#                                     | 18.7                |
| Piper PA-23  | 9.4#                                      | 28.3                |
| Aeronca 7    | 8.5#                                      | 18.2                |
| Piper PA-25  | 7.1#                                      | 18.3                |
| Luscombe 8   | 7.0#                                      | 18.2                |
| Forney 415   | 6.2#                                      | 18.2                |
| Piper J-3    | 4.2#                                      | 18.3                |
| Boeing A-75  | 3.7#                                      | 18.5                |
| <b>)</b> .   | Miscellaneous Acts and Conditions         |                     |
|              | Fuel Starvation                           |                     |
| iech 35      | 53.2*                                     | 23.0                |
| PA-32        | 46.3*                                     | 24.3                |
| Mar A-9      | 41.7*                                     | 24.4                |
| 23           | 40.0*                                     | 24.4                |
| PA-28        | 38.7*                                     | 23.5                |
| PA-22        | 35.3*                                     | 23.8                |
| 182          | 14.5#                                     | 25.0                |
| 177          | 13.9#                                     | 24.8                |
| 7            | 13.4#                                     | 25.0                |
| <b>172</b>   | 13.3#                                     | 25.4                |
| <b>EA-23</b> | 12.5#                                     | 30.5                |

| Aircraft       | Percent of Total Engine-Failure Accidents      | Expected<br>Percent |
|----------------|--|---------------------|
|                | Fuel Starvation (continued)                    |                     |
| Piper PA-25    | 11.9#  | 25.0                |
| Cessna 150     | 10.0#  | 26.1                |
| Boeing A-75    | 7. <del>4#</del>                               | 25.3                |
|                | Fuel Exhaustion                                |                     |
| Cessna 177     | 63.9*  | 24.7                |
| Cessna 172     | 48.4*  | 23.6                |
| Piper PA-25    | 44.0*  | 24.6                |
| Cessna 182     | 41.8*  | 24.5                |
| Piper PA-24    | 39.1*  | 24.6                |
| Cessna 150     | 35.0*  | 24.2                |
| Beech 18, C-45 | 34.4*  | 15.5                |
| Piper PA-22    | 13.8#  | 26.1                |
| Cessna 120/140 | 13.4#  | 25.5                |
| Beech 35       | 12.6#  | 25.9                |
| Forney 415     | 6.2#   | 25.6                |
| Piper PA-18    | 5.4#   | 25.7                |
| Piper PA-32    | 4.9#   | 25.5                |
|                | Personnel (Maintenance, Servicing, Inspection) |                     |
|                | Inadequate Maintenance and Inspection          |                     |
| Luscombe 8     | 16.9*  | 8.9                 |
| Stinson 108    | 16.4*  | 9.0                 |
| Cessna 150     | 4.6#   | 9.6                 |

ei Ci engine-failure accidents significantly for all aircraft.

The causes and related factors involving the powerplant which were significantly higher or lower than expected in percentage involvement by aircraft makes and models are summarized below.

The explanation for a particular aircraft having a significantly higher-than-expected percentage of engine-failure accidents for a specific powerplant cause/factor involves identification of the engines installed in the aircraft (Table 10).

The Piper PA-25 experienced significantly higher-than-expected engine structure crankshaft problems. The engine most common to the Piper PA-25 was the Avco/Lycoming 0-540 series engine (Table 43), which had higher-than-expected involvement with engine-structure crankshaft problems. Likewise, the Pratt and Whitney Military R-985 series engine (Table 57), which most often powered the Boeing A-75, had higher-than-expected problems with enginestructure crankshaft.

The Mooney M20 and Boeing A-75 aircraft had significantly higher-than-expected involvement with master and connecting rods. The Mooney M20 was powered most often by the Avco/Lycoming 0-360 series engine (Table 41) and the Avco/Lycoming I0-360 series engine (Table 42).

The Pratt and Whitney R-985 engine used in the Boeing A-75 also had significantly higher-than-expected involvement with cylinder-assembly problems.

The frequency of piston and piston-ring problems was significantly higher than expected for the Navion L-17 and the Cessna 210. The Continental E-165 and E-185 series (Table 49) and Continental I0-470-D, -E, etc., (Table 54) engines were used in the Navion L-17. Both these engines had a higher-than-expected frequency of piston and piston-ring problems. The Cessna 210 was equipped with the Continental I0-470-D, -E, etc., and the Continental I0-520-A,

-B, etc. engines (Table 55), which also had a significantly higher piston and piston ring cause/factor frequency.

Valve-assembly problems were significantly higher than expected for the Piper PA-18, Stinson 108, Piper PA-24, and Piper PA-22 aircraft. The engines installed in the Piper PA-18 were the Avco/Lycoming 0-290 and 0-320 series engines, both of which had higher-than-expected significantly higher-than-expected valveassembly problems (Tables 39 and 40). The Stinson 108 was powered by the Franklin 6A4, 6AG4 series engine (Table 56), which had significantly high valve-assembly problems. The Piper PA-24 was equipped with the Avco/Lycoming 0-360, Avco/Lycoming 0-540 (Table 43), and Avco/Lycoming I0-540 (Table 44) series engines, each of which had higher-than-expected 🔌 valve-assembly problems. The Piper PA-22 was generally powered by the Avco/Lycoming 0-290 series engine (Table 39) and the Avco/Lycoming 0-320 series engines; both engines had a higheror a significantly higher-than-expected number of engine-structure valve assembly cause/factor citations.

The Boeing A-75 equipped with the Pratt and Whitney Military R-985 series engine was the only aircraft make and model which had a significantly higher-than-expected number of problems with the engine-structure blower and impeller assembly.

The Stinson 108 aircraft had significantly higher-than-expected involvement with ignition-system magnetos.

The fuel-system carburetor caused a problem area for the Cessna 182 and the Boeing A-75. The Cessna 182 was powered by the Continental 0-470 engine (Table 53), which had a significantly higher-than-expected frequency of fuel-system carburetor cause/factor citations.

The Forney 415, powered by the Continental C-75 and C-85 series engine (Table 46), had higher-than-expected involvement in the fuel-system pumps causal area, as did the Beech 35 aircraft with the Continental E-225 and Continental I0-470 engines (Tables 51 and 54).

| Aircraft    | Percent of Total Engine-Failure Accidents     | Expected<br>Percent |
|-------------|---|---------------------|
| •           | Engine Structure – Crankshaft                 |                     |
| Piper PA-25 | 4.8*  | 1.8                 |
| Boeing A-75 | 4.6*  | 1.8                 |
|             | Engine Structure – Master and Connecting Rods |                     |
| Mooney M-20 | 6.0*  | 2.3                 |
| Boeing A-75 | 5.6*  | 2.4                 |
|             | Engine Structure – Cylinder Assembly          |                     |
| Boeing A-75 | 13.9*   | 1.6                 |
|             | Engine Structure – Piston, Piston Rings       |                     |
| Navion L-17 | 7.3*  | 2.0                 |
| Cessna 210  | 6.9*  | 2.0                 |
|             | Engine Structure – Valve Assemblies           |                     |
| Piper PA-18 | 13.5*   | 3.9                 |
| Stinson 108 | 13.1*   | 4.0                 |
| Piper PA-24 | 8.7*  | 4.0                 |
| Piper PA-22 | 7.8*  | 3.9                 |
| Beech 35    | 1.2#  | 4.4                 |
|             | Engine Structure – Blower, Impeller Assembly  |                     |
| Boeing A-75 | 3.7*  | .3                  |
|             | Ignition System— Magnetos                     |                     |
| Stinson 108 | 6.6*  | 1.8                 |

| Aircraft    | Percent of Total Engine-Failure Accidents    | Expected<br>Percent |
|-------------|--|---------------------|
|             | Fuel System-Carburetor                       |                     |
| Cessna 182  | 8.2*   | 3.0                 |
| Boeing A-75 | 6.5*   | 3.1                 |
|             | Fuel System – Pumps                          |                     |
| Forney 415  | 6.2*   | .7                  |
| Beech 35    | 4.2*   | .6                  |
|             | Fuel System – Vents, Drains, Tank Caps       |                     |
| Aeronca 7   | 4.9*   | 1.3                 |
| Piper PA-24 | 3.5*   | 1.3                 |
|             | Lubricating System – Lines, Hoses, Fittings  |                     |
| Piper PA-23 | 12.5*  | .0                  |
|             | Lubricating System – Filters, Screens        |                     |
| Beech 35    | 2.4*   | .1                  |
|             | Lubricating System – Seals and Gaskets       |                     |
| Piper PA-22 | 1.7*   | .2                  |
|             | Exhaust Systems – Mufflers                   |                     |
| Piper PA-25 | 6.0*   | .4                  |
| Piper PA-22 | 1.7*   | .4                  |
|             | Powerplant Instruments – Fuel Quantity Gauge |                     |
| Cessna 177  | 11.1*  | 1.1                 |

Vents, drains, and tank caps were a problem for the Aeronca 7 aircraft with the Avco/Lycoming 0-235 series engine (Table 38). Likewise, the Piper PA-24 aircraft with the Avco/Lycoming 0-540 series engine had a significantly higher-than-expected number of problems with its fuel-system vents, drains, and tank caps.

The Piper PA-23 when powered by Avco/ Lycoming 0-320 series engine was the only aircraft which had significant citations concerning the lubricating-system lines, hoses, and fittings.

The Beech 35 aircraft, powered by the Continental E-225, Continental 0-470, Continental 10-470, and Continental 10-520 series engines, had more problems than expected with the lubricating-system filters and screens, with no single engine dominating the problem area.

Lubricating-system seals and gaskets caused more problems than expected for the Avco/Lycoming 0-290 and the Avco/Lycoming 0-320

series engines, both of which were used in the Piper PA-22 aircraft.

The Piper PA-25 aircraft had higher-than-expected involvement with exhaust-system mufflers cause/factor citations. This aircraft experienced the majority of its engine-failure accidents with the Avco/Lycoming 0-320 and the Avco/Lycoming 0-540 series engine, both of which were either higher-or significantly higher-than-expected in the exhaust-system muffers causal area. Likewise, the Piper PA-22, powered by the Avco-Lycoming 0-290 and 0-320 series engines, experienced significantly higher-than-expected problems with its exhaust-system mufflers.

The Cessna 177 aircraft with the Avco/ Lycoming 0-320 series engine had significantly higher-than-expected involvement in the powerplant-instruments-fuel quantity gauge causal area.

# TABLE 9

# ELIGIBLE AIRCRAFT BY SELECTED MAKE AND MODEL December 31, 1969

| Make and Model | Eligible Aircraft |
|----------------|-------------------|
| Aeronca 7      | 3,626             |
| Beech 18       | 1,357             |
| Beech 23       | 1,411             |
| Beech 35       | 7,099             |
| Boeing A-75    | 1,048             |
| Callair A-9    | 119               |
| Cessna 120/140 | 3,064             |
| Cessna 150     | 10,221            |
| Cessna 170     | 2,599             |
| Cessna 172     | 11,135            |
| Cessna 177     | 1,052             |
| Cessna 182     | 7,485             |
| Cessna 210     | 1,931             |
| Piper J-3      | 2,329             |
| Piper PA-18    | 2,372             |
| Piper PA-22    | 4,925             |
| Piper PA-23    | 3,120             |
| Piper PA-24    | 3,368             |
| Piper PA-25    | 1,642             |

# TABLE 9 (continued)

| Make and Model | Eligible Aircraft |
|----------------|-------------------|
| Piper PA-28    | 10,805            |
| Piper PA-32    | 1,311             |
| Forney 415     | 1,660             |
| Luscombe 8     | 1,771             |
| Mooney M20     | 3,977             |
| Navion L-17    | 1,159             |
| Stinson 108    | 1,697             |

# ENGINE FAILURE ACCIDENTS PER SELECTED AIRCRAFT MAKES AND MODELS AND ENGINE MAKES AND MODELS

| Engine Make and Model  | Aeronca 7          | Beech 18      | Beech 23 | Beech 35            | Boeing A-75         | Callair A-9 | Cessna 120/140 | Cessns 150 | Cessna 170 | Cessna 172         | Cessna 177 | Cessna 182 | Cessna 210                   | Forney 415         | Газветре В    | Mooney M20    | Navion L-17  | Piper J-3          | Piper PA-18,18A | Hper PA-22      | Piper PA-23  | Piper PA-24 | Piper PA-25 | Piper PA.28          | Piper PA-32 | Stinson 108 |
|--|--------------------|---------------|----------|---------------------|---------------------|-------------|----------------|------------|------------|--------------------|------------|------------|------------------------------|--------------------|---------------|---------------|--------------|--------------------|-----------------|-----------------|--------------|-------------|-------------|----------------------|-------------|-------------|
| Aveo/Lycoming: 0-145-A 0-145-B, -C 0-255 0-290 0-320 0-340 0-360 10-360 0-435 G0-435 G0-480 0-540  | 7<br>4<br>5        |               | 20       |                     |                     | 5           |                |            | 2          | 6                  |            |            |                              |                    | 1             | 8<br>70<br>38 | 10<br>7<br>1 | 12481              | 2<br>13<br>57   | 40<br>60<br>132 | 48<br>1<br>1 | 1 24        | 1<br>15     | 1<br>131<br>54<br>12 | 29          | 2           |
| IO-540 R-670 R-680-B4 R-680-E IO-720 Continental: A-65 A-75 C-75, C-85 C-90 C-145 E-165, E-185 0-200 D-225 0-300 GO-306 IO-346 IO-360 O-470  | 35<br>8<br>20<br>3 |               | 16       | 52<br>39            | 1 1 3               | 8           | 70<br>12       | 1<br>279   | 35         | 3<br>1<br>174<br>2 |            | 107        | 1                            | 1<br>1<br>51<br>12 | 43<br>29<br>6 |               |              | 32<br>6<br>12<br>5 | 1               |                 | 7            | 2           | 1           |                      | 12          |             |
| IO-W70-A, -C IO-W70-D, -E, etc. TSIO-Y70 IO-520 TSIO-520 GTSIO-520 GTSIO-520 R-670-A R-670-B W-670 Curtiss-Wright: R-975, A,B,D,E, Willtary R-975 Franklin: 5A4, 6AG4 5VS0 Jacobs: R-755 |                    |               |          | 13<br>27<br>20<br>1 | 1<br>10<br>10<br>1  |             |                |            | 1          |                    |            | 1 2        | 7<br>30<br>1<br>11<br>6<br>1 |                    |               |               | 1            |                    |                 |                 | 1            |             |             |                      |             | 59          |
| Pratt and Whitney:<br>#Llitary R-985<br>#Llitary R-1340<br>MASP, JR.<br>Airesearch:<br>TPE 331   | 72                 | 30<br>2<br>32 | 40       | 167                 | 77<br>8<br>2<br>108 | 36          | 82             | 280        | 45         | 188                | 36         | 110        | 58                           | 65                 | 71.           | 116           | 55           | 71                 | 74              | 232             | 64           | 115         | 84          | 225                  | 41          | 61          |

TABLE 11 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION

AS A FIRST ACCIDENT TYPE

AERONCA 7 AIRCRAFT

| TOTAL ACCIDENTS - 82  |               | PER CENT<br>OF TOTAL | EXPECTED     |
|---|---------------|----------------------|--------------|
| CAUSE/FACTOR  | FREQUENCY     |                      |              |
| CAUSE/FACTUR  |               |                      | ,            |
| PILOT IN COMMAND  |               |                      |              |
|   | 26            | 31.7                 | 28.1         |
| IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROL                           | LS 17         | 20.7                 | 14.3<br>18.2 |
| MISMANAGEMENT OF FUEL   | 7             | 8.5#                 |              |
| IMPROPER IN-FLIGHT DECISIONS OR PLANNING                                      | <b>4</b><br>- | 4.9                  |              |
| BECAME LOST/DISORIENTED   | 2             | 2 • 4                | 3.2          |
| LACK OF FAMILIARITY WITH AIRCRAFT   | 1             | 1.2<br>1.2           | 1.8<br>.4    |
| SPONTANEOUS-IMPROPER ACTION PHYSICAL-IMPAIRMENT                               | 1             | 1.2                  |              |
| PERSONNEL (MAINTENANCE, SERVICING   |               |                      |              |
| INADEQUATE MAINTENANCE AND INSPECTION   |               | 12.2                 | 9.0          |
| IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL)                                  | 2             |                      |              |
| IMPROPERLY SERVICED ATRORAGET (GROUND CREW)                                   | 1             | 1.2                  | •8           |
| INADEQUATE INSPECTION OF AIRCRAFT (MAINT PERSONNEL                            | ) 1           | 1.2                  | •3           |
| POWERPLANT  |               |                      |              |
| FUEL SYSTEM - CARBURETOR  | 5<br>4        | 6.1                  | 3.1          |
| FUEL SYSTEM - VENTS, DRAINS, TANK CAPS  | 4             | 6.1<br>4.9*          |              |
| ENGINE STRUCTURE - VALVE ASSEMBLIES   | 3             | 3.7                  | 4.2          |
| ENGINE STRUCTURE - MASTER AND CONNECTING RODS                                 | 2             | 2 • 4                | 2.5          |
| ENGINE CONTROLS - COCKPIT -   | ^             | 3 4                  | ^            |
| THROTTLE - POWER LEVER ASSEMBLIES   |               | 2 • 4                |              |
| ENGINE STRUCTURE - CRANKSHAFT   | 1<br>1        | 1 • 2<br>1 • 2       | 1.9<br>2.1   |
| ENGINE STRUCTURE - CYLINDER ASSEMBLY  | 1             | 1.2                  | 1.0          |
| FUEL SYSTEM - LINES AND FITTINGS FUEL SYSTEM - FILTERS, STRAINERS, SCREENS    | 1             | 1•2<br>1•2           |              |
| FUEL SYSTEM - FILTERS, STRAINERS, SCREENS FUEL SYSTEM - FUEL INJECTION SYSTEM | 1             | 1.2                  | •3           |
| PROPELLER AND ACCESSORIES - OTHER   | l             | 1.2*                 |              |
| ***************************************                                       | TIONS         |                      |              |
| MISCELLANEOUS ACTS AND CONDI  | 1 1042        |                      |              |
| FUEL EXHAUSTION   |               | 34.1                 |              |
| FUEL STARVATION   | 11            | 13.4#                | 25.0         |

# TABLE 12

# ACCIDENTS INVOLVING ENGINE FAILURE DR MALFUNCTION AS A FIRST ACCIDENT TYPE BEECH 18, C-45 AIRCRAFT

| TOTAL ACCIDENTS - 32   |             | PER CENT<br>OF TOTAL      |                |
|--|-------------|---------------------------|----------------|
|  | FREQUENCY   | ACCIDENTS                 | PER CENT       |
| CAUSE/FACTOR   | /           | //                        | '/             |
| PILOT IN COMMAND   |             |                           |                |
|  | 11          | 34.4                      | 23.0           |
| MISMANAGEMENT OF FUEL INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING | 10          | 21 2                      | 25.7           |
| IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROL                    | LS 3        | 9.4<br>9.4<br>6.2*<br>3.1 | 10.6           |
| IMPROPER IN-FLIGHT DECISIONS OR PLANNING                               | 3           | 9.4                       | 5.3            |
| IMPROPER IFR OPERATION   | 2           | 6.2*                      | • <del>4</del> |
| BECAME LOST/DISORIENTED  | 1           | 3.1                       | 1.9            |
| INADEQUATE SUPERVISION OF FLIGHT                                       | 1           | 3.1                       | • 8            |
| PHYSICAL-IMPAIRMENT  | 1           | 3.1*                      | • 0            |
| PERSONNEL (MAINTENANCE, SERVICING                                      | , INSPECTIO | N)                        |                |
| INADEQUATE MAINTENANCE AND INSPECTION                                  |             | 3.1                       | 9.1            |
| IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL)                           | ī           | 3.1                       |                |
| POWERPLANT   |             |                           |                |
| ENGINE STRUCTURE - MASTER AND CONNECTING RODS                          | 1           | 3.1                       | 3.8            |
| ENGINE STRUCTURE - CYLINDER ASSEMBLY                                   | i           | 3.1<br>3.1                | 3.0            |
| ENGINE STRUCTURE - PISTON, PISTON RINGS                                | ī           | 3.1<br>3.1                | 1.9            |
| FUEL SYSTEM - PUMPS  | 1           | 3.1                       | .8             |
| FUEL SYSTEM - FUEL INJECTION SYSTEM                                    | 1           | 3.1                       | 1.9            |
| COMPRESSOR ASSEMBLY - OTHER  | 1           | 3.1*                      | • 0            |
| MISCELLANEOUS ACTS AND CONDI   | TIONS       |                           |                |
| FUEL EVIIALIETION  | 11          | 34.4*                     | 15.5           |
| FUEL EXHAUSTION FUEL STARVATION  | 9           | 28.1                      | 26.4           |
| LUCE STANAMITON  | •           |                           |                |

# TABLE 13 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE BEECH 23 AIRCRAFT

|  | FREQUENCY | PER CENT<br>OF TOTAL<br>ACCIDENTS | EXPECTED PER CENT |
|--|-----------|-----------------------------------|-------------------|
| CAUSE/FACTOR   | ,         | •                                 | . ,               |
| PILOT IN COMMAND   |           |                                   |                   |
| LIEUL IN COMMAN  |           | <b>.</b>                          | 17.0              |
| MISMANAGEMENT OF FUEL  | 12        | 30.0*                             | 17•8<br>14•4      |
| TMPPOPER OPERATION OF POWERPLANT + PWRPLANT CONIKUL              | \$ 8      |                                   | 14•4<br>28•4      |
| INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING                 | 4         | 10.0#<br>10.0                     | 28•4<br>9•1       |
| INADECHATE MAINTENANCE AND INSPECTION                            | 4<br>2    | 10.0<br>5.0                       |                   |
| TMPROPER IN-FLIGHT DECISIONS OR PLANNING                         | 2         |                                   |                   |
| LACK OF FAMILIARITY WITH AIRCRAFT                                | 2         | 2.5* .                            |                   |
| DELAYED IN INITIATING GO-AROUND                                  |           | 2.5<br>2.5                        |                   |
| BECAME LOST/DISORIENTED  |           | 2.5*                              |                   |
| FAILED TO USE OR INCORRECTLY USED MISC EQUIPMENT                 | 1         | 2.5                               |                   |
| EXERCISED POOR JUDGMENT  | ī         | 200                               | •0                |
| PERSONNEL (MAINTENANCE, SERVICING,                               | INSPECTIO | ON )                              |                   |
|  |           | 2.5                               | 1.4               |
| IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL)                     | 1         | 2 • 5<br>2 • 5                    | .8                |
| IMPROPERLY SERVICED AIRCRAFT (OWNER-PILOT)                       | T         | 200                               | • 0               |
| POWERPLANT   |           |                                   |                   |
|  | 3         | 7.5                               | 3 • 2             |
| FUEL SYSTEM - CARBURETOR   | 3<br>2    | 5.0                               | 2.0               |
| ENGINE STRUCTURE - CYLINDER ASSEMBLY                             | 2         | 5.0*                              |                   |
| FUEL SYSTEM - PUMPS  | 1         | 2.5*                              | •1                |
| ENGINE STRUCTURE - CRANKCASE                                     | 1         | 2.5                               |                   |
| ENGINE STRUCTURE - VALVE ASSEMBLIES                              | 1         | 2.5                               |                   |
| ENGINE STRUCTURE - OTHER   | •         | = •                               |                   |
| ENGINE CONTROLS - COCKPIT -<br>THROTTLE - POWER LEVER ASSEMBLIES | 1         | 2.5                               | •9                |
| MISCELLANEOUS ACTS AND CONDI                                     | TIONS     |                                   |                   |
|  | 16        | 4() <u>.</u> () *                 | 24.4              |
| FUEL STARVATION  | 5         | 12.5                              | 25.3              |
| FUEL EXHAUSTION  | ,         |                                   | <del>- •</del> -  |

# ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE BEECH 35 AIRCRAFT

| TOTAL ACCIDENTS - 167   |                             | PER CENT               | EXPECTED           |
|---|-----------------------------|------------------------|--------------------|
| TOTAL ACCIDENTS - 167   | FREQUENCY                   | ACC IDENTS             | PER CENT           |
|   |                             |                        |                    |
| PILOT IN COMMAND  |                             |                        |                    |
| MISMANAGEMENT OF FUEL INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING BECAME LOST/DISORIENTED LACK OF FAMILIARITY WITH AIRCRAFT IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROL IMPROPER IN-FLIGHT DECISIONS OR PLANNING   | 76<br>20<br>13<br>11<br>S 8 | 1.8<br>6.6*<br>4.8#    | 3.2<br>1.5<br>15.0 |
| FAILED TO USE OR INCORRECTLY USED MISC EQUIPMENT INADEQUATE SUPERVISION OF FLIGHT IMPROPER STARTING PROCEDURE ATTEMPTED OPERATION WITH KNOWN DEFICIENCIES IN EQUIFAILED TO FOLLOW APPROVED PROCEDURES DIRECTIVES, ET IMPROPER OPERATION OF FLIGHT CONTROLS  | 2                           | 1.2*                   | 1.4<br>0.0         |
| IMPROPER OPERATION OF FLIGHT CONTROLS IMPROPER IFR OPERATION MISJUDGED DISTANCE AND ALTITUDE PHYSICAL IMPAIRMENT  | 1<br>1<br>1<br>1            | .6<br>.6<br>.6*<br>.6* | 0.0<br>0.0<br>0.0  |
|   | î                           | .6*                    | •07                |
| PERSONNEL (MAINTENANCE, SERVICING, INADEQUATE MAINTENANCE AND INSPECTION IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL) INADEQUATE INSPECTION OF AIRCRAFT (MAINT PERSONNEL) IMPROPERLY SERVICED AIRCRAFT (OWNER-PILOT)  |                             |                        | 9.1<br>1.4<br>.3   |
|   |                             |                        |                    |
| FUEL SYSTEM - PUMPS ENGINE STRUCTURE - MASTER AND CONNECTING RODS ENGINE STRUCTURE - PISTON, PISTON RINGS FUEL SYSTEM - LINES AND FITTINGS FUEL SYSTEM - CARBURETOR LUBRICATING SYSTEM - FILTERS, SCREENS ENGINE STRUCTURE - CRANKSHAFT ENGINE STRUCTURE - CYLINDER ASSEMBLY ENGINE STRUCTURE - OTHER ENGINE STRUCTURE - VALVE ASSEMBLIES IGNITION SYSTEM - SPARK PLUG FUEL SYSTEM - SELECTOR VALVES FUEL SYSTEM - RAM AIR ASSEMBLY IGNITION SYSTEM - MAGNETOES IGNITION SYSTEM - DISTRIBUTOR FUEL SYSTEM - FILTERS, STRAINERS, SCREENS |                             |                        |                    |
| FUEL SYSTEM - PUMPS  ENCINE STRUCTURE - MASTER AND CONNECTING BODS  | 7                           | 4.2*                   | .6                 |
| ENGINE STRUCTURE - PISTON, PISTON RINGS   | 4                           | 2.4                    | 2.1                |
| FUEL SYSTEM - LINES AND FITTINGS  | 4                           | 2.4                    | •9                 |
| FUEL SYSTEM - CARBURETOR  | 4                           | 2.4                    | 3.3                |
| ENGINE STRUCTURE - CRANKSHAFT   | 3                           | 4•4*<br>1•8            | 1.9                |
| ENGINE STRUCTURE - CYLINDER ASSEMBLY  | 3                           | 1.8                    | 2.1                |
| ENGINE STRUCTURE - OTHER  | 3                           | 1.8                    | 1.2                |
| ENGINE STRUCTURE - VALVE ASSEMBLIES   | 2                           | 1.2#                   | 4.4                |
| FUEL CACLEM - CELECTUD AVIACE   | 2                           | 1.2                    | 1.5                |
| FUEL SYSTEM - RAM AIR ASSEMBLY  | 2                           | 1.2*                   | • 1                |
| IGNITION SYSTEM - MAGNETOES   | 1                           | •6                     | 2.0                |
| IGNITION SYSTEM - DISTRIBUTOR FUEL SYSTEM - FILTERS, STRAINERS, SCREENS FUEL SYSTEM - PRIMING SYSTEM  | 1                           | •6*                    | • 04               |
| FUEL SYSTEM - FILTERS, STRAINERS, SCREENS   | 1                           |                        | = =                |
| FUEL SYSTEM - PRIMING SYSTEM<br>FUEL SYSTEM - FUEL INJECTION SYSTEM   | 1<br>1                      | ∙6 <b>*</b><br>•6      | • 1<br>• 4         |
| FUEL SYSTEM - VENTS. DRAINS. TANK CAPS  | i                           | •6                     | 1.4                |
| FUEL SYSTEM - OTHER   | ī                           | •6                     | • 2                |
| LUBRICATING SYSTEM - PUMP-PRESSURE  | 1                           | •6                     | • 1                |
| LUBRICATING SYSTEM - PUMP-SCAVENGER   | 1                           | •6*                    | • 04               |
| LUBRICATING SYSTEM - SEALS AND GASKETS EXHAUST SYSTEM - MANIFOLDS   | 1<br>1                      | .6<br>.6*              | •3<br>•04          |
| ENGINE ACCESSORIES - STARTERS   | 1                           | •6*                    | 0.0                |
| ENGINE CONTROLS - COCKPIT - THROTTLE - POWER LEVER ASSEMBLIES   | 1                           | •6                     | 1.0                |
| MISCELLANEOUS ACTS AND CONDIT   | FIONS                       |                        |                    |
| FUEL STARVATION FUEL EXHAUSTION   | 89<br>21                    | 53.3*<br>12.6#         | 23.0<br>25.9       |

TABLE 15 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION
AS A FIRST ACCIDENT TYPE
BOEING A-75 AIRCRAFT

| TOTAL ACCIDENTS - 108                                      |            | PER CENT<br>OF TOTAL |          |
|--|------------|----------------------|----------|
| CAUSE/FACTOR   | FREQUENCY  | ACCIDENTS            | PER CENT |
|  |            |                      |          |
| PILOT IN COMMAND   |            |                      |          |
| INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING           | 35         | 32.4                 | 28.0     |
| IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROL        | S 4        | 3.7#                 |          |
| MISMANAGEMENT OF FUEL                                      | 4          | 3.7#                 | 18.5     |
| IMPROPER OPERATION OF FLIGHT CONTROLS                      | 1          | •9                   | • 2      |
| IMPROPER IN-FLIGHT DECISIONS OR PLANNING                   | 1          | • 9                  | 3.6      |
| LACK OF FAMILIARITY WITH AIRCRAFT                          | 1          | • 9                  | 1.8      |
| PERSONNEL (MAINTENANCE, SERVICING,                         | INSPECTION | N)                   |          |
| INADEQUATE MAINTENANCE AND INSPECTION                      | 6          | <br>5.6              | 9.3      |
| IMPROPERLY SERVICED AIRCRAFT (OWNER-PILOT)                 | 2          | 1.9                  | •8       |
| DOUEDOLANT   |            |                      |          |
| POWERPLANT   |            |                      |          |
| ENGINE STRUCTURE - CYLINDER ASSEMBLY                       | 15         | 13.9*                | 1.6      |
| FUEL SYSTEM - CARBURETOR                                   | 7          | 6.5*                 | 3.1      |
| ENGINE STRUCTURE - MASTER AND CONNECTING RODS              | 6          | 5•6*                 | 2 • 4    |
| ENGINE STRUCTURE - CRANKSHAFT                              | 5          | 4.6*                 | 1.8      |
| ENGINE STRUCTURE - OTHER                                   | 5          | 4.6*                 | 1.1      |
| ENGINE STRUCTURE - BLOWER, IMPELLER ASSEMBLY               | 4          | 3.7≭                 | •3       |
| ENGINE STRUCTURE - VALVE ASSEMBLIES                        | 3          | 2.8                  | 4 • 2    |
| ENGINE STRUCTURE - PISTON, PISTON RINGS                    | 2          | 1.9                  | 2 • 1    |
| FUEL SYSTEM - VENTS, DRAINS, TANK CAPS                     | 2          | 1.9                  | 1.3      |
| POWERPLANT-INSTRUMENTS - FUEL QUANTITY GAUGE               | 2          | 1.9                  | 1.2      |
| IGNITION SYSTEM - SPARK PLUG                               | 1          | • 9                  | 1.5      |
| FUEL SYSTEM - LINES AND FITTINGS                           | 1          | • 9                  | 1.0      |
| FUEL SYSTEM - RAM AIR ASSEMBLY ENGINE CONTROLS - COCKPIT - | 1          | • 9                  | • 1      |
| MIXTURE CONTROL ASSEMBLIES                                 | 1          | 0                    | _        |
| MISCELLANEOUS - FOREIGN OBJECT DAMAGE                      | 1          | • 9                  | • 5      |
| MISCELLANEOUS - DETONATION                                 | 1          | •9*                  | • 0      |
| REDUCTION GEAR ASSEMBLY - OTHER                            | 1          | • 9                  | • 1      |
| KEDOCITON GERK #22EWREA - DIHEK                            | 1          | •9*                  | • 0      |
| MISCELLANEOUS ACTS AND CONDIT                              | IONS       |                      |          |
| FUEL EXHAUSTION  | 32         | 29.6                 | 25.0     |
| FUEL STARVATION  | 8          | 7.4#                 | 25.3     |
|  | =          |                      |          |

# TABLE 16 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE CALLAIR A-9 AIRCRAFT

| TOTAL ACCIDENTS - 36   |              | PER CENT           |          |
|--|--------------|--------------------|----------|
|  |              | OF TOTAL ACCIDENTS | PER CENT |
| CAUSE/FACTOR   | /            | //                 | //       |
|  |              |                    |          |
| PILOT IN COMMAND   |              |                    |          |
| MISMANAGEMENT OF FUEL  | 13           | 36.1*              | 17.7     |
| INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING   | 12           | 33.3               | 28.1     |
| INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROL EXERCISED POOR HUDGMENT | .S 2         | 5.6                | 14.6     |
| EXERCISED POOR JUDGMENT  | 2            | 5.6*               | •6       |
| IMPROPER OPERATION OF FLIGHT CONTROLS  | 1            | 2.3*               |          |
| PERSONNEL (MAINTENANCE, SERVICING,   |              |                    | _        |
| IMPROPERLY SERVICED AIRCRAFT (OWNER-PILOT)   | 3            | 8.3*               |          |
| INADEQUATE MAINTENANCE AND INSPECTION  | 2            | 5.6                | 9.2      |
| . POWERPLANT   |              |                    |          |
| ENGINE STRUCTURE - CRANKSHAFT  | 2            | 5.6                | 1.8      |
| ENGINE STRUCTURE - VALVE ASSEMBLIES  |              | 5.6                | 4.2      |
| ENGINE STRUCTURE - MASTER AND CONNECTING RODS  | 1            | 2.3                | 2.5      |
| ENGINE STRUCTURE - OTHER ENGINE CONTROLS - COCKPIT -   | 1            | 2.3                | 1.2      |
| INDUCTION AIR, PREHEAT CONTROLS  | 1            | 2.3*               | • 2      |
| REDUCTION GEAR ASSEMBLY - GEARS, ACCESSORY DRIVE   |              | 2.3*               |          |
| MISCELLANEOUS ACTS AND CONDIT  | ΓIONS        |                    |          |
| FUEL STARVATION  | <del>-</del> | 41.7*              |          |
| FUEL EXHAUSTION  | 4            | 11.1               | 25.3     |

# TABLE 17 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE CESSNA 120/140 AIRCRAFT

| TOTAL ACCIDENTS - 82   |                            | PER CENT<br>OF TOTAL                   |                              |
|--|----------------------------|--|------------------------------|
| CAUSE/FACTOR   | FREQUENCY                  | ACCIDENTS                              | PER CENT<br>//               |
| PILOT IN COMMAND   |                            |  |                              |
| MISMANAGEMENT OF FUEL  | 17                         | 22.0<br>20.7<br>18.3                   | 17.9                         |
| IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROL FAILED TO FOLLOW APPROVED PROCEDURES DIRECTIVES, ET LACK OF FAMILIARITY WITH AIRCRAFT  | C 2<br>2                   | 2 • 4*<br>2 • 4                        | •5<br>1•7                    |
| IMPROPER IN-FLIGHT DECISIONS OR PLANNING<br>BECAME LOST/DISORIENTED<br>INADEQUATE SUPERVISION OF FLIGHT  | 2<br>1<br>1                | 2 • 4<br>1 • 2•<br>1 • 2               | 3.6<br>3.2<br>1.4            |
| FAILED TO INITIATE GO-AROUND  PERSONNEL (MAINTENANCE, SERVICING,   | 1<br>INSPECTIO             | 1.2*<br>IN)                            | •0                           |
| INADEQUATE MAINTENANCE AND INSPECTION IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL) INADEQUATE INSPECTION OF AIRCRAFT (MAINT PERSONNEL) IMPROPER MAINTENANCE (OWNER PERSONNEL) IMPROPERLY SERVICED AIRCRAFT (OWNER-PILOT) | 7<br>2<br>2<br>1<br>1      | 2 • 4                                  | 9•1<br>1•4<br>•3<br>•7<br>•8 |
| POWERPLANT   |                            |  |                              |
| ENGINE STRUCTURE - VALVE ASSEMBLIES FUEL SYSTEM - CARBURETOR IGNITION SYSTEM - SPARK PLUG ENGINE STRUCTURE - CRANKSHAFT ENGINE STRUCTURE - MASTER AND CONNECTING RODS ENGINE STRUCTURE - PISTON, PISTON RINGS            | 5<br>5<br>3<br>2<br>2<br>2 | 6.1<br>6.1<br>3.7<br>2.4<br>2.4<br>2.4 | 1.8<br>2.5<br>2.1            |
| FUEL SYSTEM - LINES AND FITTINGS ENGINE STRUCTURE - CYLINDER ASSEMBLY IGNITION SYSTEM - IGNITION HARNESS, SHIELDING FUEL SYSTEM - SELECTOR VALVES ENGINE CONTROLS - COCKPIT -  | 2<br>1<br>1                | 1.2*<br>1.2                            | •8                           |
| THROTTLE - POWER LEVER ASSEMBLIES  MISCELLANEOUS ACTS AND CONDITER   | TIONS                      | 1•2                                    | 1.0                          |
| FUEL STARVATION FUEL EXHAUSTION  | 24<br>11                   | 29•3<br>13•4#                          |                              |

# ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE CESSNA 150 AIRCRAFT

| TOTAL ACCIDENTS - 280  | - DEQUENCY   | PER CENT<br>OF TOTAL  |  |
|--|--|---|--|
|  |  | ACCIDENTS   |  |
|  |  |   |  |
| PILOT IN COMMAND   |  |   |  |
| IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROL INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING MISMANAGEMENT OF FUEL BECAME LOST/DISORIENTED IMPROPER IN-FLIGHT DECISIONS OR PLANNING INADEQUATE SUPERVISION OF FLIGHT SPONTANEOUS IMPROPER ACTION CONTINUED VFR FLIGHT INTO ADVERSE WEATHER CONDITION ATTEMPTED OPERATION BEYOND EXPERIENCE/ABILITY LEVEL EXERCISED POOR JUDGMENT ATTEMPTED OPERATION WITH KNOWN DEFICIENCIES IN EQUI DIVERTED ATTENTION FROM OPERATION OF AIRCRAFT LACK OF FAMILIARITY WITH AIRCRAFT DPERATED CARELESSLY INITIATED FLIGHT IN ADVERSE WEATHER CONDITIONS MISUNDERSTANDING OF ORDERS OR INSTRUCTIONS PHYSICAL IMPAIRMENT                                 | 78<br>29<br>23<br>11<br>9<br>7<br>IS 5<br>2              | 33.6* 27.9 10.4# 8.2* 3.9 3.2* 2.5* 1.8 .7 .4 .4 .4* .4*  | 28.2<br>18.7<br>2.6<br>3.5<br>1.2<br>.2<br>1.2<br>.3<br>.6<br>.9<br>.07<br>1.9 |
| PERSONNEL (MAINTENANCE, SERVICING,   | INSPECTIO  | ON )  |  |
| INADEQUATE MAINTENANCE AND INSPECTION IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL)   | 13<br>2  | 4.6#<br>.7  | 9.6<br>1.5   |
| POWERPLANT   |  |   |  |
| ENGINE STRUCTURE - PISTON, PISTON RINGS ENGINE STRUCTURE - VALVE ASSEMBLIES IGNITION SYSTEM - MAGNETOES FUEL SYSTEM - CARBURETOR ENGINE STRUCTURE - MASTER AND CONNECTING RODS ENGINE STRUCTURE - CYLINDER ASSEMBLY IGNITION SYSTEM - SPARK PLUG LUBRICATING SYSTEM - LINES, HOSES, FITTINGS LUBRICATING SYSTEM - OTHER ENGINE STRUCTURE - OTHER ENGINE CONTROLS - COCKPIT - MIXTURE CONTROL ASSEMBLIES ENGINE STRUCTURE - CRANKSHAFT FUEL SYSTEM - LINES AND FITTINGS FUEL SYSTEM - VENTS, DRAINS, TANK CAPS LUBRICATING SYSTEM - MAGNETIC PLUGS ENGINE CONTROLS - COCKPIT - THROTTLE - POWER LEVER ASSEMBLIES INDUCTION AIR, PREHEAT CONTROLS OTHER ENGINE INDICATING EQUIPMENT - TACHOMETER | 9<br>6<br>5<br>4<br>4<br>3<br>3<br>2<br>1<br>1<br>1<br>1 | 3 · 2<br>2 · 1<br>1 · 8<br>1 · 8<br>1 · 4<br>1 · 1<br>1 · 1 *<br>· 7<br>· 7<br>· 4<br>· 4<br>· 4<br>· 4<br>· 4<br>· 4<br>· 4<br>· 4<br>· 4<br>· 4 | 1.9<br>3.4<br>2.6<br>2.1<br>1.6  |
| MISCELLANEOUS ACTS AND CONDI   | TIONS  |   |  |
| FUEL EXHAUSTION FUEL STARVATION  | 98<br>28   | 35.0*<br>10.0#  | 24.2<br>26.1   |

| ACCIDENTS INVOLVING ENGINE | AC A FIRST ACT |
|----------------------------|----------------|
| TABLE 19                   |                |

VOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE CESSNA 170 AIRCRAFT

|    | TOTAL ACCIDENTS - 45   | q<br>O VUENCEGE | PER CENT<br>OF TOTAL EX | EXPECTED<br>PER CENT |
|----|--|-----------------|-------------------------|----------------------|
|    | CAUSE/FACTOR /   |                 |                         | ,                    |
|    | PILOT IN COMMAND   |                 |                         |                      |
|    | T PREPARATION  | ۷-              | 37.8<br>17.8            | 28.0                 |
|    |  | <b>.</b> 4      | . œ (                   | •                    |
|    | BECAME LOST/DISORIENTED IMPROBED INTELLENT DECISIONS OR PLANNING     |                 | 2.5                     | 2 9<br>0 8<br>0 8    |
|    | MENT   | f <del></del> 1 | •                       |                      |
|    | MISUSED OR FAILED TO USE FLAPS                                       | <b>,</b> 4      | 2.2*                    | 0.                   |
|    | PERSONNEL (MAINTENANCE, SERVICING,                                   | INSPECTION)     |                         |                      |
|    | IRCRAFT (OWNER-PILOT)  |                 | 2.2                     | ω.                   |
| 48 | POWERPLANT   |                 |                         |                      |
|    |  |                 | <b>∻</b> 2 • 9          | 2.0                  |
|    | STRUCTURE -  | ~               | <b>6.7</b> *            | 2.1                  |
|    | /E ASSEMBLIES  |                 | 2.9                     | 4.1                  |
|    | JATE MAINTENANCE AND   | <b>0</b> 1      | <b>7. 7</b>             | 9.2                  |
|    | TION SYSTEM - SPAR   |                 | 2.2                     | 1.5                  |
|    | SYSTEM - SELECTOR VALVES   |                 | 7•7                     | • •                  |
|    | FUEL SYSTEM - VENTS, DRAINS, TANK CAPS<br>LUBRICATING SYSTEM - OTHER | <b>=</b> =      | 2.2*                    | ۲.<br>م س            |
|    | ISCELLANEDUS ACTS AND CONDITIO                                       |                 |                         |                      |
|    | FUEL EXHAUSTION  |                 | 20.0                    | 25.3                 |
|    | FUEL STARVATION  | 7               | 15.6                    | 24.8                 |

# TABLE 20

# ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE CESSNA 172 AIRCRAFT

| TOTAL ACCIDENTS - 188  CAUSE/FACTOR   |            | PER CENT<br>OF TOTAL    | EXPECTED       |
|---|------------|-------------------------|----------------|
| CAUSE/FACTOR  | FREQUENCY  | ACCIDENTS               | PER CENT<br>// |
| · PILOT IN COMMAND  |            |                         |                |
| INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING  | 72         | 38.3*                   |                |
| MISMANAGEMENT OF FUEL   | 27         | 14.4                    |                |
| IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROLS IMPROPER IN-FLIGHT DECISIONS OR PLANNING |            | 13.8                    |                |
| BECAME LOST/DISORIENTED   | 22<br>17   | 11.7*<br>9.0*           | 3.0            |
| CONTINUED VER FLIGHT INTO ADVERSE WEATHER CONDITIONS  |            | 3.0*                    | 2•8<br>1•2     |
| ATTEMPTED OPERATION BEYOND EXPERIENCE/ABILITY LEVEL   | ì          | •5                      | •4             |
| DIVERTED ATTENTION FROM OPERATION OF AIRCRAFT   | 1          | • 5                     | • 07           |
| FAILED TO FOLLOW APPROVED PROCEDURES DIRECTIVES, ET( IMPROPER OPERATION OF FLIGHT CONTROLS    | 1          | <b>.</b> 5              | •6             |
| INADEQUATE SUPERVISION OF FLIGHT  | 1          | • 5                     | • 2            |
| LACK OF FAMILIARITY WITH AIRCRAFT   | 1          | •5<br>•5                | 1.4<br>1.8     |
| EXERCISED POOR JUDGMENT   | i          | •5<br>•5                | •6             |
| MISJUDGED SPEED   | ī          | •5*                     | • 0            |
| PERSONNEL (MAINTENANCE, SERVICING,  | INSPECTION | ١)                      |                |
| INADEQUATE MAINTENANCE AND INSPECTION   | 14         | 7.4                     | 9.2            |
| IMPROPERLY SERVICED AIRCRAFT (OWNER-PILOT)  | 2          | 1.1                     | •8             |
| POWERPLANT  |            |                         |                |
| IGNITION SYSTEM - SPARK PLUG  | 4          | 2 • 1                   | 1.5            |
| MOTING STRUCTORE - AMERIC W22ENDFIEZ  | 3          | 1.6                     | 4 • 4          |
| GNITION SYSTEM - MAGNETOES  | 3          | 1 4                     | 1 0            |
| UEL SYSTEM - CARBURETOR   | 3          | 1.6                     | 3.3            |
| NGINE STRUCTURE - MASTER AND CONNECTING RODS NGINE STRUCTURE - PISTON, PISTON RINGS           | 2          | 1.1                     | 2.6            |
| UEL SYSTEM - SELECTOR VALVES  | 2          | 1.1                     | 2 • 2          |
| UEL SYSTEM - VENTS, DRAINS, TANK CAPS   | 2<br>2     | $1 \cdot 1$ $1 \cdot 1$ | •7<br>1•4      |
| UBRICATING SYSTEM - LINES, HOSES, FITTINGS  | 2          | 1•1                     | •3             |
| NGINE STRUCTURE - OTHER   | ï          | •5                      | 1.2            |
| GNITION SYSTEM - SWITCHES   | 1          | •5                      | • 07           |
| UEL SYSTEM - LINES AND FITTINGS UEL SYSTEM - FILTERS, STRAINERS, SCREENS                      | l          |                         | 1.0            |
| UBRICATING SYSTEM - VALVES  | 1<br>1     | •5<br>•5*               | • 5            |
| UBRICATING SYSTEM - FILTERS, SCREENS<br>NGINE CONTROLS COCKPIT -                              | 1          | •5                      | •03<br>•2      |
| THROTTLE - POWER LEVER ASSEMBLIES   | 1          | • <b>5</b>              | 1.0            |
| MIXTURE CONTROL ASSEMBLIES INDUCTION AIR, PREHEAT CONTROLS                                    | 1          | • 5                     | • 5            |
| OWERPLANT-INSTRUMENTS - FUEL QUANTITY GAUGE   | 1<br>1     | •5<br>•5                | •2<br>1•3      |
| MISCELLANEOUS ACTS AND CONDITI  | ONS        |                         |                |
| UEL EXHAUSTION  | 91         | 48.4*                   | 23.6           |
| UEL STARVATION  | 25         | 13.3#                   | 25.4           |

# TABLE 21

# ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE CESSNA 177 AIRCRAFT

| TOTAL ACCIDENTS - 36  |  | CENT<br>OTAL<br>ENTS | EXPECTED<br>PER CENT |
|---|--|----------------------|----------------------|
| CAUSE/FACTOR  | //                                       | /                    | /                    |
| LOT IN COM  |  |                      |                      |
| INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING 22   |  | . L *                | 27.8                 |
| + PWRPLANT CONTROLS   |  | \$<br>0,0            | 3.1                  |
| BECAME LOST/DISORIENTED CONTINUED VFR FLIGHT INTO ADVERSE WEATHER CONDITIONS INADEQUATE SUPERVISION OF FLIGHT |  | 2 8 8 8              | 1 H H                |
| POWERPLANT  |  |                      |                      |
|   | 11 5 2 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 | 11.1*<br>5.6*<br>2.8 | 1.1                  |
| FUEL SYSTEM - CARBURETOR<br>LUBRICATING SYSTEM - LINES, HOSES, FITTINGS                                       | ]  | *<br>0 00            | 1 m                  |
| MISCELLANEOUS ACTS AND CONDITIONS   |  |                      |                      |
| 2   | 63                                       | *6•                  | 24.7<br>24.8         |

# TABLE 22 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE CESSNA 182 AIRCRAFT

| TOTAL ACCIDENTS - 110  |   | PER CENT  | EXPECTED   |
|--|---|---|--|
| CAUSE/FACTOR   | FREQUENCY                                   | ACCIDENTS   | PER CENT   |
| · PILOT IN COMMAND   |   |   |  |
| INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING MISMANAGEMENT OF FUEL IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROL IMPROPER IN-FLIGHT DECISIONS OR PLANNING ATTEMPTED OPERATION WITH KNOWN DEFICIENCIES IN EQUI  | 6   | 30.9<br>17.3<br>10.9<br>5.5                               | 28.1<br>18.0<br>14.6<br>3.5  |
| BECAME LOST/DISORIENTED EXERCISED POOR JUDGMENT  | 1<br>1                                      | 2•7*<br>•9<br>•9  | •8<br>3•2<br>•6  |
| PERSONNEL (MAINTENANCE, SERVICING,   | INSPECTION                                  | 1)  |  |
| INADEQUATE MAINTENANCE AND INSPECTION IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL) IMPROPER MAINTENANCE(OWNER PERSONNEL) IMPROPERLY SERVICED AIRCRAFT (GROUND CREW)  | _   | 12.7<br>.9<br>.9  | 9.0<br>1.5<br>.7   |
| POWERPLANT   |   |   |  |
| FUEL SYSTEM - CARBURETOR ENGINE STRUCTURE - VALVE ASSEMBLIES FUEL SYSTEM - TANKS FUEL SYSTEM - VENTS, DRAINS, TANK CAPS ENGINE STRUCTURE - CRANKSHAFT IGNITION SYSTEM - MAGNETOES ENGINE STRUCTURE - CYLINDER ASSEMBLY ENGINE STRUCTURE - DISTON, PISTON RINGS ENGINE STRUCTURE - OTHER IGNITION SYSTEM - SPARK PLUG FUEL SYSTEM - LINES AND FITTINGS FUEL SYSTEM - LINES AND FITTINGS FUEL SYSTEM - OTHER LUBRICATING SYSTEM - LINES, HOSES, FITTINGS LUBRICATING SYSTEM - VALVES LUBRICATING SYSTEM - OTHER ENGINE CONTROLS - COCKPIT - THROTTLE - POWER LEVER ASSEMBLIES INDUCTION AIR, PREHEAT CONTROLS POWERPLANT-INSTRUMENTS - FUEL QUANTITY GAUGE | 9 7 3 3 2 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | 8.2* 6.4 2.7 2.7 1.8 1.8 .9 .9 .9 .9 .9 .9 .9 .9 .9 .9 .9 | 3.0<br>4.1<br>.3<br>1.3<br>1.9<br>1.9<br>2.1<br>2.2<br>1.5<br>1.0<br>.1<br>.2<br>.3<br>.03<br>.3 |
| MISCELLANEOUS ACTS AND CONDITE   | ONS -                                       |   |  |
| FUEL EXHAUSTION<br>FUEL STARVATION   | 46<br>16                                    | 41.8*<br>14.5#  | 24.5<br>25.0   |

# TABLE 23 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE CESSNA 210 AIRCRAFT

| TOTAL ACCIDENTS - 58   | FREQUENCY   | PER CENT<br>OF TOTAL E<br>ACCIDENTS F                          | EXPECTED<br>PER CENT   |
|--|---|--|--|
| CAUSE/FACTOR   |   |  |  |
| PILOT IN COMMAND   |   |  |  |
| MISMANAGEMENT OF FUEL INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROLS LACK OF FAMILIARITY WITH AIRCRAFT BECAME LOST/DISORIENTED IMPROPER IN-FLIGHT DECISIONS OR PLANNING ATTEMPTED OPERATION WITH KNOWN DEFICIENCIES IN EQUIP ATTEMPTED OPERATION BEYOND EXPER/ABILITY LEVEL CONTINUED VFR FLIGHT INTO ADVERSE WEATHER CONDITIONS FAILED TO USE OR INCORRECTLY USED MISC EQUIPMENT SELECTED UNSUITABLE TERRAIN   | 10  | 22.4<br>17.2<br>6.9<br>5.2*<br>3.4<br>3.4<br>1.7<br>1.7<br>1.7 | 28.4   |
| PERSONNEL (MAINTENANCE, SERVICING,   | INSPECTIO   | ON )   |  |
| INADEQUATE MAINTENANCE AND INSPECTION IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL) INADEQUATE INSPECTION OF AIRCRAFT (MAINT PERSONNEL)   | 6<br>1<br>1   | 10.3<br>1.7<br>1.7   | 9•1<br>1•5<br>•3   |
| DOWERDIANT   |   |  |  |
| ENGINE STRUCTURE - PISTON, PISTON RINGS ENGINE STRUCTURE - CYLINDER ASSEMBLY ENGINE STRUCTURE - CRANKSHAFT ENGINE STRUCTURE - MASTER AND CONNECTING RODS IGNITION SYSTEM - SPARK PLUG FUEL SYSTEM - VENTS, DRAINS, TANK CAPS POWERPLANT-INSTRUMENTS - FUEL QUANTITY GAUGE ENGINE STRUCTURE - VALVE ASSEMBLIES ENGINE STRUCTURE - OTHER IGNITION SYSTEM - IGNITION HARNESS, SHIELDING IGNITION SYSTEM - OTHER FUEL SYSTEM - TANKS FUEL SYSTEM - SELECTOR VALVES FUEL SYSTEM - PUMPS FUEL SYSTEM - PUMPS FUEL SYSTEM - RAM AIR ASSEMBLY LUBRICATING SYSTEM - FILTERS, SCREENS PROPELLER AND ACCESSORIES - BLADES EXHAUST SYSTEM - GASKETS EXHAUST SYSTEM - STACKS ENGINE CONTROLS - COCKPIT - MIXTURE CONTROL ASSEMBLIES | 2<br>2<br>2<br>2<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1 | 3.4<br>3.4<br>3.4<br>3.4<br>1.7<br>1.7<br>1.7*<br>1.7*<br>1.7  | 1.8<br>2.5<br>1.5<br>1.3<br>1.2<br>4.2<br>1.2<br>.2<br>.03<br>.4<br>.7 |
| MISCELLANEOUS ACTS A'ND CONDI  | TIONS   |  | <b>.</b>   |
| FUEL STARVATION FUEL EXHAUSTION  | 20<br>10  | 34•5<br>17•2   | 24.5<br>25.3   |

TABLE 24 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION
AS A FIRST ACCIDENT TYPE
FORNEY 415 AIRCRAFT

| TOTAL ACCIDENTS - 65   |  | PER CENT                              |  |
|--|--|---------------------------------------|--|
| CAUSE/FACTOR ,   | FREQUENCY                                      | ACCIDENTS                             | EXPECTED<br>PER CENT<br>//                         |
| PILOT IN COMMAND   |  |                                       |  |
| INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROLS MISMANAGEMENT OF FUEL BECAME LOST/DISORIENTED ATTEMPTED OPERATION WITH KNOWN DEFICIENCIES IN EQUIPATED TO USE OR INCORRECTLY USED MISC EQUIPMENT INADEQUATE SUPERVISION OF FLIGHT  PERSONNEL (MAINTENANCE, SERVICING,                              | 2<br>2<br>1<br>1<br>1                          | 18.5<br>6.2#<br>3.1<br>1.5<br>1.5     | 14.4<br>18.2<br>3.2<br>.8                          |
| INADEQUATE MAINTENANCE AND INSPECTION IMPROPER MAINTENANCE (OWNER PERSONNEL) INADEQUATE INSPECTION OF AIRCRAFT (MAINT PERSONNEL)   |  | 6.2<br>1.5<br>1.5                     | 9•2<br>•7<br>•3                                    |
| POWERPLANT   |  |                                       |  |
| FUEL SYSTEM - PUMPS ENGINE STRUCTURE - CRANKSHAFT ENGINE STRUCTURE - MASTER AND CONNECTING RODS ENGINE STRUCTURE - VALVE ASSEMBLIES FUEL SYSTEM - CARBURETOR ENGINE STRUCTURE - OTHER IGNITION SYSTEM - MAGNETOES FUEL SYSTEM - LINES AND FITTINGS FUEL SYSTEM - OTHER ENGINE CONTROLS - COCKPIT - THROTTLE - POWER LEVER ASSEMBLIES POWER LEVER - CABLE | 4<br>2<br>2<br>2<br>2<br>1<br>1<br>1<br>1<br>1 | 6.2* 3.1 3.1 3.1 1.5 1.5 1.5 1.5 1.5* | .7<br>1.8<br>2.5<br>4.2<br>3.2<br>1.2<br>1.9<br>.9 |
| MISCELLANEOUS ACTS AND CONDITI   | ONS  |                                       |  |
| FUEL STARVATION FUEL EXHAUSTION  | 18<br>4  | 27.7<br>6.2#                          | 24.6<br>25.6                                       |

# TABLE 25 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE LUSCOMBE 8 AIRCRAFT

| TOTAL ACCIDENTS - 71   |           | PER CENT<br>OF TOTAL | EXPECTED   |
|--|-----------|----------------------|------------|
|  | FREQUENCY |                      |            |
|  |           |                      |            |
| PILOT IN COMMAND   |           |                      |            |
| INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING                   | 19        | 26.8                 | 28.2       |
| IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROL                | S 14      | 19.7                 | 14.3       |
| FAILED TO FOLLOW APPROVED PROCEDURES DIRECTIVES, ET                | C 6       | 8•4*                 | • 4        |
| MISMANAGEMENT OF FUEL  | 5         | 7.0#                 |            |
| IMPROPER IN-FLIGHT DECISIONS OR PLANNING                           | 2         | 2.8                  | 3.6        |
| EXERCISED POOR JUDGMENT  | 2         | 2.9*                 | •6         |
| ATTEMPTED OPERATION BEYOND EXPERIENCE/ABILITY LEVEL                |           | 1 • 4<br>1 • 4       | •3         |
| CONTINUED VFR FLIGHT INTO ADVERSE WEATHER CONDITION                |           |                      |            |
| FAILED TO USE OR INCORRECTLY USED MISC EQUIPMENT                   | 1         | 1 • 4                | • 2        |
| INADEQUATE SUPERVISION OF FLIGHT LACK OF FAMILIARITY WITH AIRCRAFT | 1<br>1    | 1.4<br>1.4           | 1.4<br>1.8 |
| EACK OF TAMILIANITY WITH AIRCRAFT                                  |           | 1.4                  | 1.0        |
| PERSONNEL (MAINTENANCE, SERVICING,                                 | INSPECTIO | N )<br>              |            |
| INADEQUATE MAINTENANCE AND INSPECTION                              | 12        | 16.9*                | 8.9        |
| IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL)                       | 2         | 2.8                  | 1.4        |
| IMPROPER MAINTENANCE (OWNER PERSONNEL)                             | 1         | 1.4                  | •7         |
| POWERPLANT   |           |                      |            |
| FUEL SYSTEM - CARBURETOR   | 5         | 7.0                  | 3.1        |
| ENGINE STRUCTURE - CRANKSHAFT                                      | 3         | 4.2                  | 1.8        |
| IGNITION SYSTEM - MAGNETOES  | 2         | 2.8                  | 1.9        |
| FUEL SYSTEM - LINES AND FITTINGS                                   | 2         | 2.8                  | •9         |
| FUEL SYSTEM - FILTERS, STRAINERS, SCREENS                          | 2         | 2.8*                 | • 5        |
| FUEL SYSTEM - VENTS, DRAINS, TANK CAPS                             | 2         | 2.8                  | 1.3        |
| ENGINE CONTROLS - COCKPIT -  | -         | 2.00                 | 143        |
| THROTTLE - POWER LEVER ASSEMBLIES                                  | 2         | 2.8                  | • 9        |
| ENGINE STRUCTURE - CYLINDER ASSEMBLY                               | ĩ         | 1.4                  | 2.1        |
| ENGINE STRUCTURE - VALVE ASSEMBLIES                                | ī         | 1.4                  | 4.2        |
| ENGINE STRUCTURE - OTHER   | 1         | 1.4                  | 1.2        |
| FUEL SYSTEM - SELECTOR VALVES                                      | 1         | 1.4                  | •7         |
| EXHAUST SYSTEM - BAFFLES   | 1         | 1.4*                 | • 07       |
| MISCFLLANEOUS - DETUNATION   | 1         | 1.4*                 | • 1        |
| MISCELLANEOUS ACTS AND CONDIT                                      | IONS      |                      |            |
| FUEL EXHAUSTION  | 14        | 19.7                 | 25.3       |
| FUEL STARVATION  | 13        | 18.3                 |            |
| · · · · · · · · · · · · · · · · ·                                  |           |                      | - · • ··   |

# TABLE 26 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE MOONEY M20 AIRCRAFT

| TOTAL ACCIDENTS - 116  |           | PER CENT             |              |
|--|-----------|----------------------|--------------|
|  | EREQUENCY | OF TOTAL ' ACCIDENTS |              |
| CAUSE/FACTOR   | /         | .//                  | '/           |
|  |           |                      |              |
| PILOT IN COMMAND   |           |                      |              |
| INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING   | 34        | 29.3                 | 28.1         |
| MISMANAGEMENT OF FUEL  | 26        | 22•4<br>11•2*        | 17.8<br>3.2  |
| IMPROPER IN-FLIGHT DECISIONS OR PLANNING IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROL | .S 11     | 9.5                  | 3•2<br>14•7  |
| BECAME LOST/DISORIENTED  | 5         | 4.3                  | 3.1          |
| CONTINUED VER FLIGHT INTO ADVERSE WEATHER CONDITION  | IS 5      | 4.3*                 | 1.2          |
| LACK OF FAMILIARITY WITH AIRCRAFT  | 3         | 2.6                  | 1.7          |
| ATTEMPTED OPERATION WITH KNOWN DEFICIENCIES IN EQUI  | iP 2      | 1.7<br>1.7           | •8<br>1•3    |
| INADEQUATE SUPERVISION OF FLIGHT   | 2<br>1    | .9                   | •2           |
| PHYSICAL IMPAIRMENT  | 1         | • /                  | • -          |
| PERSONNEL (MAINTENANCE, SERVICING,   |           | DN )                 |              |
| INADEQUATE MAINTENANCE AND INSPECTION  | 6         | 5.2                  | 9.3          |
| IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL)   | 1         | •9                   | 1.5          |
| IMPROPER MAINTENANCE (OWNER PERSONNEL)   | 1         | • 9                  | • 7          |
| IMPROPERLY SERVICED AIRCRAFT (OWNER-PILOT)   | 1         | • 9                  | •8           |
| POWERPLANT   |           |                      |              |
| ENGINE STRUCTURE - MASTER AND CONNECTING RODS  | 7         | 6.0*                 | 2.3          |
| ENGINE STRUCTURE - VALVE ASSEMBLIES  | 3         | 2.6                  | 4 • 2        |
| ENGINE STRUCTURE - CYLINDER ASSEMBLY   | 2         | 1.7                  | 2•1<br>3•3   |
| FUEL SYSTEM - CARBURETOR   | 2<br>2    | 1.7<br>1.7           | 1.3          |
| FUEL SYSTEM - VENTS, DRAINS, TANK CAPS POWERPLANT-INSTRUMENTS - FUEL QUANTITY GAUGE          | 2         | 1.7                  | 1.2          |
| ENGINE STRUCTURE - CRANKSHAFT  | ī         | •9                   | 1.9          |
| ENGINE STRUCTURE - OTHER   | 1         | • 9                  | 1.2          |
| IGNITION SYSTEM - MAGNETOES  | 1         | • 9                  | 2.0          |
| FUEL SYSTEM - LINES AND FITTINGS   | 1         | •9                   | 1.0          |
| FUEL SYSTEM - FUEL INJECTION SYSTEM  | 1         | •9<br>•9             | •3<br>•2     |
| FUEL SYSTEM - OTHER LUBRICATING SYSTEM - LINES, HOSES, FITTINGS                              | 1         | • 9                  | • 3          |
| LUBRICATING SYSTEM - DIL COOLERS   | î         | •9*                  | • 1          |
| LUBRICATING SYSTEM - SEALS AND GASKETS   | 1         | • 9                  | • 3          |
| LUBRICATING SYSTEM - OTHER   | 1         | • 9                  | •3           |
| ENGINE CONTROLS - COCKPIT -  |           | 0                    | 1 0          |
| THROTTLE - POWER LEVER ASSEMBLIES  | 1<br>1    | •9<br>•9             | 1.0<br>.2    |
| INDUCTION AIR, PREHEAT CONTROLS  | _         | • 7                  | • 4          |
| MISCELLAMEOUS ACTS AND CONDI   | TIONS     |                      |              |
| FUEL STARVATION  | 37        | 31•9<br>29•3         | 24•4<br>25•0 |
| FUEL EXHAUSTION  | 34        | 27 • J               | 29.0         |

# TABLE 27 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE NAVION L-17 AIRCRAFT

| TOTAL ACCIDENTS - 55  CAUSE/FACTOR  | FREQUENCY  | PER CENT<br>OF TOTAL<br>ACCIDENTS<br>//             | PER CENT  |
|---|--|---|---|
|   |  |   |   |
| PILOT IN COMMAND  |  |   |   |
| INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING MISMANAGEMENT OF FUEL IMPROPER IN-FLIGHT DECISIONS OR PLANNING BECAME LOST/DISORIENTED IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROL LACK OF FAMILIARITY WITH AIRCRAFT MISJUDGED SPEED AND ALTITUDE PERSONNEL (MAINTENANCE, SERVICING,   | 1  | 25.5<br>14.5<br>5.5<br>3.6<br>3.6#<br>1.8           | 18.0<br>3.5<br>3.1<br>14.7<br>1.8   |
| INADEQUATE MAINTENANCE AND INSPECTION IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL) IMPROPER MAINTENANCE (OWNER PERSONNEL) IMPROPERLY SERVICED AIRCRAFT (GROUND CREW) INADEQUATE INSPECTION OF AIRCRAFT (OWNER-PILOT) POWERPLANT   | 7<br>1<br>1  | 12.7<br>1.8<br>1.8<br>1.8                           | 1.5<br>.7<br>.2   |
| ENGINE STRUCTURE - PISTON, PISTON RINGS ENGINE STRUCTURE - CRANKSHAFT ENGINE STRUCTURE - CYLINDER ASSEMBLY POWERPLANT-INSTRUMENTS - FUEL QUANTITY GAUGE ENGINE STRUCTURE - MASTER AND CONNECTING RODS ENGINE STRUCTURE - VALVE ASSEMBLIES FUEL SYSTEM - LINES AND FITTINGS IGNITION SYSTEM - MAGNETOES IGNITION SYSTEM - SPARK PLUG FUEL SYSTEM - SELECTOR VALVES FUEL SYSTEM - FILTERS, STRAINERS, SCREENS FUEL SYSTEM - CARBURETOR FUEL SYSTEM - PUMPS FUEL SYSTEM - VENTS, DRAINS, TANK CAPS PROPELLER AND ACCESSORIES HYDRAULIC PITCH CONTROL MECHANISM EXHAUST SYSTEM - MUFFLERS | 4<br>3<br>3<br>2<br>2<br>2<br>1<br>1<br>1<br>1<br>1<br>1 | 7.3* 5.5* 5.5 5.5* 3.6 3.6* 1.8 1.8 1.8 1.8 1.8 1.8 | 1.8<br>2.0<br>1.2<br>2.5<br>4.2<br>.9<br>1.9<br>1.5<br>.4<br>.7<br>.5<br>3.2<br>.8<br>1.4 |
| MISCELLANEOUS ACTS AND CONDI  | 17 12  | 30.9<br>21.8  | 25•1<br>24•7  |

# TABLE 28 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE PIPER J-3 AIRCRAFT

| TOTAL ACCIDENTS - 71   |              | PER CENT       | EXPECTED   |
|--|--------------|----------------|------------|
|  |              | ACCIDENTS      | PER CENT   |
| CAUSE/FACTOR   | /            | /              | //         |
| <del></del>  |              |                |            |
| PILOT IN COMMAND   |              |                |            |
| INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING                       | 20           | 28.2           | 28.2       |
| IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROL                    | S 17         | 23.9*          | 14.2       |
| MISMANAGEMENT OF FUEL  | 3            | 4.2#           |            |
| ATTEMPTED OPERATION WITH KNOWN DEFICIENCIES IN EQUI                    |              | 2 • 8          | •8         |
| ATTEMPTED OPERATION BEYOND EXPER/ABILITY LEVEL BECAME LOST/DISORIENTED | 1<br>1       | 1.4            | •3         |
| CONTINUED VFR FLIGHT INTO ADVERSE WEATHER CONDITION                    | <del>-</del> | 1 • 4<br>1 • 4 | 3.2        |
| FAILED TO OBTAIN/MAINTAIN FLYING SPEED                                 | 3 I          | 1.4*           | 1.3<br>.03 |
| IMPROPER IN-FLIGHT DECISIONS OR PLANNING                               | 1            | 1.4            | 3.6        |
| INADEQUATE SUPERVISION OF FLIGHT                                       | 1            | 1.4            | 1.4        |
| LACK OF FAMILIARITY WITH AIRCRAFT                                      | i            | 1.4            | 1.8        |
| EXERCISED POOR JUDGMENT  | 1            | 1.4            | •6         |
| SPONTANEOUS IMPROPER ACTION  | i            | 1.4            | •4         |
| FAILED TO ABORT TAKEOFF  | î            | 1.4*           |            |
|  |              |                |            |
| PERSONNEL (MAINTENANCE, SERVICING,                                     | INSPECTIO    | N )            |            |
| INADEQUATE MAINTENANCE AND INSPECTION                                  | 11           | 15.5           | 9.0        |
| IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL)                           | 1            | 1 • 4<br>1 • 4 | 1.5        |
| IMPROPERLY SERVICED AIRCRAFT (OWNER-PILOT)                             | 1            | 1 • 4          | •8         |
| POWERPLANT   |              |                |            |
| ENGINE STRUCTURE - VALVE ASSEMBLIES                                    | 5<br>3       | 7.0            | 4.1        |
| ENGINE STRUCTURE - PISTON, PISTON RINGS                                | 3            | 4.2            |            |
| IGNITION SYSTEM - MAGNETOES  | 3            | 4.2            | 1.9        |
| FUEL SYSTEM - CARBURETOR   | 3            | 4 • 2          |            |
| FUEL SYSTEM - PRIMING SYSTEM   | 2            | 2.8*           | •07        |
| ENGINE STRUCTURE - MASTER AND CONNECTING RODS                          | 1            | 1.4            | 2.5        |
| ENGINE STRUCTURE - OTHER   | 1            | 1.4            | 1.2        |
| FUEL SYSTEM - LINES AND FITTINGS                                       | 1            | 1.4            | 1.0        |
| LUBRICATING SYSTEM - PUMP-PRESSURE                                     | 1            | 1.4*           | . • 1      |
| ENGINE CONTROLS - COCKPIT -  |              |                |            |
| THROTTLE - POWER LEVER ASSEMBLIES                                      | 1            | 1 • 4          | 1.0        |
| MISCELLANEOUS ACTS AND CONDIT  | IONS         |                |            |
| FUCL CVIIAUCTION   |              |                | 27.2       |
| FUEL EXHAUSTION  | 13           | 18.3           |            |
| FUEL STARVATION  | 13           | 18.3           | 24.8       |

TABLE 29 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION
AS A FIRST ACCIDENT TYPE
PIPER PA-18 AIRCRAFT

| TOTAL ACCIDENTS - 74                                |            | PER CENT       |            |
|---|------------|----------------|------------|
|   | EDE OUENOV |                | EXPECTED   |
| CAUSE/FACTOR  |            | ACCIDENTS      |            |
|   | ,          | ,              | ,,         |
|   |            |                |            |
| PILOT IN COMMAND                                    |            |                |            |
| MISMANAGEMENT OF FUEL                               | 20         | 27.0*          | 17.7       |
| INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING    | 12         | 16.2#          | 28.5       |
| IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROL | S 11       | 14.9           | 14.5       |
| LACK OF FAMILIARITY WITH AIRCRAFT                   | 3          | 4.1            | 1.7        |
| INADEQUATE SUPERVISION OF FLIGHT                    | 1          | 1 • 4          | 1.4        |
| PERSONNEL (MAINTENANCE, SERVICING,                  | INSPECTIO  | NI )           |            |
|   |            | <del></del>    |            |
| IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL)        | 1          | 1.4            | 1.5        |
| INADEQUATE MAINTENANCE AND INSPECTION               | 7          | 9.5            | 9.1        |
| IMPROPER MAINTENANCE (OWNER PERSONNEL)              | 2          | 2.7*           | •6         |
| IMPROPERLY SERVICED AIRCRAFT (OWNER-PILOT)          | 1          | 1.4            | •8         |
| OTHER   | 1          | 1.4*           | •03        |
| POWERPLANT  |            |                |            |
|   |            |                |            |
| ENGINE STRUCTURE - VALVE ASSEMBLIES                 | 10         | 13.5*          | 3.9        |
| FUEL SYSTEM - CARBURETOR                            | 3          | 4.1            | 3.2        |
| ENGINE STRUCTURE - MASTER AND CONNECTING RODS       | 2          | 2.7            | 2.5        |
| IGNITION SYSTEM - MAGNETOES                         | 2          | 2 • 7          | 1.9        |
| IGNITION SYSTEM - SPARK PLUG                        | 2          | 2.7            | 1.5        |
| FUEL SYSTEM - SELECTOR VALVES                       | 2          | 2.7            | •7         |
| ENGINE STRUCTURE - CRANKSHAFT                       | 1          | 1.4            | 1.9        |
| ENGINE STRUCTURE - PISTON, PISTON RINGS             | 1          | 1.4            | 2.1        |
| ENGINE STRUCTURE - OTHER                            | 1          | 1.4            | 1.2        |
| IGNITION SYSTEM - IGNITION HARNESS, SHIELDING       | ī          | 1.4*           | • 2        |
| LUBRICATING SYSTEM - SEALS AND GASKETS              | ī          | 1.4            | •3         |
| EXHAUST SYSTEM - MUFFLERS                           | ī          | 1.4            | •5         |
| ENGINE CONTROLS - COCKPIT -                         | 1          | 1 • **         | • 5        |
| MIXTURE CONTROL ASSEMBLIES                          | 1          | 1.4            | •5         |
| POWERPLANT-INSTRUMENTS - FUEL QUANTITY GAUGE        | i          |                |            |
| POWERPLANT-INSTRUMENTS (FUEL QUANTITY GUAGE         | 1          | 1 • 4<br>1 • 4 | 1.3<br>1.3 |
|   | -          | 1.             | 1.0        |
| MISCELLANEOUS ACTS AND CONDIT                       | IONS       |                |            |
| FUEL STARVATION                                     | 23         | 31.1           | 24.5       |
| FUEL EXHAUSTION                                     | 4          | 5.4#           | 25.7       |

# ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE PIPER PA-22 AIRCRAFT

| TOTAL ACCIDENTS - 232  | #0.F0U.FNE.V |              | EXPECTED     |
|--|--------------|--------------|--------------|
| CAUSE/FACTOR   |              | ACCIDENTS    |              |
| PILOT IN COMMAND   |              |              |              |
| INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING   | 65           | 28.0         | 28.2         |
| MISMANAGEMENT OF FUEL  | 60           | 25.9*        | 17.3         |
| IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROL  | .S 22<br>7   | 9•5#<br>3•0  | 14•9<br>3•2  |
| BECAME LOST/DISORIENTED<br>LACK OF FAMILIARITY WITH AIRCRAFT                                     | 7            | 3.0          | 1.7          |
| IMPROPER IN-FLIGHT DECISIONS OR PLANNING   | 4            | 1.7          | 3.7          |
| CONTINUED VFR FLIGHT INTO ADVERSE WEATHER CONDITION EXERCISED POOR JUDGMENT                      | NS 3<br>3    | 1.3<br>1.3   | 1.3<br>.6    |
| ATTEMPTED OPERATION WITH KNOWN DEFICIENCIES IN EQUI  |              | • 9          | <b>.</b> 8   |
| FAILED TO FOLLOW APPROVED PROCEDURES DIRECTIVES, E   | rc 2         | •9           | •5           |
| INADEQUATE SUPERVISION OF FLIGHT IMPROPER OPERATION OF FLIGHT CONTROLS                           | 2<br>1       | • 9<br>• 4   | 1 • 4<br>• 2 |
| PHYSICAL IMPAIRMENT  | 1            | . 4          | • 3          |
| SPATIAL DISORIENTATION   | 1            | .4*          | •04          |
| PSYCHOLOGICAL CONDITION  | 1            | • 4 *        | • 04         |
| PERSONNEL (MAINTENANCE, SERVICING  | , INSPECTIO  | IN )         |              |
| INADEQUATE MAINTENANCE AND INSPECTION  | 20           | 8.6          | 9.2          |
| IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL) INADEQUATE INSPECTION OF AIRCRAFT (MAINT PERSONNEL) | 3<br>} 2     | 1.3          | 1.5<br>.3    |
| IMPROPERLY SERVICED AIRCRAFT (OWNER-PILOT)   | , <u>,</u>   | 4            | .8           |
| INADEQUATE INSPECTION OF AIRCRAFT (OWNER-PILOT)  | 1            | •4           | • 1          |
| POWERPLANT   |              |              |              |
| ENGINE STRUCTURE - VALVE ASSEMBLIES  | 18           | 7.8*         |              |
| ENGINE STRUCTURE - PISTON, PISTON RINGS  | 6<br>4       | 2.6<br>1.7   | 2•1<br>2•1   |
| ENGINE STRUCTURE - CYLINDER ASSEMBLY IGNITION SYSTEM - MAGNETOES                                 | 4            | 1.7          | 1.9          |
| IGNITION SYSTEM - SPARK PLUG   | 4            | 1.7          | 1.5          |
| FUEL SYSTEM - CARBURETOR   | 4            | 1.7          | 3.3          |
| LUBRICATING SYSTEM - SEALS AND GASKETS EXHAUST SYSTEM - MUFFLERS                                 | 4<br>4       | 1.7*<br>1.7* | • 2<br>• 4   |
| FUEL SYSTEM - MOFFLERS FUEL SYSTEM - LINES AND FITTINGS  | 3            | 1.3          | • 9          |
| FUEL SYSTEM - SELECTOR VALVES  | 3            | 1.3          | • 7          |
| ENGINE CONTROLS - COCKPIT - MIXTURE CONTROL ASSEMBLIES   | 3            | 1.3          | •4           |
| ENGINE STRUCTURE - CRANKSHAFT  | 2            | •9           | 1.9          |
| ENGINE STRUCTURE - MASTER AND COMMECTING RODS  | 2            | • 9          | 2•6          |
| FUEL SYSTEM - FILTERS, STRAINERS, SCREENS<br>LUBRICATING SYSTEM - OIL COOLERS                    | 2<br>2       | •9<br>•9*    | •5<br>•07    |
| POWERPLANT-INSTRUMENTS - FUEL QUANTITY GAUGE   | 2            | • 9          | 1.3          |
| ENGINE STRUCTURE - CRANKCASE   | 1            | •4           | • 1          |
| IGNITION SYSTEM - LEADS FUEL SYSTEM - VENTS, DRAINS, TANK CAPS                                   | 1<br>1       | • 4<br>• 4   | .07<br>1.4   |
| LUBRICATING SYSTEM - LINES, HOSES, FITTINGS  | ī            | • 4          | •4           |
| EXHAUST SYSTEM - STACKS  | 1            | • 4          | • 1          |
| EXHAUST SYSTEM - BAFFLES<br>ENGINE CONTROLS - COCKPIT -  | 1            | • 4          | • 07         |
| THROTTLE - POWER LEVER ASSEMBLIES  | 1            | • 4          | 1.0          |
| MISCELLANEOUS ACTS AND CONDI   | IT IONS      |              |              |
| FUEL STARVATION  | 82           | 35.3*        | 23.8         |
| FUEL EXHAUSTION  | 32           | 13.8#        | 26.1         |

# TABLE 31 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE PIPER PA-23 AIRCRAFT

| TOTAL ACCIDENTS - 64  CAUSE/FACTOR   |  | PER CENT           | FYDECTED       |
|--|--|--------------------|----------------|
|  | FREQUENCY                                | ACCIDENTS          | PER CENT       |
| CAUSE/FACTOR   | /  | //                 | '/             |
| PILOT IN COMMAND   |  |                    |                |
| The state of the s | 20                                       | 31.2               | 34.0           |
| INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROL   | S 9                                      | 14.1               |                |
| MISMANAGEMENT OF FUEL  | 6  |                    |                |
| IMPROPER IN-FLIGHT DECISIONS OR PLANNING   | 4  | 9•4#<br>6•2        | 5.6            |
| ATTEMPTED OPERATION WITH KNOWN DEFICIENCIES IN EQUI  | IP 3                                     | 4.7                | 2.6            |
| BECAME LOST/DISORIENTED  | 2  | 3.1<br>1.6         | 1.7            |
| CONTINUED VFR FLIGHT INTO ADVERSE WEATHER CONDITION DIVERTED ATTENTION FROM OPERATION OF AIRCRAFT  | NS 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | 1.6<br>1.6         | • <del>1</del> |
| EXCEEDED DESIGN STRESS LIMITS OF AIRCRAFT FAILED TO OBTAIN/MAINTAIN FLYING SPEED FAILED TO FOLLOW APPROVED PROCEDURES DIRECTIVES, ET LACK OF FAMILIARITY WITH AIRCRAFT   | ī  | 1.00               | • •            |
| FAILED TO OBTAIN/MAINTAIN FLYING SPEED   | 1  | 1.6*<br>1.6        | • 0            |
| FAILED TO FOLLOW APPROVED PROCEDURES DIRECTIVES, ET  | TC 1                                     | 1.6<br>1.6         | 4.3            |
| LACK OF FAMILIARITY WITH AIRCRAFT  | 1  |                    |                |
| SPATIAL DISORIENTATION SELECTED WRONG RUNWAY RELATIVE TO EXISTING WIND   | 1  | 1.6*<br>1.6*       | •0             |
| PERSONNEL (MAINTENANCE, SERVICING  | , INSPECTIO                              | ON )               |                |
| INADEQUATE MAINTENANCE AND INSPECTION  | 6  | 9.4                | 8.2            |
| IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL) IMPROPER MAINTENANCE (OWNER PERSONNEL)  | 1  | 1.6                | • 4            |
|  | 1  | 1.6<br>1.6*<br>1.6 | •0             |
| IMPROPERLY SERVICED AIRCRAFT (OWNER-PILOT)   | 1  | 1.6                | ÷4             |
| POWERPLANT   |  |                    |                |
| LUBRICATING SYSTEM - LINES, HOSES, FITTINGS  | 8<br>2                                   | 12.5*              | 0              |
| LUBRICATING SYSTEM - LINES, HOSES, FITTINGS<br>ENGINE STRUCTURE - PISTON, PISTON RINGS   | 2  | 3.1                |                |
|  |  | 3.1                |                |
| ENGINE STRUCTURE - CRANKSHAFT  | 2<br>1<br>1                              | 1.6*               | 3.0            |
| ENGINE STRUCTURE - CYLINDER ASSEMBLY ENGINE STRUCTURE - VALVE ASSEMBLIES   | 1  | 1.6                | 3 • 4<br>1 2   |
| IGNITION SYSTEM - MAGNETOES  | 1  | 1.6<br>1.6         | 1.3<br>1.7     |
| IGNITION SYSTEM - IGNITION HARNESS, SHIELDING  | ī  | 1.6*               | ^              |
| FUEL SYSTEM - SELECTOR VALVES  | 1  | 1.6                | 1.3            |
| FUEL SYSTEM - CARBURETOR   | 1<br>1<br>1                              | 1.6                | •9             |
| FUEL SYSTEM - FUEL INJECTION SYSTEM  | 1  | 1.6<br>1.6         | 2 • 1          |
| FUEL SYSTEM - VENTS, DRAINS, TANK CAPS   | 1  | 1.6*               | 2•1<br>•0      |
| FUEL SYSTEM - RAM AIR ASSEMBLY LUBRICATING SYSTEM - SEALS AND GASKETS  | 1  | 1.6*               | •0             |
| LUBRICATING SYSTEM - OTHER   | ī  | 1.6                | •9             |
| PROPELLER AND ACCESSORIES - OTHER  | ī  | 1.6*               | • 0            |
| EXHAUST SYSTEM - MANIFOLDS   | 1  | 1.6*               | • 0            |
| MISCELLANEOUS - OTHER  | 1  | 1.6*               | •0             |
| MISCELLANEOUS ACTS AND CONDI   | TIONS                                    |                    |                |
| FUEL STARVATION  | 8  | 12.5#              | 30.5           |
| FUEL EXHAUSTION  | 7  | 10.9               | 19.3           |

# TABLE 32 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE PIPER PA-24 AIRCRAFT

| TOTAL ACCIDENTS - 115   |           | PER CENT       |            |
|---|-----------|----------------|------------|
|   |           | OF TOTAL       |            |
| ALUAE (EACTOD   |           | ACCIDENTS      |            |
| CAUSE/FACTOR  | /         | /              | //         |
| · ·   |           |                |            |
| PILOT IN COMMAND  |           |                |            |
| INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING                | 38        | 33.0           | 28.0       |
| MISMANAGEMENT OF FUEL   | 25        | 21.7           | 17.8       |
| IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROL             |           | 10 4           | 14.6       |
| IMPROPER IN-FLIGHT DECISIONS OR PLANNING                        | 8<br>4    | 7 ∔0*<br>3 • 5 | 3.4<br>3.1 |
| BECAME LOST/DISORIENTED LACK OF FAMILIARITY WITH AIRCRAFT       | 3         | 2.6            | 1.7        |
| CONTINUED VER FLIGHT INTO ADVERSE WEATHER CONDITION             | =         | 1.7            | 1.3        |
| ATTEMPTED OPERATION BEYOND EXPERIENCE/ABILITY LEVEL             | -         | •9             | •3         |
| PERSONNEL (MAINTENANCE, SERVICING,                              | INSPECTIO | IN)            |            |
| INADEQUATE MAINTENANCE AND INSPECTION                           | 7         | 6.1            | 9.2        |
| IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL)                    | 3         | 2.6            | 1.4        |
| INADEQUATE INSPECTION OF AIRCRAFT (OWNER-PILOT)                 | 1         | •9×            | • 1        |
| POWERPLANT  |           |                |            |
| ENGINE STRUCTURE - VALVE ASSEMBLIES                             | 10        | 8.7*           | 4.0        |
| FUEL SYSTEM - VENTS, DRAINS, TANK CAPS                          | 4         | 3.5*           | 1.3        |
| ENGINE STRUCTURE - MASTER AND CONNECTING RODS                   | 3         | 2.6            | 2.5        |
| IGNITION SYSTEM - SPARK PLUG                                    | 3         | 2 • 6          | 1.5        |
| FUEL SYSTEM - TANKS   | 3         | 2.6*           | •3         |
| POWERPLANT-INSTRUMENTS - FUEL QUANTITY GAUGE                    | 3         | 2.6            | 1.2        |
| ENGINE STRUCTURE - CRANKSHAFT                                   | 2<br>2    | 1.7            | 1.9        |
| ENGINE STRUCTURE - OTHER  | 2         | 1.7<br>1.7     | 1•2<br>3•3 |
| FUEL SYSTEM - CARBURETOR LUBRICATING SYSTEM - SEALS AND GASKETS | 2         | 1.7*           | •3         |
| EXHAUST SYSTEM - MUFFLERS                                       | 2         | 1.7            | •5         |
| FUEL SYSTEM - LINES AND FITTINGS                                | î         | • 9            | 1.0        |
| FUEL SYSTEM - FUEL INJECTION SYSTEM                             | î         | • 9            | •3         |
| LUBRICATING SYSTEM - FILTERS, SCREENS                           | ì         | • 9            | • 2        |
| LUBRICATING SYSTEM - PUMP-PRESSURE                              | ī         | • 9            | • 1        |
| LUBRICATING SYSTEM - OIL COOLERS                                | 1         | •9*            | • 1        |
| EXHAUST SYSTEM - MANIFOLDS                                      | 1         | •9*            | •03        |
| ENGINE ACCESSORIES - OTHER                                      | 1         | •9*            | • O        |
| ENGINE CONTROLS - COCKPIT -                                     | _         | _              |            |
| THROTTLE - POWER LEVER ASSEMBLIES                               | 1         | •9             | 1.0        |
| MIXTURE CONTROL ASSEMBLIES                                      | 1         | •9             | • 5        |
| MISCELLANEOUS ACTS AND CONDI                                    | TIONS     |                |            |
| FUEL EXHAUSTION   | 45        | 39.1*          |            |
| FUEL STARVATION   | 27        | 23.5           | 24.7       |
|   |           |                |            |

# TABLE 33 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE PIPER PA-25 AIRCRAFT

| TOTAL ACCIDENTS - 84   |           | PER CENT<br>OF TOTAL |              |
|--|-----------|----------------------|--------------|
| CAUSE/FACTOR   | FREQUENCY | ACC IDENTS<br>/,     |              |
|  |           |                      |              |
| PILOT IN COMMAND   |           |                      |              |
| INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROL | 39        | 46.4*                |              |
| MISMANAGEMENT OF FUEL  MISMANAGEMENT OF FUEL   | .5 10     |                      |              |
| IMPROPER IN-FLIGHT DECISIONS OR PLANNING   | 1         | 7.1#<br>1.2          | 3.6          |
| PERSONNEL (MAINTENANCE, SERVICING,   |           |                      |              |
| INADEQUATE MAINTENANCE AND INSPECTION  | 12        | 14.3                 | 9.0          |
| IMPROPERLY SERVICED AIRCRAFT (OWNER-PILOT)   | 3         | 3.4*                 | • 7          |
| IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL) IMPROPERLY SERVICED AIRCRAFT (GROUND CREW)              | 2<br>1    | 2•4<br>1•2           | 1 • 4<br>• 2 |
| POWERPLANT   |           |                      |              |
|  | _         | 4 0*                 |              |
| EXHAUST SYSTEM - MUFFLERS<br>ENGINE STRUCTURE - CRANKSHAFT   | 5<br>4    | 6.0*<br>4.8*         |              |
| IGNITION SYSTEM - MAGNETOES  | 3         | 3.4                  | 1.9          |
| FUEL SYSTEM - VENTS, DRAINS, TANK CAPS   | 3         | 3.4                  | 1.3          |
| POWERPLANT-INSTRUMENTS - FUEL QUANTITY GAUGE   | 3         | 3.6                  | 1.2          |
| ENGINE STRUCTURE - VALVE ASSEMBLIES  | 2         | 2.4                  | 4.2          |
| IGNITION SYSTEM - SPARK PLUG   | 2         | 2.4                  | 1.5          |
| FUEL SYSTEM - SELECTOR VALVES  | 2         | 2.4                  | . 7          |
| ENGINE STRUCTURE - MASTER AND CONNECTING RODS  | 1         | 1.2                  | 2.5          |
| IGNITION SYSTEM - LOW TENSION WIRING   | 1<br>1    | 1.2*                 | •03          |
| IGNITION SYSTEM - HIGH TENSION WIRING  | 1         | 1.2*<br>1.2*         | •0<br>•2     |
| IGNITION SYSTEM - IGNITION HARNESS, SHIELDING  | 1         | 1.2*                 | • 07         |
| IGNITION SYSTEM - SWITCHES   | 1         | 1.2                  | •4           |
| FUEL SYSTEM - TANKS<br>FUEL SYSTEM - CARBURETOR  | 1         | 1.2                  | 3.3          |
| EXHAUST SYSTEM - STACKS  | i         | 1.2*                 |              |
| EXHAUST SYSTEM - BAFFLES   | ī         | 1.2*                 |              |
| ENGINE CONTROLS - COCKPIT -  | _         |                      |              |
| MIXTURE CONTROL ASSEMBLIES   | 1         | 1.2                  | <b>.</b> 5   |
| MISCELLANEOUS ACTS AND CONDI   | TIONS     |                      |              |
| FUEL EXHAUSTION  | 37        | 44.0*                | 24.6         |
| FUEL STARVATION  | 10        | 44.0*<br>11.9#       | 25.0         |
|  |           |                      |              |

# ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE PIPER PA-28 AIRCRAFT

| TOTAL ACCIDENTS - 225   |  | PER CENT   | r   |
|---|--|--|---|
| CAUSE/FACTOR  | FREQUENCY                                      | ACCIDENTS  | S PER CENT  |
| PILOT IN COMMAND  |  |  |   |
| MISMANAGEMENT OF FUEL INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROLS BECAME LOST/DISORIENTED INADEQUATE SUPERVISION OF FLIGHT IMPROPER IN-FLIGHT DECISIONS OR PLANNING CONTINUED VFR FLIGHT INTO ADVERSE WEATHER CONDITIONS LACK OF FAMILIARITY WITH AIRCRAFT EXERCISED POOR JUDGMENT ATTEMPTED OPERATION WITH KNOWN DEFICIENCIES IN EQUIP ATTEMPTED OPERATION BEYOND EXPER/ABILITY LEVEL DELAYED IN INITIATING GO-AROUND FAILED TO FOLLOW APPROVED PROCEDURES DIRECTIVES, ETC   | 11<br>9<br>8<br>6<br>5<br>3<br>2<br>1          | 30.2* 22.7 15.1 4.9 4.0* 3.6 2.7 2.2 1.3 .9 .4   | 14.4  |
| PERSONNEL (MAINTENANCE, SERVICING,  | l<br>Incore                                    | • 4  | • 04  |
| INADEQUATE MAINTENANCE AND INSPECTION IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL) IMPROPER MAINTENANCE (OWNER PERSONNEL) IMPROPERLY SERVICED AIRCRAFT (GROUND CREW) IMPROPERLY SERVICED AIRCRAFT (OWNER-PILOT) INADEQUATE INSPECTION OF AIRCRAFT (MAINT PERSONNEL)   | 15   | 6.7<br>.9<br>.9<br>.4<br>.4  | 9.3<br>1.5<br>.7<br>.3<br>.8  |
| POWERPLANT  |  |  |   |
| NGINE STRUCTURE - VALVE ASSEMBLIES NGINE STRUCTURE - MASTER AND CONNECTING RODS SNITION SYSTEM - SPARK PLUG HIGHE STRUCTURE - OTHER SNITION SYSTEM - MAGNETOES LEL SYSTEM - CARBURETOR LEL SYSTEM - FUEL INJECTION SYSTEM LEL SYSTEM - VENTS, DRAINS, TANK CAPS WERPLANT-INSTRUMENTS - FUEL QUANTITY GAUGE LINE STRUCTURE - CRANKCASE LINE STRUCTURE - CYLINDER ASSEMBLY LEL SYSTEM - LINES AND FITTINGS LARICATING SYSTEM - OTHER HAUST SYSTEM - MUFFLERS LINE STRUCTURE - CRANKSHAFT LINE STRUCTURE - PISTON, PISTON RINGS LITION SYSTEM - BISTON, PISTON RINGS LITION SYSTEM - FILTERS, STRAINERS, SCREENS LL SYSTEM - SELECTOR VALVES LL SYSTEM - FILTERS, STRAINERS, FITTINGS RICATING SYSTEM - LINES, HOSES, FITTINGS RICATING SYSTEM - LINES, HOSES, FITTINGS RICATING SYSTEM - FILTERS, SCREENS LL SYSTEM - SEALS AND GASKETS LICATING SYSTEM - SEALS AND CONDITION  MISCELLANEOUS ACTS AND CONDITION | 14 7 5 3 3 3 3 3 2 2 2 2 1 1 1 1 1 1 1 1 1 1 1 | 6.2<br>3.1<br>2.2<br>1.3<br>1.3<br>1.3<br>1.3<br>1.3<br>1.3<br>1.3<br>1.3<br>1.4<br>9.9<br>9.9<br>9.4<br>4.4<br>4.4<br>4.4<br>4.4<br>4.4<br>4.4<br>4 | 4.0<br>2.4<br>1.5<br>1.2<br>2.0<br>3.4<br>.3<br>1.4<br>1.3<br>.07<br>2.2<br>1.0<br>.3<br>.5<br>2.0<br>2.3<br>.2<br>.8<br>.5<br>.8<br>.2<br>.4<br>.3<br>.0<br>.0<br>.0<br>.0<br>.0<br>.0<br>.0<br>.0<br>.0<br>.0 |
| L STARVATION  | 87   | 38.7*  | 23.5  |
| EARAUST IUN   | 46   | 20.4   | 25.6  |

# TABLE 35 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE PIPER PA-32 AIRCRAFT

| TOTAL ACCIDENTS - 41   |               | PER CENT   |          |
|--|---------------|------------|----------|
|  |               | OF TOTAL   |          |
|  | FREQUENCY     | ACCIDENTS  | PER CENT |
| CAUSE/FACTOR   | /             | /          | /        |
|  |               |            |          |
| PILOT IN COMMAND   |               |            |          |
| MISMANAGEMENT OF FUEL  | 13            | 31.7*      | 17.8     |
| TNADEDUATE PREFITGHT PREPARATION AND/OR PLANNING                                   | 7             | 17.1       | 28.3     |
| IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROL                                | .S 4          | 9.8        | 14.5     |
| LACK OF FAMILIARITY WITH AIRCRAFT  | 3 2           | 7.3*       | 1.7      |
| INADEQUATE SUPERVISION OF FLIGHT   | 2             | 4.9        |          |
| RECAME LOST/DISORIENTED  | 1<br>NS 1     | 2 • 4      | 3.2      |
| CONTINUED VER FLIGHT INTO ADVERSE WEATHER CONDITION                                |               | 2.4        |          |
| IMPROPER IN-FLIGHT DECISIONS OR PLANNING   | 1             | 2.4        |          |
| OPERATED CARELESSLY  | 1             | 2.4*       | • 03     |
| PERSONNEL (MAINTENANCE, SERVICING  | , INSPECTIO   | ON )       |          |
|  | 2             | 4.9        | 1.4      |
| IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL) INADEQUATE MAINTENANCE AND INSPECTION | 1             |            |          |
|  |               |            |          |
| POWERPLANT   |               |            |          |
| ENGINE STRUCTURE - VALVE ASSEMBLIES  | 2             | 4.9        | 4.2      |
| FUEL SYSTEM - CARBURETOR   | Ž             | 4.9<br>2.4 | 3.2      |
| ENGINE STRUCTURE - CRANKSHAFT  | 1             | 2.4        | 1.8      |
| ENGINE STRUCTURE - OTHER   | 1             | 2.4        | 1.2      |
| IGNITION SYSTEM - MAGNETOES  | 1             | 2 • 4      | 1.9      |
| FUEL SYSTEM - MAGNETOLS FUEL SYSTEM - SELECTOR VALVES                              | ī             | 2.4        | •7       |
| FUEL SYSTEM - PUMPS  | ī             | 2.4        | .8       |
| FUEL SYSTEM - FUEL INJECTION SYSTEM  | <u>1</u><br>1 | 2.4        | •3       |
| FUEL SYSTEM - OTHER  | i             | 2 • 4*     | •2       |
| ENGINE CONTROLS - COCKPIT -  |               |            |          |
| THROTTLE - POWER LEVER ASSEMBLIES  | 1             | 2 • 4      | .9       |
| POWERPLANT-INSTRUMENTS (FUEL QUANTITY GUAGE  | 1             | 2.4        | 1.2      |
| REDUCTION GEAR ASSEMBLY - GEARS, ACCESS DRIVE                                      | 1             | 2 • 4      | •07      |
| MISCELLANEOUS ACTS AND CONDI   | ITIONS        |            |          |
| _ & @ @ m = & & p = & & d = = = & d p = & & & m = & & & = & & = & & = & = & =      | 19            | 46.3*      | 24.3     |
| FUEL STARVATION  | 2             | 4.9#       |          |
| FUEL EXHAUSTION  | ۲.            | -T # 2 #   |          |

# ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE STINSON 108 AIRCRAFT

| AL ACCIDENTS - 61  |                    | PER CENT      |              |
|--|--------------------|---------------|--------------|
|  |                    | OF TOTAL      | EXPECTED     |
| USE/FACTOR   | FREQUENCY          | ACCIDENTS     | PER CENT     |
|  | /                  | /             | //           |
| λ.   |                    |               |              |
| PILOT IN COM   |                    |               |              |
| AVEQUATE PREFLIGHT PREPARATION AND/OR PLA<br>PROPER OPERATION OF POWERPLANT + PWRPLANT   | NNING 12           | 10.7          | 30.4         |
| PROPER OPERATION OF POWERPLANT + PWRPLANT  | CONTROLS 10        | 16.4          | 14.4         |
|  |                    |               | 18.0         |
| WINUED VFR FLIGHT INTO ADVERSE WEATHER C<br>MPTED OPERATION BEYOND EXPER/ABILITY LE<br>ME LOST/DISORIENTED   | ONDITIONS 2        | 3.3           | 1.2          |
| MENTED UPERATION BEYOND EXPERIABILITY LE   | VEL 1              | 1.6           | •3           |
|  | 1                  | 1.6           | 3.2          |
| OF FAMILIARITY WITH AIRCRAFT   | 1                  |               | 1.8          |
| PERSONNEL (MAINTENANCE, SE   | PVICING INCRECTION |               |              |
|  |                    | N )           |              |
| DEQUATE MAINTENANCE AND INSPECTION ROPER MAINTENANCE (OWNER PERSONNEL)   | 10                 | 16.4*         | 0 0          |
| OPER MAINTENANCE (OWNER PERSONNEL)   | 2                  | 3-3*          | 9.0          |
| OPER MAINTENANCE (MAINTENANCE PERSONNEL  | )                  | 3.3*<br>1.6   | 1.5          |
|  |                    | 1.0           | 1.4.7        |
| POWERPLAN  | Т                  |               |              |
| NE STRUCTURE - VALVE ASSEMBLIES  | <b>-</b><br>8      |               |              |
| TAPN SYSTEM - MAGNETOES  | 8<br>4             | 13.1*<br>6.6* | 4.0          |
| SYSTEM - CARBURETOR  | 4                  | 0.0¥          | 1.8          |
| STRUCTURE - CRANKSHAFT   | 2                  | 6.6           |              |
| STRUCTURE - MASTER AND CONNECTING RO   | DS 2               | 3.3<br>3.3    | 1.8<br>2.5   |
| STRUCTURE - CYLINDER ASSEMBLY  | i                  | 1.6           |              |
| TOSTRUCTURE - CYLINDER ASSEMBLY TOSTRUCTURE - PISTON, PISTON RINGS   | ī                  | 1.6           |              |
| STRUCTURE - MOUNT AND VIBRATION ISOLA  | ATORS 1            | 1.6*          | •0           |
| 端型N SYSTEM ~ SPARK PLUG  | ī                  | 1.6*<br>1.6   | 1.5          |
| ON SYSTEM - LOW TENSION WIRING   | 1                  | 1.6*          |              |
| STEM - FILTERS, STRAINERS, SCREENS   | 1                  | 1.6           | • 0 <i>5</i> |
| CATING SYSTEM - LINES, HOSES, FITTINGS   | ĩ                  |               | •3           |
| ANT-INSTRUMENTS - FUEL QUANTITY GAUG   | Ē                  | 1.6<br>1.6    | 1.3          |
| MISCELLANEOUS ACTS AND   | D COMPLETIONS      |               |              |
| ON THE PROPERTY AND THE | OUNDITIONS         |               |              |
| \$ TARVATION   | 16                 | 26.2          | 24.4         |
| EXHAUST ION  | 9                  | 20.2<br>14.8  |              |
| A-to.  | 7                  | 14.0          | 25.4         |

# Engine Make and Model Causes/Factors

The causes/factors associated with the engines involved in the 3,312 engine-failure accidents being considered in Section II are presented in Table 37. The pilot was a cause/factor in the majority (64.31%) of the accidents while the powerplant was a cause/factor in 38.82% of the occurrences.

factors were: inadequate preflight preparation and/or planning, mismanagement of fuel, and improper operation of powerplant and powerplant controls. Improper and inadequate maintenance was involved as a cause/factor in 420 occurrences or 12.68% of the 3,312 accidents. The leading powerplant causes/factors involved the engine structure and fuel system; for example, valve assemblies (130), master and connecting rods (86), cylinder assembly (71), piston and piston rings (70), and carburetor (100) were the most-recorded citations.

To investigate the problems which caused engine-failure accidents, twenty engine types were examined using the same technique described in the previous subsection concerning aircraft makes and models. The comparisons made of the causes/factors for each engine make and model are presented in Tables 38 through 57. Of particular interest were the powerplant causes/factors, because these involved mechanical or equipment problems that resulted in engine-failure accidents.

Summary of the Comparisons. Powerplant causes/factors which were significantly higher (\*) or lower (#) than expected in percentage involvement by engine makes and models are summarized below.

The predominant causes and factors involved engine structures. For example, 13.0% of the engine-failure accidents involving the Avco/Lycoming IO-360 engine were attributed to the

master and connecting rods. Failure of piston and piston rings were a cause in 11.9% of the Continental IO-520 engine-failure accidents, while valve assemblies were cited in 11.1% of the Franklin 6A4, 6AG4 engine-failure accidents. The cylinder assembly was cited as a causel factor in 10.8% of the engine-failure accidents involving the Pratt and Whitney R-985 engine and in 9.2% of the Continental IO-470 engine-failure accidents.

All the 20 engines considered in this study, excluding the Pratt and Whitney Military R-985 series engine, are basically the same type of engine, i.e., horizontally opposed engines. (The Pratt and Whitney R-985 is a radial engine). For the horizontally opposed engines, engine structure valve assemblies were cited as a cause factor in 119 (4.4%) of the 2,709 engine-failure accidents while for the Pratt and Whitney engine 1.4% of the 139 engine-failure accidents were attributed to valve assemblies. The Avco Lycoming engines had frequent valve-assembly involvements, with this causal area being higher than-expected or significantly higher-than expected for the 0-290, 0-320, 0-360, 0-540 and 10-540 series engines.

Some of the engines considered in the study are very old and may be out of pro duction, such as the Continental A-65, C-75 C-85 and C-90 series engines, and many of the problems associated with these engines may have already been recognized and corrective action taken by the issuance of service bulletins by the manufacturers. There still remains in use todal however, a large number of these older engine in the general aviation fleet. Owners and open tors of the older aircraft should be cognizant? the problems which the older engines had whi led to engine-failure accidents. Maintenance p sonnel should be certain that they comply wi the most recent manufacturer's service bullet and Federal Aviation Administration's airwort ness directives when repairing older engines.

| rine                          | Percent of Total<br>Engine-Failure Accidents | Expected<br>Percent |
|-------------------------------|--|---------------------|
| E                             | ingine Structure – Crankshaft                |                     |
| ntinental IO-520              | 6.0*   | 1.6                 |
| ntinental IO-470              | 5.1*   | 1.6                 |
| co/Lycoming O-320             | .6#  | 1.9                 |
| Engine Sti                    | ructure – Master and Connecting Rods         | •                   |
| co/Lycoming IO-360            | 13.0*  | 2.4                 |
| ntinental IO-470              | 6.1*   | 2.5                 |
| tt and Whitney Military R-985 | 5.8*   | 2.5                 |
| CA/Lycoming O-540             | .4#  | 2.8                 |
| Engi                          | ne Structure – Cylinder Assembly             |                     |
| and Whitney Military R-985    | 10.8*  | 1.8                 |
| dinental IO-470               | 9.2*   | 1.9                 |
| Engin                         | e Structure – Piston, Piston Rings           |                     |
| inental IO-520                | 11.9*  | 1.9                 |
| Engi                          | ne Structure – Valve Assemblies              |                     |
| lin 6A4, 6AG4                 | 11.1*  | 3.9                 |
| Lycoming O-320                | 6.8*   | 3.4                 |
| Engine S                      | tructure – Blower, Impeller Assembly         |                     |
| Whitney Military R-985        | 5.0*   | .2                  |
| I                             | gnition System – Magnetos                    |                     |
| 6A4, 6AG4                     | 6.9*   | 1.8                 |
| 80 as                         |  |                     |

| Engine                 | Percent of Total<br>Engine-Failure Accidents                   | Expected<br>Percent |
|------------------------|--|---------------------|
|                        | Fuel System – Tanks  |                     |
| Avco/Lycoming O-540    | 1.7*   | .4                  |
|                        | Fuel System – Lines and Fittings                               |                     |
| Continental IO-470     | 4.1*   | .9                  |
|                        | Fuel System – Carburetor                                       |                     |
| Continental O-470      | 6.2*   | 3.2                 |
| Avco/Lycoming O-540    | .9#  | 3.6                 |
|                        | Fuel System –Pumps   |                     |
| Continental E-225      | 8.5*   | .7                  |
|                        | Fuel System – Vents, Drains, Tank Caps                         |                     |
| Avco/Lycoming O-235    | 4.0*   | 1.3                 |
| Avco/Lycoming O-540    | 3.5*   | 1.3                 |
| i                      | Lubricating System – Lines, Hoses, Fittings                    |                     |
| Avco/Lycoming O-320    | 1.6*   | .4                  |
|                        | Exhaust System – Mufflers                                      |                     |
| Avco/Lycoming O-290    | 3.5*   | .4                  |
| Avco/Lycoming O-540    | 1.7*   | .4                  |
|                        | Engine Controls – Cockpit<br>Throttle – Power Lever Assemblies |                     |
| Continental A-65       | 2.3*   | .8                  |
| Continental C-75, C-85 | 2.2*   | .8                  |

# CAUSE/FACTOR TABLE

ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE U. S. GENERA MINITION
1965 - 1969
CAUSES DISPLAYED RELATE TO FIRST ACCIDENT TYPE ONLY

EXCLUDES ACCIDENTS WITH CAUSE UNDETERMINED, HOMEBUILT AND EXPERIMENTAL AIRCRAFT, AND ACCIDENTS INVOLVING SIMULATED ENGINE FAILURES

INVOLVES 3312 TOTAL ACCIDENTS INVOLVES 220 FATAL ACCIDENTS

|                                       | FAT/         | FATAL ACCIDENTS | SINTS        | NONFAT        | NONFATAL ACCIDENTS | ENTS          | ALL           | ALL ACCIDENTS | TS           |
|---------------------------------------|--------------|-----------------|--------------|---------------|--------------------|---------------|---------------|---------------|--------------|
| BRDAD CAUSE/FACTOR                    | CAUSE        | FACTOR          | TOTAL*       | CAUSE         | FACTOR             | TOTAL*        | CAUSE         | FACTOR        | TOTAL*       |
| PILOT                                 | 150<br>68.18 | 11 5.00         | 150<br>68.18 | 1977<br>63.94 | 66<br>2.13         | 1980          | 2127<br>64.22 | 77<br>2.32    | 2130         |
| PERSONNEL                             | 38<br>17.27  | 6<br>2.73       | 44<br>20.00  | 393<br>12.71  | 31<br>1.00         |               | 431<br>13.01  | 37            | 467<br>14•10 |
| AIRFRAME                              | 1.45         | 00•             | 1 + 45       | 1.03          | 00                 |               | 2<br>•06      | 00•           | 90•          |
| LANDING GEAR                          | • 00         | 8               | 00•          | 1.03          | • 00               | 1<br>•03      | 1<br>•03      | 00•           | 1 • 03       |
| POWERPLANT                            | 72<br>32•73  | 3               | 74<br>33.64  | 950<br>30.72  | 68<br>2.20         | 1013<br>32.76 | 1022<br>30.86 | 71 2.14       | 1087         |
| SYSTEMS                               | • 00         | 1.45            | 1.45         | 16            | 1<br>• 03          | 17            | 16            | 2.06          | 18<br>•54    |
| INSTRUMENTS/EQUIPMENT AND ACCESSORIES | 1.45         | 99.             | 1.45         | 5             | 5<br>• 16          | 10            | 6<br>•18      | 5.15          | 13<br>• 33   |
| ROTORCRAFT                            | 00•          | • 00            | 00•          | 00            | 00                 | 00            | 00            | S             | 9            |
| AIRPORTS/AIRWAYS/FACILITIES           | 00•          | 00*             | 90•          | 1.03          | 10.03              | 2<br>•06      | 103           | 1 03          | 200          |
| WEATHER                               | 12<br>5•45   | 20<br>9.09      | 30<br>13•64  | 143           | 161<br>5.21        | 301<br>9.73   | 155<br>4•68   | 181<br>5,46   | 331<br>9.99  |
| TERRAIN                               | 00.          | 00•             | 00•          | 00.           | • 00               | 00•           | 00•           | . 0           | 00           |
| MISGELLANEOUS                         | 10<br>4•55   | 00•             | 10<br>4.55   | 114<br>3.69   | 8                  | 122<br>3•95   | 124<br>3•74   | 8.24          | 132<br>3,99  |
| UNDETERMINED                          | 00•          | 00.             | 00.          | 00            | 00•                | 00+           | 00•           | 00•           | 00•          |

69

THE FIGURES OPPOSITE EACH CAUSAL CATEGORY REPRESENT THE NUMBER AND PERCENT OF ACCIDENTS IN WHICH THAT PARTICULAR CAUSAL CATEGORY WAS ASSIGNED

<sup>\*</sup> IF AN ACCIDENT INCLUDES BOTH A CAUSE AND RELATED FACTOR IN THE SAME CAUSAL CATEGORY, THE ACCIDENT IS REPRESENTED ONCE UNDER THE TOTAL FOR THAT CATEGORY

|  | FATA     | FATAL ACCIDENTS | ENTS   | NGNFATAL       | <u> </u> | DENTS                   | ALL        | L ACCIDENTS    | 415               |   |
|--|----------|-----------------|--------|----------------|----------|-------------------------|------------|----------------|-------------------|---|
| DETAILED CAUSE/FACTOR  | CAUSE    | FACTOR TOT      | 1014   | CAUSE          |          | TOTAL                   | CAUSE      | FACTOR         | TOTAL             |   |
| ** PICOT **  |          |                 |        |                |          |                         |            |                |                   |   |
| PILOT IN COMMAND DESTRIENCIES IN SOUIPHENT   | •        | -               | •      | 22             | in e     | 27                      | 82         | •-             | 34                |   |
| ZZ   | m •      |                 | en co  | 8              | ==       | , E                     | 5          | ·=             | 101               |   |
| BECAME LOST/DISORTENTED CONTINUED VFR FLIGHT INTO ADVERSE WEATHER CONDITIONS   | ø        |                 | •      | 8 °            | •        | 35                      | 37         | •              | 2                 |   |
| DELAYED IN INSTRAING GO-ARGUND DELAYED IN INSTRAIN FAIRCRAFT   |          |                 |        | ; #N -         | ~        | <b>4</b> 0 ~            | e =        | ~              |                   |   |
| ENCREDED DESIGN STRESS LIMITS OF BIRCRAFT  | 2        |                 | N      | 4 po f         |          | , P.                    | ጥወ         | ٠              | <b>ሐ</b>          |   |
| FAILED TO USE OR INCORRECTLY USED MISC EQUIPMENT FAILED TO FOLLOW APPROYED PROCEDURES OBJECTIVES ETC   | 2-2      |                 | 2-1-6  | 23             | •        | 24                      | 404<br>104 | 4              | 28<br>467         |   |
| SMPROPER OPERATION OF POWERLAND * FURENTERM CONTROLS IMPROPER OPERATION OF FLIGHT CONTROLS   | -        |                 |        | r # 3          | •        | - A -                   | - * 2      | -              | 124               |   |
| INFROPER LEVELIGHT DECISIONS OR PLANNING IMPROPER COMPENSATION FOR MIND CONDITIONS   | <u> </u> | -               | î 3    |                | · w      | 8                       | 922        | •              | 928               |   |
| INADEQUATE PREFILEM PREPARATION AND/OR PLANKING INADEQUATE SUPERISTON OF FILEMY  | *        |                 | 10     | 1 mg           | 22       | 103                     | \$ 22.5    | 28             | 613               |   |
|  | 20       |                 | 6 N    | 200<br>200     | • •      | 17                      | - 2        |                | 61                |   |
| DEFATISTO CARELESSA<br>OPERATED CARELESSA<br>FREE CHAIN INVITABLE TERRAIN  |          |                 | •      | en o           |          | u m N                   | • EN EN    | •              | mm                |   |
| SECULO CONTROL PROCEDURES IMPROPER STATING PROCEDURES INITIATED FLIGHT IN ADVERSE MEATHER CONDITIONS   |          |                 | •      | 1 2            |          | 12                      | - 2        |                | -2                |   |
| SPONTANEOUS-IMPROPER ACTION MISJUDGED DISTANCE, SEED, AND ALTITUDE   |          | =               | -      | ļ <del>~</del> | •        | <b></b> .               | -          |                |                   |   |
| MISTAGGE DISTANCE AND STOCK MISTAGGED DISTANCE AND ALTITUDE MISTANCED AND ALTITUDE MISTANCED AND ALTITUDE  |          |                 |        |                | <b>→</b> |                         |            | •              |                   |   |
| MISJUDGED SPEED<br>IMADEQUATE TRAINING OF STUDENT  |          |                 |        |                |          |                         | ~ m ,      |                |                   |   |
|  | w.       |                 | •      | <b>→</b> 60 (  |          | ⊷ iū ¢                  | - ec r     | -              | 4 ØP PM           |   |
| PHYSICAL INTERNACY: SPATIAL DISORIENTATION SECUND OFFICE CONDITION   | <b></b>  | -               | .a. =4 | N              | ~        | u N                     | 1          | ~ ~            | ~~                |   |
| MISUSED OR FAILED TO USE FLAPS<br>SELECTED WRONG RUNWAY RELATIVE TO EXISTING WIND  |          |                 | m      | 7              | -        |                         | 4.         | <b>→</b>       | -4-               |   |
| FAILED TO ABORT TAKEOFF FAILED TO INITIATE GO-ARDUND DIRECT ERRAIES  |          |                 | -      | -=             |          | -=                      | 17         | i              | 12                |   |
| SUBTOTAL   | 207      | =               | 218    | 2280           | 89       | 2348                    | 2487       | 6              | 0847              |   |
| COPILOT FALLED TO OBTAIN/MAINTAIN FLVING SPEED INPROPER OPERATION OF POWERPLANT + POWERPLANT CONTROLS IMPROPURE OFFICHT PREPARATION AND/OR PLANNING NAMES OF THE OFFICE OF THE OFFICE OF |          |                 |        |                |          |                         |            |                |                   |   |
| SUBTOTAL   |          |                 |        | 4              |          | 4                       | 4          |                | 4                 |   |
| DUAL STUDENT<br>SEAMED ACTION IN ABORTING TAKEOFF  |          |                 |        | -              |          |                         | -          |                | .=                |   |
|  |          |                 |        |                | - 000 m  | The State State Control |            | and the second | Actor Value Latin | 0 |

|  | FAT   | FATAL ACCIDENTS | ENTS       | NONFA           | NONFATAL ACCIDENTS | DENTS     | ₹          | ALL ACCIDENTS | NTS                  |  |
|--|-------|-----------------|------------|-----------------|--------------------|-----------|------------|---------------|----------------------|--|
|  | CAUSE | FACTOR          | TOTAL      | CAUSE           | FACTOR             | TOTAL     | CAUSE      | FACTOR        | TOTAL                |  |
| FALLED TO OBTAIN/MAINTAIN FLYING SPEED IMPROPER OPERATION OF POWERPLANT + POWERPLANT CONTROLS IMADEOWATE PRETIGHT PREMARATION AND/OR PLANNING LACK OF FAMILIARITY WITH ARGRAGATION   |       |                 |            | 17              |                    | 1,71,5    | 1,7        |               | 171                  |  |
| HISMANAGEMENT OF FUEL<br>Spontanedus-Improper action   |       |                 |            | 10              |                    | -11-      | 10         |               | -1-                  |  |
| SUBTOTAL ** PERSONNEL **   |       |                 |            | 35              | N                  | 37        | 35         | N             | 37                   |  |
| FLIGHT INSTRUCTOR IMADEQUATE SUPERVISION OF FLIGHT IMADEQUATE TAXINING OF STUDENT MAINTEAMANCE, CRUNTAING, IMADEMANCE,   |       |                 |            | ~~              | <b>~</b> €         | £ 01      | NF         | - r           | ωč                   |  |
| TATHERMONEUR - SERVILLON, INSPECTION INPROPER MAINTENANCE PERSONNEL) IMPROPER MAINTENANCE CHANGE PERSONNEL) IMPROPER VEGITARY CONTROLLONGE   | rv w  |                 | st w       | 41              |                    | 41        | . 4.0      | 1 0           | 9 4 6                |  |
| INFAGERAT SERVICED ARKARFILIROUND (RRW) IMPROPERTY SERVICED AIRCRAFTICHNER-PILOT INADEQUATE INSPECTION OF AIRCRAFTIANT/REANCE PERSONNEL) IMPOECUATE INSPECTION OF AIRCRAFTIANT/REANCE IMPOECUATE INSPECTION OF AIRCRAFTIANT/REANCE IMPOECUATE AIRCRAFTION OF AIRCRAFTIANT/REANCE IMPOECUATE IMPOECUATE AIRCRAFTIANT/REANCE IMPOECUATE AIRCRAFTIANT/RE | 7     | -               | # N #      | e 52 e e        | 100                | . 128 6 4 | 2 % = "    | 100 -         | 31<br>36<br>11<br>11 |  |
| OTHER DAINIE MAINIEMANCE AND INSPECTION OTHER DAINIEMANCE AND INSPECTION   | 1 25  | 4               | 53         | 259             | 12                 | 271       | 28<br>4 %- | 16            | 300                  |  |
| UPERA IUDRAL SUPERVISORY PERSONNEL INDECOATE LUBERVISION OF FELICAT CREW FAILURE TO PROVINCE AGEO OFFECTIVES, MANUALS, EQUIPMENT DEFICIENCY, COMPANY MAINTAINED ECHT; SERV, REGILATIONS  |       | ~               | -          |                 | ,                  | -         | -          | -             |                      |  |
| MEATHER PERSONNEL<br>INCORRECT MEATHER FORECAST<br>INCORPETER MEATHER REPORT   | ٦,    |                 |            | -               | <b>-</b> -         | ~ ~       | - <b>-</b> |               | ~ ~                  |  |
| INADEQUATE/INCORRECT WEATHER BRIEFING<br>FRAFFIC CONFROL PERSONNEL   |       |                 | -4         | 1               |                    | 1         |            |               |                      |  |
| A AFRORS SUPERVISORY PERSONNEL IMPROPER AUTHOR AT A MAINTENANCE - AT ROOM FACTOR FOR THE AND T |       |                 |            | 1 2             |                    | 1 2       |            |               | m °                  |  |
| TATIONS IN MOITH OF UNSAFE CONDITION IMPROPER INSPECTION OF FACILITIES OTHER   |       |                 |            | -               |                    | 7         |            |               | v v                  |  |
| ATRMAYS FACILITIES PERSONNEL<br>PRODUCTION-DESIGN<br>INCORRECT FACIORY INSTALLATION  | -     |                 |            |                 |                    |           |            | -             | -                    |  |
| POOR/INADEQUATE DESIGN<br>OTHER<br>ATCHER AMERIC DESIGNATION   |       |                 | <b>-</b>   | wow             | 2 =                | rv ao 4   | <b>∞</b>   | ~-            | 0 O U                |  |
| n sacelmarias-persunnel<br>Passenger<br>Other  |       |                 |            |                 |                    | · w       | •          |               | n vo                 |  |
| DIRECT ENTRIES THIRD PLOUT FLIGHT PROGINEER DISPATCHING  |       |                 |            | - ~             |                    | ~ ~       | 2          |               | 2 1                  |  |
| SUBTOTAL   | 75    | •               | <b>6</b> 2 | 400             | 31                 | 431       | 445        | 37            | 614                  |  |
| ** AIRFRAME **   |       |                 |            |                 |                    |           |            | i             | :                    |  |
| HINGS<br>BRACING HIRES, STRUTS<br>FUSELAGE   | -     |                 | -          |                 |                    |           | 1          |               | ٦                    |  |
| WINDSMIELOS, WINGOWS, CANDPIES<br>LANDING GEAR   |       |                 |            |                 |                    | 1         | 1          |               | -                    |  |
| NORMAL RETACTION EXTENSION ASSEMBLY FLIGHE CONTROL SUBFACES ATTACHMENTS ALLERON, SURFACES ATTACHMENTS  | -     |                 | -          | 1               |                    | 7         |            |               | ٦.                   |  |
| SUBTOTAL   | 7     |                 | 7          | ~               |                    | 2         | 4          |               | - 4                  |  |
| ** POWERPLANT **   |       |                 |            |                 |                    | ı         |            |               | •                    |  |
| ENGINE SRUCTURE<br>CANACASS<br>CANACASSE<br>CASSIBLE   | ~     |                 | ^          | ٠٠ <del>١</del> | -                  | 40 y      | 9 2        |               | } •                  |  |
|  |       |                 |            | ;               | -                  | n.        | 0          | 4             | ž                    |  |

|                    |                    | TOTAL        | 86<br>71<br>70<br>130 | 41       | 63<br>1<br>1<br>2  | <b>⊢</b> 8 € 4 € | 15<br>34<br>27<br>17<br>100<br>27<br>17<br>47           | 19<br>20<br>80<br>70<br>71<br>11<br>11  |    |           |               |   | £ 4                           | 4   | •           |
|--------------------|--------------------|--------------|-----------------------|----------|--------------------|------------------|---|---|----|-----------|---------------|---|-------------------------------|-----|-------------|
|                    | ACCIDENTS          |              | 121                   |          | N 4                | -                | 81 1 1 1 1 1 1 2 2 2 4                                  | 1   |    |           |               |   |                               | 1,  | A           |
|                    | ALL                | CAUSE FACTOR | 86<br>70<br>68<br>129 | 1 3      | 61<br>2<br>49<br>1 | 1                | 11<br>232<br>16<br>16<br>27<br>27<br>39                 | 18<br>2<br>8<br>8<br>2<br>2<br>2<br>4<br>4<br>4<br>111<br>13                                      | 11 | 3 1 3     | 15<br>15<br>8 | 1 | 29<br>16<br>6                 | 4   | ผนอกผู้     |
|                    | 118                | TOTAL C      | 80<br>67<br>63<br>124 |          | 56<br>1<br>1<br>1  | 1 B A A A A      | 15<br>23<br>15<br>15<br>20<br>21<br>24<br>46<br>66      | 19<br>2 2 8 8 2 2 2 1 1 1 1 1 1 1 1 1 1 1 1 1   |    | 7 7 7     | 159<br>159    |   | 29<br>15<br>6                 | 4,4 | 0 m m 9 m 5 |
|                    | ACCIDEN            | FACTOR TO    |                       |          | п <i>е</i>         | 1                | 9 I I I 8   | 1   |    |           | m             |   | H                             | 04  | •           |
|                    | NONFATAL ACCIDENTS | AUSE         | 80<br>67<br>62<br>123 | 14<br>36 | 141                | 2 T F E E E      | 11<br>29<br>21<br>21<br>14<br>14<br>12<br>12<br>38<br>6 | 18<br>2<br>8<br>8<br>8<br>8<br>8<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1 |    | 2         | 6 4 1 4 8 6   |   | 28<br>15<br>6                 | 4   | 2           |
|                    | ,                  | TOTAL        | 941-9                 | ۲V       | r 1 6              | e                | «47N00941 F   |   |    | -         | 1             |   |                               | 1   | -I          |
| R TABLE            | L ACCIDENTS        | FACTOR       | 1.1                   |          | m =                |                  |   |   |    |           |               |   |                               | -   |             |
| CAUSE/FACTOR TABLE | FATAL              | AUSE         | 0 m o o               | ur       | 4 1 8              | -                | 64460000000000000000000000000000000000                  | 4   |    | -         |               |   |                               |     | •           |
| CA                 |                    |              |                       | RS       |                    | <b>12</b>        | vs  |   |    | MECHANISM |               |   | SSEMBLIES<br>LIES<br>CONTROLS |     |             |
|                    |                    |              | S                     | TORS     |                    | ING              | ENS   |   |    | ¥.        |               |   | SSE                           |     |             |

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| POWERPLANT (CONTINUED)   |       |                 |       |               |                    | ŧ     |              |               |          |
|--|-------|-----------------|-------|---------------|--------------------|-------|--------------|---------------|----------|
|  | FAT   | FATAL ACCIDENTS | 13    | AHNON         | NONFATAL ACCIDENTS | DENTS | 4            | ALL ACCIDENTS | S T S    |
|  | CAUSE | FACTOR TO       | TOTAL | CAUSE         | FACTOR             | TOTAL | CAUSE        | FACTOR        | TOTAL    |
| OTHER<br>COMPRESSOR ASSEMBLY   |       |                 |       | 7             |                    | 7     | -            |               | -        |
| OTHER<br>COMBUSTION ASSEMBLY   | -     |                 | -     |               |                    |       | 7            |               |          |
| UKBINE ASSEMBLY<br>ACCESSORY DRIVE ASSEMBLY<br>LUBRICATING SYSTEM  |       |                 |       |               |                    |       |              |               |          |
| OTHER<br>SAFETY SYSTEM   |       |                 |       | -             |                    | 4     | 7            |               | -        |
| IGNITION SYSTEM<br>TORGHETER<br>ATR RIFFD  |       |                 |       |               |                    |       |              |               | •        |
| THE STATEM THRUST SYSTEM THRUST REVERSER   |       |                 |       |               |                    |       |              |               |          |
| OTHER<br>PROPELLER SYSTEM  |       |                 |       | ٦             |                    | -     |              |               | 1        |
| GOVERNOR CONSTANT SPEED DRIVE  |       |                 |       | -             |                    |       | 1            |               | ٠ -      |
| GOVERNOR VALVE<br>POWER LEVER  |       |                 |       | -             |                    | -     | 1            |               | -        |
| P.CABLE<br>P.CABLE<br>REVERSE THRIST I FVER  |       |                 |       | -             |                    |       | 1            |               | -        |
| ENGINE INDICATING EQUIPMENT TACHOREFER TOTAL NOTALLATION   |       |                 |       | -             |                    | 7     | г            |               | -        |
| SUBTOTAL   | 88    | ιn              | 06    | 1023          | 72                 | 1095  | 8011         |               | •        |
| ## SYSTEMS ##  |       |                 |       |               |                    |       |              |               | 1185     |
| FLECTRICAL SYSTEM BATTERIES GENERATORS ALTERNATORS HYDRAULIC SYSTEMS ATTI-LIGHT CONTROL SYSTEMS ATTI-LIGHG, DE-LGING, SYSTEMS  |       |                 |       | -             | -                  |       | -            | 7             |          |
| CAKBUKETOR DE-ICING SYSTEM   |       |                 |       | 17            |                    | 7 1   | <u> </u>     |               | 14       |
| AIN COMDITION, HEATING AND PRESSURIZATION CABIN TEMP CONTROL AND TEMP INDICATING SYSTEM AUTO PILOT FIRE HARMING SYSTEM FIRE EXTINGUISHER SYSTEM OXYGEN SYSTEM OTHER SYSTEM   |       | -               | -     | •             |                    | ı     | •            | ~             | <b>-</b> |
| SUBTOTAL   |       | -               |       | 16            | 1                  | 13    | 16           | ć             |          |
| ** INSTRUMENTS/EQUIPMENT AND ACCESSORIES **  |       |                 |       |               |                    |       |              | v             | 8        |
| FLIGHT AND NAVIGATION INSTRUMENTS COMPASS COMMUNICATIONS AND NAVIGATION EQUIPMENT VOR RECEIVERS COMMUNICATIONS AND COMPACTION RECEIVERS COMPANS OFFETABLE  |       |                 |       | m ===         | ww                 | - 44  | # <b>-</b> - | ma            | - +      |
| OTHER SOURCES OF THE SOURCE OF THE SECURE OF | -     |                 | _     | an .          | ~                  | - 2   | N = .        | n =           | 4 N N    |
| SUBTOTAL   |       |                 | -     | - •           | 7                  |       | <b>-</b> -   |               | ~        |
| ** AIRPORTS/AIRWAYS/FACILITIES ***   | •     |                 |       | ,             |                    | ;     | -            | ~             | 41       |
| AIRDRT FACELITIES AIRDRT COMOITIONS SOOM ON RUNMAY   |       |                 |       |               | -                  |       |              |               |          |
| IRMAYS FACILITIES  |       |                 |       | <del></del> 1 | <b>-</b>           |       | -            | -             | ~        |
|  |       |                 |       |               |                    |       |              |               |          |

|                    | 1                                    | 1      | ~ | 90       | ın o        |             | o. c     | 127                | 5 2      |                  | - 2               | 397   |          | <b></b> (        | <b>&gt;</b> > ( | 115<br>6 | 133  | 6836    |       |             | 408<br>16                         |          | 28      | 2 1  | - 2                | 1 J 1        | 7   | 25<br>8            | 8 44  | e .            | 111   | , r- n     | . 7. "           | 2 2 2  | 89  | ູ້ທີ່ສວ  | w 4                  | 811<br>63                                       |   |
|--------------------|--------------------------------------|--------|---|----------|-------------|-------------|----------|--------------------|----------|------------------|-------------------|---|----------|------------------|-----------------|----------|--|---------|-------|-------------|-----------------------------------|----------|---------|--|--------------------|--------------|---|--------------------|---|----------------|---|------------|------------------|--|---|--|----------------------|---|---|
| 1                  | S I                                  | TOTAL  |   |          |             | 11          |          |                    |          | ٠ ٩              | <b>ب</b> د        |   |          |                  |                 | 4        | <b>30</b>  |         | 443   |             | 4 [                               | ٠        | 1 7     | 2  | - C                | 4 1          | 1.2<br>9  | 5 E                | ٦- ٣  | , ,            | ° 4.  |            | 2 1              | ~ ~ -  | 19:   | ~-   | 1 C M                | - 2   | A STATE OF THE STATE OF   |
|                    | ALL ACCIDENTS                        | FACTOR |   | 4        | 0 = 0       | 20.         | 106      | . ~                | <b></b>  | ,- •             | •                 | 232   |          |                  |                 |          | 10   |         |       |             | 4 n                               |          | 1 1     | _  |                    |              | 128<br>1  | 73                 |   | - e            | 46  | 6 t-       | ~                | (  | 23<br>28  | r 1  |                      | 810<br>61                                       | in and  |
|                    | AF                                   | CAUSE  | - | •        | m ev        | 4 C         | 140      |                    |          | -                | •                 | 165   |          |                  | rc              | 111      | 125  |         | 4394  |             | 404                               |          | -       |  |                    |              | -   |                    |   |                |   |            |                  |  | <b>.</b>  | C/ 4T  | ~ (                  | n 40 kg   | and control of the  |
|                    | 2                                    | TOTAL  | N |          | 29<br>11    | 18          | 229      | <b>8</b>           | 4        | ٠٠.              | • 4 •             | 342   |          |                  | • • -           | 106      | 123  |         | 4414  |             | 392                               | 14       | 2 5     | `  | 7 -                | N 4          | 141   | 87                 | so en i   | 40             | 110   | 74         |                  |  |   | 12   |                      | 766   | eriore de dese  |
|                    | VCC1DEN                              |        | - |          | <b>4</b> 50 | . 52 9      | 13<br>08 | <b></b>            | 4        | ø                | n 4               | 1<br>194  |          |                  | 4               | 4        | Œ  |         | 384   |             | 4                                 | 10       | ٠;      | 71   | 27                 | N 4          | 56  | 1,0                | ໝາ  | e              | e 4   | -4         | ^                | 2  | 53.1  | 11 2   | 1                    | w v   | and the state of  |
|                    | NONFATAL ACCIDENTS                   | FA     | - |          | 25          | u m         | e -      | 1.                 | _        |                  | -                 | 148   | !        |                  | ⊶ rv ∗          | 102      | ٠ إ  | ì       | 4030  |             | 388                               | 4        | _       | <b>∞</b>   |                    |              | 115   | -0                 |   | 75             | 4 4   | 4.         | - 2              |  | 18 2  | 7 - 2  | 9 1                  | 766   |   |
|                    | D I                                  | CAUSE  |   |          |             |             | ,        | Ä                  |          |                  |                   |   |          |                  |                 | ø        |  | 10      |       |             | 4                                 | 20.      |         | 8 -  |                    |              | 14  | ď                  | , ,   | n d            |   | ٠w         |                  | ٦.   | - 4 i   | 5  |                      | 4° 1  | 1   |
|                    | NTS                                  | TOTAL  |   |          | 12          | 4 4 1       | n o      |                    |          | ~ ~              |                   |   | n<br>n   |                  |                 |          | •  | -       | 4.25  |             |                                   |          |         | 2  |                    |              |   |                    | <b>v</b> :  | N              |   |            |                  | -4   | -   | 8 -1   | ,                    | , 1   |   |
| . TABLE            | ACC 1DENTS                           | FACTOR |   |          | ::          | 4 w         | m N      | œ                  |          | 2 -              |                   | • !   | 86       |                  |                 |          |  |         | 14    | Ď           |                                   |          |         |  |                    |              |   |                    | m.  | v <del>t</del> |   | - 6        |                  |  | 4   | 7  | <b>.</b> -           | 1 4   | -   |
| CAUSE/FACTOR TABLE | FATAL                                | CAUSE  |   |          |             |             | N 4      | o                  |          |                  |                   |   | 11       |                  |                 | ď        |  | 2       | ;     | 30 t        |                                   | 16       | -       | Φ.   |                    |              | -   | •                  |   | - •            |   |            |                  |  |   |  |                      |   |   |
| CAUSE              |                                      |        |   |          |             |             |          |                    |          |                  |                   |   |          |                  |                 |          |  |         |       |             |                                   | 1 TO USE |         |  |                    |              |   |                    |   |                |   |            |                  |  |   |  |                      |   |   |
|                    |                                      |        |   |          |             |             | ;        | T ICING            | S X      |                  |                   |   |          |                  |                 |          | ş  |         |       |             |                                   | /FAILED  |         |  |                    |              | АКЕВ  |                    |   |                |   |            |                  | MOLDIN   | VISIO   |  |                      |   | FUEL  |
|                    |                                      |        |   |          |             |             | •        | ZING KA<br>N SYSTE | DERSTOR  |                  |                   |   |          |                  |                 |          | ERATION  |         |       |             |                                   | PER. OF  |         | ш  | 4                  |              | ANDING  |                    |   | RAFT           |   |            |                  | 7EM  | KILIED  |  |                      |   | PILOT FALLOUG<br>FUEL EXHAUSTION<br>FUEL CONTAMINATION-EXCLUSIVE OF WATER IN FUEL |
|                    | NUED 1                               |        |   |          |             |             |          | PREE<br>*DUCTIO    | S, THUN  |                  |                   |   |          |                  | ISION           | RCRAFT   | RMAL OP  |         |       |             | ## SN0                            | ROPER OF |         | PRACTIC  | ,                  | 0 TO KE      | ENDED L   |                    | 暑   | F A1RC         |   |            |                  | ING SYS  | TC-REST   | NES  |                      |   | VE OF W   |
|                    | (CONT)                               |        |   |          |             |             |          | S SLEET<br>CARB/IN | 1/CLOUD: |                  |                   |   |          |                  | 100 010         | ATEN A   | ON SNI   |         |       |             | CONDIT                            | JP-IMP   | щ.      | AT ING   | JUEGONE.           | R FAILE<br>D | HAY/INT   | UPPLY              | CH<br>RSUMPTI   | D USE (        | !   |            |                  | JBR I CAT<br>VERSPEE   | 066Y, E   | MKUNG FAN'<br>IMPROPER ALIGNMENT/ADJUSTMENT<br>EATLURE OF TWO OR MORE ENGINE |                      | TTERN   | EXCLUST   |
|                    | 11.17165                             |        |   |          |             |             |          | INCLUDE<br>IVE TO  | ATED 4   | Ħ                | 11 S 1 CIN        | TUDE<br>IVITY   |          | :                | 4               | ON OPER  | AFFECT   |         |       |             | ACTS,                             | ING EQU  | o to us | OD OPE   | ENGINE             | READ OF      | TH RUN  | FUEL S             | APPROA<br>FUEL CO   | D<br>THORIZE   | URED  | LURE       | IRE<br>SOPER     | ABLE-0   | IRTY F  | NIZENT/A   | FL 164T<br>E         | CORRODED/CORROSION<br>CONGESTED TRAFFIC-PATTERN | ON<br>AT 10N-E  |
| LOGIC              | YS/FAC                               |        |   |          | #           | _           |          | CONDUC             | ASSOC    | LHIND<br>NDS ALO | RATURE<br>NS TO V | TY ALTI   | یا       | NEDUS            | ISION           | ED PERS  | ATERIAL<br>TRIES   | -       | P.    | TOTAL       | ANEOUS                            | 719075   | 1-FA1LE | ROINAT 1   | EMERGE<br>D WRONG  | NTS-MIS      | GNED W  | TED CUY            | LANNED  | NED LOA        | LY SEC  | CAL FAI    | FRACTU           | R GRADE  | ELD, D  | R ALIG   | 10N 1N               | ED/CORR<br>TED TRA                              | XHAUST 1  |
| . CONTINUED!       | S/AIRWA                              |        |   | SUBTOTAL | WEATHER ##  | LOW CETLING | _        | G COND             | VORABL   | RSE WIL          | H TEMPE           | H DENSI<br>NDERSTO                                      | SUBTOTAL | MISCELLANEDUS ** | .0 COLL         | SIVE M   | SABUTAGE<br>FOREIGN MATERIAL AFFECTING NORMAL OPERATIONS<br>STORET FOTRIES | STOTOLS | 20810 | GRAND TOTAL | ** MISCELLANEOUS ACTS, CONDITIONS |          | ECKLIS  | CREW COORDINATION-FUOR<br>DISREGARD OF GOOD OPERATING PRACTICE | HPROPER<br>SATHFRE | NSTRUME      | SEA! BEL! NO! HITH RUNHAY/INTENDED LANDING AKEA<br>NOT ALLIGNED WITH RUNHAY/INTENDED LANDING AKEA | NWARRAN<br>NATTENT | POORLY PLANNED APPROACH<br>MISCALCULATED FUEL CONSUMPTION | ETTISO         | STOLEN UN | ELECTRICAL | FATIGUE FRACTURE | FUEL GRADE-INFOSTER IMPROPE OIL-LUBRICATING SYSTEM IMPROPER OIL-LUBRICATING SYSTEM | MINDSHIELD, DIRIY, FOGGY, ETC-RESTRICTED VISION | IMPROPE<br>CALLIRE   | SEPARATION IN PLICHT | CORRODI   | PILOT<br>FUEL E<br>FUEL C   |
|                    | TABLE 37 TOWN TOWN TO THE CONTINUED! |        |   | ŭ        | # #         | 3           | 4 5<br>5 | SNO.<br>1C IN      | TURE     | 204              | H16               | HIGH DENSITY ALTITUDE<br>THUNDERSTORM ACTIVITY<br>THERE | 5        | *                | 818             | ŽŠ       | ¥ 9.5  | 5       |       |             | *                                 | 4        | ₹ 亡     | 56   | 11 11              | L = 1        | νz  | ⊋ ⊢                | · O. 3  | 7 1            | ., I  |            |                  | _  |   |  |                      |   |   |
|                    |                                      |        |   |          |             |             |          |                    |          |                  |                   |   |          |                  |                 |          |  |         |       |             |                                   |          |         |  |                    |              |   |                    |   |                |   |            |                  |  |   |  |                      |   |   |

|  |          | FATAL ACCIDENTS | ENTS       | MONE         | MONFATAL ACCIDENTS | DENTS      | ALE                                     | L ACCIDENTS | NTS            |  |
|--|----------|-----------------|------------|--------------|--------------------|------------|---|-------------|----------------|--|
|  | CAUSE    | FACTOR          | TOTAL      | CAUSE        | FACTOR             | TOTAL      | CAUSE                                   | FACTOR      | TOTAL          |  |
| ALCOHOLIC IMPAIRMENT OF EFFICIENCY AND JUDGMENT  | 4        | •               | ļ          |              |                    |            |   |             |                |  |
| ICE-IN FUEL  | n        | 7 →             | ~ ~        | 4            |                    | 4          | ٥                                       | 7           | 7              |  |
| ICE-CARAINETON   |          |                 |            | 2.           | 7                  | 12         | ======================================= | - 2         | 13             |  |
| ICE-PROPELLER<br>AIRERAL   | 16       |                 | 16         | 324          | 7                  | 331        | 34.6                                    | ^           | 9              |  |
| ICE-WINDSHIELD   |          |                 |            | ₽.           | 4                  | <b>-</b> 0 | 4                                       | . ,         | <del>,</del> ( |  |
| LACK DE LIBETATION FOR THE SHIP AND OR CE  | -        | ,               |            |              |                    | ٠,         | o -1                                    | •           | ÷ ~            |  |
| OIL EXHAUSTION-ENGINE LUBRICATION SYSTEM   | ••       | n               | <b>+</b> → | 10           | ~ ~                | 7 :        | =                                       | ν.          | •              |  |
| OIL CONTAMINATION  | 4        |                 | 4          | 54           | 2                  | 56         | 82                                      | ٠.          | 2 9            |  |
| MATER IN THE   |          |                 |            | N In         |                    | ν ιν       | ~ 4                                     |             | N 10           |  |
| AIRCRAFT CAME TO REST IN MATER   | •        |                 | 7          | 182          | w                  | 4 5        | 6 9                                     | <b>~</b> u  | *              |  |
| MISSING MOISTURE   |          | 4               | 4          |              | 19                 | 19         | ì                                       | 23.0        | 23             |  |
| OVER OR COLANDING  | 1        | ~ .             | ю          | <b>7</b>     | ۳                  | 17         | 4 SI                                    |             | 4 č            |  |
| MATERIAL FAILURE   |          | -               | ~          | -            | 'n                 | ٠,         | •                                       | 4           | 30             |  |
| OIL STARVATION   | 18       | 1 0             | 19         | 463          | 11                 | 474        | 481                                     | 12          | 493<br>493     |  |
| FUEL CELEARANCE TOLERANCE  |          |                 | 'n         | 32           |                    | 4.<br>96   | 950                                     | - ۵         | 822            |  |
| FIRE OF UNDETERIOR DATE OF TANKS UNAPAPARIED ORIGIN  | n &      | 2               | F 01       | 30<br>30     | ~ s                | 19<br>35   | 38                                      |             | 55             |  |
| IMPROPER/INADEGUATE VENTING  |          |                 |            | <b>~</b> w   | ~                  |            | ; w                                     |             | } <b>~</b> !   |  |
| POOR TACK OF   |          |                 |            |              | ım.                | - 00       | a In                                    | <b>v</b> m  | - 40           |  |
| LEAK TOUS DAMAGE   |          |                 |            | 2            | -                  | - ~        | ^                                       |             |                |  |
| LOW FLUID LEVEL  | m        |                 | 6          | ~ <u>~</u>   | m 4                | 8 %        | ın ş                                    | М.          | 1 60           |  |
| SOL COMMENT OF THE PROPERTY OF |          |                 | •          | }            | - 7                | 2 2        | 63                                      | <b>*</b> ~  | ₹~             |  |
| CAPECIA  | 4        |                 |            | 1            |                    | ,          | <b>~</b> r                              |             | - 1            |  |
| OVER TOROIEN   | v        |                 | ٦,         |              | 4                  | - 4        | -                                       | ın          | ~ es           |  |
| LOOSE TORQUED  | ,        | •               | 0          | <b>.</b>     | m                  | 27         | 54                                      | 4           | E -            |  |
| BENT PART/FITTING  | •        |                 | 4          | [            | •                  | - 5        | •                                       |             |                |  |
| BURNED   | r        |                 | ) 1        | . 6          | •                  | F          | m<br>m                                  | m           | 9, "           |  |
| CHAFFED  | •        | -               | <b>m</b> ⊷ | <u>.</u>     | ٦,                 | 9 2        | ٠.                                      |             | יסי            |  |
| CROSSED  | ~-       |                 |            | . ~ .        | , 7,               | 4          | <b>-</b>                                | m N         | <b>1</b> 4     |  |
| DISCONNECTED   |          | i               |            | n            | -                  | ø          | • →                                     | -           | ۲-             |  |
| EXCESSIVE<br>ERRATIO   | <b>-</b> |                 | 7          | 4 £          |                    | ٠.4        | re E                                    | 26          | . ~ ;          |  |
| FRICTION, EXCESSIVE  | -        |                 |            | <i>د</i> م   | 14                 | <u>د ت</u> | , o n                                   | ' ½         | 30;            |  |
| HIGH VOLTAGE BREAKDOWN   |          |                 |            | ⊶ ro         | ;                  |            | J W                                     | :           | 9-1            |  |
| JAMMED TALLED  | -        | -               | ć          | -;           |                    | ٠-:        | , m                                     |             | Λ              |  |
| OBSTRUCTED<br>OPEN   | •        | -               | N          | 9 4          | m                  | Ç 4        | 27                                      | 4           | 31             |  |
| OUT OF BALANCE   |          | p=+)            | _          | 21           | -                  | 27         | 21                                      |             | 52             |  |
| PINCHED  |          |                 |            | → :          | → 62               | <b></b> €0 | -                                       | ~ ~         | - m            |  |
| EXCESSIVE PRESSURE   |          |                 |            | <u>*</u> -   | -                  | 51         | <u>*</u> 1                              |             | 15             |  |
| PRESSURE TOO LOW   |          |                 |            | <b>†</b> :   | -                  | 4 7        | 4:                                      |             | 4              |  |
| SHEARED  | 2        |                 | 2          | ٥            | ٠.                 | ::'        | : ° 4                                   | - 2         | 2 = 1          |  |
| STATES OF STATES | NI       |                 | ~          | <b>.0 so</b> | 8                  | 9 01       | r ap «c                                 | *           | * ** \$        |  |
| EXCESSIVE TEMPERATION  | -        |                 | -          | <b>-</b> ;   |                    | ~ ;        |   | J           | 2 ~            |  |
| MARPED WESTER  | ł N      |                 | ٠.         | j 4 .        | n 🚁 .              | E 80       | E 9                                     | w 4         | 401            |  |
| ICE-INDUCTION  | -        |                 | -          | t ~-         | 4                  | 10 e       | 4 (                                     | 4           | 80 <b>~</b> 1  |  |

DIRECT ENTRY CAUSES (CONTINUED)

PWR PLT-LEFT ENGINE COUNTERMEIGHT ATTACHMENT FAILD
COPIOT-IMAOVERTENITY NOW DAR LYST TO CUTOFF,
DAR PLT-EUEL STRANTION CAUSE BY DAGS
PHEN PLT-SALL ON OUT FILTER IMPOPERTY INSTALLED.
PHEN PLT-SALL ON OUT FILTER IMPOPERTY INSTALLED.
PHEN PLT-SALL ON OUT FILTER IMPOPERTY INSTALLED.
PHEN PLT-EACES INFRATION FOR NUMETHEN NED CAUSE.
PHEN PLT-ANTERIL FAILURE, CAM RUDUTION GEAR ASSEMBLY PREPARED ASSEMBLY TO A FEBRUARY PROPERTY TOWN OF THE CAUSE BY DAGS
PHEN PLT-ANTERIL CARROLLING GENERAL LEGALS.
PHEN PLT-ANGERILE HOUSING FOUR CAUSE.
PHEN PLT-ANGERILE HOUSING FOUR CAUSE.
PHEN PLT-ANGERILE HOUSING FOUR DEFORMED TAWN VENT.
PHEN PLT-SALLSHE WITHERE CARROLLING TOWN VENT.
PHEN PLT-ANGERILE HOUSING BOOKE FOUR OF FIREMAL
PHEN PLT-ANGERILE HOUSING BOOKE FOUR OF FIREMAL
PHEN PLT-ANGERILE HOUSING BOOKE FOUR OF FIREMAL
PHEN PLT-ANGERILE MATERA AND SCHOOL PARK PLT-CARG. ELOTA IMPROPERLY INSTALLED.
PHEN PLT-ANGERILE CANDING TOWN VENT.
PHEN PLT-ANGERILE MATERA AND SCHOOL PARK PLT-CARG. ELOTA IMPROPERLY INSTALLED.
PHEN PLT-ANGERILE MATERA AND SCHOOL PARK PLT-CARG. ELOTA IMPROPERLY INSTALLED.
PHEN PLT-ANGERILE MATERA AND SCHOOL PARK PLT-CARG. ELOTA IMPROPERLY INSTALLED.
PHEN PLT-ANGERILE MATERA AND SCHOOL FAILURE CAUSE UNKNOW
PHEN PLT-ANGERILE MATERA AND SCHOOL FAILURE CAUSE WINTON FOUR FAILURE CAUSE WINTON FOUR PARK PLT-CARG. FAILURE OF PRICE CONSUMPTION CAUSE WOT OTHER PROPERTY INSTALLED.
PHEN PLT-CARGES FOR THE CANDING PROPING FAILURE CAUSE WINTON FOUR PROPING FAILURE CAUSE WINTON FOR WINTON BACKET FAILED.
PHEN PLT-CASSIVE FUEL CONSUMPTION CAUSE FAILURE FOR PREPARED TO THE CANDING PROPING FAILURE CAUSE WINTON FOR WINTON BACKET FAILED.
PHEN PLT-CASSIVE WELL CONTONING PREPARED TO THE PROPING FAILURE CANDING FAILURE CAUSE WINTON FOR WINTON BACKET FAILED.
PHEN PLT-CASSIVE WELL CONTONING PREPARED TO THE PROPING FAILURE FOR EASE FAILURE FOR FAILURE CANDING FAILURE FOR FAILURE FOR EASE FAILURE FOR FAILURE FOR FAILURE TO THE CAUSE WINTON BACKET FAILED.
PHEN PLT-CASKET ON THE CASSIVE FAILURE FOR PARK PLT-ARITHER CONTONING FAILURE FAILURE FOR INTERPRETATION OF WITH TURBO SUPERCHARGERS FULL BOOST PROFILED TO BE WITH TURBO SUPERCHARGERS FULL BOOST PAR PIT-FUEL STARWATION FOR WORFTERNING REASON PAR PIT-FUEL STARWATION FOR MAN UNDETERMINED REASON PILOT-ART ON ANOTOFICE, PLT ASLEEP. PHR PLT-CARRURETOR NEEDLE VALVE STUCK.

PAR PLT-THTAKE HANIFOLD CRACKED.

PHP PLT-THARDERENT RIGGED MIXTURE CONTROL.

PHR PLT-CIL STRAVATION FOR UNDETERMINED REASON

PHR PLT-CIL STRAVATION FOR UNDETERMINED PLOTING TO THE PROPERTY. DIRECT ENTRY CAUSES

DIRECT ENTRY CAUSES ARE CARRIED UNDER THEIR APPROPRIATE CAUSAL CATEGORIES AND ARE INCLUDED IN THE TOTALS

# TABLE 38 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE AVCO/LYCOMING 0-235 SERIES ENGINE

| TOTAL ACCIDENTS - 99  |           | PER CEN      | IT<br>L EXPECTED |
|---|-----------|--------------|------------------|
| CAUSE/FACTOR  | FREQUENC  | Υ Δεετισμίσ  | S PER CENT       |
|   | ,         | -/           | -//              |
| PILOT IN COMMAND  |           |              |                  |
| MISMANAGEMENT OF FILE   | 22        | 22.2         |                  |
| INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING                                  | 21        | 22.2<br>21.2 | 18.4<br>28.2     |
| BECAME LOSTADISORIENTED   | LS 17     | 17.2         | 20•2<br>14•0     |
| IMPROPER IN-FLIGHT DECISIONS OF DIAMANA   | 5         | 5.0          | 3.0              |
| **************************************  | 2         | 2.0          | 3.8              |
| LAUK OF FAMILIARITY WITH, AIRCOLG   | 2         | 2.0          | 1.3              |
| TITEMPTED UPPKATION WITH PROUNT DEFICE-   | 2<br>IP 1 | 2.0          | 1.8              |
|   |           | 1.0<br>1.0   | 1.0              |
|   |           | 1.0          | •3               |
| EXERCISED POOR JUDGMENT PROCEDURES DIRECTIVES, ET                                 | TC 1      | 1.0          | 1.2<br>.8        |
| PONTANEOUS IMPROPER ACTION  | 1         | 1.0          | •6               |
| HYSICAL IMPAIRMENT  | 1         | 1.0          | • 3              |
|   | 1         | 1.0          | • 2              |
| PERSONNEL (MAINTENANCE, SERVICING,  | INSPECTIO | N)           |                  |
| NADEQUATE MAINTENANCE AND INSPECTION  |           |              |                  |
| UENUPER MAINLENANCE (MAINTENIALE  | 12        | 12.1         | 9.0              |
| TO THE POLICY TOTAL ATRIBATION OF THE PARTY.                                      | 2         | 2.0          | 1.4              |
| NADEQUATE INSPECTION OF AIRCRAFT (OWNER-PILOT)                                    | 1         | 1.0          |                  |
| POWERPLANT  | L         | 1.0*         | • 1              |
|   |           |              |                  |
| JEL SYSTEM - CARBURETOR   | 5         | <b>.</b> -   |                  |
| SNITION SYSTEM - MAGNETOES<br>SNITION SYSTEM - SPARK PLUG                         | 4         | 5.0<br>4.0   | - • •            |
| IEL SYSTEM - VENTS, DRAINS, TANK CAPS   | 4         | 4.0          | 1.8<br>1.5       |
|   | 4         | 4.0*         | 1.3              |
| OTHE CONTROLS - CHERDIT -   | 3         | 3.0          | 4.0              |
| THROTTLE - POWER LEVER ASSEMBLIES   | _         |              |                  |
| PENTLANTEINSTRUMENTS - ENEL OUANETER  | 3<br>3    | 3.0*         | • 8              |
| VINE SINOCIONE - CRANKFACE  | 1         | 3.0          | 1.3              |
| GINE STRUCTURE - CRANKSHAFT GINE STRUCTURE - MASTER AFT                           | i         | 1.0<br>1.0   | • 2              |
| GINE STRUCTURE - MASTER AND CONNECTING RODS GINE STRUCTURE - PISTON, PISTON RINGS | ī         | 1.0          | 1•7<br>2•6       |
| EL SYSTEM - FILTERS, STRAINERS, SCREENS   | 1         | 1.0          | 2.1              |
| STATINGTON STREET   | 1         | 1.0          | • 5              |
| MISCELLANEOUS ACTS AND CONDITI  | IONS      |              |                  |
| EL STARVATION   |           |              |                  |
| EL EXHAUSTION   | 31        | 31.3         | 24.6             |
|   | 14        | 14.1#        | 24.8             |

# TABLE 39 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE AVCO/LYCOMING 0-290 SERIES ENGINE

| TOTAL ACCIDENTS - 114  CAUSE/FACTOR  | FREQUENCY /                     | PER CENT<br>OF TOTAL EX<br>ACCIDENTS PE | PECTED<br>R CENT |
|--|---------------------------------|---|------------------|
| CAUSEY PACTOR  |                                 |   |                  |
| PILOT IN COMMAND   |                                 |   |                  |
| AND COR DI ANNI NG   | 24                              | 21.1                                    | 28.3             |
| INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING   | 21                              | 10.                                     | 18.5<br>14.2     |
| MISMANAGEMENT OF FUEL  MISMANAGEMENT OF FUEL  IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROL  IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROL | S 14                            |   | 1.7              |
| IMPROPER OPERATION OF WITH AIRCRAFT LACK OF FAMILIARITY WITH AIRCRAFT LACK OF FAMILIARITY DECISIONS OR PLANNING  | 6                               | 1.8                                     | 3.8              |
| LACK OF FAMILIARITY WITH ATROOMS OR PLANNING IMPROPER IN-FLIGHT DECISIONS OR PLANNING IMPROPER IN-FLIGHT DECISIONS OR PLANNING                         |                                 | •9                                      | 1.0              |
| ATTEMPTED OPERATION WITH KNOWN 33.1.   | -                               | •9                                      | 3.1<br>.8        |
| BECAME LOST/DISORIENTED  BECAME LOST/DISORIENTED  FAILED TO FOLLOW APPROVED PROCEDURES DIRECTIVES, ET  | TC 1 1 1 1 1 1 1                | •9<br>•9                                | . 2              |
|  | 1                               | •9                                      | 1.3              |
| THADEDHATE SUPERVISION OF TELOTION   | i                               | • 9                                     | •3               |
| ANDRETER POOR JUDGMENT   |                                 | •9<br>•9*<br>•9                         | .06<br>.3        |
| CELECTED INSHITABLE LENDAIN  | 1                               | • 9                                     | • 5              |
| SPONTANEOUS IMPROPER ACTION  | INSPECTIO                       | N)                                      |                  |
| PERSONNEL (MAINTENANCE, SERVICING  |                                 |   | 8.9<br>.6        |
| - WITHTENANCE AND INSPECTION   | 14                              | 12.5                                    | •6               |
| INADEQUATE MAINTENANCE (DWNER PERSONNEL) IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL)  | 2                               | •9                                      | 1.4              |
| IMPROPER MAINTENANCE (MAINTENANCE (OWNER-PILOT)  |                                 | 12.3<br>1.8<br>.9                       | •8               |
| POWERPLANT   | 8<br>4<br>4<br>4<br>2<br>2<br>2 |   |                  |
|  | 8                               | 7.0                                     | 3.8              |
| ENGINE STRUCTURE - VALVE ASSEMBLIES  | 4                               | 3.5                                     | 1.8<br>3.4       |
| IGNITION SYSTEM - MAGNETOES  | 4                               | 3.5<br>3.5                              | •2               |
| FUEL SYSTEM - CARBURETOR LUBRICATING SYSTEM - SEALS AND GASKETS  | 4                               | 3.5*                                    | • 4              |
| EXHAUST SYSTEM - MUFFLERS  EXHAUST SYSTEM - MUFFLERS AND CONNECTING RODS   | 2                               | 3.5*<br>1.8                             | 2.6              |
| EXHAUST SYSTEM - MUFFLERS ENGINE STRUCTURE - MASTER AND CONNECTING RODS ENGINE STRUCTURE - MISTON RINGS  | 2                               | 1.8                                     | 2•1<br>•8        |
| ENGINE STRUCTURE - MASTER APISTON RINGS ENGINE STRUCTURE - PISTON, PISTON RINGS  | 2                               | 1.8                                     | • 0              |
| = $=$ $=$ $=$ $=$ $=$ $=$ $=$ $=$ $=$  | 2                               | 1.8                                     | •9               |
| TUROTTIE - DOWER LEVER ASSEMBLIES  | 2<br>2                          |   | - 4              |
| MIXTURE CONTROL ASSEMBLIES   | 2                               | 1.8                                     | 1.3<br>1.8       |
| DOUGROU ANT TRICTRUMENTS - FUEL WORK   |                                 | •9<br>•9                                | 2.2              |
| ENGINE STRUCTURE - CRANKSHAFT ENGINE STRUCTURE - CYLINDER ASSEMBLY ENGINE STRUCTURE - CYLINDER ASSEMBLY  | 1<br>1                          | .9                                      | 1.6              |
| TONITTION SYSTEM - SPACE 1000  | 1                               | •9*                                     | .0<br>.1         |
| IGNITION SYSTEM - CUILS  | 1                               | •9*<br>•9                               | • 5              |
| IGNITION SYSTEM - LEADS  IGNITION SYSTEM - FILTERS, STRAINERS, SCREENS  FUEL SYSTEM - FILTERS, STRAINERS, SCREENS                                      | 1                               | • 9                                     | .8               |
| FUEL SYSTEM - PUMPS  | i                               | • 9                                     | • 2              |
| FUEL SYSTEM - OTHER  | 1                               | •9<br>•9                                | .6<br>.1         |
| LUBRICATING SYSTEM - PUMP-PRESSURE   | 1<br>1                          | •9*                                     | •1               |
| LUBBICATING CYCIEM - DIE COGERNO   | i                               | • 9                                     | • 4              |
| LUNDICATING SYSTEM - UTILL   | 1                               | •9*                                     | •1               |
| FXHAUST SYSTEM - BAFFLES   |                                 |   |                  |
| MISCELLANEOUS ACTS AND COM   | ADITION2                        |   |                  |
|  | 33                              | 28.9                                    |                  |
| FUEL STARVATION FUEL EXHAUSTION  | 13                              | 11.4#                                   | 25.0             |
|  |                                 |   |                  |

### ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE AVCO/LYCOMING 0-320 SERIES ENGINE

| CAUSE/FACTOR  | FREQUENCY   | PER CENT<br>OF TOTAL<br>ACCIDENTS     | EVOCATOR          |
|---|-------------|---------------------------------------|-------------------|
|   | /           | /                                     | PER CENT<br>//    |
| PILOT IN COMMAND  |             |                                       |                   |
| INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING  | 148         | 30.4                                  | 07.               |
| IMPROPER OPERATION OF POWERS  | 107         | 22.0*                                 | 27•6<br>17•9      |
| IMPROPER IN-FLIGHT DECISIONS OR PLANNING  |             | 14.2                                  | 14.1              |
| INADEQUATE SUPERVISION OF STREET  | 14<br>12    | 2.9<br>2.5                            | 3.9               |
| VONIANUED VER ELICHT TATA ARABET  | 10          | 2.1                                   | 3,2<br>1,2        |
| LACK OF FAMILIARITY WITH AIRCRAFT   | 15 R<br>8   | 1.6                                   | 1.2               |
| ATTEMPTED OPERATION WITH KNOWN DEFICIENCIES IN EQUI<br>FAILED TO FOLLOW APPROVED PROCEDURES DIRECTIVES.ET<br>EXERCISED POOR JUDGMENT          | P 4         | 1.6<br>.8                             | 1.8               |
| EXERCISED POOR JUDGMENT PROCEDURES DIRECTIVES.ET  | C 3         | -6                                    | l•1               |
| ATTEMPTED OPERATION BEYOND EXPERIENCE/ABILITY LEVEL DELAYED IN INITIATING CO-APPRISE  | 3<br>1      | •6                                    | ,6                |
| FAILED TO USE OR INCORPORTING MACO  | i           | •2<br>•2                              | •4                |
|   | 1           | ę 2                                   | •04<br>•3         |
| SELECTED UNSUITABLE TERRAIN PHYSICAL IMPAIRMENT   | 1           | €2                                    | . 2               |
| SPATIAL DISORIENTATION  | · 1         | •2                                    | ●07               |
| PSYCHOLOGICAL COMPITION   | î           | • 2                                   | •3<br>•07         |
| SELECTED WRONG RUNWAY RELATIVE TO EXISTING WIND   | 1           | . 2                                   | .04               |
|   | 1           | •2*                                   | •0                |
| PERSONNEL IMAINTENANCE SERVICING. INADEQUATE MAINTENANCE AND INSPECTION   | INSPECTIONA |                                       |                   |
|   | 36          | 7.4                                   | 9.3               |
| IMPROPERLY SERVICED AIRCRAFT (OWNER-PILOT)  | 7           | 1.4                                   | 1.4               |
| INADEQUATE INSPECTION OF ATTOCHMEL)   | 3           | •8<br>•6                              | •8<br>"           |
| IMPROPERLY SERVICED AIRCRAFT (GROUND CREW)  | 3<br>2      | <b>6</b>                              | • 7<br>• 3        |
| POWERPLANT  | •           | <b>.</b> 4                            | <b>e</b> 3        |
| ENGINE STRUCTURE - VALVE ASSEMBLIES<br>FUEL SYSTEM - CARBURETOR   | 33          |                                       |                   |
| ENGINE STRUCTURE - MACTED AND ASSURED   | 14          | 6 <sub>●</sub> 8≠<br>2 <sub>●</sub> 9 | 3.4               |
|   | 9           | 1.8                                   | 3.5<br>2.7        |
| ENGINE STRUCTURE - PISTUN. PISTON RINGS IGNITION SYSTEM - SPARK PLUG  | 9<br>8      | 1.8                                   | 1 • 3             |
| UBRICATING SYSTEM - LINES WOOD  | 8           | 1,6<br>1,6                            | 2.2               |
|   | 8           | 1.64                                  | 1.6<br>.4         |
| MOINE SIKUCIURE - CVIIMOED ACCEUS   | 6           | 1.2                                   | .7                |
| UEL SYSTEM - LINES AND FITTINGS UEL SYSTEM - VENTS. DRAIMS. TANK CAPS   | 5<br>5      | 1.0                                   | 2 3               |
|   | 5           | $1 \bullet 0$ $1 \bullet 0$           | 1.0<br>1.5        |
| UNITUN SYSTEM - MACHETOER   | 5           | 1.0                                   | -4                |
| NGINE STRUCTURE - CRANKSHAFT  | 4<br>3      | -8                                    | 2.1               |
| GNITION SYSTEM - IGNITION HARNESS. SHIELDING UEL SYSTEM - FILTERS. STRAIMERS. SCREENS UEL SYSTEM - PHAGE                                      | 3           | •6#<br>•6                             | 1,9               |
|   | 3           | 6                                     | . <b>2</b><br>. 5 |
| UBRICATING SYSTEM - SEALS AND GASKETS  XHAUST SYSTEM - STACKS   | 3<br>3      | •6                                    | <b>8</b> •        |
| NOINE CONTROLS - COCKRIT  | 3           | <b>ა</b> 6⊅                           | <b>6</b> .5       |
| INNUTIES TO PROPER LEVED ACCOUNTING   | _           | _                                     | •1                |
| NGINE STRUCTURE - CRANKELES   | 3<br>2      | •6<br>•4                              | 1.0               |
| UNITION SYSTEM - HIGH TENETON WESTER  | 1           | •2                                    | • 5<br>• 2        |
|   | 1           | •2≄                                   | 0                 |
| XHAUST SYSTEM - MANIFOLDS<br>NGINE CONTROLS - COCKPIT -   | 1<br>1      | •2                                    | • 1               |
| INDUCTION ATR. ORGHEAT CONTON.  |             | •2                                    | •07               |
| INCHII ANEDUS - DIDO TUO  | 1           | •2                                    | •2                |
| DUCTION GEAR ACCENT INGESTION   | 1           | •2                                    | 04                |
| GEARS ASSEMBLY - GEARS ACCESSORY DRIVE  | 1           | •2                                    | • .               |
| MISCELLANEOUS ACTS AND CONDITION  |             | ●4                                    | •1                |
| ISCELLANEOUS - BIRD INGESTION EDUCTION GEAR ASSEMBLY - GEARS. ACCESSORY DRIVE  MISCELLANEOUS ACTS AND CONDITION JEL STARVATION JEL EXHAUSTION | is          | 0.70                                  | 4.1               |

# TABLE 41 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE AVCO/LYCOMING 0-360 SERIES ENGINE

|   |             | DEN CENT               |             |
|---|-------------|------------------------|-------------|
| TOTAL ACCIDENTS - 169   |             | PER CENT<br>OF TOTAL E | XPECTED     |
|   | FREQUENCY   | ACCIDENTS P            | ER CENT     |
|   | /           | //-                    | /           |
| CAUSE/FACTOR  |             |                        |             |
| PILOT IN COMMAND  |             |                        |             |
| # #   |             | 30.2*                  | 17.0        |
| MISMANAGEMENT OF FUEL   | 51<br>49    | 29.0                   | 28.0        |
|   | S 20        | 11.8                   | 14.2        |
| IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROL                               | 14          | 11.8<br>8.3*<br>5.3    | 3.5         |
| IMPROPER IN-FLIGHT DECISIONS OR PLANNING BECAME LOST/DISORIENTED                  | 9           | 5.3                    | 2.9         |
| ACK OF EAMTITARITY WITH AIRCRAFT  | 6           | 3 • 6                  | 1 + t       |
| TARLED VED ELICHT INTO ADVERSE WEATHER CUNDITION                                  | NS 4        | 2.4                    | 1.2<br>1.0  |
| ARREMOTED ODEDATION WITH KNOWN DEFICIENCIES IN EMO                                |             | 1.2                    | •3          |
| ATTEMPTED OPERATION BEYOND EXPERIENCE/ADILLI' CLYCL                               | - 1<br>1    | -6                     | 1.4         |
| INADEQUATE SUPERVISION OF FLIGHT  | 1<br>1      | •6≭                    | • 06        |
| IMPROPER STARTING PROCEDURE   | 1           | •6                     | • 2<br>• 06 |
| PHYSICAL IMPAIRMENT<br>SPATIAL DISORIENTATION                                     | ī           | •6*                    | •06         |
| PERSONNEL (MAINTENANCE, SERVICING   | , INSPECTIO | ON)                    |             |
| ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~  |             | 4.7#                   | 0 2         |
| INADEQUATE MAINTENANCE AND INSPECTION   | 8<br>4      | 4•7#<br>2•4            | 7.0<br>1.3  |
| IMPRODER MAINTENANCE (MAINTENANCE PERSONNEL)                                      |             |                        | •7          |
| IMPROBED MAINTENANCE (OWNER PERSONNEL)  | 1<br>1      | •6<br>•6               | •3          |
| IMPROPERLY SERVICED AIRCRAFT (GROUND CREW)  | -           |                        |             |
| POWERPLANT  |             |                        |             |
| ENGINE STRUCTURE - VALVE ASSEMBLIES   | 7           | 4 • 1<br>2 • 4         | 2.0         |
| ENGINE STRUCTURE - VALVE ASSEMBLIES ENGINE STRUCTURE - MASTER AND CONNECTING RODS | 4           | 2 • 4                  | 2.6         |
| FUEL SYSTEM - CARBURETOR  | 4           | 2.4                    | 3.5<br>1.9  |
| TONITION SYSTEM - MAGNETOES   | 3.          | 1.8                    | 1.9         |
| POWERPLANT-INSTRUMENTS - FUEL QUANTITY GAUGE                                      | 3<br>2      | 1.8                    |             |
| FNGINE STRUCTURE - CYLINDER ASSEMBLY  | 2           | 1.2                    | 1.2         |
| FNGINE STRUCTURE - OTHER  | 2           | 1.2                    | 1.6         |
| IGNITION SYSTEM - SPARK PLUG<br>FUEL SYSTEM - LINES AND FITTINGS                  | 2           | 1 • 2                  | • 4         |
| ENGINE CONTROLS - COCKPIT -   |             |                        | 0           |
| THROTTLE - POWER LEVER ASSEMBLIES   | 2           | 1 • 2<br>• 6           | .9<br>1.8   |
| ENGINE STRUCTURE - CRANKSHAFT   | 1           | •6                     | 1.5         |
| THE SYSTEM - VENTS. DRAINS. TANK CAPS   | 1           | •6                     | .6          |
| LUBRICATING SYSTEM - LINES, HDSES, FITTINGS LUBRICATING SYSTEM - FILTERS, SCREENS | 1           | •6                     | • Z         |
| LUBRICATING SYSTEM - OIL COOLERS  | 1           | •6*                    | • l         |
| LUBRICATING SYSTEM - SEALS AND GASKEIS  | 1           | •6<br>•6               | •3<br>•5    |
| EXHAUST SYSTEM - MUFFLERS   | 1<br>1      | •6<br>•6               | •5          |
| MIXTURE CONTROL ASSEMBLIES  | 1           | •6                     | •2          |
| INDUCTION AIR, PREHEAT CONTROLS   | -           |                        |             |
| MISCELLANEOUS ACTS AND COND   | ITIONS      |                        |             |
| FUEL STARVATION   | 56          | 33.1*                  | 24.4        |
| FUEL STARVATION FUEL EXHAUSTION   | 54          | 32.0*                  | 24.1        |
| I VEE EMMOVIES.   |             |                        |             |

TABLE 42 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION

AS A FIRST ACCIDENT TYPE

AVCO/LYCOMING 10-360 SERIES, AID-360 SERIES ENGINE

| TOTAL ACCIDENTS - 54  CAUSE/FACTOR   | FREQUENCY                            | PER CENT<br>OF TOTAL<br>ACCIDENTS          | EXPECTED PER CENT                                 |
|--|--------------------------------------|--|---|
|  |                                      |  |   |
| PILOT IN COMMAND   |                                      |  |   |
| INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING MISMANAGEMENT OF FUEL IMPROPER IN-FLIGHT DECISIONS OR PLANNING CONTINUED VFR FLIGHT INTO ADVERSE WEATHER CONDITION IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROBECAME LOST/DISDRIENTED INADEQUATE SUPERVISION OF FLIGHT EXERCISED POOR JUDGMENT  PERSONNEL (MAINTENANCE, SERVICING          | 9<br>6<br>NS 4<br>LS 3<br>2<br>1     | 16.7<br>11.1*<br>7.4*<br>5.6<br>3.7<br>1.9 | 18.5<br>3.6<br>1.1<br>14.2<br>3.0                 |
| PERSONNEL (MAINTENANCE, SERVICING  | , INSPECTIO                          | N }  |   |
| INADEQUATE MAINTENANCE AND INSPECTION IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL) IMPROPERLY SERVICED AIRCRAFT (OWNER-PILOT) POWERPLANT   | 3<br>1<br>1                          | 5.6<br>1.9<br>1.9                          | 9•1<br>1•4<br>•8                                  |
| ENGINE STRUCTURE - MASTER AND CONNECTING RODS FUEL SYSTEM - FUEL INJECTION SYSTEM LUBRICATING SYSTEM - OTHER FUEL SYSTEM - VENTS, DRAINS, TANK CAPS LUBRICATING SYSTEM - LINES, HOSES, FITTINGS ENGINE STRUCTURE - CRANKCASE ENGINE STRUCTURE - CYLINDER ASSEMBLY ENGINE STRUCTURE - VALVE ASSEMBLIES ENGINE STRUCTURE - OTHER FUEL SYSTEM - OTHER | 7<br>4<br>3<br>2<br>2<br>1<br>1<br>1 | 13.0* 7.4 5.6* 3.7 3.7* 1.9* 1.9           | 3.9<br>.3<br>1.4<br>.5<br>.2<br>2.1<br>4.0<br>1.2 |
|  | -                                    | 1.9*                                       | • 2   |
| MISCELLANEOUS ACTS AND CONDI   | TIONS                                |  |   |
| FUEL EXHAUSTION FUEL STARVATION  | 16<br>15                             | 29.6<br>27.8                               |   |

# ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE AVCO/LYCOMING 0-540 SERIES ENGINE

TAI

| AVCO/LYCOMING 0-340 SERVER  |   |  |  |
|---|---|--|--|
| TOTAL ACCIDENTS - 231   | PREQUENCY AC  | PER CENT<br>DF TOTAL EXF<br>CCIDENTS PER   | PECTED<br>R CENT   |
| CAUSE/FACTOR  |   |  |  |
| PILOT IN COMMAND  |   |  | <b>.</b>   |
|   | 83  | 23.4*  | 24.4<br>18.1   |
| INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING MISMANAGEMENT OF FUEL IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROL IMPROPER IN-FLIGHT DECISIONS OR PLANNING BECAME LOST/DISORIENTED CONTINUED VFR FLIGHT INTO ADVERSE WEATHER CONDITION INADEQUATE SUPERVISION OF FLIGHT LACK OF FAMILIARITY WITH AIRCRAFT LACK OF FAMILIARITY WITH KNOWN DEFICIENCIES IN EQUIPMENT EXERCISED POOR JUDGMENT ATTEMPTED OPERATION BEYOND EXPERIENCE/ABILITY LEVERALLED TO OBTAIN/MAINTAIN FLYING SPEED  | LS 24<br>6<br>3<br>INS 3  | 1()-4  | 14.4<br>3.8<br>3.2<br>1.2<br>1.3<br>1.8  |
| OPERATED CARELESSLY   | G. INSPECTION   | N)   |  |
| PERSONNEL (MAINTENANCE, SERVICING  PERSONNEL (MAINTENANCE, SERVICING  INADEQUATE MAINTENANCE AND INSPECTION  IMPROPERLY SERVICED AIRCRAFT (OWNER-PILOT)  IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL)  IMPROPER MAINTENANCE (OWNER PERSONNEL)  INADEQUATE INSPECTION OF AIRCRAFT (OWNER-PILOT)  | 16<br>6.<br>3<br>1  | 6.9<br>2.6*<br>1.3<br>.4   | 9.2<br>.6<br>1.4<br>.7   |
| IMPROPER MAINTENANT OF AIRCRAFT (OWNER-PILOT) INADEQUATE INSPECTION OF AIRCRAFT (OWNER-PILOT) POWERPLANT  |   |  |  |
| ENGINE STRUCTURE - VALVE ASSEMBLIES FUEL SYSTEM - VENTS, DRAINS, TANK CAPS FUEL SYSTEM - VENTS, DRAINS, TANK CAPS ENGINE STRUCTURE - CRANKSHAFT POWERPLANT-INSTRUMENTS - FUEL QUANTITY GAUGE ENGINE STRUCTURE - OTHER FUEL SYSTEM - TANKS EXHAUST SYSTEM - MUFFLERS IGNITION SYSTEM - MAGNETOES IGNITION SYSTEM - SPARK PLUG ENGINE STRUCTURE - PISTON, PISTON RINGS FUEL SYSTEM - SELECTOR VALVES FUEL SYSTEM - CARBURETOR REDUCTION GEAR ASSEMBLY - GEARS, ACCESSORY DRIV ENGINE STRUCTURE - CRANKCASE ENGINE STRUCTURE - MASTER AND CONNECTING RODS IGNITION SYSTEM - LOW TENSION WIRING IGNITION SYSTEM - LOW TENSION WIRING IGNITION SYSTEM - SWITCHES FUEL SYSTEM - WITCHES FUEL SYSTEM - UNDER SAND FITTINGS FUEL SYSTEM - DUMPS FUEL SYSTEM - DIHER LUBRICATING SYSTEM - PUMP-PRESSURE LUBRICATING SYSTEM - PUMP-PRESSURE LUBRICATING SYSTEM - SEALS AND GASKETS EXHAUST SYSTEM - MANIFOLDS EXHAUST SYSTEM - MANIFOLDS EXHAUST SYSTEM - BAFFLES ENGINE ACCESSORIES - OTHER ENGINE CONTROLS - COCKPIT - ENGINE | 14<br>8<br>7<br>6<br>5<br>4<br>4<br>3<br>3<br>2<br>2<br>2<br>2<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1 | 6.1<br>3.5*<br>3.0<br>2.6<br>2.2<br>1.7*<br>1.3<br>1.3<br>1.3<br>9.9<br>4*<br>4*<br>4*<br>44<br>44<br>44<br>44<br>44<br>44<br>44 | 3.8<br>1.3<br>1.6<br>1.3<br>1.2<br>.4<br>.4<br>1.9<br>1.6<br>2.2<br>.8<br>3.6<br>.06<br>.2<br>2.8<br>.03<br>.2<br>.06<br>1.1<br>.8<br>.2<br>.1 |
| MIXTURE CONTROL MATERIA ANERIIS ACTS AND  | CONDITIONS  |  |  |
| CUEL EXHAUSTION   | 74<br>69  | 3 n C  | 0* 23.9<br>9 24.4  |
| FUEL STARVATION   |   |  |  |
| 82  |   |  |  |

# TABLE 44 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE AVCO/LYCOMING IO-540 SERIES ENGINE

| TOTAL ACCIDENTS - 50  |            | PER CEN             | JT                    |
|---|------------|---------------------|-----------------------|
| CAUSE/FACTOR  | FREQUENCY  | OF TOTA<br>ACCIDENT | L EXPECTED S PER CENT |
| PILOT IN COMMAND  |            |                     |                       |
| INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING                | • •        |                     |                       |
| MISMANAGEMENT OF FUEL   | 13         | 26.0                | 28.0                  |
| IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROL             | 7<br>S 4   | 14.0                | 18.6                  |
| LACK OF FAMILIARITY WITH AIRCRAFT                               | 3          | 8.0                 | 14.5                  |
| IMPROPER IN-FLIGHT DECISIONS OR PLANNING                        | 2          | 6.0*                |                       |
| AFAULT FOSTA DISHKIENI EN                                       | 1          | 4.0                 | 3.7                   |
| DIVERTED ATTENTION FROM OPERATION OF AIRCRAFT                   | ì          | 2.0                 | 3.1                   |
|   | i          | 2.0*                |                       |
| IMPROPER OPERATION OF FLIGHT CONTROLS  EXERCISED POOR JUDGMENT  | 1          | 2.0*                | • 0                   |
| SPATIAL DISORIENTATION  | 1          | 2.0*                |                       |
| ON THE DISONIEW ALTON   | i          | 2.0                 | •6                    |
| DEDCOME   | -          | 2.0*                | • 06                  |
| PERSONNEL (MAINTENANCE, SERVICING,                              | INSPECTION | ٠ .                 |                       |
| INADEQUATE MAINTENANCE AND INSPECTION                           |            |                     |                       |
| IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL)                    | 6<br>2     | 12.0                | 9.0                   |
|   | ۷          | 4.0                 | 1.3                   |
| POWERPLANT  |            |                     |                       |
| ENGINE STRUCTURE - VALVE ASSEMBLIES                             | 4          | 0 -                 |                       |
| TOLL STATEM - FUEL INJECTION SYSTEM                             | 4          | 8.0                 | 3.9                   |
| ENDING SIKULIURE — CRANKSWAET                                   | 2          | 8.0                 | 3.8                   |
| IGNITION SYSTEM - MAGNETOES                                     | 2          | 4.0                 | 1.7                   |
| IGNITION SYSTEM - SPARK PLUG                                    | 2          | 4.0                 | 1.9                   |
| FUEL SYSTEM - VENTS, DRAINS, TANK CAPS                          | 2          | 4.0                 | 1.6                   |
| MGINE STRUCTURE - MASTER AND CONNECTING RODS                    | ì          | 4.0                 | 1.4                   |
| MGINE STRUCTURE - CYLINDER ASSEMBLY GNITION SYSTEM - LEADS      | ī          | 2.0                 | 2.6                   |
| WEL SYSTEM - LEADS  | ī          | 2.0<br>2.0*         | 2 • 1                 |
| FUEL SYSTEM - SELECTOR VALVES FUEL SYSTEM - OTHER               | î          | 2.0*                | • •                   |
| INDICATING CACTER   | î          | 2.0*                | •8                    |
| UBRICATING SYSTEM - FILTERS, SCREENS                            | î          | 2.0*                | • 2                   |
| UBRICATING SYSTEM - OIL COOLERS                                 | î          | 2.0*                | • 2                   |
| UBRICATING SYSTEM - SEALS AND GASKETS  XHAUST SYSTEM - MUFFLERS | ĩ          | 2.0                 | • 1                   |
| INE CONTROLS - COCKPIT -  | ī          | 2.0                 | • 3                   |
| RETTLE - POWED - CUCKPII -                                      | -          | 2.0                 | • 5                   |
| ROTTLE - POWER LEVER ASSEMBLIES                                 | 1          | 2.0                 |                       |
| PLANT-INSTRUMENTS - FUEL QUANTITY GAUGE                         | ī          | 2.0                 | • 9                   |
|   |            | 2.00                | 1.3                   |
| MISCELLANEOUS ACTS AND CONDITION                                | NS<br>     |                     |                       |
| SHAUSTION   | 12         | 24.0                | 34 6                  |
| (F  | 8          | 16.0                | 24.8<br>24.6          |
|   |            |                     | 4 T + O               |
|   |            |                     |                       |

# ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE CONTINENTAL A-65 SERIES ENGINE

| TOTAL ACCIDENTS - 172  | FREQUENCY                  | PER CENT<br>OF TOTAL EX<br>ACCIDENTS PE | PECTED<br>R CENT                      |
|--|----------------------------|---|---------------------------------------|
|  |                            |   |                                       |
| PILOT IN COMMAND   |                            | 26.2                                    | 29 1                                  |
| INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROL MISMANAGEMENT OF FUEL PROCEDURES DIRECTIVES ET  |                            | 22.7*                                   | 13.6<br>19.2                          |
| MISMANAGEMENT OF FUEL FAILED TO FOLLOW APPROVED PROCEDURES DIRECTIVES, ET EXERCISED POOR JUDGMENT INADEQUATE SUPERVISION OF FLIGHT ATTEMPTED OPERATION WITH KNOWN DEFICIENCIES IN EQUI   | 2                          | 3.5*<br>2.9*<br>2.3<br>1.7              |                                       |
| BECAME LOST/DISORIENTED CONTINUED VFR FLIGHT INTO ADVERSE WEATHER CONDITION IMPROPER IN-FLIGHT DECISIONS OR PLANNING FAILED TO OBTAIN/MAINTAIN FLYING SPEED FAILED TO OBTAIN/MAINTAIN FLYING SPEED   | us 3                       | 1 • 7<br>1 • 7<br>1 • 2*                | . 1 • 2                               |
| ATTEMPTED OPERATION BEYOND EXPERIENCE/ABILITY LEVE   | 2<br>L 1<br>1              | •6                                      | • 4                                   |
| SPONTANEOUS IMPROPER ACTION PHYSICAL IMPAIRMENT FAILED TO ABORT TAKEOFF  | 1                          | .6*                                     | • 2                                   |
| PERSONNEL (MAINTENANCE, SERVICING  |                            |   | o 0                                   |
| INADEQUATE MAINTENANCE AND INSPECTION IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL) IMPROPER MAINTENANCE (OWNER PERSONNEL) IMPROPERLY SERVICED AIRCRAFT (OWNER-PILOT) INADEQUATE INSPECTION OF AIRCRAFT (OWNER-PILOT) INADEQUATE INSPECTION OF AIRCRAFT (OWNER-PILOT) | 21<br>3<br>3<br>1<br>L) 1  | 12.2<br>1.7<br>1.7<br>.6<br>.6          | 1.4<br>.6<br>.8<br>.3                 |
| INADEQUATE INSPECTION OF AIRCRAFT CONCERNIANT  |                            |   |                                       |
| POWERFLANT   | 7                          | 4.1                                     | 3.9                                   |
| ENGINE STRUCTURE - VALVE ASSEMBLIES FUEL SYSTEM - CARBURETOR ENGINE STRUCTURE - CRANKSHAFT THROTTLE - POWER LEVER ASSEMBLIES ENGINE STRUCTURE - PISTON, PISTON RINGS   | 7<br>4<br>4<br>3<br>3      | 4.1<br>4.1<br>2.3<br>2.3*<br>1.7<br>1.7 | 3.4<br>1.7<br>.8<br>2.1<br>1.2<br>1.9 |
| IGNITION SYSTEM - MAGNETOES FUEL SYSTEM - LINES AND FITTINGS FNGINE STRUCTURE - CYLINDER ASSEMBLY ENGINE STRUCTURE - CYLINDER ASSEMBLY   | 3<br>3<br>3<br>2<br>2<br>2 | 1.7<br>1.7<br>1.2<br>1.2*<br>1.2        | 1.0<br>2.2<br>.06<br>1.4              |
| FUEL SYSTEM - VENTS, DRAINS, TANK IGNITION SYSTEM - SPARK PLUG FUEL SYSTEM - SELECTOR VALVES FUEL SYSTEM - FILTERS, STRAINERS, SCREENS   | 1<br>1<br>1<br>1           | •6<br>•6<br>•6*                         | 1.7<br>.8<br>.5<br>.06                |
| PROPELLER AND ACCESSORIES - OTHER EXHAUST SYSTEM - BAFFLES ENGINE CONTROLS - COCKPIT - INDUCTION AIR, PREHEAT CONTROLS MISCELLANEOUS - DETONATION  | 1<br>1<br>1                | •6*<br>•6                               | • 06<br>• 2<br>• 2                    |
| MISCELLANEOUS ACTS AND CO  | NDITIONS                   |   |                                       |
| FUEL EXHAUSTION FUEL STARVATION  | 38<br>27                   | 22.1<br>15.7#                           |                                       |

# ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE CONTINENTAL C-75 AND C-85 SERIES ENGINE

| STATE COTS AND C-85 SERI   | LES FNGTNE   |                     |                            |
|--|--------------|---------------------|----------------------------|
| TOTAL ACCIDENTS - 186  | - CO CHOTNE  |                     |                            |
|  |              | PER CE              | NT                         |
| CAUSE/FACTOR   | FPEOMENO     | OC 70-              |                            |
|  | /            | ACCIDEN             | AL EXPECTED<br>TS PER CENT |
|  |              | /                   | TS PER CENT                |
| PILOT IN COMMAND   |              |                     |                            |
| ''MUEDUATE DOCC' *   |              |                     |                            |
| MPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROL  ACK OF FAMILIARITY  MERCHANT CONTROL   |              |                     |                            |
| ASMANAGEMENT OF FUEL TOWERPLANT + PWRPLANT CONTROL   | 58<br>.S 28  | 31.2                | 27.8                       |
| CK OF FAMILIARITY WITH AIRCRAFT  | 21           | 15.1                | 14 0                       |
| TEMPTED OPERATION WITH AIRCRAFT  GAME LOST/DISORIENTED  PROPER, IN-ELICHT DESCRIPTION  PROPER, IN-ELICHT DESCRIPTION  PROPER, IN-ELICHT DESCRIPTION  PROPER  | 3            | 11.3#               | 18.9                       |
| PROPER IN EURIENTED  | P Ž          | 1.6                 | 1.8                        |
| ADEQUATE SUPERIOR DECISIONS OR PLANNING  | 2            | 1.1                 | 1.0                        |
| FEMP(PI) COEDATION - ' LIGHT   | 2            | 1.1<br>1.1#         | 3.2                        |
| ILED TO USE OF THE BEYOND EXPERIENCE (ADT. T.  | 2            | 1.1                 | 3 • <del>9</del>           |
| ILED TO USE OR INCORRECTLY USED MISC EQUIPMENT   | ī            | • 5                 | 1.3                        |
|  | . 1          | •5                  | • 4                        |
| LED TO INITIATE GO-AROUND  | 1            | •5                  | • 3<br>• 9                 |
|  | 1<br>1       | • 5                 | • 3                        |
| PERSONNEL (MAINTENANCE   | 1            | •5*                 | • 0                        |
| PERSONNEL (MAINTENANCE, SERVICING,   | INSPECTION   | 1                   |                            |
|  |              | •                   |                            |
| REPER MATHITEMANCE PERSONNEL   | 22<br>5<br>3 | 11.8                | 0.0                        |
|  | 5            | 2.7                 | 8.9<br>1.3                 |
| POUATE INSPECTION OF AIRCRAFT (MAINT PERSONNEL) PERLY SERVICED AIRCRAFT (OWNER-PILOT)  | ~            | 1.6                 | •6                         |
| AT (UNNER-PILOT)   | 3<br>1       | 1.6*                | •3                         |
| 1 · 30···  | 4            | • 5                 | •8                         |
| POWERPLANT STRUCTURES STRUCTURES   |              |                     |                            |
|  |              |                     |                            |
|  | 11           | 5.9                 |                            |
| ON SYSTEM - MAGNET   | 7            | 3.8                 | 3.3<br>3.9                 |
|  | 6            | 3.2                 | 1.6                        |
| CONTROLS - COCKPIT -   | 5<br>5       | 2.7                 | 1.9                        |
|  | 5            | 2.7                 | 1.5                        |
| STOTEL TO THE TOTAL TOTA | 4            |                     |                            |
| STRUCTURE - OTHER AND CONNECTING RODS  | 3            | 2.2*                | •8                         |
| BUNDIEM TIMES AND  | 3            | 1.6                 | 2.7                        |
| SOLDIEM - DIMOS TOTAL SURFENC  | 3            | 1.6<br>1.6          | 1.2                        |
| E STRUCTURE  | 3            | 1.6*                | 1.0                        |
| E STRUCTURE - CYLINDER ASSEMBLY E STRUCTURE - PISTON, PISTON RINGS SYSTEM - VENTS, DRAIMS  | 3            | 1.6                 | •4<br>•8                   |
| SYSTEM - VENTS - SIGN FISION RINGS   | 2            | 1.1                 | 2.2                        |
| ION SYSTEM - IGNITION HARMESS  | 2<br>2       | 1.1                 | 2.2                        |
| ION SYSTEM - IGNITION HARNESS, SHIELDING SYSTEM - SELECTOR VALVES E CONTROLS - SPORTS  | 1            | 1.1                 | 1.4                        |
| - CONTRICE - COAGA   | i            | • 5                 | • 2                        |
| TURE CONTROL ASSEMBLIES LEVER - CABLE  |              | • 5                 | •8                         |
| CABLE  | 1            | •5                  | -                          |
| MISCELL  | 1            | .5*                 | •5<br>•0                   |
| MISCELLANEOUS ACTS AND CONDITIONS  | ç            |                     | • •                        |
|  | -            |                     |                            |
| EXHAUSTION   | 46 2         | 4.7                 |                            |
|  |              | 4• <i>1</i><br>3•4# | 24.8                       |
|  |              | ✓ • Ŧ#              | 25.1                       |
|  |              |                     |                            |

| OR MALFUNCTION<br>PE<br>NGINE   |
|---|
| ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION<br>AS A FIRST ACCIDENT TYPE<br>CONTINENTAL C-90 SERIES ENGINE |
| ⋖   |

TABLE 47

# CONTINENTAL C-145 SERIES ENGINE

| TOTAL ACCIDENTS - 54   |             | PER CENT              |                      |
|--|-------------|-----------------------|----------------------|
|  | REQUENCY    | OF TOTAL<br>ACCIDENTS | EXPECTED<br>PER CENT |
| PILOT IN COMMA   |             |                       |                      |
| PREPARATION AND/<br>POWERPLANT + PW  | 23<br>8     | 42.6*<br>14.8         | 27.8<br>14.1         |
| BECAME LOST/DISORIENTED IMPROPER IN-FLIGHT DECISIONS OR PLANNING   | เกษ         | 9°3                   | 18.7<br>3.0<br>3.8   |
| EAERCISED PUUR JUUGMENT<br>MISUSED DR FAILED TO USE FLAPS  | ਜਿ ਜ        | 1.9<br>1.9*           | 60.                  |
| , SERVICING,   | INSPECTION) |                       |                      |
| AIRCRAFT (   | 2 2         | 3.7*                  | •7<br>9•1            |
| OWERPLAN   |             |                       |                      |
| ENGINE STRUCTURE - PISTON, PISTON RINGS ENGINE STRUCTURE - CYLINDER ASSEMBLY ENGINE STRUCTURE - VALVE ASSEMBLIES | m N r       | 5.00                  | 2.1                  |
| EM - TANKS<br>RUCTURE - OTHER  | V ~ ~~      |                       | w -                  |
| IGNITION SYSTEM - SPARK PLUG<br>FUEL SYSTEM - SELECTOR VALVES  | م ہے۔       | • •                   | 7 9 H                |
| EM - FIL   | →           | 1•9<br>1•9            | ထိုက်                |
| EM = CAK<br>NG SYSTE   | r=1 r=1     | 1.9<br>1.9            | 3.5                  |
| MISCELLANEOUS ACTS AND CONDITION   | S           |                       |                      |
|  | <b>8</b> ∞  | 33.3<br>14.8          | 24.3<br>25.0         |

TABLE 49 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION

AS A FIRST ACCIDENT TYPE

CONTINENTAL E-165 AND E-185 SERIES ENGINE

| TOTAL ACCIDENTS - 82   | FREQUENCY              | PER CENT<br>OF TOTAL E<br>ACCIDENTS P | ER CENT |
|--|------------------------|---------------------------------------|---------|
| CAUSE/FACTOR   | //                     |                                       | •       |
| PILOT IN COMMAND   |                        |                                       |         |
|  |                        | 45.1*                                 | 17.8    |
| MISMANAGEMENT OF FUEL  | 37<br>13               | 15.9#                                 | 28.3    |
| THARCOHATE DREET IGHT PREPARATION AND TO   | 13<br>7                | 8.5*                                  | 1.6     |
| LACK OF FAMILIARITY WITH AIRCRAFT  | 4                      | 4.9                                   | 3.0     |
|  | <del>4</del><br>4      | 4.9                                   | 3.7     |
|  |                        | 2 4#                                  | 14.4    |
| THROUGED ROFRATION OF PUNCKERNI ' ''''   | KULS 2<br>2            | 2-4                                   | 1.3     |
| TNADEDUATE SUPERVISION OF FLIGHT   | 1                      | 2•4<br>1•2*                           | • 1     |
| FAILED TO ABORT TAKEOFF  | •                      |                                       |         |
| SERVICE CHAINTENANCE, SERVICE  | NG, INSPECTIO          | IN)                                   |         |
|  | 8                      | 9.8                                   | 9.0     |
| INADEQUATE MAINTENANCE AND INSPECTION  | 1                      | 1.2                                   | 1.4     |
| THEOLOGIC MAINTENANCE (MAINTENANCE PERSONNEC)  | ì                      | 1.2                                   | •7      |
| IMPROPER MAINTENANCE (OWNER PERSONNEL)   |                        |                                       | •3      |
| IMPROPERLY SERVICED AIRCRAFT (GROUND CREW)   | 1011                   | 1.2                                   | •3      |
| IMPROPER MAINTENANCE (UWNER PERSONNEL) IMPROPERLY SERVICED AIRCRAFT (GROUND CREW) INADEQUATE INSPECTION OF AIRCRAFT (MAINT PERSONN | 4CL) *                 |                                       |         |
| POWERPLANT   |                        |                                       |         |
|  | 3                      | 3.7                                   | 2.1     |
| ENGINE STRUCTURE - PISTON, PISTON RINGS  | 3<br>3                 | 3.7*                                  | .7      |
|  | 2                      | 2.4                                   | 2.6     |
| THE THE CTRICTURE - MASTER AND CONNECTING ADDITIONS  | 2                      | 2.4                                   | 2.1     |
| -MATHE CTRICTIBE - I VI INDER HOOGENDE!  | 2                      | 2.4                                   | 4.0     |
| ENCINE STRUCTURE - VALVE ASSEMBLIES  | 2                      | 2.4                                   | 1.0     |
| ELICA CVCTEM - LINES AND FITTINGS  | 2                      | 2.4                                   | 3 • 5   |
| ener system - CARBUKETUK   | 2                      | 2.4*                                  | - 1     |
| ELIEL CVCTEM - RAM AIK ADDEMDLI  | ī                      | 1 • 2                                 | 147     |
| ENCINE STRUCTURE - CRANKSMAFT  | ī                      | 1.2                                   | 1.9     |
| TONITION CYCTEM - MAGNETUES  | ī                      | 1.2                                   | 1.6     |
| IGNITION SYSTEM - SPARK PLUG   | i                      | 1.2                                   | • 4     |
| TANIC  | ĩ                      | 1.2                                   | •5      |
| CHEL CYCTEM - FILTERS, SIRAINERS, SCHEENS  | 1                      | 1.2*                                  |         |
| FUEL SYSTEM - PRIMING STOLEM   | 1                      | 1.2                                   | .8      |
|  |                        | 1.2*                                  | • 0     |
| PRODELLER AND ACCESSORIES - HIDE PICH COM  | y., ,, <del>,,</del> - |                                       |         |
| ENCINE CONTROLS - LUCKPII -  | . 1                    | 1.2                                   | • 9     |
| THROTTLE - POWER LEVER ASSEMBLIES  | 1                      | 1 • ∠                                 | 1.4     |
| THROTTLE - POWER LEVER ASSEMBLIATE GAUGE POWERPLANT-INSTRUMENTS - FUEL QUANTITY GAUGE POWERPLANT-INSTRUMENTS - FUEL QUANTITY GAUGE | ve 1                   | 1.2*                                  | . 1     |
| REDUCTION GEAR ASSEMBLY - GEARS, AGGESTA   |                        |                                       |         |
| MISCELLANEOUS ACTS AND C   | OND IT IONS            |                                       |         |
|  | 43                     | 52.4*                                 | 24.1    |
| FUEL STARVATION  | 16                     | 19•5                                  | 24.6    |
| FUEL EXHAUSTION  |                        |                                       |         |
|  |                        |                                       |         |

# ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE CONTINENTAL D-200 SERIES ENGINE

| TOTAL ACCIDENTS - 284   |   | PER CENT   |   |
|---|---|--|---|
| CAUSE/EACTOR  | FREQUENCY   | OF TOTAL ACCIDENTS                                       | EXPECTED<br>PER CENT  |
| PILOT IN COMMAND  |   |  | •   |
| IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROL INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING MISMANAGEMENT OF FUEL BECAME LOST/DISORIENTED IMPROPER IN-FLIGHT DECISIONS OR PLANNING INADEQUATE SUPERVISION OF FLIGHT SPONTANEOUS IMPROPER ACTION CONTINUED VFR FLIGHT INTO ADVERSE WEATHER CONDITIONS EXERCISED POOR JUDGMENT ATTEMPTED OPERATION BEYOND EXPERIENCE/ABILITY LEVEL ATTEMPTED OPERATION WITH KNOWN DEFICIENCIES IN EQUIP DIVERTED ATTENTION FROM OPERATION OF AIRCRAFT UPERATED CARELESSLY INITIATED FLIGHT IN ADVERSE WEATHER CONDITIONS | 79<br>30<br>23<br>11<br>10<br>7<br>5<br>2<br>2<br>2 | 33.1* 27.8 10.6# 8.1* 3.9 3.5* 2.5* 1.8 .7 .7 .4 .4* .4* | 19.3<br>2.6<br>3.7<br>1.1<br>.2<br>1.2<br>.6<br>.3<br>1.1<br>.1 |
| MISONDERSTANDING OF ORDERS OR INSTRUCTIONS  | 1   | • 4 ×  | •0  |
| PERSONNEL (MAINTENANCE, SERVICING,  | INSPECTION  | )  |   |
| INADEQUATE MAINTENANCE AND INSPECTION IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL)  |   | 4.9#   |   |
| POWERPLANT  |   |  |   |
| ENGINE STRUCTURE - PISTON, PISTON RINGS ENGINE STRUCTURE - VALVE ASSEMBLIES IGNITION SYSTEM - MAGNETOES FUEL SYSTEM - CARBURETOR ENGINE STRUCTURE - MASTER AND CONNECTING RODS ENGINE STRUCTURE - CYLINDER ASSEMBLY IGNITION SYSTEM - SPARK PLUG LUBRICATING SYSTEM - LINES, HOSES, FITTINGS LUBRICATING SYSTEM - OTHER ENGINE STRUCTURE - OTHER ENGINE STRUCTURE - OTHER ENGINE CONTROLS - COCKPIT - MIXTURE CONTROL ASSEMBLIES  | 9655443332<br>2                                     | 1 • 4<br>1 • 1<br>1 • 1<br>1 • 1<br>• 7                  | 3.6<br>2.7<br>2.2<br>1.7<br>.5<br>.4<br>1.3                     |
| ENGINE STRUCTURE - CRANKSHAFT FUEL SYSTEM - LINES AND FITTINGS FUEL SYSTEM - VENTS, DRAINS, TANK CAPS LUBRICATING SYSTEM - MAGNETIC PLUGS ENGINE CONTROLS - COCKPIT - THROTTLE - POWER LEVER ASSEMBLIES INDUCTION AIR, PREHEAT CONTROLS ENGINE INDICATING EQUIPMENT - TACHOMETER  | 1 1 1 1 1 1   | • 7<br>• 4<br>• 4<br>• 4<br>• 4 **                       | .5<br>1.8<br>1.1<br>1.5<br>.0                                   |
| MISCELLANEOUS ACTS AND CONDITIE   | 1<br>DNC  | .4*  | • 0   |
| FUEL EXHAUSTION FUEL STARVATION   | 98<br>29<br>29                                      | 34.5*<br>10.2#   | 23.5<br>26.2  |

#### TABLE 51 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE CONTINENTAL E-225 SERIES ENGINE

| TOTAL ACCIDENTS - 47  | FREQUENCY                       | PER CENT<br>OF TOTAL E<br>ACCIDENTS P | XPECTED<br>ER CENT                                 |
|---|---------------------------------|---------------------------------------|--|
| CAUSE/FACTOR /  |                                 | , <del></del> · ,                     | •  |
|   |                                 |                                       |  |
| PILOT IN COMMAND  |                                 |                                       |  |
| MISMANAGEMENT OF FUEL INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING IMPROPER IN-FLIGHT DECISIONS OR PLANNING ATTEMPTED OPERATION WITH KNOWN DEFICIENCIES IN EQUI IMPROPER IFR OPERATION LACK OF FAMILIARITY WITH AIRCRAFT IMPROPER, STARTING PROCEDURE PHYSICAL IMPAIRMENT   | 9<br>4<br>1<br>1<br>1           | 2•1<br>2•1*<br>2•1*                   | 3.7<br>1.0<br>.1<br>1.8                            |
| PERSONNEL (MAINTENANCE, SERVICING,  | 1N2AEC111                       | <del>-</del>                          |  |
| INADEQUATE MAINTENANCE AND INSPECTION IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL) IMPROPERLY SERVICED AIRCRAFT (OWNER-PILOT) INADEQUATE INSPECTION OF AIRCRAFT (MAINT PERSONNEL) POWERPLANT  | 2<br>1<br>1                     | 8.5<br>4.3<br>2.1<br>2.1*             | 1.3  |
| FUEL SYSTEM - PUMPS ENGINE STRUCTURE - CRANKSHAFT ENGINE STRUCTURE - VALVE ASSEMBLIES ENGINE STRUCTURE - OTHER FUEL SYSTEM - LINES AND FITTINGS FUEL SYSTEM - FILTERS, STRAINERS, SCREENS FUEL SYSTEM - CARBURETOR LUBRICATING SYSTEM - FILTERS, SCREENS LUBRICATING SYSTEM - PUMP-SCAVENGER EXHAUST SYSTEM - MANIFOLDS ENGINE ACCESSORIES - STARTERS  MISCELLANEOUS ACTS AND CONDI | 2<br>1<br>1<br>1<br>1<br>1<br>1 | 4.3<br>2.1<br>2.1                     | 1.7<br>3.9<br>1.2<br>1.0<br>.5<br>3.4<br>.2<br>.03 |
| FUEL STARVATION FUEL EXHAUSTION   |                                 | 36.2<br>19.1                          |  |

# TABLE 52 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE CONTINENTAL 0-300 SERIES ENGINE

| TOTAL ACCIDENTS - 191   |            | PER CENT           |             |
|---|------------|--------------------|-------------|
| TOTAL ACCIDENTS - 191  CAUSE/FACTOR   | FREQUENCY  | OF TOTAL ACCIDENTS | PER CENT    |
| *****   | •          | , <b></b>          | / <b></b> / |
| PILOT IN COMMAND  |            |                    |             |
| INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING                                      | 70         | 36 6*              | 27 5        |
| O'ENMITON OF FUNCKSIANT & PARPLANT CONTROLL   | S 28       | 14.7               | 14.1        |
| MISMANAGEMENT OF FUEL   | 24         | 12.6#              |             |
| IMPROPER IN-FLIGHT DECISIONS OR PLANNING<br>BECAME LOST/DISORIENTED                   | 23         | 12.07              | 3.3         |
| CONTINUED VER ELICHT INTO ADVENCE MEATURE   | 17         | 8.9*               | 2.7         |
| CONTINUED VFR FLIGHT INTO ADVERSE WEATHER CONDITIONS INADEQUATE SUPERVISION OF FLIGHT |            | 3.1*               | 1.1         |
| ATTEMPTED OPERATION BEYOND EXPERIENCE/ABILITY LEVEL                                   | 2          | Z • 4              | 1.3         |
| DIVERTED ATTENTION FROM OPERATION OF AIRCRAFT   |            | • 5                | • 4         |
| PAILED TO FOLLOW APPROVED PROCEDURES DIRECTIVES ET                                    | 1          | • 5                | • 1         |
| THE ROLE OF THE PERSON OF PLICE CHAIRMING   | 1          | • 5                | •9          |
| INADEQUATE SUPERVISION OF FLIGHT  | 1          | • 5<br>• 5         | •2<br>1•4   |
| LACK OF FAMILIARITY WITH AIRCRAFT   | ì          | • 5<br>• 5         | 1.4         |
| EXERCISED POOR JUDGMENT   | î          | •5                 | 1.9<br>.6   |
| MISJUDGED SPEED   | ī          | •5*                | 0.0         |
| DED CONNEL (MATATEMANCE OFFICE  |            |                    |             |
| PERSONNEL (MAINTENANCE, SERVICING,  | INSPECTION | 1)                 |             |
| INADEQUATE MAINTENANCE AND INSPECTION   | 1 /        |                    |             |
| IMPROPERLY SERVICED AIRCRAFT (OWNER-PILOT)  | 14<br>2    | 7.3<br>1.0         | 9.2         |
|   | 2          | 1.0                | •8          |
| POWERPLANT  |            |                    |             |
| ENGINE STRUCTURE - VALVE ASSEMBLIES   |            |                    |             |
| IGNITION SYSTEM - SPARK PLUG  | 5          | 2.6                | 4.0         |
| FUEL SYSTEM - CARBURETOR  | 4          | 2.1                | 1.6         |
| IGNITION SYSTEM - MAGNETOES   | 3          | 1.6                | 3.6         |
| FUEL SYSTEM - VENTS, DRAINS, TANK CAPS  | 3          | 1.6                | 1.9         |
| ENGINE STRUCTURE - MASTER AND CONNECTING PODE   | 3<br>3     | 1.6                | 1.4         |
| ENGINE SIRUCTURE - PISTON. PISTON RINGS   | 2          | 1.6                | 2.7         |
| FUEL SYSTEM - SELECTOR VALVES   | 2          | 1.0                | 2.2         |
| IGNITION SYSTEM - SWITCHES  | 1          | 1.0<br>.5          | •8<br>•1    |
| FUEL SYSTEM - TANKS   | i          | •5                 | • 4         |
| LUBRICATING SYSTEM - LINES, HOSES, FITTINGS   | 1          | •5                 | •6          |
| LUBRICATING SYSTEM - VALVES ENGINE CONTROLS - COCKPIT -                               | 1          | •5*                | 0.0         |
| MIXTURE CONTROL ASSEMBLIES  |            |                    |             |
| INDUCTION AIR - PREHEAT CONTROLS  | 1          | • 5                | • 9         |
| POWERPLANT-INSTRUMENTS - FUEL QUANTITY GUAGE  | 1          | • 5                | <b>.</b> 5  |
| ENGINE CONTROLS - COCKPIT -   | 1          | • 5                | • 2         |
| THROTTLE - POWER LEVER ASSEMBLIES   | 1          | F                  |             |
| FUEL SYSTEM - LINES AND FITTINGS  | i          | • 5<br>• 5         | 1.1         |
| FUEL SYSTEM - FILTERS, STRAINERS, SCREENS   | ī          | •5                 | 1•1<br>•5   |
|   | ·          | • -                | • )         |
| MISCELLANEOUS ACTS AND CONDITI  | ONS        |                    |             |
| FUEL EXHAUSTION   |            |                    |             |
| FUEL STARVATION   | 86         | 45.0*              | 23.2        |
|   | 24         | 12.6#              | 25.6        |

#### TABLE 53 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE CONTINENTAL O-470-A,B,E,G,H,J,K,L,M,N,P,R ENGINE

| TOTAL ACCIDENTS - 176  |             | PER CENT<br>OF TOTAL | CYDECTED |
|--|-------------|----------------------|----------|
| a  | ERECHENCY   | ACCIDENTS            |          |
| CAUSE/FACTOR   | /           | //                   | /        |
|  |             |                      |          |
| PILOT IN COMMAND   |             |                      |          |
| INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING                           | 54          | 30.7                 | 27.9     |
| MISMANAGEMENT OF FUEL  | 54<br>36    | 20.5                 | 18.4     |
| IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROL                        |             | 12.5<br>4.5          | 14.2     |
| IMPROPER IN-ELIGHT DECISIONS OR PLANNING                                   | 8           | 4.5                  | 3.7      |
| ATTEMPTED OPERATION WITH KNOWN DEFICIENCIES IN EQUI                        | P 4         | 2.3                  |          |
| BECAME LOST/DISORIENTED  | 1           | •6#                  | 3.2      |
| FAILED TO USE OR INCORRECTLY USED MISC EQUIPMENT                           | 1           | •6                   | •9       |
| LACK OF FAMILIARITY WITH AIRCRAFT  | 1           | •6                   | 1.9      |
| EXERCISED POOR JUDGMENT  | 1           | •6                   | •6       |
| PSYCHOLOGICAL CONDITION  | ì           | .6*                  | • 03     |
| PERSONNEL (MAINTENANCE, SERVICING,   | INSPECTI    | ON )                 |          |
| INADEQUATE MAINTENANCE AND INSPECTION                                      | 22          | 12.5                 | 8.9      |
| IMPROPER MAINTENANCE (OWNER PERSONNEL)                                     | 2           | 1.1                  | •6       |
| IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL)                               | ĩ           | •6                   | 1.4      |
| IMPROPERLY SERVICED AIRCRAFT (GROUND CREW)                                 | 2<br>1<br>1 | •6                   | •3       |
| In November Services have been a serviced as                               |             |                      |          |
| POWERPLANT   |             |                      |          |
| FUEL SYSTEM - CARBURETOR   | 11          | 6.2*                 |          |
| ENGINE STRUCTURE - VALVE ASSEMBLIES  | 8<br>5      | 4.5<br>2.8           | 3.9      |
| FUEL SYSTEM - VENTS, DRAINS, TANK CAPS                                     | 5           | 2.8                  | 1.3      |
| IGNITION SYSTEM - MAGNETOES  | 4           | 2.3                  | 1.9      |
| ENGINE STRUCTURE - CRANKSHAFT  | 3           | 1.7                  | 1.7      |
| ENGINE STRUCTURE - MASTER AND CONNECTING RODS                              | 3<br>3      | 1.7<br>1.7*          | •4       |
| FUEL SYSTEM - TANKS  | 3           |                      | 1.3      |
| POWERPLANT-INSTRUMENTS - FUEL QUANTITY GAUGE                               | 2           | 1.1                  | 2.2      |
| ENGINE STRUCTURE - PISTON, PISTON RINGS                                    | 2           | 1.1                  | 1.6      |
| IGNITION SYSTEM - SPARK PLUG   | 2           | 1.1                  | •5       |
| LUBRICATING SYSTEM - LINES, HOSES, FITTINGS<br>ENGINE CONTROLS - COCKPIT - | ۷           | 1 • 1                | •        |
| THROTTLE - POWER LEVER ASSEMBLIES  | 2           | 1.1                  | •9       |
| MIXTURE CONTROL ASSEMBLIES   | 2           | 1.1                  | . 4      |
| ENGINE STRUCTURE - CYLINDER ASSEMBLY                                       | 1           | •6                   | 2.2      |
| ENGINE STRUCTURE - OTHER   | 1           | •6                   | 1.3      |
| FUEL SYSTEM - LINES AND FITTINGS   | ĩ           | •6                   | 1.1      |
| FUEL SYSTEM - RAM AIR ASSEMBLY   | ī           | • 6                  | • 2      |
| FUEL SYSTEM - OTHER  | î           | •6                   | • 2      |
| LUBRICATING SYSTEM - VALVES  | ī           | .6*                  | • 03     |
| LUBRICATING SYSTEM - FILTERS, SCREENS                                      | ī           | •6                   | • 2      |
| LUBRICATING SYSTEM - OTHER   | 1           | •6                   | .4       |
| ENGINE CONTROLS - COCKPIT -  |             |                      |          |
| INDUCTION AIR, PREHEAT CONTROLS  | 1           | •6                   | • 2      |
| MISCELLANEOUS ACTS AND CONDI   | TIONS       |                      |          |
| CHCL EVHAUCTION  | 61          | 34.7*                | 23.9     |
| FUEL EXHAUSTION  | 36          | 20.5                 | 25.1     |
| FUEL STARVATION  | 20          |                      |          |

TABLE 54 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION

AS A FIRST ACCIDENT TYPE

CONTINENTAL 10-470-D,E,F,G,H,J,K,L,M,N,P,R,S,T,U LIO-470-A ENGINE

| PILOT IN COMMAND  MISMANAGEMENT OF FUEL INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING LACK OF FAMILIARITY WITH AIRCRAFT IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTRO IMPROPER IN-FLIGHT DECISIONS OR PLANNING ATTEMPTED OPERATION WITH KNOWN DEFICIENCY.  |            | /              | -/        |
|--|------------|----------------|-----------|
| MISMANAGEMENT OF FUEL INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING LACK OF FAMILIARITY WITH AIRCRAFT IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTRO IMPROPER IN-ELIGHT DECISIONS   | 34         |                |           |
| INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING LACK OF FAMILIARITY WITH AIRCRAFT IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROLL OF THE PROPERTY OF THE | 34         |                |           |
| IMPROPER IN-ELIGHT DECISIONS OF PWRPLANT CONTRO  | <b>→</b> - | 34 34          |           |
| IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTRO   | 15         | 34.7*<br>15.3# | 18.0      |
| IMPROPER IN-FLIGHT DECISIONS OR PLANNING   | 6          | 6.1*           | 1.7       |
| ATTEMPTED ODES TO STONE OF PLANNING  | DLS 5      | 5.1#           | 14.4      |
| TITETHEOUTERATION WITH KNOWN DEFICIENCE  | 3          | 3.1            | 3.8       |
| FAILED TO FOLLOW APPROVED DESCENCIES IN EQU  | JIP 2      | 2.0            | 1.0       |
| BECAME LOST/DISORIENTED PROCEDURES DIRECTIVES, E   | ETC 2      | 2.0            | .8        |
| ALLED TO HEE OD INCORPERA  | 1          | 1.0            | .8<br>3.1 |
| MPROPER COMPENSATION FOR WIND CONDITIONS NADEQUATE SUPERVISION OF FLIGHT   | 1          | 1.0            | • 2       |
| NADEQUATE SUPERVISION OF FLIGHT  | Ţ          | 1.0*           | •0        |
|  | -          | 1.0            | 1.3       |
| PERSONNEL (MAINTENANCE, SERVICING  | , INSPECTI | 0N)            |           |
| NADEQUATE MAINTENANCE AND INSPECTION   |            | ~-~            |           |
|  | 0          | 8.2            | 9.1       |
| POWERPLANT   |            |                |           |
| NGINE STRUCTURE - CYLINDER ASSEMBLY  | 9          |                |           |
| WOTHE STRUCTURE - MASTED AND CONNECTAL -   | 6          | 9.2*           | 1.9       |
| THE STREET LABOR CHARL   | 5          | 6 · 1 ×        | 2.5       |
| JEL SYSTEM - LINES AND FITTINGS  | <i>,</i>   | 5.1*           |           |
| NGINE STRUCTURE - PISTON, PISTON RINGS JEL SYSTEM - PUMPS  | 4<br>3     | 4.1*           | • 9       |
|  | 3          | 3.1            | 2.1       |
| DWERPLANT-INSTRUMENTS - FUEL QUANTITY GAUGE  | <i>3</i>   | 3.1*           | • 7       |
| BRICATING SYSTEM - SPARK PLUG  | _          | 3.1            | 1.3       |
| BRICATING SYSTEM - FILTERS, SCREENS  | 2          | 2.0            | 1.6       |
| GINE STRUCTURE - VALVE ASSEMBLIES  TIME STRUCTURE - OTHER  | 2          | 2.0*           | • 2       |
|  | 1          | 1.0            | 4.0       |
| SYSTEM - IGNITION HARNESS, SHIELDING   | 1<br>1     | 1.0            | 1.2       |
| SYSTEM - SELECTOR VALVES   |            | 1.0            | • 2       |
| SYSTEM - FUEL INJECTION SYSTEM   | 1          | 1.0            | •4        |
|  | 1          | 1.0            | • 8       |
| RECATING SYSTEM - CEALS AND  | î          | 1.0<br>1.0     | 5.5       |
|  | ī          | 1.0            | • 2       |
| MAN SAZIEM - CVCNESS   | ī          | 1.0            | • 3       |
| PROLOTOTEM - CIVCAC  | 1          | 1.0*           | • 4       |
| REPL CUNIKUIA — CACVATT  | 1          | 1.0            | • 0       |
| TURE CONTROL ASSEMBLIES  | _          |                | • 2       |
|  | 1          | 1.0            | • 5       |
| MISCELLANEOUS ACTS AND CONDITIO  | INS        |                |           |
| MCTADUAT TO  |            |                |           |
| STARVATION   |            |                |           |
| EXHAUSTION   | 39<br>17   | 39.8*          | 24.4      |

#### TABLE 55 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE CONTINENTAL 10-520-A, B, C, D, E, F, J, K, L ENGINE

| TOTAL ACCIDENTS - 84   | FREQUENCY   | PER CENT<br>OF TOTAL EX<br>ACCIDENTS PE | PECTED<br>R CENT |
|--|-------------|---|------------------|
| CAUSE/FACTOR   |             |   |                  |
| PILOT IN COMMAND   |             |   |                  |
| FILUT  | 20          | 23.8<br>21.4                            | 18.4             |
| MISMANAGEMENT OF FUEL MISMANAGEMENT OF FUEL PREPARATION AND/OR PLANNING  | 18          |   | 28•2<br>•7       |
| THANKOUNTE PREFLICIT TOE TO THE DIDECTIVES   | rc 4        | 4.8*<br>4.8#                            |                  |
| FAILED TO FOLLUM APPROVED TOTAL . SUBSILANT CONTRUL  | .S 4        | 1.2                                     | 1.0              |
| IMPROPER OPERATION OF POWERPLANT + PWRPLANT SIN EQUIPMENT OF THE PROPERTY OF T | 1           | 1.2                                     | 3.1<br>.2        |
| A POLICE TO THE TOTAL PROPERTY OF THE PROPERTY | <u> </u>    | 1.2*<br>1.2                             | • ∠<br>3 • 8     |
| THE POOR TO DERATION UP FLIGHT CONTINUES   | 1           |   | 1.3              |
| IMPROPER IN-FLIGHT DECISION OF FLIGHT  | 1<br>1<br>1 | 1 • 2<br>1 • 2*                         | 1.8              |
| INADEQUATE SUPERVISION WITH AIRCRAFT   | 1           | 1.2*                                    | • 06             |
| TO TED UNSUITABLE TERRAIN  | 1           | 1.2*<br>1.2*                            | •00              |
|  | 1           | 1 • 2 **                                | •                |
| MISJUDGED DISTANCE AND ALTITUDE  | . INSPECTI  | ON)                                     |                  |
| PERSONNEL (MAINTENANCE, SERVICING  |             | <br>7 1                                 | 9.1              |
| - WANTENANCE AND INSPECTION  | 6           | 4.8*                                    | 1.3              |
| INADEQUATE MAINTENANCE (MAINTENANCE PERSONNEL)   | 2           | 2 • 4**                                 | • 3              |
| PERSONNEL (MAINTENANCE, SERVIOLANDINADEQUATE MAINTENANCE AND INSPECTION IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL) IMPROPERLY SERVICED AIRCRAFT (GROUND CREW) IMPROPERLY SERVICED AIRCRAFT (OWNER-PILOT)   | ī           | 1.2                                     | • 0              |
| POWERPLANT   |             |   |                  |
| DINCS  | 10          | 11.9*                                   | 1.9<br>1.6       |
| ENGINE STRUCTURE - PISTON, PISTON RINGS  | 5           | 6.0*<br>4.8                             |                  |
| ENGINE STRUCTURE - CRANKSTIAN CONNECTING RODS  | 4<br>2      | 4.8                                     | 2.1              |
| ENGINE STRUCTURE - CYLINDER ASSEMBLY   | 2           | 2.4                                     | 1.6              |
| IGNITION SYSTEM - SPARK PLUG   | 2           | 2 • 4<br>2 • 4*                         | 4.9<br>.2        |
| IGNITION SYSTEM - SPARK TOO SYSTEM FUEL SYSTEM - FUEL INJECTION SYSTEM FUEL SYSTEM - FUEL TERS. SCREENS  | 2           | 2 • 4**                                 | _                |
| LUBBICATING SYSTEM = TIPLES  | 1<br>1      | 1.2<br>1.2*                             | .03              |
| ENGINE STRUCTURE - OTHER IGNITION SYSTEM - OTHER IGNITION SYSTEM - OTHER   | î           | 1.2                                     | 1.0              |
| EUCL SYSTEM - LINES AND FIFTH  | 1           | 1.2                                     | .8               |
|  | 1           | 1 • 4 **<br>1 - 2 *                     | .1               |
| FUEL SYSTEM - RAM ATK HOSENDE  | 1<br>1      | 1.2*                                    | • 0              |
|  | 1           | 1.2                                     | . 9              |
| POWERPLANT-INSTRUMENTS - FUEL QUANTITY GAUGE   | 1           | 1.•2                                    | 1 • 4            |
| MISCELLANEOUS ACTS AND COL   | ND IT IONS  |   |                  |
|  | 32          | 38.1*                                   | 24•5<br>24•8     |
| FUEL STARVATION FUEL EXHAUSTION  | 11          | 13.1#                                   | Ÿ-4 <b>•</b> 0   |

### TABLE 56 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE FRANKLIN 6A4 AND 6AG4 SERIES ENGINE

| TOTAL ACCIDENTS - 72  |   | PER CENT   |   |
|---|---|--|---|
| CAUSE/FACTOR  | FREQUENCY   | OF TOTAL ACCIDENTS                                 | PER CENT  |
|   | •   | ,  | , <b>,</b>  |
| PILOT IN COMMAND  |   |  |   |
| INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING MISMANAGEMENT OF FUEL IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROL CONTINUED VFR FLIGHT INTO ADVERSE WEATHER CONDITION ATTEMPTED OPERATION WITH KNOWN DEFICIENCIES IN EQUI ATTEMPTED OPERATION BEYOND EXPERIENCE/ABILITY LEVEL BECAME LOST/DISORIENTED LACK OF FAMILIARITY WITH AIRCRAFT SPONTANEOUS IMPROPER ACTION MISJUDGED DISTANCE AND SPEED   | IS 2<br>P 1   | 18.1# 18.1 15.3 2.8 1.4 1.4 1.4 1.4                | 29.1<br>19.1<br>14.5<br>1.2<br>1.0<br>.4<br>3.2<br>1.9                                      |
| PERSONNEL (MAINTENANCE, SERVICING,  | INSPECTIO   | ١)   |   |
| INADEQUATE MAINTENANCE AND INSPECTION IMPROPER MAINTENANCE (OWNER PERSONNEL) IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL)   | 13<br>3<br>1  | 18.1*<br>4.2*<br>1.4                               | 8.9<br>.6<br>1.4  |
| POWERPLANT  |   |  |   |
| ENGINE STRUCTURE - VALVE ASSEMBLIES IGNITION SYSTEM - MAGNETOES FUEL SYSTEM - CARBURETOR ENGINE STRUCTURE - MASTER AND CONNECTING RODS ENGINE STRUCTURE - CYLINDER ASSEMBLY IGNITION SYSTEM - SPARK PLUG ENGINE STRUCTURE - PISTON, PISTON RINGS. ENGINE STRUCTURE - OTHER IGNITION SYSTEM - LOW TENSION WIRING FUEL SYSTEM - LINES AND FITTINGS FUEL SYSTEM - SELECTOR VALVES FUEL SYSTEM - FILTERS, STRAINERS, SCREENS FUEL SYSTEM - PUMPS LUBRICATING SYSTEM - LINES, HOSES, FITTINGS POWERPLANT-INSTRUMENTS - FUEL QUANTITY GAUGE | 8<br>5<br>4<br>3<br>2<br>2<br>2<br>1<br>1<br>1<br>1<br>1<br>1 | 11.1* 6.9* 5.6 4.2 2.8 2.8 2.8 1.4 1.4 1.4 1.4 1.4 | 3.9<br>1.8<br>3.4<br>2.6<br>1.8<br>2.2<br>1.6<br>2.2<br>1.3<br>.03<br>1.0<br>.8<br>.5<br>.8 |
| MISCELLANEOUS ACTS AND CONDIT   | IONS  |  |   |
| FUEL STARVATION FUEL EXHAUSTION   | 22<br>9   | 30.6<br>12.5#                                      |   |

#### TABLE 57 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE PRATT AND WHITNEY MILITARY R-985 SERIES ENGINE

| TOTAL ACCIDENTS - 139   | FREQUENCY | PER CENT<br>OF TOTAL<br>ACCIDENTS | PER CENT     |
|---|-----------|-----------------------------------|--------------|
| CAUSE/FACTOR .  | /         | •                                 |              |
| PILOT IN COMMAND  |           |                                   |              |
|   | 37        | 26.6                              | 28.1         |
| INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING  | 18        | 12•9<br>5•8#                      | 18.8<br>14.5 |
| MISMANAGEMENT OF POWERPLANT + PWRPLANT CONTROL  | 5 0       | 2.2                               | 3.8          |
| TMODODER IN-FLIGHT DECISIONS  | 2<br>1    | 1.4*                              | 3.2          |
| IMPROPER IFR OPERATION  BECAME LOST/DISORIENTED  BECAME LOST/DISORIENTED ADVERSE WEATHER CONDITION  |           | • 7                               | 1.3          |
| BECAME LOST/DISORIENTED  BECAME LOST/DISORIENTED  CONTINUED VFR FLIGHT INTO ADVERSE WEATHER CONDITION  IMPROPER OPERATION OF FLIGHT CONTROLS  IMPROPER OPERATION OF FLIGHT  | 1<br>1    | • 7<br>• 7                        | 1.4          |
| INADEQUATE SUPERVISION OF TELEVISION  | 1         | •7                                | •3           |
| AUDOTONI TMDNIKMENI   | THEBECTI  | ON )                              |              |
| PERSONNEL (MAINTENANCE, SERVICING   | , INSECTI | ,                                 | 9.1          |
| THANGE AND INSPECTION   | 11<br>1   | 7 • 9<br>• 7                      | .8           |
| IMPROPERLY SERVICED AIRCRAFT COMPA  | -         | •                                 |              |
| POWERPLANT  |           |                                   | 1.8          |
| ENGINE STRUCTURE - CYLINDER ASSEMBLY MASTER AND CONNECTING RODS   | 15<br>8   | 10.8*<br>5.8*                     | 2.5          |
| PROTRIE CTRICILIKE - MASILIN MINE -   | 8         | 5.8                               | 3.3          |
| FUEL SYSTEM - CARBURETOR IMPELLER ASSEMBLY  | 7<br>5    | 5.0*<br>3.6                       | 1.6          |
| PURTUE STRIFTIIRE - UNANNOUN'   | 4         | 2.9<br>2.2                        | 1.6<br>1.6   |
| ENGINE STRUCTURE TOTTLE TANK CAPS   | 3<br>2    | 1.4                               | 2.           |
| FUEL SYSTEM - VENTS, DRAINS,<br>ENGINE STRUCTURE - PISTON, PISTON RINGS<br>ENGINE STRUCTURE - PISTON, PISTON RINGS  | 2         | 1 • 4<br>1 • 4                    | 4.           |
| ENGINE STRUCTURE - VALVE ASSESSED   | 2<br>1    | .7                                | 2.           |
|   | 1         | .7<br>.7*                         | 1.           |
| IGNITION SYSTEM - SPARK TESS  | 1<br>1    | .7                                | 1.           |
|   | 1         | • 7<br>• 7                        |              |
| FUEL SYSTEM - SELECTOR VALUERS, SCREENS   | 1<br>1    | .7:                               |              |
|   |           | <del>.,,</del>                    |              |
| ENGINE CONTROLS - COCKPIT -  THROTTLE - POWER LEVER ASSEMBLIES  | 1         | • 7<br>• 7                        |              |
| MIXTURE CONTROL ASSEMBLIES  | 1         | • 7                               |              |
| MISCELLANEOUS - FOREIGN OBJECT DANS - PORTION   | 1<br>1    | •7<br>•7                          |              |
| DEDUCTION GEAR ASSEMBLY STREET  | _         |                                   | j            |
| MISCELLANEOUS ACTS AND COM  | DITIONS   |                                   |              |
| * = # + + = 4 + = | 39        |                                   |              |
| FUEL EXHAUSTION FUEL STARVATION   | 2.4       | II .                              |              |
| LOGE STANTAGES  |           |                                   |              |

#### Interrelationship of Causes/Factors

In the previous two subsections, causes and related factors of engine-failure accidents for specific aircraft and engine makes and models were discussed. In this subsection, the interrelationship between fifteen frequently cited causes/factors is further examined. Table 58 is a matrix display of the causes/factors.

Became Lost/Disoriented. This cause/factor was cited in 101 engine-failure accidents. The pilots, after becoming lost, continued to fly until their fuel supply was exhausted, which resulted in 96 engine-failure accidents.

Improper Operation of Powerplant, Powerplant Controls. This cause usually meant the pilot improperly used or failed to use the antising or de-icing equipment, which led to carburetor icing or conditions conducive to carburetor/induction system icing.

Improper In-flight Decisions or Planning. This cause/factor was related to other citations, such as the pilot becoming lost/disoriented, mismanaging the fuel supply, being inattentive to he fuel supply, miscalculating the fuel supply, ad ending up with fuel exhaustion and an ngine-failure accident.

Inadequate Preflight Preparation. Inadetate preflight preparation or planning resulted engine-failure accidents because of water in fuel (182 accidents), fuel starvation (120 ddents), or fuel exhaustion (563 accidents).

Mismanagement of Fuel. This causal area related to the pilot not making adequate light preparations or planning, being inattento the fuel supply, lacking familiarity with aircraft, miscalculating fuel consumption, having the fuel selector positioned between tanks.

Fuel Exhaustion. Fuel exhaustion was d primarily by the pilot making inadequate wht preparations, mismanaging the fuel, ing improper in-flight decisions, becoming or disoriented, being inattentive to the fuel , and miscalculating the fuel supply.

Fuel Starvation. Fuel starvation resulted primarily from the pilot mismanaging the fuel, making inadequate preflight perparations, and being inattentive to the fuel supply, along with inadequate maintenance and inspection, and foreign material affecting normal operations.

Inadequate Maintenance and Inspection. This cause/factor was closely associated with fuel starvation, foreign material affecting normal operations, and mechanical problems such as material failure, fuel system-carburetor, and ignition system - spark plugs and magnetos.

Improper Maintenance (Maintenance Personnel). This cause/factor was associated with improperly installed parts, fuel system - carburetor, and fuel starvation.

Engine Structure - Valve Assemblies. Fifty-eight of the 130 valve assembly failures were due to material failure and 19 were due to inadequate maintenance and inspection.

Engine Structure - Cylinder Assembly. Failures of the cylinder assembly were caused primarily by material failure. Inadequate maintenance and inspection contributed, along with fatigue fractures.

Engine Structure - Master and Connecting Rods. The 86 master-and-connecting-rod failures were due to material failure and fatigue fracture.

Ignition System - Magnetos. The principle causes attributed to the magneto failures were inadequate maintenance and inspection and material failure.

Ignition System – Spark Plugs. Failure of the spark plugs was a result of inadequate maintenance and inspection, along with carbon deposits.

Fuel System - Carburetor. The causes/ factors associated with carburetor failures were inadequate maintenance and inspection, improper maintenance by maintenance personnel, material failure, the engine being loaded-up, and improper alignment or adjustment. Carburetor failure contributed to fuel starvation in 44 engine-failure accidents.

|  |                             |   |                                   |       |                            |              | CAUSIES                                | - TOTA                     |   |                |   |           |             |                        |        |                 | •                                  |                         |                     | •   |                | 927           | -#<br>-T                                |   |
|--|-----------------------------|---|-----------------------------------|-------|----------------------------|--------------|--|----------------------------|---|----------------|---|-----------|-------------|------------------------|--------|-----------------|------------------------------------|-------------------------|---------------------|---|----------------|---------------|---|---|
| Became Lost.   | Receme Lost,<br>Disoriented | Improper Oper-<br>ation Power-<br>Plant | Ingreper<br>Inflight<br>Dectaions |       | Mismenegement<br>o of Fuel | Fuel Exhaus. | Fuel Starv-<br>stion<br><br>Insdequate | Meintenance,<br>Inspection | Improper<br>Maintenance<br>(Maint. Pers.) | Valve Assembly | Assembly<br>Master and<br>Connecting Rods | seodengeM | Spark Plugs | Carburetor<br>Material | Failwe | Carbon Deposits | -ngila raqorqmI<br>tnamtautba tnam | Piston,<br>Piston Aings | Fatigue<br>Fracture | Fuel Contami-<br>nation<br>(Except Water) | Inattentive to | Improper Emer | Limet to Moal<br>LA ditw vitra<br>flaro |   |
| Disoriented  | (101)                       |   | 멁                                 | 젊     | 0                          | R            | ,                                      |                            |   |                |   |           |             |                        |        |                 |                                    |                         |                     |   |                | 2             | 9                                       |   |
| Improper<br>Operation<br>Fowerplant,<br>Fowerplant<br>Controls |                             | (194)                                   |                                   | ដ     | ω ΄                        |              | 39                                     |                            |   |                |   |           |             |                        |        | E.              | <u>.</u>                           |                         |                     |   | ¢-             | . v           |   |   |
| Improper<br>Inflight<br>Decisions or<br>Flamming               | ឌ                           | 9                                       | (12t)                             | 25    | 18                         | £1.1         | σ,                                     |                            |   |                |   |           |             |                        | ထ      |                 |                                    |                         |                     | φ.  | - 8            | ,             | 15                                      |   |
| Inadequate<br>Preflight  | 뛵                           | ដ                                       | 8                                 | (928) | 977 (                      | 563          | 027<br>1750                            | 12                         |   |                |   |           |             |                        | 8      |                 |                                    |                         |                     | }   | 8              | 00            | 3                                       | _ |
| Mismanagement<br>of Fuel                                       | ω                           | 7                                       | 32                                | 31    | (613)                      | 241 (        | 165                                    |                            |   |                |   |           |             |                        |        |                 |                                    |                         |                     |   | 8              | 2             |   |   |
| % Fuel<br>Exhaustion   | 8                           |   | या                                | 88    | 3 142                      | (113)        | _                                      | 7.                         |   |                |   |           |             | :                      | ţ      |                 |                                    |                         |                     | ₹   | 8              | 6             | £4                                      | m |
| Fuel<br>Starvation   |                             | 33                                      |                                   | 44    | 9 1465                     |              | (882)                                  | 83                         | 0,  | 6              |   |           |             | -                      | 2.7    |                 | 2                                  | 19                      | 13                  |   |                |               |   |   |
| Inadequate<br>Maintenance.                                     |                             |   |                                   | 81    | 9                          | #<br>5       | 83                                     | (300)                      | ~   | 19             | σ   | 9         | 31 33       | χ.<br>Α                | Ç      |                 | l                                  |                         |                     |   |                |               |   |   |
| Inspection   |                             |   |                                   |       |                            |              | ٥                                      |                            | <u>ೆ</u>                                  | (9 <u>4</u> )  |   |           |             | 97                     |        |                 |                                    |                         |                     |   |                |               |   |   |
| Maintenance,<br>(Maint. Pers.)                                 |                             |   |                                   |       |                            |              | •                                      |                            |   |                |   |           |             |                        | 8      | 7               |                                    |                         | 6                   | 6   |                |               |   |   |
| Engine<br>Structure<br>(Valve Assembly)                        | ب                           |   |                                   |       |                            |              |  | A                          | 19  | (130)          | Q.  |           |             |                        |        |                 |                                    |                         | r                   | 5   |                |               |   |   |
| Engline  |                             |   |                                   |       |                            |              |  |                            | φ   |                | (五  |           |             |                        | \$     | _               |                                    |                         | า                   |   |                |               |   |   |
| Structure<br>(Cylinder Assembly)                               | woly)                       |   |                                   |       |                            |              |  |                            |   |                |   | Ş         |             |                        | 4      |                 |                                    |                         | ⅎ                   | φ   |                |               |   |   |
| Engine Structure<br>(Master and                                | e<br>H                      |   |                                   |       |                            |              |  |                            | 9   |                |   | <u>8</u>  |             |                        | •      | _               |                                    |                         |                     |   |                |               |   |   |
| Connecting Rod)  | <del>g</del>                |   |                                   |       |                            |              |  |                            | ಜ್ಞ                                       |                |   |           | (63)        |                        | Ø      | 83              |                                    |                         |                     |   |                |               |   |   |
| System<br>(Magnetoes)  |                             |   |                                   |       |                            |              |  |                            |   |                |   |           |             | (53)                   |        | cu              | ដ                                  |                         |                     |   | ,              |               |   |   |
| Ignition   |                             |   |                                   |       |                            |              | •                                      |                            | 33  | . <del></del>  |   |           |             | 3                      |        |                 |                                    |                         |                     |   |                |               |   |   |
| (Spark Plugs)  |                             |   |                                   |       |                            |              | 4                                      |                            | 8   | q              |   |           |             |                        | (300)  | Я               | я                                  | #                       |                     |   |                |               |   | 1 |

TABLE 58

| tang Quantity<br>Geoge   |   |  |                         |                          | 음 :                | E<br>E             |  |   |
|--|---|--|-------------------------|--------------------------|--------------------|--------------------|--|---|
| Between Tanks  |   |  |                         |                          |                    |                    |  |   |
| Positioned   |   |  |                         | 3 12                     | NI.                |                    |  |   |
| Fuel Selector  |   |  | -                       |                          | ×                  |                    |  |   |
| Leuf ni reteW  |   |  | ğ                       | Y<br>Q                   |                    |                    |  |   |
| Fuel Consumption   |   |  |                         |                          |                    |                    |  |   |
| Macalculated   |   | 8  | ď                       | ξ ,                      | તે જ્ઞ             | 3                  |  |   |
| Carburetor Ice   | 122   |  | 00                      | •                        |                    |                    |  |   |
| ment Failed to Use   |   |  |                         |                          |                    |                    |  |   |
| -dŢnbg Butot   | 302   | <b>m</b> -                                       | Φ                       |                          |                    |                    |  |   |
| -su\guisI ituv   | Ø.  |  |                         |                          |                    |                    |  |   |
| Conduction Sys. Induction Sys. Icing   | <b>2</b> 7  |  |                         |                          |                    |                    |  |   |
| Continued VFR Elight Into Adverse Westher Conditions                           | ឧ   | m  | 36                      |                          | ន                  |                    |  |   |
| Weather low<br>Ceiling, Precip-<br>Ceiling, brackor<br>Obstruction to<br>Malon | #   | 19   | %                       | - 21                     | 55                 |                    |  |   |
| Pailure of Two<br>r or More Engines  | 큠   | ۲-   | 31                      | 33                       | æ                  | _                  |  |   |
|  |   |  | (1)                     | m                        | 88                 | 31                 |  |   |
| Affecting Normal<br>Operations   |   |  |                         |                          |                    |                    |  |   |
| Foreten Material   |   |  | 17                      |                          |                    | ₫                  | &  |   |
|  |   |  |                         |                          |                    |                    |  | _   |
| Became Lost<br>Disoriented   | Improper<br>Operation<br>Powerplant<br>Powerplant<br>Controls | Improper<br>Inflight<br>Decisions or<br>Planning | Inadequate<br>Preflight | Mismenagement<br>of Fuel | Fuel<br>Ethaustion | Fuel<br>Starvation | Inadequate<br>Maintenance,<br>Inspection | Improper<br>Maintenance<br>(Maint, Pers.) |
|  |   |  |                         | 99                       |                    | H 02               | чУН                                      | HEC                                       |

Engine Structure (Valve Assembly)

Engine Structure (Cylinder Assembly)

Engine Structure (Master and Connecting Rod)

Ignition System (Magnetoes)

Ignition System (Spark Flugs)

Fuel System (Carburetor)

#### **SECTION III**

NATURE AND SERIOUSNESS OF THE SECOND ACCIDENT TYPE INVOLVED

The purpose of Section III is to display graphically the relative seriousness of the type of accidents which followed engine failure. This was done by calculating the percentage of times that each second accident type resulted in fatal or serious injury to any occupant of the aircraft. The percentages are shown in Figures 1, 2, and 3 for all fixed-wing, single-engine fixed-wing, and multiengine fixed-wing aircraft, respectively. For example, as seen in Figure 1, of the 85 spin accidents which followed engine failure, 94.1% resulted in death or serious injury. The con-

clusion to be drawn from Figures 1, 2, and 3 is that a pilot who experiences an engine failure in his aircraft and is required to initiate a precautionary or forced landing should do everything possible to avoid a stall spin, stall spiral, stall, or uncontrolled collision with ground/water, because these accidents result in the highest percentage of deaths and serious injuries.

The Safety Board has previously examined and published guidelines relating to forced and precautionary landings.<sup>5</sup>

<sup>&</sup>lt;sup>5</sup>National Transportation Safety Board, "Emergency Landing Techniques in Small Fixed-Wing Aircraft," NTSB-AAS-72-3.

# SECOND TYPE OF ACCIDENT (FREQUENCY)

2.7

STALL, SPIRAL [20] STALL, SPIN (85) STALL [227]

COLLISION WITH GROUND/WATER UNCONTROLLED [42]

COLLISION WITH GROUND/WATER CONTROLLED (78) COLLISION WITH BUILDING(S) (16) STALL, MUSH [109]

COLLISION WITH WIRES/POLES (202)

COLLISION WITH TREES (595)

COLLISION WITH AUTOMOBILE (15) OVERSHOOT (33)

ALL SECOND ACCIDENT TYPES (4310)

COLLISION WITH CROPS (13)

COLLISION WITH OBJECTS (118) UNDERSHOOT (50)

COLLISION WITH DIRT BANK (100) DITCHING (103)

FIRE OR EXPLOSION IN FLIGHT (10) WHEELS-UP LANDING (292)

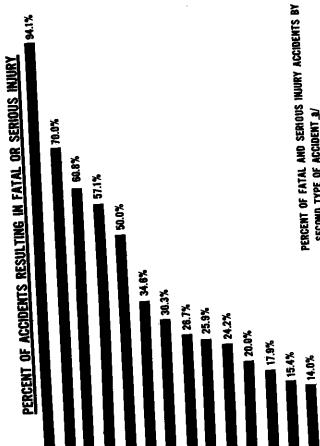
HARD LANDING (206)

COLLISION WITH FENCE, FENCE POSTS (227) COLLISION WITH DITCHES (193) NOSE OVER-DOWN (583)

GEAR COLLAPSED (896)

GROUND-WATER LOOP-SWERVE (40)

COLLISION WITH SNOWBANK [11]



SECOND TYPE OF ACCIDENT\_3/

ACCIDENTS INVOLVING ENGINE FAILURE/MALFUNCTION AS A FIRST TYPE OF ACCIDENT FIXED-WING AIRCRAFT

13.6% 13.6%

12.0% 10.3% 10.0% 9.7% 6.2% 5.3% 5. 4.5% 2.5%

U.S. GENERAL AVIATION

1965 -- 1969

INCLUDES ONLY THOSE SECOND AGGIDENT TYPES WHICH OCCURRED 10 OR MORE TIMES DURING THE STUDY PERIOD þ

# SECOND TYPE OF ACCIDENT (FREQUENCY)

STALL SPIN [55]

COLLISION WITH GROUND/WATER/ UNCONTROLLED (22) COLLISION WITH GROUND/WATER CONTROLLED (56) COLLISION WITH WIRES/POLES (193) COLLISION WITH BUILDINGS [16] STALL SPIRAL (16) STALL MUSH [85] STALL (187)

COLLISION WITH TREES (552) DVERSHOOT (32)

ALL SECOND ACCIDENT TYPES (3855) COLLISION WITH AUTOMOBILES (15)

COLLISION WITH OBJECTS (115)

UNDERSHOOT (46)

COLLISION WITH DIRT BANK (92)

HARD LANDING (196)

WHEELS -UP LANDING (178)

DITCHING [71]

CROP (11)

COLLISION WITH FENCE, FENCEPOSTS (216) COLLISION WITH DITCHES (186)

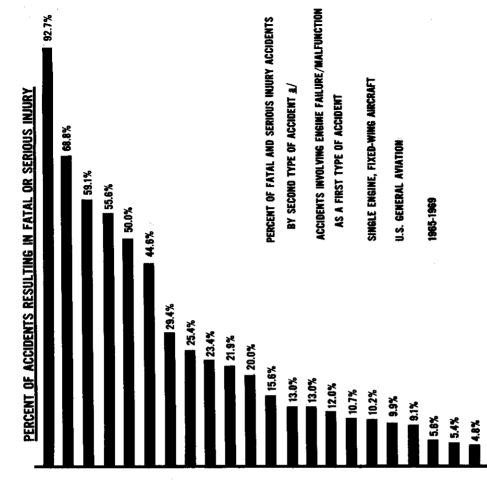
HOSE OVER-DOWN (580)

GEAR COLLAPSED (853)

4.2% 3.0% 0.0%

COLLISION WITH SNOWBANK [10]

GROUND-WATER LOOP-SWERVE (33)



A/ INCLUDES ONLY THOSE SECOND ACCIDENT TYPES WHICH OCCURRED 10 OR MORE TIMES DURING THE STUDY PERIOD

SECOND TYPE OF ACCIDENT (FREQUENCY)

STALL, SPIN (30)

COLLISION WITH GROUND/WATER UNCONTROLLED [20]

STALL [40]

COLLISION WITH GROUND/WATER CONTROLLED [22]

COLLISION WITH TREES (43)

COLLISION WITH WIRES/POLES (9)

ALL SECOND ACCIDENT TYPES (455)

STALL, MUSH [24]

COLLISION WITH DITCHES [7]

DITCHING (32)

COLLISION WITH DIRT BANKS (8)

WHEELS-UP LANDING (114)

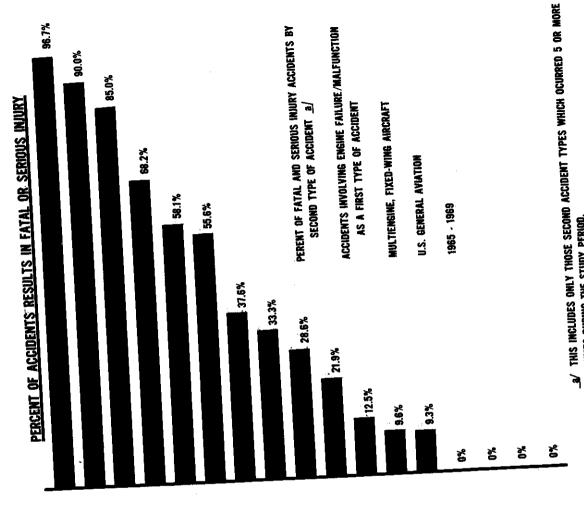
GEAR COLLAPSED [43]

COLLISION WITH FENCE, FENCE POSTS (11)

HARD LANDING (10)

GROUND-WATER LOOP-SWERVE (7)

FIRE OR EXPLOSION IN FLIGHT (5)



TIMES DURING THE STUDY PERIOD.

106

## BY THE NATIONAL TRANSPORTATION SAFETY BOARD

| /s/        | JOHN H. REED       |     |
|------------|--------------------|-----|
|            | Chairman           |     |
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| /s/        | ISABEL A. BURGESS  |     |
|            | Member             | · · |
| <u>/s/</u> | WILLIAM R. HALEY   |     |
|            | Member             |     |

Louis M. Thayer, Member, was not present and did not participate in the adoption of this report.

November 29, 1972

#### APPENDIX A

# FIXED-WING AIRCRAFT U. S. GENERAL AVIATION

APPENDIX A

|          | TOTAL<br>4310<br>94<br>310   | 1<br>3<br>10<br>29<br>3864                  | 8630   | 3 22                             | 8655        |
|----------|--|---|--------|----------------------------------|-------------|
|          |  |   | ABOARD |                                  | •           |
|          | UNKNOWN  |   |        |                                  |             |
| INJURIES | NONE<br>2714<br>55<br>198  | 2<br>10<br>14<br>2501                       | 2502   | N W                              | 5509        |
|          | MINDR<br>909<br>12<br>57   | 670   | 1652   | 1 10                             | 1663        |
|          | SERIOUS<br>418<br>7<br>29  | 1<br>4<br>378                               | 837    | 4                                | 841         |
|          | FATAL<br>269<br>20<br>26<br>26                                     | 315   | 639    | m                                | 642         |
|          | PILOT<br>COPILOT<br>DUAL STUDENT<br>CHECK PILOT<br>FLIGHT ENGINEER | CABIN ATTENDANT<br>EXTRA CREW<br>PASSENGERS | TOTAL  | * OTHER AIRCRAFT<br>OTHER GROUND | GRAND TOTAL |

TOTAL ACCIDENTS FATAL ACCIDENTS 4310 312 INVOLVES INVOLVES

INJURIES CARRIED OPPOSITE OTHER-AIRCRAFT ARE INJURIES OCCURRING IN AIRCRAFT THAT ARE NOT PART OF THIS SUBJECT TABULATION, BUT WERE PART OF THE TOTAL INJURIES INVOLVED IN COLLISIONS BETWEEN AIRCRAFT.

TABLE A-2

KIND OF FLYING VS AIRCRAFT DAMAGE ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE FIXED-WING AIRCRAFT U. S. GENERAL AVIATION 1965 - 1969

| KIND OF FLYING                          | AIRCRAFT DAMAGE | RECORDS ACCIDENTS |     |
|---|-----------------|-------------------|-----|
| ======================================= |                 | 313 313           |     |
| INSTRUCT IONAL                          | 62 251          | 113 113           |     |
| DUAL                                    | 10 103          | 10 10             |     |
| SOF0                                    | 3 7             | 166 166           |     |
| CHECK                                   | 16 150          |                   |     |
| TRAINING                                |                 | 1998 1998         |     |
| NONCOMMERC I AL                         | 410 1588        | 211 211           |     |
| PLEASURE                                | 22 189          | 534 534           |     |
| PRACT ICE                               | 102 432         | . 45 45           |     |
| BUSINESS                                | 15 30           | 4 4               |     |
| CORPORATE/EXECUTIVE                     | 4               |                   |     |
| AERIAL SURVEY                           |                 | 3                 | 3   |
| COMPANY FLIGHT                          | 1 2             |                   |     |
| OTHER                                   |                 | 211 21            | .1  |
| COMMERCIAL                              | 27 184          | 208 20            | 80  |
| AERIAL APPLICATION                      | 38 170          | 2                 | 2   |
| ASSOCIATED CROP CONTROL ACTIV           | 1 1             | 8                 | 8   |
| FIRE CONTROL                            | 1 7             | 6                 | 6   |
| ASSOCIATED FIRE CONTROL ACTIV           | 1 5             | 2                 | 2   |
| AERIAL MAPPING/PHOTOGRAPHY              | 1 1             | 7                 | 7   |
| AERIAL ADVERTISING                      | 1 6             | 2                 | 2   |
| POWER AND PIPELINE PATROL               | 1 1             |                   | 127 |
| FISH SPOTTING                           | 37 90           | 41                | 41  |
| AIR TAXI-PASSENGER OPERATIONS           | 16 25           | •                 |     |
| AIR TAXI-CARGO OPERATIONS               | 10 25           |                   |     |
| CONSTRUCTION WORK                       |                 | 1                 | 1   |
| SCHEDULED PASSENGER SERVICE             | 1               | -                 |     |
| SCHEDULED CARGO SERVICE                 | 1               |                   |     |
| NONSCHEDULED/CHARTER REVENUE            |                 |                   |     |
| NONSCHEDULED/CHARTER REVENUE            |                 |                   |     |
| MILITARY CONTRACT-PASSENGER             |                 | 2                 | 2   |
| MILITARY CONTRACT-CARGO                 | 1 1             | 2                 | .2  |
| CONTRACT/CHARTER-CARGO-DOMEST           | -               | 2                 |     |
| CONTRACT/CHARTER-PASSENGER-DO           | 1 1             |                   |     |
| CONTRACT/CHARTER-CARGO-INTERN           | ·               |                   |     |
|   | 112             |                   |     |

|                               | ANALYTIC TABLE      |           | APPENDIX  |
|-------------------------------|---------------------|-----------|-----------|
|                               | AIRCRAFT DAMAGE     |           | 4         |
| KIND OF FLYING                | DEST SUBST WIN NONE |           |           |
| CONTRACT/CHARTER-PASSENGER-IN |                     | RECORDS   | ACCIDENTS |
| ОТНЕЯ                         | 3 7                 |           |           |
| UNKNOWN/NOT REPORTED          |                     | 10        | 10        |
| MISCELLANEDUS                 |                     |           |           |
| EXPERIMENTATION               |                     |           |           |
| TEST                          | 23 57               | <b>F4</b> | 1         |
| DEMONSTRATION                 | 7.<br>2.            | 80        | 80        |
| FERRY                         | _                   | 30        | 30        |
| SEARCH AND RESCUE             |                     | 130       | 130       |
| AIR SHOW/AIR RACING           |                     | 4         | 4         |
| PARACHUTE JUMP                | 2 10                | 10        | 10        |
| PARACHUTE JUMP IN CONNECTION  |                     | 12        | 12        |
| TOWING GLIDERS                |                     | 7         | -         |
| SEEDING CLOUDS                |                     | 2         | 2         |
| HUNT ING                      | •                   | 7         | 1         |
| POLICE PATROL                 | _                   |           |           |
| HIGHWAY TRAFFIC ADVISORY      |                     | -         |           |
| ALL OTHER PUBLIC FLYING       | ო                   |           |           |
| ОТНЕЯ                         | 2 3                 | m         | m         |
| UNKNOWN/NOT REPORTED          | w<br>               | ın .      | r.        |
|                               |                     | 4         | 4         |
|                               |                     |           |           |
| NECUKUS                       | 841 3469            | 4310      |           |
| ACC I DENTS                   | 841 3469            |           | 4310      |
|                               |                     |           |           |

|  | INJURY INDEX      | Y INC                               | EX       | RECORDS |              | ACC I DENTS |
|--|-------------------|-------------------------------------|----------|---------|--------------|-------------|
| AIRPORT PROXIMITY  | FATAL SER MIN NON | Z   <br>        <br>           <br> |          |         |              |             |
|  |                   |                                     |          | 7.2     | 728          | 728         |
| ON AIRPORT   | 09 64             | 132                                 | 0 "      |         | -            |             |
| ON SEAPLANE BASE   |                   |                                     | •        |         |              |             |
| ON HELIPORT  |                   |                                     |          |         |              |             |
| ON BARGE/SHIP/PLATFORM   |                   |                                     |          | 9       | 999          | 999         |
| Namitine State Sta | 57 92             | 168                                 | 8 349    |         |              | 213         |
| IN EXAMPLE OF THE STATE OF THE  | 22 38             |                                     | 51 102   | Ş       | CT.          |             |
| WITHIN 1/4 MILE  |                   |                                     |          | 1       | 149          | 149         |
| WITHIN 1/2 MILE  | 15 23             |                                     | 35 10    |         | 47           | 47          |
| 311W 4/6 NICHE:  | 9                 | 9 ]                                 | 14 18    |         | 142          | 142         |
| U 1 2 7 2 7 1 7 1 7 1 7 1 7 1 7 1 7 1 7 1  | 13 1              | 18 3                                | 31 80    |         |              | 287         |
|  | 25 4              | 42                                  | 78 142   | •       |              | 102         |
| WITHIN 2 MILES   | 20                | 15 (                                | 42 115   |         | 261          | 761         |
| WITHIN 3 MILES   |                   |                                     | 7.5      |         | 125          | 125         |
| WITHIN 4 MILES   |                   | 7.                                  | 67       |         | 4.5          | 45          |
| A MILL MAN   | 7                 | 9                                   | 7 25     | -       | 1675         | 1675        |
| OUT THE COURT OF T | 86 14             | 144 3                               | 353 1092 |         |              | 4           |
| BEYOND 3 MICES   | -                 | ^                                   | 16 21    |         | <del>1</del> | 2           |
| UNKNOWN/NOT REPORTED   | -1                | J                                   |          |         |              |             |

4310

4310

RECORDS ACCIDENTS FIRST PHASE OF OPERATION VS AIRCRAFT DAMAGE ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE U. S. GENERAL AVIATION 1965 - 1969

AIRCRAFT DAMAGE

| FIRST PHASE OF OPERATION     | SESESSESSESSES      | = | ecoppe  | ******    |             |
|------------------------------|---------------------|---|---------|-----------|-------------|
|                              | DEST SUBST MIN NONE | É | VECOKD2 | ACCIDENTS | PERCENT     |
| STATIC                       |                     | _ |         |           |             |
| STARTING ENGINE/S            |                     |   |         |           |             |
| IDLING ENGINE/S              |                     |   |         |           |             |
| ENGINE RUNUP                 |                     |   |         |           |             |
| IDLING ROTORS                |                     |   |         |           |             |
| PARKED-ENGINES NOT OPERATING |                     |   |         |           |             |
| OTHER                        |                     |   |         |           |             |
| <u>TAX I</u>                 |                     |   |         |           |             |
| TO TAKEOFF                   |                     |   |         |           |             |
| FROM LANDING                 |                     |   |         |           |             |
| OTHER                        |                     |   |         |           |             |
| GROUND TAXI TO TAKEOFF       |                     |   |         |           |             |
| GROUND TAXI FROM LANDING     |                     |   |         |           |             |
| GROUND TAXI. OTHER           |                     |   |         |           |             |
| AERIAL TAXI TO TAKEOFF       |                     |   |         |           |             |
| AERIAL TAXI TO/FROM LANDING  |                     |   |         |           |             |
| AERIAL TAXI, OTHER           |                     |   |         |           |             |
| TAKEOFF                      |                     |   |         |           |             |
| RUN                          | 15 39               |   |         |           |             |
| INITIAL CLIMB                | 240 818             |   | 54      | 54        | 1.25        |
| VERTICAL                     |                     |   | 1058    | 1058      | 24.55       |
| RUNNING                      |                     |   |         |           |             |
| ABORTED                      | 1                   |   |         |           |             |
| ABDRTED                      | •                   |   | 1       | 1         | . 02        |
| ABORTED                      |                     |   |         |           |             |
| OTHER                        |                     |   |         |           |             |
| INFLIGHT                     |                     |   |         |           |             |
| CLIMB TO CRUISE              | 23 86               |   |         |           |             |
| NORMAL CRUISE                | 326 1404            |   | 109     | 109       | 2.53        |
| DESCENDING                   | 21 178              |   | 1730    | 1730      | 40.14       |
| HOLD ING                     | 1 1                 |   | 199     | 199       | 4.62        |
| HOVERING                     |                     |   | 2       | 2         | .05         |
| POWER-ON DESCENT             |                     |   |         |           |             |
| AUTOROTATIVE DESCENT         |                     |   |         |           |             |
| ACROBATICS                   | 4 7                 |   |         |           |             |
|                              | . ,                 |   | 11      | 11        | <b>.</b> 26 |
|                              | 115                 |   |         |           |             |

| RECORDS ACCIDENTS PERCENT | 3 3 .07                  | 1 1. |                      | 63 63 1,46       | 86 86 2,00 | 36 36 •84 | 17 17 .39 | 7 7 416              | 15 15 •35              | 58 58 1.35         | , 2 .05            | 34 76 76  | 98 98 2,27             | 70. 8 %               |                      |               | 15 15 .55                     |                 |          | 302 302 7+01            | 10 10 •23 | 10 10 .23      | 41. 6 4          |                |                     |      |                | 70               | ,                             |           | 60. 4 4         | 2 2 .05 |                    |                       | 4310 | 4310     |            |
|---------------------------|--------------------------|------|----------------------|------------------|------------|-----------|-----------|----------------------|------------------------|--------------------|--------------------|-----------|------------------------|-----------------------|----------------------|---------------|-------------------------------|-----------------|----------|-------------------------|-----------|----------------|------------------|----------------|---------------------|------|----------------|------------------|-------------------------------|-----------|-----------------|---------|--------------------|-----------------------|------|----------|------------|
| AIRCRAFT DAMAGE           | DEST SUBST MIN NONG      | 2 1  | r.                   |                  | 15 48      | 23 63     | 4 32      | 2 15                 |                        | 15                 | 4 54               | 2         | 6 31                   | 20 78                 | ĸ                    |               |                               | 2 13            |          | 42 193                  | 49 253    | 4              | 3 7              | ·c             | , •                 | 4    |                |                  |                               | 26 105    | 4               | r.      | 2                  |                       |      | 841 3469 | 841 3469   |
|                           | FIRST PHASE OF OPERATION |      | INCONTROLLED DESCENT | THEOREM OF SCENT |            | LOW PASS  | OTHER     | EN KOUTE TO THE AMEN | EN ROUTE TO RECOMMENDE | SURVEY FIELD/ MICH | STARTING SHAID NOT | SMATH RUN | FLAREDUT FUR SHATE NOT | PULLUP FROM SWAIN NOW | PROCEDURE TURNAROUND | CLEANUP SHATH | MANEUVER TO AVOID OBSTRUCTION | RETURN TO STRIP | LAND ING | TOWELL PATTERN-CIRCLING |           | TINET ATTICION | INITIAL APPROACE | FINAL APPROACH | LEVEL OFF/TOUCHDOWN | ROLL | ROLL-ON/RUN-DN | POWER-ON LANDING | POWER-OFF AUTOROTATIVE LANDIN | GO-AROUND | MISSEN APPROACH | 201101E | CHI Table a second | UNKNOWN/NOT KE PORTER |      | 0803     | ACC IDENTS |

SECOND ACCIDENT TYPE VS INJURY INDEX ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE FIXED-WING AIRCRAFT U. S. GENERAL AVIATION 1965 - 1969

|                             | 2200 | INJU  | RY IN |     |         |    |
|-----------------------------|------|-------|-------|-----|---------|----|
| OF ACCIDENT                 | FATA | L SEI | R MI  |     | RECORDS | Δ٥ |
| UND-WATER LODP-SWERVE       |      |       |       |     |         |    |
| AGGED WINGTIP, POD, OR FLOA |      | 1     |       |     | 40      |    |
| EELS-UP LANDING             |      |       | 2     |     | 4       |    |
| HEELS-DOWN LANDING IN WATER | 2    | 2.8   | 28    | 234 | 292     |    |
| EAR COLLAPSED               | _    |       |       | 1   | 1       |    |
| EAR RETRACTED               | 1    | 39    |       |     | 896     |    |
| RD LANDING                  |      |       | 1     |     | 4       |    |
| DSE OVER/DOWN               | 2    | 18    |       |     | 206     |    |
| OLL OVER                    | 3    | 27    | 135   | 418 | 583     |    |
| ERSHOOT                     |      |       |       |     |         |    |
| DERSHOUT                    | 1    | 7     | _     | 19  | 33      |    |
| LLISION WITH AIRCRAFT       | 2    | 5     | 16    | 27  | 50      |    |
| TH IN FLIGHT                |      |       |       |     |         |    |
| E AIRBORNE                  | 1    |       |       |     | 1       |    |
| TH ON GROUND                |      |       |       |     |         |    |
|                             |      |       | 1     |     | 1       |    |
| LLISION WITH GROUND/WATER   |      |       |       |     |         |    |
| ONTROLLED                   | 20   | 20    | 21    | 17  | 7.8     |    |
| LLIDED WITH                 | 24   | 7     | 7     | 4   | 4?      |    |
| RES/POLES                   |      |       |       |     |         |    |
| ES                          | 14   | 40    | 65    | 83  | 202     |    |
| IDENCE/S                    | 44   | 110   | 155   | 286 | 595     |    |
| LDING/S                     | 3    | Z     | 1     | 2   | A       |    |
| CE. FENCEPOSTS              | 2    | 6     | 4     | 4   | 16      |    |
| CTRONIC TOWERS              | 1    | 11    | 43    | 172 | 227     |    |
|                             | 1    |       |       |     | 1       |    |
| WAY OR APPROACH LIGHTS      | 1    |       | 1     | 1   | 3       |    |
| PORT HAZARD<br>Mals         |      |       |       |     |         |    |
| P P                         |      |       |       | 5   | ?       |    |
|                             |      | 2     | 3     | 8   | 13      |    |
| GMAN LOADER                 |      |       |       |     |         |    |
| CHES                        | 2    | 10    | 49    | 132 | 193     |    |
| IBANK                       |      |       |       | 11  | 11      |    |
| ED AIRCRAFT                 |      |       | 2     | 2   | . 4     |    |
| MO8ILE                      |      | 3     | 5     | 7   | 15      |    |

|                               | • •           | M 111214 | INDE | v    |
|-------------------------------|---------------|----------|------|------|
| YPE OF ACCIDENT               | ****          |          |      | ***  |
| re or activent                | FATÁL<br>**** | 5 E R    | MIN  | NONE |
| 10*0.4 ku                     | ,             | 11       | 23   | 65   |
| IRTBANK                       | 1             | 11       |      |      |
| BJECT                         | 4             | 12       | 23   | 79   |
| IRD STRIKE                    |               |          |      |      |
| TALL                          | 88            | 50       | 46   | 43   |
| PIN                           | 64            | 17       | 4    |      |
| PIRAL                         | 10            | 4        | 3    | 3    |
| USH                           | 7             | 26       | 35   | 41   |
| IKE OR EXPLOSION              |               |          |      |      |
| N FLIGHT                      | 1             |          | 1    | 8    |
| N GROUND                      |               |          | 1    | 3    |
| IRFRAME FAILURE               |               |          |      |      |
| N FLIGHT                      | 2             |          |      | 1    |
| N GROUND                      |               |          |      |      |
| NGINE TEARAWAY                |               |          |      |      |
| NGINE FAILURE OR MALFUNCTION  |               |          |      |      |
| ROPELLER/ROTOR FAILURE        |               |          |      |      |
| ROPELLER                      |               | 1        |      | 2    |
| AIL ROTOR                     |               |          |      |      |
| MAIN ROTOR                    |               |          |      |      |
| PROPELLER/ROTOR ACCIDENT TO P |               |          |      |      |
| PET INTAKE/EXHAUST ACCIDENT T |               |          |      |      |
| PROPELLER/JET/ROTOR BLAST     |               |          |      |      |
| TURBULENCE                    |               |          |      |      |
| MAIL DAMAGE TO AIRCRAFT       |               |          |      |      |
| IGHTNING STRIKE               |               |          |      |      |
| EVASIVE MANEUVER              |               |          |      |      |
| UNCONTROLLED ALTITUDE DEVIATI |               |          |      |      |
| DITCHING                      | 11            | 3        | 26   | 63   |
| HISSING ALRCRAFT NOT RECOVERE |               | _        |      |      |
| 41SCELLANEOUS. OTHER          |               |          | ı    | 5    |
| UNDETERMINED                  |               | 1        |      |      |
|                               |               | -        |      |      |
|                               |               |          |      |      |
| CORDS                         | 312           | 461      | 956  | 2581 |

ANALYTIC TABLE

A-5 CONTINUED

C 10ENTS

APPENDIX A

4310

312 461 956 2581

CAUSE/FACTOR TABLE

APPENDIX A

ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE

FIXED-WING AIRCRAFT

U. S. GENERAL AVIATION

1965 - 1969

CAUSES DISPLAYED RELATE TO FIRST ACCIDENT TYPE ONLY

INVOLVES 4310 TOTAL ACCIDENTS INVOLVES 312 FATAL ACCIDENTS

|                                       | FAT          | FATAL ACCIDENTS | ENTS         | NONFA         | NONFATAL ACCIDENTS | DENTS       | V           | ALL ACCIDENTS | STS         |
|---------------------------------------|--------------|-----------------|--------------|---------------|--------------------|-------------|-------------|---------------|-------------|
|                                       |              |                 | -            | i<br>         |                    |             | -           |               |             |
| BKUAD CAUSE/FACTOR                    | CAUSE        | FACTOR          | TOTAL*       | CAUSE         | FACTOR             | TOTAL*      | CAUSE       | FACTOR        | TOTAL*      |
|                                       |              |                 |              |               |                    |             |             |               |             |
| P11.07                                | 163<br>52.41 | 14              | 166<br>53.38 | 2060<br>51.51 | 72<br>1•80         | 2067        | 2223        | 86            | 2233        |
| PERSONNEL                             | 38<br>12,22  | 6<br>1.93       | 44           | 398<br>9.95   | 32                 |             | 436         | 38            | 473         |
| AIRFRAME                              | 1.32         |                 | 1.32         | 2 2 2 0.5     |                    | 2 2         | 33.01       | £ .           | 3.          |
| LANDING GEAR                          |              |                 | i<br>i       |               |                    | 60.         | ē.          | • 00          | •01         |
|                                       | • 00         | 8               | • 00         | •03           | .03                | 2<br>•05    | 1.02        | 1<br>• 02     | 05          |
| PUMERFLANI                            | 142          | 3<br>• 96       | 144          | 1716          | 70                 | 1779        | 1858        | 73            | 1923        |
| SYSTEMS                               | 00.          | .32             | 1            | 18            | 1                  | 19          | 18          | ~             | 20          |
| INSTRUMENTS/EQUIPMENT AND ACCESSORIES | 1.32         | 00              | 1 22         | , 70 .        |                    | 10          | . <b>.</b>  | 5 .           | .46         |
| ROTORCRAFT                            |              | !               | :<br>:       |               | • •                | 67.         | • 14        | •15           | •26         |
|                                       | 00*          | • 00            | • 00         | • 00          | 00*                | 00•         | 00•         | 00•           | 00•         |
| AIRPORTS/AIRWAYS/FACILITIES           | 00           | 8               | 00           | 1             | 1,000              | ~ '         | <b>.</b> ;  | pro?          | °.          |
| WEATHER                               | 2            |                 |              | 5             | 60.                | • 62        | 20.         | -02           | • 02        |
| TCDD 0 1 14                           | 4.18         | 00.6            | 38<br>12-22  | 145<br>3•63   | 176<br>4•40        | 318<br>7.95 | 3.67        | 204<br>4•73   | 356<br>8.26 |
| LENAIN                                | 00•          | 00•             | <b>00</b> •  | • 00          | 1.03               | ,<br>03     | 00.         | 1.02          | .02         |
| HISCELLANEUUS                         | 10<br>3•22   | 00•             | 10<br>3.22   | 2.85          | 8<br>• 20          | 122<br>3•05 | 124<br>2.88 | 8<br>• 19     | 132<br>3.06 |
|                                       | 1.29         | 00•             | 1.29         | 3<br>• 08     | 00•                | 3<br>• 08   | 7.16        | 00.           | 7.16        |

THE FIGURES OPPOSITE EACH CAUSAL CATEGORY REPRESENT THE NUMBER AND PERCENT OF ACCIDENTS IN WHICH THAT PARTICULAR CAUSAL CATEGORY WAS ASSIGNED

\* IF AN ACCIDENT INCLUDES ROTH A CAUSE AND RELATED FACTOR IN THE SAME CAUSAL CATEGORY, THE ACCIDENT IS REPRESENTED ONCE UNDER THE TOTAL FOR THAT CATEGORY

#### TABLE A-7

#### CAUSE/FACTOR TABLE

APPENDIX A

ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE

FIXED-WING AIRCRAFT

U. S. GENERAL AVIATION

1965 - 1969

CAUSES DISPLAYED RELATE TO FIRST ACCIDENT TYPE ONLY

INVOLVES 4310 TOTAL ACCIDENTS INVOLVES 312 FATAL ACCIDENTS

| VOLVES 312 FATAL ACCIDENTS   | FATA   | AL ACCIDE    | ENTS              |                        | NONFA   | TAL ACCI                               | IDENTS      | ;<br><i>-</i>  |                  | L ACCIO                                |             |  |
|--|--|--------------|-------------------|------------------------|---|--|-------------|--|------------------|--|-------------|--|
| _  | CAUSE  | FACTOR       |                   |                        | CAUSE   | FACTOR                                 | TOTA        | AL   | CAUSE            | FACTO                                  | R 10        | TAL  |
| DETAILED CAUSE/FACTOR  |  |              |                   |                        |   |  |             |  |                  |  |             |  |
| ** PILOT **  |  |              |                   |                        | 25  | 5                                      |             | 30   | 32               | 6                                      |             | 38<br>12   |
| ATTEMPTED OPERATION W/KNOWN DEFICIENCIES IN EQUIPMENT ATTEMPTED OPERATION BEYOND EXPERIENCE/ABILITY LEVEL BECAME LOST/OISORIENTED CONTINUED VFF FLIGHT INTO ADVERSE WEATHER CONDITIONS DELAYED IN INITIATING GO-AROUND DIVERTED ATTENTION FROM OPERATION OF AIRCRAFT EXCEDED DESIGN STRESS LIMITS OF AIRCRAFT FAILED TO USE OR INCORRECTLY USED MISC EQUIPMENT FAILED TO USE OR INCORRECTLY USED MISC EQUIPMENT FAILED TO USE OR INCORRECTLY USED MISC EQUIPMENT FAILED TO FOLLOW APPROVED PROCEDURES, DIRECTIVES ETC IMPROPER OPERATION OF POWERPLANT + POWERPLANT CONTROLS IMPROPER OPERATION OF FLIGHT CONTROLS IMPROPER IN-FLIGHT DECISIONS OR PLANNING IMPROPER IN-FLIGHT DECISIONS OR PLANNING IMPROPER IN-FLIGHT PEPPARATION AND/OR PLANNING INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING INADEQUATE SUPERVISION OF FLIGHT LACK OF FAMILIARITY WITH AIRCRAFT MISMANAGEMENT OF FUEL EXERCISED POOR JUDGMENT OPERATED CARELESSLY SELECTED UNSUITABLE TERRAIN IMPROPER STARTING PROCEDURES INITIATED FLIGHT IN ADVERSE WEATHER CONDITIONS INITIATED FLIGHT IN ADVERSE WEATHER CONDITIONS PONTANEOUS-IMPROPER STARTING PROCEDURES INITIATED FLIGHT IN ADVERSE WEATHER CONDITIONS MISJUDGED DISTANCE AND SPEED AND ALTITUDE MISJUDGED DISTANCE AND ALTITUDE MISJUDGED DISTANCE AND ALTITUDE MISJUDGED SPEED AND ALTITUDE MISJUDGED ALTITUDE OPERATOR OR INSTRUCTIONS  | 7<br>3<br>8<br>10<br>4<br>2<br>1<br>27<br>1<br>1<br>1<br>4<br>5<br>9<br>4<br>1 |              | 14<br>6<br>1<br>5 | 4422117711144422100554 | 8 82 29 3 4 1 6 8 8 30 0 477 7 7 3 106 6 2 29 555 311 1 1 4 1 1 1 | 1 11 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | ,<br>7<br>5 | 9333336616.833647777311387006223331141111111111111111111111111111111 | 14               | 11 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 | ì           | 101<br>43<br>6<br>1<br>10<br>10<br>10<br>10<br>10<br>12<br>7<br>50<br>8<br>4<br>127<br>51<br>64<br>64<br>65<br>65<br>65<br>11<br>11<br>11<br>11<br>11<br>11<br>11<br>11<br>11<br>1 |
| MISUNDERSTANDING OF STREET |  | 6            | 1                 | 7<br>1<br>1            |   | 3                                      | 1<br>3<br>1 | 3<br>2<br>1<br>3<br>1<br>1   |                  | 3                                      | 2<br>3<br>1 |  |
| MISUSED OR FAILED TO USE PLAPS<br>SELECTED WRONG RUNWAY RELATIVE TO EXISTING WIND<br>FAILED TO ABORT TAKEOFF<br>FAILED TO INITIATE GU-ARQUND<br>DIRECT ENTRIES   | 2.   | 5<br>1<br>24 | 14                | 5<br>1<br>238          |   | 1<br>1<br>12<br>380                    | 74          | 1  | į                | 1<br>13<br>504                         | 88          | 26   |
| SUBTOTAL   | 2  | <b>-</b> '   |                   |                        |   | 2                                      |             | Ž  |                  | ?<br>1                                 |             |  |
| COPILOT FAILED TO OBTAIN/MAINTAIN FLYING SPEED IMPROPER OPERATION OF PONERPLANT + POWERPLANT CONTROL INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING DIRECT ENTRIES   | S  |              |                   |                        |   | 1 1 1 5                                |             | 1  | 1<br>1<br>1<br>5 | 1 1 1 5                                |             |  |
| SURTOTAL   |  |              |                   |                        |   |  |             |  | 1                | 1                                      |             |  |
| DUAL STUDENT DELAYED ACTION IN ABORTING TAKEOFF DELAYED IN INITIATING GO-AROUND FAILED TO EXTEND LANDING GEAR  |  |              |                   |                        |   | 1<br>1<br>1                            |             |  | 1 1              | 1                                      |             |  |

# TABLE A-7 CONTINUED DUAL STUDENT (CONTINUED)

#### CAUSE/FACTOR TABLE

| , and the second |                             |        |                                       |  |   |   | APPENDIX A  |   |  |  |
|--|-----------------------------|--------|---------------------------------------|--|---|---|---|---|--|--|
|  |                             |        |                                       | NONF                                       | NONFATAL ACCIDENTS                      |   |   | LL ACCID                                    | ENTS ,   |  |
|  | CAUSE                       | FACTOR | TOTAL                                 | CAUSE                                      | FACTOR                                  | TOTAL   |   | FACTOR                                      | TOTAL  |  |
| FAILED TO OBTAIN/MAINTAIN FLYING SPEED IMPROPER OPERATION OF POWERPLANT + POWERPLANT CONTROLS IMPROPER LEVEL OFF INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING LACK OF FAMILIARITY WITH AIRCRAFT MISMAMAGEMENT OF FUEL SPONTANEOUS—IMPROPER ACTION MISUNDERSTANDING OF ORDERS OR INSTRUCTIONS FAILED TO MAINTAIN DIRECTIONAL CONTROL  |                             |        |                                       | 2<br>22<br>1<br>5                          | 1                                       | 2<br>22<br>1<br>5<br>1<br>12  | 2<br>22<br>1<br>5   | 1 1   | 2<br>22<br>1<br>5<br>1<br>12   |  |
| SUBTOTAL   |                             |        |                                       | 2  |   | 2   | 2 2   |   | 2  |  |
| CHECK PILOT INADEQUATE SUPERVISION OF FLIGHT   |                             |        |                                       | 49   | 2                                       | 51  | 49  | 2   | 2<br>51  |  |
| SUBTOTAL   | 1                           |        | 1                                     | 1  |   |   |   |   |  |  |
| ** PERSONNEL **  | 1                           |        | 1                                     | 1  |   | 1   | 2   |   | 2  |  |
| FLIGHT INSTRUCTOR INADEQUATE SUPERVISION OF FLIGHT INADEQUATE TRAINING OF STUDENT MAINTENANCE, SERVICING, INSPECTION IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL) IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL) IMPROPERLY SERVICED AIRCRAFTIGROUND CREW) IMPROPERLY SERVICED AIRCRAFTIGROUND CREW) IMPROPERLY SERVICED AIRCRAFTIGROUND CREW) IMPROPERLY SERVICED AIRCRAFTIGNENTANCE PERSONNEL) IMADEQUATE INSPECTION OF AIRCRAFTIMAINTENANCE PERSONNEL) INADEQUATE INSPECTION OF AIRCRAFTIMAINTENANCE PERSONNEL) OTHER UNK/NR DEFRATIONAL SUPERVISORY PERSONNEL INADEQUATE FLIGHT TRAINING-PROCEDURES INADEQUATE SUPERVISORY PERSONNEL INADEQUATE SUPERVISION OF FLIGHT CREW FAILURE TO PROVIDE ADEO DIRECTIVES, MANUALS, EQUIPMENT MEATHER PERSONNEL INCOMPLETE WEATHER FORECAST INCOMPLETE WEATHER FORECAST INCOMPLETE WEATHER FORECAST INADEQUATE/INCORRECT WEATHER BRIEFING TAFFIC CONTROL PERSONNEL INADEQUATE/INCORRECT WEATHER BRIEFING TAFFIC CONTROL PERSONNEL INADEQUATE/INCORRECT WEATHER BRIEFING TAFFIC CONTROL PERSONNEL INADEQUATE/INCORRECT FACILITIES FAILURE TO ADVISE OF UNSAFE AIRPORT CONDITION AIRPORT SUPERVISORY PERSONNEL IMPROPER MAINTENANCE-AIRPORT FACILITIES FAILURE TO NOTIFY OF UNSAFE CONDITION OTHER AIRMAYS FACILITIES PERSONNEL PRODUCTION—DESIGN SUBSTANDARD QUALITY CONTROL INCORRECT FACIORY INSTALLATION PODR/INDOCMMAR  | 5<br>3<br>1<br>2<br>25<br>1 | 1 4    | 5<br>3<br>1<br>2<br>1<br>29<br>2<br>1 | 2 7 41 17 9 23 9 3 262 2 1 1 1 1 2 1 1 2 1 | 1 3 2 2 2 2 2 1 2 1 1 1 1 1 1 1 1 1 1 1 | 3<br>10<br>41<br>19<br>11<br>25<br>9<br>3<br>274<br>2<br>1<br>2<br>2<br>1 | 2<br>2<br>7<br>46<br>20<br>9<br>24<br>11<br>287<br>2<br>1 | 1 3 2 2 2 2 1 1 1 6 1 1 1 1 1 1 1 1 1 1 1 1 | 2<br>3<br>10<br>46<br>22<br>11<br>26<br>11<br>20<br>3<br>2<br>1<br>1<br>1<br>2<br>2<br>2<br>1<br>1<br>1<br>1<br>2<br>2<br>2<br>1<br>1<br>1<br>1<br>1 |  |
| PODM/INADEQUATE DESIGN OTHER HISCELLANEOUS-PERSONNEL   | 1                           |        | 1                                     | 1<br>5                                     |   | 1<br>5  | 1 6   |   | 1  |  |
| PASSENGER<br>OTHER   | 1                           |        | 1                                     | 7<br>3                                     | 2<br>1                                  | 9   | 8   | 2   | 10   |  |
| DIRECT ENTRICE   |                             |        |                                       | 4  | 1                                       |   | 4   | 1   | 5  |  |
| HIRD PILOT<br>LIGHT ENGINEER<br>HISPATCHING  |                             |        |                                       | 2  | •                                       | 5<br>1<br>2   | 4<br>1<br>2   | 1   | 5<br>1<br>2  |  |
| SUBTOTAL   |                             |        |                                       |  |   |   |   |   | ٠  |  |
| ** AIRFRAME **   | 42                          | 6      | 48                                    | 405  | 33 4                                    | ¥38   | 447   | 39 4  | •  |  |
| INGS BRACING HIRES, STRUTS SSELAGE DOORS, DOOR FRAMES  | 1                           |        | 1                                     |  |   |   |   | -7 4  | 86   |  |
| WINDSHIELDS, WINDOWS, CANOPIES   |                             |        | •                                     |  |   |   | 1   |   | 1  |  |
|  |                             |        |                                       | 1<br>1                                     |   | 1   | 1   |   | 1  |  |
|  | 101                         |        |                                       | •  |   | 1   | 1   |   | 1  |  |

| AIRFRAME (CONTINUED)   | FAT               | AL ACCIO    |                       |                                  | TAL ACCI                |                                  | ALL ACCIDENTS                    |                   |                                  |
|--|-------------------|-------------|-----------------------|----------------------------------|-------------------------|----------------------------------|----------------------------------|-------------------|----------------------------------|
|  | CAUSE             | FACTOR      |                       | CAUSE                            | FACTOR                  | TOTAL                            | CAUSE                            | FACTOR            | TOTAL                            |
| LANDING GEAR NORMAL RETRACTION/EXTENSION ASSEMBLY  |                   |             |                       | 1                                | 1                       | 1                                | 1                                | 1                 | 1<br>1                           |
| NORMAL RETRACTION/EXTENSION ASSUME<br>LANDING GEAR WARNING AND INDICATING COMPONENTS<br>FLIGHT CONTROL SURFACES<br>AILERON, SURFACES ATTACHMENTS | 1                 |             | 1                     |                                  |                         |                                  | 1<br>5                           | 1                 | 1<br>6                           |
| SUBTOTAL   | 2                 |             | 2                     | 3                                | 1                       | 4                                | 5                                | 1                 | u                                |
| ** POWERPLANT **   |                   |             |                       |                                  |                         |                                  |                                  |                   |                                  |
| ENGINE STRUCTURE CRANKCASE CRANKSHAFT MASTER AND CONNECTING ROOS CYLINDER ASSEMBLY PISTON, PISTON RINGS  | 2<br>6<br>3<br>6  | 1           | 2<br>6<br>4<br>7<br>6 | 6<br>54<br>80<br>68<br>62<br>123 | 1<br>1<br>1             | 6<br>55<br>80<br>68<br>63<br>124 | 6<br>56<br>86<br>71<br>68<br>129 | 1<br>2<br>1       | 6<br>57<br>86<br>72<br>70<br>130 |
| VALVE ASSEMBLIES<br>BLOWER, IMPELLER ASSEMBLY<br>MOUNT AND VIBRATION ISOLATORS   | 5                 |             | 5                     | 14<br>1<br>36                    |                         | 14<br>1<br>36                    | 14<br>1<br>41                    |                   | 1<br>41                          |
| OTHER IGNITION SYSTEM MAGNETOES OISTRIBUTOR SPARK PLUG COILS   | 6<br>1<br>8       | 1           | 7<br>1<br>9           | 55<br>1<br>41<br>1<br>2          | 2                       | 57<br>1<br>44<br>1<br>2          | 61<br>2<br>49<br>1<br>2          | 3<br>4            | 64<br>2<br>53<br>1<br>2          |
| LOW TENSION WIRING HIGH TENSION WIRING IGNITION HARNESS, SHIELDING SWITCHES LEADS OTHER  | 1                 |             | 1                     | 1<br>7<br>3<br>3<br>2            |                         | 3<br>3<br>2                      | 1<br>7<br>3<br>4<br>2            |                   | 8<br>3<br>4<br>2                 |
| FUEL SYSTEM TANKS LINES AND FITTINGS SELECTOR VALVES FILTERS, STRAINERS, SCREENS   | 3<br>4<br>2<br>2  | !           | 3<br>4<br>2<br>2      | 11<br>29<br>21<br>14<br>2        | 2 2                     | 31<br>23<br>15<br>2              | 11<br>32<br>25<br>16<br>4        | 2<br>5 2<br>5 1   | 34<br>2 27<br>1 17<br>4          |
| PRIMING SYSTEM CARBURETOR PUMPS FUEL INJECTION SYSTEM VENTS, DRAINS, TANK CAPS RAM AIR ASSEMBLY  | 10<br>6<br>4<br>1 | )<br>;<br>; | 10<br>6<br>4<br>1     | 91<br>21<br>12<br>39<br>6        | 1<br>2 1<br>9 8         | 1 22<br>1 13                     | 27<br>16<br>40<br>6              | 7 1<br>5 1<br>0 8 | 1 28<br>1 17                     |
| OTHER LUBRICATING SYSTEM LINES, HOSES, FITTINGS VALVES FILTERS, SCREENS PUMP-PRESSURE  | 1                 | -           | ı                     | 18<br>2<br>8<br>5                | 3 1<br>2<br>8<br>5<br>2 | 1 19<br>2<br>8<br>5              |                                  | 2<br>8<br>5<br>2  | 1 19<br>2<br>8<br>5<br>2         |
| PUMPS-SCAVENGER<br>OIL COOLERS<br>MAGNETIC PLUGS<br>SEALS AND GASKETS  |                   |             |                       | 4<br>1<br>11<br>13               | 4<br>1<br>1             | 1<br>1<br>1<br>1<br>14           |                                  | 4<br>1<br>1<br>3  | 1<br>11<br>1 14                  |
| OTHER COOLING SYSTEM RAFFLES   |                   |             |                       |                                  | 1                       | 1                                |                                  | 1                 | 1                                |
| OTHER PROPELLER AND ACCESSORIES BLADES HYDRAULIC PITCH CONTROL MECHANISM   |                   | 1           | 1                     |                                  | 1<br>1<br>2             | 1<br>1<br>2                      |                                  | 1<br>1<br>3       | ]<br>]<br>3                      |
| HYPRAULT PITCH CHAIRDE MISSIANTS.  OTHER EXHAUST SYSTEM MANIFOLDS MUFFLERS GASKETS   |                   | 1           | 1                     | ı 1                              | 3                       | 3<br>1 15<br>1<br>6              | 5 1<br>1                         | 3<br>15<br>1<br>6 | 1 10                             |
| GASKETS STACKS BAFFLES ENGINE ACCESSORIES  |                   |             |                       |                                  | 3                       | 3                                | 3                                | 3                 |                                  |
| ENGINE ALLESSURIES STARTERS OTHER ENGINE CONTROLS-COCKPIT THROTTLE-POWER LEVER ASSEMBLIES MIXTURE CONTROL ASSEMBLIES                             |                   | 1<br>1      |                       | 1 2                              | 1<br>28<br>16           | 1 29<br>16                       | ī<br>9 :                         | 1<br>29<br>17     | i 3                              |

#### TABLE A-7 CONTINUED

#### CAUSE/FACTOR TABLE

POWERPLANT (CONTINUED)

| CONTINUED)  |       |        |              |          |          |         |               |        | BEDIN A |  |
|---|-------|--------|--------------|----------|----------|---------|---------------|--------|---------|--|
|   |       |        |              | NONFA    | TAL ACCI |         | ALL ACCIDENTS |        |         |  |
|   | CAUSE | FACTOR | TOTAL        | CAUSE    | FACTOR   | TOTAL   | CAUSE         | FACTOR | TOTAL   |  |
| INDUCTION AIR, PREHEAT CONTROLS   |       |        |              | 6        |          |         |               |        |         |  |
| PONERPLANT - INSTRUMENTS  |       |        |              | ì        |          | 6<br>1  | 6<br>1        |        | 6<br>1  |  |
| FUEL QUANTITY GAUGE MISCELLANEOUS   |       | 1      | 1            | 4        | 40       | 44      | 4             | 41     | 45      |  |
| POWERPLANT FAILURE FOR UNDETERMINED REASONS<br>BIRD INGESTION                           | 70    |        | 70           | 762<br>2 |          | 762     | 832           |        | 832     |  |
| FOREIGN OBJECT DAMAGE<br>COMPRESSOR STALLS  |       |        |              | ī        |          | 2<br>1  | 2<br>1        |        | 2       |  |
| DETONATION<br>OTHER   | 1     |        |              | 1<br>6   |          | 1<br>6  | 1<br>6        |        | î<br>6  |  |
| DIRECT ENTRIES REDUCTION GEAR ASSEMBLY  | 3     |        | 1<br>3       | 1<br>40  | 1        | 1<br>41 | 2<br>43       | 1      | 2<br>44 |  |
| GEARS, ACCESSORY DRIVE<br>OTHER   |       |        |              | 4        |          | 4       | 4             | -      | 4       |  |
| COMPRESSOR ASSEMBLY OTHER   |       |        |              | 1        |          | 1       | i             |        | ĩ       |  |
| COMBUSTION ASSEMBLY TURBINE ASSEMBLY  | 1     |        | 1            |          |          |         | 1             |        | 1       |  |
| ACCESSORY DRIVE ASSEMBLY<br>LUBRICATING SYSTEM<br>FUEL SYSTEM                           |       |        |              |          |          |         |               |        |         |  |
| OTHER<br>SAFETY SYSTEM  |       |        |              | 1        |          | 1       | 1             |        | 1       |  |
| IGNITION SYSTEM<br>Torquemeter  |       |        |              |          |          |         |               |        | •       |  |
| AIR BLEED<br>EXHAUST SYSTEM   |       |        |              |          |          |         |               |        |         |  |
| THRUST REVERSER OTHER   |       |        |              |          |          |         |               |        |         |  |
| PROPELLER SYSTEM<br>GOVERNOR  |       |        |              | 1        |          | 1       | 1             |        | 1       |  |
| CONSTANT SPEED DRIVE<br>GOVERNOR VALVE  |       |        |              | 1        |          | 1       | 1             |        | 1       |  |
| POWER LEVER<br>Cable  |       |        |              | 1        |          | 1       | . 1           |        | 1       |  |
| PROPELLER LEVER<br>REVERSE THRUST LEVER<br>ENGINE INDICATING EQUIPMENT                  |       |        |              | 1        |          | 1       | 1             |        | ı       |  |
| TACHOMETER ENGINE INSTALLATION  |       |        |              | 1        |          | 1       | 1             |        | ı       |  |
| SUBTOTAL  | 156   | 5      | 14.          | 1700     |          |         |               |        | •       |  |
| ** SYSTEMS **   | .20   | ,      | 161          | 1790     | 74       | 1864    | 1946          | 79     | 2025    |  |
| ELECTRICAL SYSTEM BATTERIES   |       |        |              |          |          |         |               |        |         |  |
| GENERATORS/ALTERNATORS HYDRAULIC SYSTEM   |       |        |              | 1<br>2   | 1        | 2       | I<br>I        | 1      | 2       |  |
| FLIGHT CONTROL SYSTEMS ANTI-ICING, DE-ICING SYSTEMS                                     |       |        |              |          |          |         | _             |        | -       |  |
| CARBURETOR DE-ICING SYSTEM OTHER  |       |        |              | 15       |          | 15      | 15            |        | 15      |  |
| AIR CONDITION, HEATING AND PRESSURIZATION CABIN TEMP CONTROL AND TEMP INDICATING SYSTEM |       |        |              | 1        |          | 1       | ī             |        | 15<br>1 |  |
| FIRE WARNING SYSTEM   |       | 1      | 1            |          |          |         |               | 1      | ı       |  |
| FIRE EXTINGUISHER SYSTEM<br>OXYGEN SYSTEM<br>OTHER SYSTEMS                              |       |        |              | -        |          |         |               |        |         |  |
| SUBTOTAL  |       | 1      | ı            | 19       | 1        | 20      |               |        |         |  |
| ** INSTRUMENTS/EQUIPMENT AND ACCESSORIES **   |       | •      | <del>-</del> |          | •        | 50      | 19            | 2      | 21      |  |
| FLIGHT AND NAVIGATION INSTRUMENTS COMPASS   |       |        |              |          |          |         |               |        |         |  |
| COMMUNICATIONS AND NAVIGATION EQUIPMENT TRANSMITTERS AND/OR RECEIVERS                   |       |        |              | 1        |          | 1       | 1             |        | 1       |  |
| VOR RECEIVERS COMPASS RECEIVERS   |       |        |              | 1<br>1   | 3<br>3   | 4       | 1             | 3      | 4       |  |
|   | 1     |        | 1            | ī        | -        | 1       | 2             | 3      | 4<br>2  |  |

TABLE A-7 CONTINUED ALL ACCIDENTS NONFATAL ACCIDENTS INSTRUMENTS/EQUIPMENT AND ACCESSORIES (CONTINUED) FATAL ACCIDENTS FACTOR TOTAL CAUSE TOTAL FACTOR FACTOR TOTAL CAUSE ì OTHER MISCELLANEOUS EQUIPMENT SPRAY, DUSTING EQUIPMENT SUBTOTAL \*\* AIRPORTS/AIRWAYS/FACILITIES \*\* AIRPORT FACILITIES AIRPORT CONDITIONS SNOW ON RUNWAY AIRWAYS FACILITIES ì SUBTOTAL \*\* WEATHER \*\* 20 13 16 18 15 LOW CEILING 263 RAIN SNOW
ICING CONDITIONS-INCLUDES SLEET, FREEZING RAIN, ETC
CONDITIONS CONDUCIVE TO CARB/INDUCTION SYSTEM ICING
UNFAVORABLE WIND CONDITIONS
TURBULENCE, ASSOCIATED W/CLOUDS, THUNDERSTORMS
DOWNDRAFTS, UPDRAFTS
LOCAL WHIRLWIND
ADVERSE WINDS ALOFT
HIGH TEMPERATURE
OBSTRUCTIONS TO VISION 1 OBSTRUCTIONS TO VISION HIGH DENSITY ALTITUDE THUNDERSTORM ACTIVITY OTHER SUBTOTAL l l \*\* TERRAIN \*\* WET. SOFT GROUND SNOW-COVERED SUBTOTAL \*\* MISCELLANEOUS \*\* BIRD COLLISION
EVASIVE MANEUVER TO AVOID COLLISION
UNQUALIFIED PERSON OPERATED AIRCRAFT FOREIGN MATERIAL AFFECTING NORMAL OPERATIONS UNDETERMINED ı DIRECT ENTRIES SUBTOTAL GRAND TOTAL 17 5 \*\* MISCELLANEOUS ACTS, CONDITIONS \*\* ANTI-ICING/DEICING EQUIP-IMPROPER OPER. OF/FAILED TO USE ANTI-ICING/DEICING EQUIP-IMPROPER OPER CHECKLIST-FAILED TO USE CREW COORDINATION-POOR DISREGARD OF GOOD OPERATING PRACTICE IMPROPER EMERGENCY PROCEDURES FEATHERED WRONG ENGINE INSTRUMENTS-MISREAD OR FAILED TO READ SEAT BELT NOT FASTENED 

INSTRUMENTS—MISKEAD UR FAILEU TO READ SEAT BELT NOT FASTENED NOT ALLIGNED HITH RUNWAY/INTENDED LANDING AREA UNWARRANTED LOW FLYING INATTENTIVE TO FUEL SUPPLY

|               | WILTMOED |            |             |
|---------------|----------|------------|-------------|
| MISCELLANEOUS | ACTS,    | CONDITIONS | (CONTINUED) |

| 14-11/ INOLD)  |                |        |          |            |          |           | APPENDIX  |          |            |  |  |
|--|----------------|--------|----------|------------|----------|-----------|-----------|----------|------------|--|--|
|  | FATAL ACCIDENT |        |          | NONE       | ATAL ACC | IDENTS    |           |          |            |  |  |
|  | CAUSE          | FACTOR |          | CAUSE      | FACTOR   |           |           |          |            |  |  |
| DECHATION  |                |        |          |            |          |           |           | FACTOR   | TOTAL      |  |  |
| PREMATURE FLAP RETRACTION<br>POORLY PLANNED APPROACH   |                |        |          |            |          |           |           |          |            |  |  |
| JETTISONED LOUEL CONSUMPTION   |                |        |          | 1          |          | ,         |           |          |            |  |  |
| STOLEN OO  | 3              | 2      | 5        | 1<br>70    | . 6      | 1<br>7    | 1         | ,        | 1          |  |  |
| LANDED ON FOAMED RUNWAY IMPROPERLY SECURED   | 1              | 2      |          | 10         | 17<br>14 | 87<br>14  | 73        | 6<br>19  | 7<br>92    |  |  |
|  | 4              | -      | 3        |            | 5        | 5         | 1         | 14<br>7  | 14         |  |  |
| ELECTRICAL FAILURE<br>ENGINE LOADED UP   | 7              |        | 4        | 38         | 1<br>3   | 1<br>41   |           | 1        | 8<br>1     |  |  |
| PALIGUE FRACTURE   | 2              |        |          | 3<br>4     | 3        | 3         | 42<br>3   | 3        | 45<br>3    |  |  |
| FUEL GRADE IMPROPER IMPROPER GRADE OIL-LUBRICATING SYSTEM RPM-UNCONTROLLABLE-DYSPERSOR   | 5              |        | 2<br>5   | 113        | 17       | 7<br>130  | 4<br>115  | . 3      | 7          |  |  |
| RPM-UNCONTROLLABLE-DVERSPEED WINDSHIFT D. DIRTY  |                |        |          | 44<br>7    | 1        | 45<br>7   | 49        | 17<br>1  | 132<br>50  |  |  |
| WRONG PART PUGGY, ETC-RESTRICTED VISION  |                |        |          | 2          |          | ź         | 7<br>2    |          | 7          |  |  |
| FAILURE DE TUD OR MANA   |                | 1<br>1 | 1<br>1   |            | . 2      | 2         |           | 2        | 2          |  |  |
|  | 4<br>8         |        | 4        | 1<br>18    | 1        | 1         | 1         | 3<br>1   | 3          |  |  |
| CORRODED/CORROS  | В              | 9<br>1 | 17<br>1  | 27         | 61       | 19<br>88  | 22        | ı        | 2<br>23    |  |  |
| CONGESTED TRAFFIC DATES OF   | 1              | -      | 1        | 1<br>2     | 11       | 12        | 35<br>1   | 70<br>12 | 105        |  |  |
| PILOT FATIGUE<br>FUEL EXHAUSTION   | 1              | Z      | 1        | 6          | 3<br>1   | 5<br>7    | 3         | 3        | 13<br>6    |  |  |
|  | 1              |        | 2<br>1   | 1          |          | i         | 7<br>1    | 1 2      | 8          |  |  |
|  | 44<br>1        | 1      | 45       | 766        | 3        | 3<br>766  | ī         | 3        | 3          |  |  |
|  | 6              | 2      | 1<br>8   | 60<br>4    | 2        | 62        | 810<br>61 | 1        | 811        |  |  |
| ICE-FNGINE   |                | 1      |          | 7          | 1        | 4<br>1    | 10        | 2        | 63<br>12   |  |  |
| ICE-CARRIBETOD   | 1              | 2      | 1<br>1   | 10         |          | 1         |           | 1        | 1          |  |  |
| AIRERAME ICE   | 1<br>16        |        | 1        | 5          | 2        | 12        | 11        | 5        | 13         |  |  |
| 1UC=WINDSDICIN   |                |        | 16       | 333<br>1   | 7        | 340       | 6<br>349  | 7        | 6          |  |  |
| IMPROPERLY LOADED AIRCRAFT-WEIGHT-AND/OR CG  |                |        |          | 5          | 4        | 1         | 1         |          | 356<br>)   |  |  |
|  | 1              | 4      | 5        | 1          | 3        | í         | 5<br>1    | 4        | 9<br>1     |  |  |
| OIL CONTAMINATION  | 4              |        | 1<br>4   | 10         | 1        | 3<br>11   | 1<br>11   | 7        | 8          |  |  |
| PINVERIED CONDITIONS   |                |        | 7        | 54<br>2    | 2        | 56        | 58        | 1<br>2   | 12<br>60   |  |  |
| WATER IN FUE   | 15             | 2      | 17       | 5          |          | 2<br>5    | 2         | -        | 2          |  |  |
| AIRCRAFT CAME TO DECE  | 7              |        |          | 97<br>3    | 56<br>1  | 153       | 112       | 58       | 5<br>170   |  |  |
| MISSING  | •              | 5      | 7<br>5   | 184        | 5        | 4<br>189  | 3<br>191  | 1        | 4          |  |  |
| OUCH AND CO LANDING  | 1              | 2      |          | 4          | 39       | 39        |           | 5<br>44  | 196<br>44  |  |  |
| ATERIAL FATURE   | •              | 2      | 3<br>2   | 15         | 3        | 4<br>18   | 4<br>16   | _        | 4          |  |  |
| UEL STARVATION IL STARVATION   | 18             | ,      |          | 1          | 7        | 7         |           | 5<br>9   | 21         |  |  |
| MPKUPER CICACANO   | 73             | 1<br>2 | 19<br>75 | 465<br>758 | 11 .     | 1<br>476  | 1<br>483  |          | í          |  |  |
| IRE OF UNDER POSTLIONED BETWEEN TANKS  | 5<br>3         |        | 5        | 35         | 1        | 758<br>36 | 831       |          | 195<br>133 |  |  |
| NADDDOUGH MARKET   | 8              | 2      | 3<br>10  | 18<br>30   | ĭ        | 19        | 40<br>21  | 1        | 41         |  |  |
| TION. LACK OF  |                | 1      |          | 1          | 5        | 35<br>1   | 38        |          | 22<br>45   |  |  |
| JUK WELD   |                | •      | 1        | 5<br>5     | 2        | 7         | 1<br>5    | 3        | 1          |  |  |
| REVIOUS DAMAGE<br>AK/LEAKAGE   |                |        |          |            | 1        | 8<br>1    | 5         | 3        | 8<br>8     |  |  |
| W FLUID LEVEL  | 3              |        |          | 2<br>5     | 3        | ē         | 2         | 1        | 1 2        |  |  |
| W COMPRESSION  |                |        | 3        | 22         | 4        | 8<br>26   |           | 3        | 8          |  |  |
| MUNIUD   | 1              |        | 1        |            | 2        | ž         |           |          | 29         |  |  |
| RBON DEPOSITS<br>NDED IN CONSTRUCTION AREA<br>ER TORQUEONSTRUCTION AREA  | _              | 1      | 1        | 7          |          | 7         | 1 7       |          | ı          |  |  |
| ER TORQUED DER TORQUED   | 5              | 1      | 6        |            | 4<br>3 ; | 4<br>27   |           | 5        | 7<br>5     |  |  |
| JSE, PART/FITTING  |                |        |          |            | 1 1      | 1         | 29 .      | 4 3      | 3          |  |  |
| NT PROPERTY AND THE PRO | 6              |        |          | 1          |          | 1         | 1         |          | 1<br>1     |  |  |
| NED  |                |        | 6        | 27         |          | 0         | 1<br>33 : | _        | 1          |  |  |
| FFED   | 3              |        | 3        | 5 ;        |          | 3<br>6    | 3 ~       | 3 36     |            |  |  |
|  | 1              |        | 1        | 11 2       | 2        | _         | 8 1       | و ا      | •          |  |  |
|  |                |        | -        | 2 2        |          | 4         | 3 2       |          |            |  |  |
|  | 100            |        |          |            |          |           |           | -        |            |  |  |

#### TABLE A-7 CONTINUED

МΙ

#### CAUSE/FACTOR TABLE

APPENDIX A

| ABLE A-7 CONTINUED   | CAUSE/FACT | AL ACCIO                      | ENTS                  | NONFA | TAL ACCI                   | DENTS             |       | ACCIDE           |                    |
|--|------------|-------------------------------|-----------------------|-------|----------------------------|-------------------|-------|------------------|--------------------|
| IISCELLANEOUS ACTS, CONDITIONS (CONTINUED)   |            | FACTOR                        | TOTAL                 | CAUSE | FACTOR                     | TOTAL             | CAUSE | FACTOR           | 10TAL              |
| COLLAPSED CROSSED OFTERIORATED DISCONNECTED EXCESSIVE ERRATIC FRICTION, EXCESSIVE GROUNDED HIGH VOLTAGE BREAKDOWN IMPROPERLY INSTALLED JAMMED OBSTRUCTED OPEN OUT OF BALANCE OVERHEATED PINCHED EXCESSIVE PRESSURE PRESSURE TOO LOW PRESSURE, NONE SCORED STICKING STRICKING STRICKE EXCESSIVE TEMPERATURE VIBRATION, EXCESSIVE WARPED ICE—INDUCTION |            | 1 1 1 1 2 2 2 2 2 1 1 2 2 1 1 | 1<br>1<br>2<br>1<br>1 | 1     | 1<br>1<br>2<br>2<br>6<br>8 | 3<br>15<br>1<br>4 |       | ;<br>;<br>;<br>; | 15<br>1<br>4<br>13 |
| 104  |            |                               |                       |       |                            |                   |       |                  |                    |

DIRECT ENTRY CAUSES

PILOT-IMPROPERLY EXECUTED EMERGENCY LANDING
PILOT-INCAPACITATION CAUSED BY DRUGS
PWR PLT-LEFT CRANKSAFT IDLER GEAR CAP SCREW FAILD
PWR PLT-OIL STARVATION FOR UNDETERMINED REASON
PWR PLT-EMGINE CRANKCASE BREATHER PLUGGED BY ICE
PWR PLT-EMGINE CRANKCASE BREATHER PLUGGED BY ICE
PWR PLT-RE-INGESTION OF EXHAUST GAS
PWR PLT-RE-INGESTION OF EXHAUST GAS
PWR PLT-SLUSH ENTERED CABBURETOR AIR INTAKE SCOOPPWR PLT-SLUSH ENTERED CABBURETOR AIR INTAKE SCOOPPWR PLT-FUEL SIPHONED OUT FROM DEFORMED TANK VENTPWR PLT-LOARS-FLOAT IMPROPERLY INSTALLED.
PWR PLT-IMPROPER CABBURETOR INSTALLED.
PWR PLT-IMPROPER FUEL GAUGE INSTALLED.
PWR PLT-IMPROPER FUEL GAUGE INSTALLED.
PWR PLT-SEAL ON OIL FILTER IMPROPERLY INSTALLED.
PWR PLT-IMPROPER FUEL FAILURE OM INTURE CONTROL
PWR PLT-IMPROPERLY RIGGED MIXTURE CONTROL
PWP PLT-IMPROPERLY RIGGED MIXTURE CONTROL
PWR PLT-ATTEMPED FLIGHT WITH AUTOMOBILE FUEL.
PWR PLT-ATTEMPED FLIGHT WITH AUTOMOBILE FUEL
PHATE-CARRURETOR NEEDLE VALVE STUCK.
PWR PLT-CARRURETOR NEEDLE VALVE STUCK.
PWR PLT-CARRURETOR

#### TABLE A-7 CONTINUED

DIRECT ENTRY CAUSES (CONTINUED)

CAUSE/FACTOR TABLE

APPENDIX A

MISC-DESCENT WAS TOO STEEP PRECLUDING FUEL FLOW PMR PLT-CAMSHAFT DRIVE GEAR BOLTS FALLED.
PERSONNEL-TRI-PACER OHNERS HANDBOOK INADEQUATE.
PERSONNEL-TRI-PACER OHNERS HANDBOOK INADEQUATE.
PMR PLT-NO GASKET, NO. 3 CYLINDER ROCKER BOX COVER.
MISC-MATER CONTAM INATED FUEL SOURCE
PMR PLT-EXCESSIVE FUEL CONSUMPTION, CAUSE UNDETERMN PLIOT-POSITIONED MIXTURE CONTROL TO IDLE-CUT-OFF.
PMR PLT-DETONATION IN ALL CYLINDERS.
PMR PLT-FUEL STARWATION FOR UNDETERMINED CAUSE.
PMR PLT-OIL FILLER CAP MISSING.
PMR PLT-TRIEL STARWATION FOR UNDETERMINED CAUSE.
PMR PLT-TOTONATION FOR UNDETERMINED CAUSE.
PMR PLT-INCOTTLE HOUSING BROKE FORMARD OF FIREWALL
PMR PLT-CARB INGESTED WATER, ATR SCREEN SATURATED.
PMR PLT-CARB INGESTED WATER, ATR SCREEN SATURATED.
PMR PLT-EXCESSIVE FUEL CONSUMPTION—CAUSE UNDTRMOD.
PMR PLT-EXCESSIVE FUEL CONSUMPTION.
PMR PLT-FUEL PRESSURE DROPPED TO ZERO-CAUSE UNDTMD
PMR PLT-FUEL PRESSURE DROPPED TO ZERO-CAUSE UNDTMD
PMR PLT-FUEL STAM PUEL CONSUMPTION CAUSE NOT DRAMD
PMR PLT-EXCESSIVE FUEL CONSUMPTION CAUSE NOT DRAMD
PMR PLT-FUEL SCHAFFINITY TURNED ENG OFF.
PMR PLT-FUEL SCHAFFINITY TURNED OFF FUEL.
PMR PLT-PUSH ROD SOCKETS NOT INSTALLED.
PMR PLT-FUEL SCHAFFINITY TURNED OFF FUEL.

DIRECT ENTRY CAUSES ARE CARRIED UNDER THEIR APPROPRIATE CAUSAL CATEGORIES AND ARE INCLUDED IN THE TOTALS

CAUSE/FACTOR TABLE

ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE FIXED-WING AIRCRAFT U. S. GENERAL AVIATION 1965 - 1965 - 1969 CAUSES DISPLAYED RELATE TO FIRST AND SECOND ACCIDENT TYPES

TABLE A-8

| ALL ACCIDENTS  L* CAUSE FACTOR TOTAL*    | 111 9 2.58                                 | 443 442 407 11.32<br>11.08 10.26 1.07 11.32<br>4 4 1 5<br>410 .09 .02 .12 | 10,      | 1850<br>4 43.16 1.72 | 3 .44 .07       | .16 .12                   |                            | 186 255<br>4.32 5.92 1<br>323 555 | 7.49 12.88                  | 8 3.60 .28          | .08 .16 .00        |              |
|--|--|---|----------|----------------------|-----------------|---------------------------|----------------------------|-----------------------------------|-----------------------------|---------------------|--------------------|--------------|
| NONFATAL ACCIDENTS CAUSE FACTOR TOTAL*   | 2403 90 241<br>60,09 2,25 60               | 444 39 44<br>10•10 •98 11<br>3 1 1<br>•08 •03                             | • 10     | 1.78                 | 19 2<br>•48 •05 | 6 5<br>•15 •13            | .00 .00<br>9 25<br>.23 .63 | 166 211<br>4.15 5.28              | 309 532<br>7•73 13•30       | 144 11<br>3.60 .28  | 3 .00              |              |
| FATAL ACCIDENTS NICE FACTOR TOTAL* CA    | 21 265 24<br>6,75 85,21                    | 45 14.47  | 00.      | 3 145                |                 | 2 .00 .32                 | 2 2 2 64                   | 9 6<br>41                         | 14 23 37<br>4.50 7.40 11.90 | 11<br>3,54 ,32 3.86 | 4<br>1.29 .00 1.29 |              |
| FATA                                     | 260  | 85.00<br>38<br>12.22  | .32      | 143                  | 00.             | 1 1                       | ·                          | 20 20 6.4                         | 14                          |                     |                    |              |
| 4310 TOTAL ACCIDENTS 312 FATAL ACCIDENTS | 20 - 1   1   1   1   1   1   1   1   1   1 |   |          | α <u>c</u>           |                 | SYSTEMS  SYSTEMS  SYSTEMS |                            | AIRPORTS/AIRWAYS/FACILITIES       |                             |                     | VEOUS              | INEO         |
| INVOLVES 4310 INVOLVES 312               | BROAD CAUSE/THOUGH                         | P1LOT<br>PERSONNEL  | AIRFRAME | LANDING GEAR         | 28 POWERPLANT   | SYSTEMS                   | ROTORCRAFT                 | AIRPORTS/                         | WEATHER                     | TERRAIN             | MISCELLANEOUS      | UNDETERMINED |

<sup>\*</sup> IF AN ACCIDENT INCLUDES BOTH A CAUSE AND RFLATED FACTOR IN THE SAME CAUSAL CATEGORY THE ACCIDENT IS REPRESENTED ONCE UNDER THE TOTAL FOR THAT CATEGORY THE FIGURES OPPOSITE EACH CAUSAL CATEGORY REPRESENT THE NUMBER AND PERCENT OF ACCIDENTS IN WHICH THAT PARTICULAR CAUSAL CATEGORY WAS ASSIGNED

# ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE FIXED-WING AIRCRAFT U. S. GENERAL AVIATION 1969 CAUSES DISPLAYED RELATE TO FIRST AND SECOND ACCIDENT TYPES

INVOLVES 4310 TOTAL ACCIDENTS
INVOLVES 312 FATAL ACCIDENTS

| DETAILED CAUSE/FACTOR  | FA1      | TAL ACCI | NONF.    | ATAL ACC      | IDENTS | AI        | ALL ACCIDENTS |         |            |  |
|--|----------|----------|----------|---------------|--------|-----------|---------------|---------|------------|--|
|  | CAUSE    | FACTOR   | TOTAL    |               | FACTOR | TOTAL     | CAUSE         | FACTOR  |            |  |
| ** PILOT **  |          |          |          |               |        |           |               |         |            |  |
| PILOT IN COMMAND   |          |          |          |               |        |           |               |         |            |  |
| ATTEMPTED OPERATION W/KNOWN DEFICIENCIES IN EQUIPMENT  |          |          |          |               |        |           |               |         |            |  |
|  | 8        | 1        | 9        | 28            |        |           |               |         |            |  |
|  | 5<br>8   | 1        | 5        | 9             | · 5    | 33<br>11  | 36            | 6       | 42         |  |
|  | 12       | î        | 9<br>13  | 82<br>32      | 12     | 94        | 14<br>90      | 2<br>13 | 16         |  |
| DIVERTED ATTENTION FROM OPERATION OF AIRCRAFT EXCEEDED DESIGN STRESS LIMITS OF AIRCRAFT  |          |          |          | 11            | 4      | 36<br>11  | 44            | 5       | 103<br>49  |  |
| FAILEN TO EVIEND " OF AIRCKAFT   | 1        |          | 1        | 11            | 1      | 12        | 11<br>11      |         | 11         |  |
| FAILED TO LETOLON COMO GEAR  | 2        |          | ż        | 6<br>1        | 2      | 8         | 7             | 1<br>2  | 12         |  |
| RETRACTED GEAR PREMATURELY<br>INADVERTENTLY RETRACTED GEAR   |          |          |          | 13            |        | 1<br>13   | 3<br>13       | _       | 3          |  |
|  |          |          |          | 1<br>2        |        | 1         | 1             |         | 13         |  |
| FAILED TO SEE AND AVOID OTHER AIRCRAFT FAILED TO OBTAIN/MAINTAIN FLYING OR OBSTRUCTIONS  | 1        |          |          | î             |        | 2<br>1    | 2             |         | 1          |  |
| FALLED TO USE  | 1        |          | 1        | 22            |        | •         | 1             |         | 1          |  |
| FAILED TO FOLLOW INCORRECTLY USED MISC FOLLOWERS   | 129<br>2 | 1        | 130      | 22<br>207     |        | 22        | 23            |         | 1<br>23    |  |
|  | 2        |          | 2        | 12            |        | 207<br>12 | 336<br>14     | 1       | 337        |  |
|  | 29       |          | 29       | 35<br>480     | 7      | 42        | 37            | 7       | 14         |  |
|  | 6        |          |          | 14            |        | 480       | 509           | ,       | 44<br>509  |  |
| IMPROPER LEVEL OFF IMPROPER IFR DPERATION  | Ü        |          | 6        | 21            |        | 14<br>11  | 14<br>17      |         | 14         |  |
|  | 2        |          | 2        | 5<br>80       |        | 5         | 5             |         | 17         |  |
| IMPROPER COMPENSATION FOR WIND CONDITIONS INADEQUATE PREFLIGHT PREPARETURE  INDEED A STATE OF THE PREPARETURE OF THE PREPARETUR | 2<br>27  |          | 2        | 4             |        | 80<br>4   | ` 8 <i>2</i>  |         | 5<br>82    |  |
| INADEQUATE PREFIGHT PREPARATION AND/OR PLANNING INADEQUATE SUPERVISION OF FLIGHT   | 2,       |          | 27       | 123           | 7      | 130       | 6<br>150      | _       | 6          |  |
| LACK (IE CAMIL TABLE)  | 64       | 4        | 68       | 2<br>867      |        | 2         | 2             | 7       | 157        |  |
| MISMANAGEMENT OF FUEL  | 11<br>8  | 9        | 11       | 91            | 8      | 875<br>91 | 931           | 12      | 943        |  |
| EXERCISED POOR JUDGMENT OPERATED CARELESSLY  | 59       | 9        | 17<br>59 | 32<br>556     | 30     | 62        | 102<br>40     |         | 102        |  |
|  | 7        |          | 7        | 39            | 1      | 557       | 615           | 39<br>1 | 79<br>616  |  |
| FAILED TO ASSURE PROCEDURES  | 2        |          | 2        | 1             | 2      | 39<br>3   | 46<br>1       |         | 46         |  |
| FAILED TO ASSURE THE GEAR WAS DOWN AND LOCKED<br>INITIATED FLIGHT IN ADVERSE WEATHER CONDITIONS<br>SPONTANEOUS-IMPROPER ACTION   | 1        |          | ĩ        | 35<br>3       |        | 35        | 37            | 2       | 3<br>37    |  |
| SPUNTAMENIC THORONOR TO TO THE MEMINER CUNDITIONS  |          |          |          | 19            |        | 3<br>19   | 4             |         | 4          |  |
| AISJUDGED DISTANCE, SPEED, AND ALTITUDE  |          |          |          | 1<br>18       | 1      | ź         | 19<br>1       | ı       | 19         |  |
| IISJUDGED DISTANCE   | 1 2      |          | 1        | 9             |        | 18        | 18            |         | 2<br>18    |  |
| IISJUOGED DISTANCE AND ALTITUDE IISJUOGED SPEED AND ALTITUDE   |          | 1        | 3        | 44            |        | 9<br>44   | 10<br>46      | _       | 10         |  |
| ISJUDGED SPEED AND ALTITUDE  | 3        |          | 3        | 1<br>28       | 1      | 1         | 1             | 1       | 47<br>1    |  |
| ISJUDGER ALTITUDE AND -  | ı        |          | 1        | 3             | 1      | 29<br>3   | 31            | 1       | 32         |  |
| ISJUDGED CLEADANCE   | 1        |          | 1        | 4             |        | 4         | 4             |         | 4          |  |
| NAUCUIATE TORINIO  | 4        |          | 4        | 3             |        | 3         | 4             |         | 4          |  |
|  |          |          |          | 4             |        | 9<br>4    | 13            |         | 13         |  |
| ICAPACITATION NONCED LANDING   |          |          |          | 1             |        | i         | 4             |         | 4          |  |
| YSICAL THE ATOLICA   |          |          |          | 4             |        | I         | 1             |         | $_{I}^{I}$ |  |
| TEHOLOGICAL COURT  | 8        |          |          | í             |        | 4<br>1    | 4             |         | 4          |  |
|  | 3 '      |          |          | 4             |        | ,         | 1<br>12 ,     | 1       |            |  |
| LED TO MAINTAIN DIRECTIONAL CONTROL  ECTED WRONG RUNNAY BETT   | 1        | 1        |          | 4             | 4      |           | 7 1           | 13<br>7 |            |  |
| TOTAL WRUNG RUNDAY DELATED SOUTHOUS  | î        | 1<br>1   |          | 1 5           | 1 6    |           | 2 2           | 2       |            |  |
| LED TO ABORT TAKEOUS CLATIVE TO EXISTING WIND  |          | Ţ        | 1        | 4             |        |           |               | 7       |            |  |
| ECTED WRONG RUNWAY RELATIVE TO EXISTING WIND LED TO ABORT TAKEOFF LED TO INITIATE GO-ARDUND  | _ 1      | 1        |          | _             | 14     | 1         | 5             |         |            |  |
| LED TO ABORT TAKEOFF<br>LED TO INITIATE GO-ARDUND<br>ECT ENTRIES   | 6        | 6        | 1        | 5<br>4        | 7      |           | .5<br>5 3     | 15      |            |  |
| ECT ENTRIES GO-ARDUND  | 6 3      |          | 1        | 5 2<br>4<br>2 |        | 2         | .5<br>5 3     |         |            |  |

### APPENDIX A CAUSE/FACTOR TABLE

|  | - 45 AC TI | OD TARIE                    | :   |                                  |  |   | -                                      |  |                        | T.   |
|--|------------|-----------------------------|-----|----------------------------------|--|---|--|--|------------------------|--|
| TABLE A-9 CONTINUED  |            | OR TABLE                    |     |                                  | ATAL ACCI  | DENTS   | ALL                                    | ACCIDE   | NT S                   | 1  |
|  |            | FACTOR                      |     |                                  | FACTOR   | TOTAL   | CAUSE F                                | FACTOR   | TOTAL                  |  |
|  | 423        | 21                          | 444 | 3025                             | 91   | 3116  | 3448                                   | 112  | 3560                   | October 1  |
| SUBTOTAL   | 46.5       | _                           |     | 3                                |  | 3   | 3                                      |  | 3<br>1                 |  |
| COPILOT  FAILED TO OBTAIN/MAINTAIN FLYING SPEED  IMPROPER OPERATION OF POWERPLANT + POWERPLANT CONTROLS  INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING  LACK OF FAMILIARITY WITH AIRCRAFT  CONTROL INTERFRENCE  DIRECT ENTRIES  |            |                             |     | 1<br>1<br>1<br>1                 |  | 1 1 1 1 1 1 8   | 1<br>1<br>1<br>1<br>1                  |  | 1<br>1<br>1<br>1       |  |
| SUBTOTAL   |            |                             |     |                                  | 1  | 1   | 1                                      |  |                        | 1  |
| DUAL STUDENT  OFLAYED ACTION IN ABDRTING TAKEOFF  DELAYED IN INITIATING GD-AROUND  DELAYED IN INITIATING GD-AROUND  FAILED TO EXTEND LANDING GEAR  INADVERTERILY RETRACTED GEAR  FAILED TO SEE AND AVOID OBJECTS OR OBSTRUCTIONS  FAILED TO OBTAIN/MAINTAIN FLYING SPEED  FAILED TO PERATION OF POMERPLANT + POMERPLANT CONTROLS  IMPROPER OPERATION OF BRAKES AND/OR FLIGHT CONTROLS  IMPROPER LEVEL OFF  IMPROPER IN-FLIGHT DECISIONS OR PLANNING  IMADEOUATE SUPERVISION OF FLIGHT  LACK OF FAMILIARITY HITH AIRCRAFT  MISMAMAGEMENT OF FUEL  FAILURE TO RELINQUISH CONTROL  SPONTANEOUS-IMPROPER ACTION  MISJUDGED DISTANCE AND ALTITUDE  MISJUDGED DISTANCE AND ALTITUDE  MISJUDGED SPEED AND ALTITUDE  MISJUDGED SPEED AND ALTITUDE  MISJUDGED SPEED AND ALTITUDE  MISJUDGED TO MAINTAIN DIRECTIONAL CONTROL  FAILED TO ABORT TAKEOFF  SUBTOTAL  CHECK PILOT  INADEQUATE SUPERVISION OF FLIGHT  SUBTOTAL | 12         |                             |     | 1<br>12 1<br>2                   | 1<br>1<br>4<br>2<br>2<br>2<br>2<br>4<br>4<br>2<br>1<br>5<br>1<br>5<br>1<br>5<br>1<br>5<br>2<br>2<br>1<br>1<br>2<br>2<br>2<br>1<br>1<br>2<br>2<br>2<br>3<br>1<br>3<br>1<br>5<br>2<br>3<br>2<br>3<br>3<br>4<br>3<br>5<br>3<br>5<br>3<br>5<br>3<br>5<br>3<br>5<br>3<br>5<br>3<br>5<br>3<br>5<br>3 | 1 1 2 2 1 1 2 2 1 1 2 2 1 1 2 2 1 2 2 1 2 2 2 1 2 2 3 3 8 6 6 | 11 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 | 5  | 2 2 2 1 1 1 1          | 1 4 4 2 2 3 3 226 22 1 1 5 1 1 5 2 2 1 1 2 2 2 1 1 5 5 2 1 1 2 2 2 1 1 2 1 2 |
| ** PERSONNEL **  |            |                             |     |                                  | 2  | 1 3   | 3<br>10                                | 2 7  | 1 3                    | 3<br>10<br>1   |
| FLIGHT INSTRUCTOR INADEQUATE SUPERVISION OF FLIGHT INADEQUATE TRAINING DF STUDENT DIRECT ENTRIES MAINTENANCE, SERVICING, INSPECTION IMPROPER MAINTENANCE(MAINTENANCE PERSONNEL) IMPROPERLY SERVICED AIRCRAFTIGNORD CREW) IMPROPERLY SERVICED AIRCRAFTIGNORD FROM INDEQUATE INSPECTION OF AIRCRAFTIGNORD FROM INADEQUATE INSPECTION OF AIRCRAFTIGNORD FROM INADEQUATE MAINTENANCE AND INSPECTION OTHER UNK/MR DPERATIONAL SUPERVISORY PERSONNEL INADEQUATE FLIGHT TRAINING-PROCEDURES INADEQUATE SUPERVISION OF FLIGHT CREW INADEQUATE SUPERVISION OF FLIGHT CREW FAILURE TO PROVIDE ADEO DIRECTIVES, MANUALS, EQUIPMI FAILURE TO ROVIDE ADEO DIRECTIVES, MANUALS, EQUIPMI MEATHER PERSONNEL INCORRECT WEATHER FORECAST INCOMPLETE WEATHER FORECAST INCOMPLETE WEATHER REPORT INADEQUATE/INCORRECT WEATHER BRIEFING TRAFFIC CONTROL PERSONNEL FAILURE TO ADVISE OF UNSAFE AIRPORT CONDITION                     | ENT        | 5<br>3<br>1<br>2<br>25<br>1 | 1 4 | 5<br>3<br>1<br>2<br>1<br>29<br>1 | 1<br>41<br>17<br>9<br>23<br>9<br>3<br>265<br>2   | 2<br>2<br>2   | 19<br>11<br>25<br>9                    | 1<br>46<br>20<br>9<br>24<br>11<br>3<br>290<br>2<br>1 | 2<br>2<br>2<br>1<br>17 | 46 22 11 26 11 26 11 27 300 1  |
|  |            | 130                         |     |                                  |  |   |  |  |                        |  |

#### TABLE A-9 CONTINUED

PERSONNEL (CONTINUED)

#### CAUSE/FACTOR TABLE

|   |              |        | -                 |                   |                          |                       |                  |                       |                   |
|---|--------------|--------|-------------------|-------------------|--------------------------|-----------------------|------------------|-----------------------|-------------------|
|   | CAUSE EACTOR |        |                   | NONF.             | ATAL ACC                 | DENTS                 | Δl               | PPENDIX A             |                   |
|   | CAUSE        | FACTOR | TOTAL             | CAUSE             | FACTOR                   | TOTAL                 |                  |                       |                   |
| ISSUED IMPROPER OR CONFLICTING INSTRUCTIONS AIRPORT SUPERVISORY PERSONNEL IMPROPER MAINTENANCE-AIRPORT FACILITIES FALLURE TO NOTIFY OF UNSAFE CONDITION OTHER |              | 1      | 1                 |                   |                          |                       | CAUSE            | FACTOR                | TOTAL             |
| AIRWAYS FACILITIES PERSONNEL<br>PRODUCTION-DESIGN   |              |        |                   | 2                 | 1<br>1<br>1              | 3<br>1<br>2           | 2                | 1<br>1<br>1           | 1<br>3<br>1       |
| POOR/INADEQUATE DESIGN OTHER MISCELLANGOUS TO THIS TALLATION  | 1            |        | 1                 | <u>1</u>          | 1                        | 1                     | 1                | 1                     | 2<br>1            |
| PASSENGER DRIVER OF VEHICLE   | 1            |        | i                 | 5<br>7<br>3       | 2<br>1                   | 5<br>9<br>4           | 1<br>6<br>8<br>4 | 2<br>1                | 1<br>6<br>10<br>5 |
| DIRECT ENTRIES THIRD PILOT FLIGHT ENGINEER DISPATCHING  |              |        |                   | 1<br>5<br>1       | 2<br>2<br>1<br>1         | 3<br>7<br>2<br>2      | 1<br>5<br>1      | 2<br>2<br>1           | 3<br>7<br>2       |
| SUBTOTAL  |              |        |                   | 2                 |                          | 5                     | 2                | 1                     | 2 2               |
| ** AIRFRAME **  | 42           | 7      | 49                | 412               |                          |                       |                  |                       |                   |
| MINGS BRACING WIKES, STRUTS OTHER FUSELAGE  |              |        |                   | 712               | 40                       | 452                   | 454              | 47                    | 501               |
| DOORS, DOOR FRAMES WINDSHIELDS, WINDOWS, CANOPIES LANDING GEAR NORMAL   | 1            |        | 1                 |                   | 1                        | 1                     | 1                | ì                     | 1                 |
| NORMAL RETRACTION/EXTENSION ASSEMBLY MOSEWHEEL ASSEMBLIES BRAKING SYSTEM (NORMAL) LANDING GFAR HERDING  |              |        |                   | 1<br>1<br>5       | 1                        | 1<br>1<br>6           | 1 1              | •                     | 1<br>1<br>1       |
| GEAR LOCKING MECHANISM DIRECT ENTRIES FLIGHT CONTROL SURFACES   |              |        |                   | 2<br>1<br>1       | 1<br>1<br>2              | 3 2 1 2               | 5<br>2<br>1<br>1 | 1 1                   | 6<br>3<br>2<br>1  |
| HORIZONTAL STABILIZER, ATTACHMENTS FLAP ASSEMBLIES  | 1            |        | 1                 | 1                 |                          | 1                     | 1<br>1           | 2                     | 2<br>1<br>1       |
| SUBTOTAL  |              |        |                   | 1                 | 1                        | 1                     | 1                |                       | 1                 |
| ** PDWERPLANT **  ENGINE STRUCTURE CRANKCASE CRANKSHAFT   | 2            |        | 2                 |                   | 7 z                      | 1                     | 1                |                       | 1 2               |
| MASTER AND CONNECTING RODS CYLINDER ASSEMBLY PISTON, PISTON RINGS VALVE ASSEMBLIES BLOWER, IMPELLER ASSEMBLY MOUNT AND VIDEATION.                             | •            |        |                   | 80<br>88          | 1 5 <u>5</u><br>86<br>68 | 5 5                   | 6<br>i6 1        | 57<br>86              | 7                 |
| OTHER IGNITION SYSTEM MAGNETORS   | 5            | •      | 12                | 52 1<br>13 1<br>4 | l 63<br>124<br>14        |                       | 8 2              | 72<br>70<br>130       | !                 |
| DISTRIBUTOR SPARK PLUG COILS LOW TENSION WIRING   | 6 1          | i      | ,                 |                   | 1<br>36<br>57            |                       | 1<br>1           | 14<br>1<br>41         |                   |
| IGNITION HARNESS, SHIELDING SWITCHES LEADS  | 8 1          | 9      | 4;<br>1<br>2<br>1 | 1 3<br>1          | 1<br>44<br>1<br>2        | 2<br>49<br>1          | 4                | 64<br>2<br>53<br>1    |                   |
| OTHER<br>FUEL SYSTEM<br>TANKS   | 1            | ì      | 7<br>3<br>3<br>2  | 1                 | 1<br>8<br>3<br>3<br>2    | 1<br>7<br>3<br>4<br>2 | 1                | 2<br>1<br>8<br>3<br>4 |                   |
|   | 131 ,        |        | 11                | 4                 | 15                       | 11                    | 4                | 2                     |                   |

APPENDIX A CAUSE/FACTOR TABLE

|  |            |          |        |        |          |         |          |          |                | APF         | ENDIX Y        |               |
|--|------------|----------|--------|--------|----------|---------|----------|----------|----------------|-------------|----------------|---------------|
| - ANITANIED  | CAUSE/FACT | OR TABLE |        |        |          |         |          |          |                | ACC IDE     | NTS            | TO Edward III |
| TABLE A-9 CONTINUED  POWERPLANT (CONTINUED)                                  | FAT        | AL ACCID | ENTS   | NO     | NEAT     | AL ACCI | DENTS    |          | ALL ACCIDENTS  |             |                | ade acti      |
| POWERVEANT   | ~          | FACTOR   | TOTAL  |        | SE       | FACTOR  |          |          | CAUSE          | FACTOR      | T 0 T A L      | a projection  |
|  | +====      |          | _+     |        |          |         |          |          |                |             |                |               |
|  | 3          |          | 3      |        | 30<br>21 | 2<br>2  | 32<br>23 |          | 33<br>25<br>16 | 2<br>2<br>1 | 35<br>27<br>17 |               |
| LINES AND FITTINGS.  | 4 2        |          | 2      | ,      | 14       | 1       | 15<br>2  | :        | 4              | ì           | 4<br>102       |               |
| SELECTOR VALVES<br>SELECTOR VALVES<br>FILTERS, STRAINERS, SCREENS            | 2<br>10    |          | 10     |        | 91       | 1       | 92<br>22 |          | 101<br>27      | 1           | 28<br>17       |               |
| PRIMING STSIEM   | 6          |          | 6<br>4 |        | 21<br>12 | ī       | 13       | 3        | 16<br>40       | 1<br>8      | 48             |               |
| CARBURETOR<br>PUMPS  | 4          |          | 1      |        | 39       | В       | 4        |          | 6              |             | 6              |               |
| PUMPS FUEL INJECTION SYSTEM VENTS. DRAINS, TANK CAPS                         |            |          | 1      |        | 6        |         |          | 6        | 7              |             |                |               |
| RAM AIR ASSEMBLY   | 1          |          | •      |        |          | 1       | 1        | 9        | 18             | 1           | 19             |               |
| OTHER  |            |          |        |        | 1B<br>2  | •       |          | 2        | 2              |             |                | 8             |
| LUBRICATING SYSTEM<br>LINES, HOSES, FITTINGS                                 |            |          |        |        | 8        |         |          | B<br>5   | 8<br>5         |             |                | 5             |
| VALVES   |            |          |        |        | 5<br>2   |         |          | 2        | 2              |             |                | 2             |
| FILTERS, SCREENS PUMP-PRESSURE   |            |          |        |        | 4        |         |          | 4        | 4              |             |                | 1             |
| PUMPS-SCAVENGEK  |            |          |        |        | 1        |         |          | 1<br>11  | 11             |             |                | 1             |
| OIL COOLERS<br>MAGNETIC PLUGS  |            |          |        |        | 11       | 1       |          | 14       | 13             |             | 1 )            | 4             |
| SEALS AND GASKETS  |            |          |        |        |          |         |          | 1        | 1              |             |                | 1             |
| OTHER  |            |          |        |        | 1        |         |          | ī        | 1              |             |                | 1             |
| COOLING SYSTEM BAFFLES   |            |          |        |        |          |         |          | 1        | 1              |             |                | 1             |
| OTHER PROPELLER AND ACCESSORIES  |            |          |        |        | 1        |         |          | 1        | 1              |             |                | 1 1           |
| BLADES SOUTHIN MECHANISM   |            | ,        |        | 1      | 3        |         |          | 3        | -              | •           |                | ,             |
| HYDRAULIC PITCH CONTROL MES  |            | 1        |        |        | 3        |         |          | 3        |                |             | 1              | 3<br>16       |
| OTHER<br>Exhaust system  |            |          |        | 1      | 14       |         | l        | 15<br>1  | 15             | 1           | -              | 1             |
| MANIFOLDS  |            | 1        |        |        | 1<br>6   |         |          | 6        | 1              | 6           |                | 6             |
| MUFFLERS<br>Gaskets  |            |          |        |        | 3        |         |          | 3        |                | 3           |                |               |
| STACKS   |            |          |        | _      |          |         |          |          |                | 1           |                | 1             |
| BAFFLES<br>ENGINE ACCESSORIES  |            | 1        |        | 1      | 1        | L       |          | 1        |                | 1           |                | i             |
| VACUUM PUMPS   |            |          |        |        | 1        | ı       |          | 1        |                |             |                | 30            |
| STARTERS<br>OTHER  |            |          |        | ì      | 21       | 8       | 1        | 29       |                | 29<br>L7    | 1              | 17            |
|  |            | 1        |        | i      | 14       | 6       |          | 16       | ,              | 6           |                | 6             |
| THROTTLE-POWER LEVELMENTES   |            | •        |        |        |          | 6<br>1  |          | 1        |                | 1           |                | 1             |
| MIXTURE CONTROL ASSEMBLING<br>INDUCTION AIR, PREHEAT CONTROLS                |            |          |        |        |          |         |          | 44       |                | 4           | 41             | 45            |
| OTHER<br>POWERPLANT-INSTRUMENTS  |            |          | 1      | 1      |          | 4       | 40       |          |                |             |                | 832           |
| CILCI DILANTIIT GAUVE  |            | 70       |        | 70     | 76       |         |          | 762<br>2 | 8              | 32<br>2     |                | 2             |
| MISCELLANEOUS POWERPLANT FAILURE FOR UNDETERMINED REASONS POWERPLANT FAILURE |            | 70       |        |        |          | )<br>5  |          | 1        |                | 1           |                | 1             |
|  |            |          |        |        |          | 1       |          | 1        |                | 1<br>6      |                | 6             |
| SODETON URJECT DANAGE  |            |          |        |        |          | 6<br>1  |          | 1        |                | , 2         | 1              | 2<br>44       |
| COMPRESSOR STALLS<br>DETONATION  |            | 1<br>3   |        | 1<br>3 |          | 40      | 1        | 41       |                | 43          | -              | 4             |
| OT LIE &   |            | ,        |        |        |          | 4       |          | 4        |                | 4           |                | ī             |
| DIRECT ENTRIES REDUCTION GEAR ASSEMBLY                                       |            |          |        |        |          | ì       |          | 1        |                | ,           |                |               |
| GEARS, ACCESSORI BALLE   |            |          |        |        |          |         |          |          |                | 1           |                | ı             |
| OTHER<br>Compressor Assembly   |            | ı        |        | 1      |          |         |          |          |                |             |                |               |
| 07 LER   |            |          |        |        |          |         |          |          |                |             |                |               |
| COMBUSTION ASSEMBLY TURBINE ASSEMBLY   |            |          |        |        |          |         |          |          |                |             |                |               |
| TAVECCURA DRIAG MODULA.  |            |          |        |        |          | 1       |          |          | 1              | 1           |                | 1             |
| LURRICATING SYSTEM<br>FUEL SYSTEM  |            |          |        |        |          | •       |          |          |                |             |                |               |
| OTHER  |            |          |        |        |          |         |          |          |                |             |                |               |
| SAFETY SYSTEM<br>Ignition system   |            |          |        |        |          |         |          |          |                |             |                |               |
| TORQUEMETER  |            |          |        |        |          |         |          |          |                |             |                | ,             |
| ATR BIFED  |            |          |        |        |          | 1       |          |          | 1              | 1           |                | 1             |
| EXHAUST SYSTEM<br>THRUST REVERSER  |            |          |        |        |          |         |          |          | 1              | 1           |                | 1             |
| OTHER  |            |          |        |        |          | 1       |          |          | •              |             |                |               |
| PROPELLER SYSTEM GOVERNOR  |            |          |        |        |          |         |          |          |                |             |                |               |
| OUT COMM.  |            | 132      | · ·    |        |          |         |          |          |                |             |                |               |

TABLE 9 (CONTINUED)
POWERPLANT (CONTINUED)

#### CAUSE/FACTOR TABLE

| POWERPLANT (CONTINUED)  |        |           |         |                |                 |           | APPENDIX A    |           |           |  |
|---|--------|-----------|---------|----------------|-----------------|-----------|---------------|-----------|-----------|--|
|   |        | TAL ACCIO |         | NONF           | TAL ACC         | DENTS     | ALL ACCIDENTS |           |           |  |
|   | CAUSE  | FACTOR    | TOTAL   | CAUSE          | FACTOR          | TOTAL     | CAUSE         | FACTOR    | TOTAL     |  |
| CONSTANT SPEED DRIVE  |        |           |         |                |                 |           |               |           |           |  |
| GOVERNOR VALVE<br>POWER LEVER   |        |           |         | 1              |                 | 1         | 1             |           | 1         |  |
| CABLE<br>PROPELLER LEVER  |        |           |         | 1              |                 | ı         | 1             |           | 1         |  |
| REVERSE THRUST LEVER<br>ENGINE INDICATING EQUIPMENT<br>TACHOMETER                                       |        |           |         |                |                 |           |               |           | •         |  |
| ENGINE INSTALLATION   |        |           |         | 1              |                 | 1         | 1             |           | 1         |  |
| SUBTOTAL  | 157    | 5         | 162     | 1792           | 74              | 1866      | 1949          | 79        | 2028      |  |
| ** SYSTEMS **   |        |           |         |                |                 |           |               | .,        | 2026      |  |
| ELECTRICAL SYSTEM<br>BATTERIES  |        |           |         |                |                 |           |               |           |           |  |
| GENERATORS/ALTERNATORS HYDRAULIC SYSTEM   |        |           |         | 1<br>2         | 1               | 2<br>2    | 1 2           | . 1       | 2         |  |
| FLIGHT CONTROL SYSTEMS HING FLAP CONTROL SYSTEM (ELECTRICAL)  |        |           |         |                |                 |           | _             |           | 2         |  |
| ANTI-ICING, DE-ICING SYSTEMS  |        |           |         | 1              | 1               | 1<br>1    | 1             | 1         | 1         |  |
| CARBURETOR DE-ICING SYSTEM OTHER AIR CONDITION MEATING  |        |           |         | 15             |                 | 15        | 15            |           | 15        |  |
| AIR CONDITION, HEATING AND PRESSURIZATION CABIN TEMP CONTROL AND TEMP INDICATING SYSTEM AUTO PILOT      |        | 1         | 1       | 1              |                 | ı         | 1             |           | 1         |  |
| FIRE MARNING SYSTEM FIRE EXTINGUISHER SYSTEM  |        | •         | 1       |                |                 |           |               | 1         | 1         |  |
| OTHER SYSTEMS   |        |           |         |                |                 |           |               |           |           |  |
| SUBTOTAL  |        | 1         |         |                |                 |           |               |           |           |  |
| ** INSTRUMENTS/EQUIPMENT AND ACCESSORIES **   |        | •         | 1       | 20             | 2               | 22        | 20            | 3         | 23        |  |
| FLIGHT AND NAVIGATION INSTRUMENTS COMPASS   |        |           |         |                |                 |           |               |           |           |  |
| COMMUNICATIONS AND NAVIGATION FOLIDWENT   |        |           |         | 1              |                 | 1         | 1             |           | 1         |  |
| TRANSMITTERS AND/OR RECEIVERS VOR RECEIVERS COMPASS RECEIVERS   |        |           |         | 1              | 3               | 4         | 1             | 3         | 4         |  |
| OTHER MISCELLANEOUS EQUIPMENT   | 1      |           | 1       | 1              | 3               | 4         | 1<br>2        | 3         | 4 2       |  |
| SPRAY+ DUSTING EQUIPMENT  |        |           |         | 1<br>2         | 1               | 2         | 1             | 1         | 2         |  |
| SUBTOTAL  | 1      |           | 1       | 7              | -               | 2         | 2             |           | 2         |  |
| ** AIRPORTS/AIRWAYS/FACILITIES **   |        |           | -       | ,              | 7               | 14        | 8             | 7         | 15        |  |
| AIRPORT FACILITIES AIRPORT CONDITIONS   |        |           |         |                |                 |           |               |           |           |  |
| MET RUNWAY<br>TCE/SLUSH ON RUNWAY   |        |           |         |                | 5               | 5         |               | _         |           |  |
| SNOW ON RUNWAY<br>SOFT SHOULDERS (RUNWAY)   |        | 1         | 1       | 5              | 1 4             | 1         | _             | 5<br>1    | 5<br>1    |  |
| HIGH VEGETATION   |        | 1         | 1       | ,              | 3               | 9<br>3    | 5             | 5<br>3    | 10<br>3   |  |
| AIRWAYS FACILITIES  |        | -         | •       | 4              | 1<br>11         | 1<br>15   | 4             | 2<br>11   | 2<br>15   |  |
| SUBTOTAL  |        | 2         | 2       | •              |                 |           |               |           |           |  |
| ** WEATHER **   |        | L         | 2       | 9              | 25              | 34        | 9             | 27        | 36        |  |
| LOW CEILING<br>Rain   | 4      | 26        | 30      |                | 20              |           |               |           |           |  |
| FOG<br>SNOW   | 1<br>5 | 7<br>11   | 8<br>16 | 6<br>3<br>7    | 33<br>11        | 39<br>14  | 10            | 59<br>18  | 69<br>22  |  |
| ICING CONDITIONS-INCLUDES SLEET, PREEZING RAIN, ETC CONDITIONS CONDUCTVE TO CARM/INDUCTION SYSTEM ICING | 2      | 6         | 8       |                | 21<br>10        | 28<br>10  | 12            | 32<br>16  | 44<br>18  |  |
| UNFAVORABLE WIND CONDITIONS SUDDEN WINDSHIFT  | 9<br>1 | 13        | 22      | 11<br>133<br>7 | 15<br>108<br>18 | 26<br>241 | 15<br>142     | 19<br>121 | 34<br>263 |  |
| ,   |        | -         | •       | í              | fo              | 25<br>l   | 8<br>1        | 21        | 29        |  |

TABLE A-9 CONTINUED

ENGINE LOADED UP FATIGUE FRACTURE

#### CAUSE/FACTOR TABLE

APPENDIX A

10

ALL ACCIDENTS NONFATAL ACCIDENTS FATAL ACCIDENTS WEATHER (CONTINUED) CAUSE FACTOR CAUSE FACTOR TOTAL CAUSE FACTOR TOTAL TURBULENCE IN FLIGHT, CLEAR AIR TURBULENCE, ASSOCIATED W/CLOUDS, THUNDERSTORMS DOWNDRAFTS, UPDRAFTS LOCAL WHIRLWIND ADVERSE WINDS ALDET 1 2 ADVERSE WINDS ALOFT 8 HIGH TEMPERATURE OBSTRUCTIONS TO VISION
HIGH DENSITY ALTITUDE
THUNDERSTORM ACTIVITY OTHER SUBTOTAL \*\* TERRAIN \*\* 1 WET, SOFT GROUND SNOW-COVERED HIGH VEGETATION HIDDEN OBSTRUCTIONS ROUGH/UNEVEN 6B ROUGH WATER HIGH OBSTRUCTIONS ı SANDY OTHER SUBTOTAL 9 \*\* MISCELLANEOUS \*\* ı BIRD COLLISION EVASIVE MANEUVER TO AVOID COLLISION UNGUALIFIED PERSON OPERATED AIRCRAFT 112 SAROTAGE FOREIGN MATERIAL AFFECTING NORMAL OPERATIONS UNDETERMINED DIRECT ENTRIES SUBTOTAL GRAND TOTAL 25 \*\* MISCELLANEOUS ACTS, CONDITIONS \*\* ANTI-ICING/DEICING EQUIP-IMPROPER OPER. OF/FAILED TO USE CHECKLIST-FAILED TO USE i CREW COORD INAT ION-PODE DISREGARD OF GOOD OPERATING PRACTICE IMPROPER EMERGENCY PROCEDURES FEATHERED WRONG ENGINE ļ INSTRUMENTS-MISREAD OR FAILED TO READ SEAT BELT NOT FASTENED NOT ALLIGNED WITH RUNWAY/INTENDED LANDING AREA NOT ALLIGNED WITH RUNHAY/INTENDED L UNMARKANTED LOW FLYING FAILED TO EXTEND THE LANDING FLAPS FAILED TO USE ALL AVAILABLE RUNHAY INATTENTIVE TO FUEL SUPPLY FLEW INTO BLIND CANYON PREMATURE FLAP RETRACTION POORLY PLANNED APPROACH MISCALCULATED FUEL CONSUMPTION JETTISONED LOAD 94 22 8 21 22 7 ı MISCALCULATED FUEL CONSUMPTION
JETTISONED LOAD
STOLEN OR UNAUTHORIZED USE OF AIRCRAFT
LANDED ON FOAMED RUNWAY
IMPROPERLY SECURED 17 BOGUS PART ELECTRICAL FAILURE 

#### CAUSE/FACTOR TABLE

APPENDIX A

MISCELLANEOUS ACTS, CONDITIONS (CONTINUED)

| TOTAL TRUEBY  | FA       | TAL ACCIO | DENTS    | NONE        | TAL ACCI  | DENTS     | <b>A</b> 1 | L ACCID   | FNTC       |
|---|----------|-----------|----------|-------------|-----------|-----------|------------|-----------|------------|
|   | CAUSE    | FACTOR    | TOTAL    |             | FACTOR    |           |            | FACTOR    | TOTAL      |
| FUEL GRADE-IMPROPER<br>Hydraulic failure  |          |           |          |             |           | •         |            |           |            |
| RPM-UNCONTROLLARIE-DUERICATING SYSTEM   |          |           |          | 7<br>1<br>2 | ı         | 7<br>2    | 7<br>1     | 1         | 7<br>2     |
| WRONG PART FOGGY, ETC-RESTRICTED VISION   |          |           |          | 2           | 2         | 2         | 2          |           | 2          |
| IMPROPER ALLCOMENT (AD DISCUSS  |          | 1<br>1    | 1<br>1   | 1           | 4         | 4         |            | 2<br>5    | 2<br>5     |
| SEPARATION IN FLIGHT  | 4<br>8   | 11        | 4        | 18          | 2         | 1<br>20   | 1<br>22    | 1         | 2          |
| FIRE IN ENGINE  |          | , Ş       | 19<br>2  | 28<br>1     | 68<br>13  | 96        | 36         | 2<br>79   | 24<br>115  |
| ASYMETRICAL FLAPS<br>CORRODED/CORROSION   | 1        |           | 1        | 4           | ้อื่      | 14<br>12  | 1<br>5     | 15<br>8   | 16         |
| CONGESTED TRAFFIC-PATTERN PILOT FATIGUE   | 1        |           | 1        | 1<br>6      | 1         | 1 7       | 1          |           | 13<br>1    |
| FUEL EXHAUSTION   | 1        | 2         | 2<br>1   | 1           | 3         | 4         | 7<br>1     | 1<br>5    | 8          |
| FUEL CONTAMINATION EVALUATION   | 44       | 1         | 45       | 766         | . 3       | 3<br>766  | i          | 3         | 6<br>4     |
| HYPOXIA   | 1 7      | 2         | 1<br>9   | 60          | 2         | 62        | 810<br>61  | 1         | 811        |
| CARRON MONDXIDE POISONING   |          | ٤         | 9        | 5           | ı         | 5         | 12         | 2         | 63<br>14   |
| ICE-IN FUEL ICE-ENGINE  | 1        | 1         | 1        |             | 1         | 1         |            | 1         | 1          |
| ICE-CARBURETOR  | i        |           | 1<br>1   | 10<br>5     | 5         | 12        | 11         | 1         | 1<br>13    |
| ICE-PROPELLER<br>AIRFRAME ICE   | 16       | 1         | 17       | 333         | 7         | 5<br>340  | 6          |           | 16         |
| ICE-WINDSHIFLD  | 3        | 1         | 4        | 2           |           | 2         | 349<br>2   | 8         | 357        |
| IMPROPERTY LOADED ATROPAGE  |          |           | •        | 9           | 6<br>2    | 15        | 12         | 7         | 2<br>19    |
| INTERFERENCE WITH FLIGHT CONTROLS WHITEHUT  | 4        | 9         | 13       | 2           | 8         | 4<br>10   | 2<br>6     | . 2       | 4          |
| SUNGLARE  |          |           |          | 1           | 1         | ŀ         | ī          | 17        | 23<br>1    |
| LACK OF LUBRICATION-SPECIFIC PART, NOT SYSTEM OIL EXHAUSTION-ENGINE LUBRICATION SYSTEM OIL EXHAUSTION-PRODUCT | 1        | 1         | 1        |             | 3         | 1         |            | 1         | 1          |
| OIL EXHAUSTION PROPERTY CONTENTION SYSTEM   | 4        |           | 1        | 10<br>54    | 1         | 11        | 11         | 1         | 12         |
| OIL CONTAMINATION<br>SIMULATED CONDITIONS   |          |           | •        | 2           | 2         | 56<br>2   | 58         | 2         | 60         |
| FUEL STRMONTHO  | 15       | 2         | 17       | 6<br>97     |           | 6         | 2<br>6     |           | 2          |
| WATER IN FUEL AIRCRAFT CAME TO REST IN WATER  | 7        |           |          | 3           | 56<br>1   | 153       | . 112      | 58        | 170        |
| · worred woll 2108F   |          | 20        | 7<br>20  | 184         | 5         | 189       | 191        | 1<br>5    | 4<br>196   |
| MISSING<br>TOUCH AND GO LANDING   |          |           |          | 4           | 130       | 130       |            | 150       | 150        |
| UVEKLOAD FAILURE  | 1        | 2<br>2    | 3        | 15          | . 3       | 18        | 4<br>16    | 5         | 4<br>21    |
| MATERIAL FAILURE<br>FUEL STARVATION   | 1        | ł         | 2        | 3           | 10<br>806 | 10<br>809 |            | 12        | 12         |
| OIL STARVATION  | 18<br>73 | 1         | 19<br>75 | 467         | 11        | 478       | 4<br>485   | 807<br>12 | 811<br>497 |
| IMPROPER CLEARANCE-TOLERANCE  | 5        |           | 5        | 758<br>35   | 1         | 758       | 831        | 2         | 833        |
| FUEL SELECTOR POSITIONED BETWEEN TANKS<br>FIRE OF UNDETERMINED ORIGIN   | 3<br>8   | 2         | 3        | 18          | i         | 36<br>19  | 40<br>21   | 1<br>1    | 41         |
|   | ·        |           | 10       | 31<br>1     | 5         | 36        | 39         | 7         | 22<br>46   |
| IMPROPER/INADEQUATE VENTING   |          | 1         | 1        | 5           | 2         | 1 7       | 1<br>5     | _         | 1          |
| POOR WELD   |          |           |          | 5           | 3         | ė         | 5          | 3<br>3    | 8<br>8     |
| PREVIOUS DAMAGE<br>LEAK/LEAKAGE   |          |           |          | 2           | 1         | 1<br>2    | -          | i         | ĭ          |
| LDW FLUID LEVFI   | 3        |           | 3        | 6           | 3         | 9         | 2<br>6     | 3         | 2          |
| CIRCUIT HREAKER POPPED ARCING   |          |           | ,        | 22          | 4<br>2    | 26<br>2   | 25         | 4         | 29         |
| LOW COMPRESSION   | 1        |           | 1        | 1           | ī         | ź         | ı          | 2<br>1    | 2          |
| RUNHAY CLOSED DDWNWIND  |          |           | •        | 7           |           | 7         | 1          | •         | 1          |
| CARBON DEPOSITS   |          | 4         | 4        | 2           | 1         | i         | 7          | 1         | 7<br>1     |
| LANDED IN CONSTRUCTION AREA<br>OVER TORQUED   | 5        | 1         | 6        | 24          | 32<br>3   | 34<br>27  | 2<br>29    | 36        | 38         |
| UNDER TORQUED   |          |           |          | 2           | 2         | 4         | 29         | 4<br>2    | 33<br>4    |
| LOOSE, PART/FITTING   | 4        |           |          | 1           |           | 1         | 1          | -         | i          |
| RINDING   | 6        |           | 6        | 27          | 3         | 30        | 1<br>33    | 3         | 1<br>36    |
| AURNED<br>CHAFFED   | 3        |           | 3        | 3<br>5      | 1         | 3<br>6    | 3          |           | 3          |
| COLLAPSED   | 1        | 1         | 1        | 11          | 2         | 13        | 8<br>11    | 1         | 9          |
| CROSSED   | 1        |           | 1<br>1   | 2<br>5      | 2<br>1    | 4         | 3          | 2         | 14<br>5    |
| DETERIORATED<br>Disconnected  | 1<br>1   |           | 1        | -           | -         | 6         | 6<br>1     | 1         | 7          |
|   | •        | l<br>l    | 2<br>1   | 4<br>13     | 1         | 5         | 5          | 2         | 7          |
|   |          |           | -        | 13          | 1         | 14        | 13         | 2         | 15         |

#### TABLE A-9 CONTINUED

#### CAUSE/FACTOR TABLE

APPENDIX A

| ABLE A-9 CONTINUED<br>ISCELLANEOUS ACTS, CONDITIONS (CONTINUED)   | FAT              | AL ACCIDE | ENTS             | NONFA  | TAL ACCI               | DENTS   | 41.1   | L ACCIDEN                   | NT S  |
|---|------------------|-----------|------------------|--|------------------------|---|--|-----------------------------|---|
|   | CAUSE            | FACTOR    | TOTAL            | CAUSE  | FACTOR                 | TOTAL   | CAUSE  | FACTOR                      | TOTAL   |
| EXCESSIVE ERRATIC FRICTION, EXCESSIVE GROUNDED HIGH VOLTAGE BREAKDOWN IMPROPERLY INSTALLED JAMMED OBSTRUCTED OPEN OUT OF BALANCE  | 1                | 1<br>1    | 2                | 5<br>2<br>1<br>5<br>1<br>26<br>4<br>21<br>1<br>14                    | 14<br>3<br>1<br>2<br>1 | 5<br>16<br>1<br>5<br>1<br>29<br>4<br>21<br>1<br>3<br>15 | 6<br>2<br>1<br>5<br>1<br>27<br>4<br>21<br>1<br>14<br>1                     | 14<br>4<br>1<br>1<br>2<br>1 | 6<br>16<br>1<br>5<br>1<br>31<br>4<br>22<br>1<br>3<br>15 |
| OVERHEATED PINCHEO PINCHEO EXCESSIVE PRESSURE PRESSURE TOO LOW PRESSURE, NONE SCORED SHEARED STICKING STRIPPED STUCK EXCESSIVE TEMPERATURE VIBRATION, EXCESSIVE WARPED ICE-INDUCTION INTENTIONAL GROUND-MATER LOOP-SWERVE INTENTIONAL WHEELS UP | 2<br>2<br>1<br>2 |           | 2<br>2<br>1<br>2 | 12<br>9<br>2<br>6<br>8<br>1<br>1<br>2<br>4<br>4<br>1<br>1<br>2<br>27 | 1                      | 1<br>15<br>8<br>6<br>1<br>1                             | 4<br>12<br>9<br>4<br>8<br>8<br>1<br>13<br>6<br>4<br>1<br>1<br>2<br>2<br>29 | 1                           | 1<br>16<br>10<br>8<br>1<br>2                            |

#### DIRECT ENTRY CAUSES

PILOT-IMPROPERLY EXECUTED EMERGENCY LANDING
PILOT-INCAPACITATION CAUSED BY DRUGS
PWR PLT-LEFT CRANKSHAFT IDLER GEAR CAP SCREW FAILD
PWR PLT-OIL STARVATION FOR UNDETERMINED REASON
PWILOT-OIL STARVATION FOR UNDETERMINED REASON
PILOT-ION NOT SEE WIRES IN TIME-EVASIVE ACT, N STAL
PILOT-INADVERTENTLY TURNED MAGNETO SWITCH OFF
PILOT-INADVERTENTLY TURNED MAGNETO SWITCH OFF
PWR PLT-ENGINE CRANKCASE BREATHER PLUGGED BY ICE
PERSONNEL-IMPROPERLY SECURED DIL FILLER CAP.
PWR PLT-SLUSH ENTERED CARBURETOR AIR INTAKE SCOPP.
PWR PLT-SLUSH ENTERED CARBURETOR AIR INTAKE SCOPP.
PWR PLT-FUEL SIPHONED OUT FRUM DEFORMED TANK VENT.
PWR PLT-IMPROPER CARBURETOR INSTALLED.
PWR PLT-IMPROPER FUEL GAUGE INSTALLED.
PWR PLT-FATIGUE FAILURE OF CARB HEAT CONTROL.
PWR PLT-CARBURETOR NEEDLE VALVE STUCK.
PWR PLT-CARBURETOR PILOT-IMPROPERLY EXECUTED EMERGENCY LANDING

#### TABLE A-9 CONTINUED

DIRECT ENTRY CAUSES (CONTINUED)

CAUSE/FACTOR TABLE

APPENDIX A

DIRECT ENTRY CAUSES ARE CARRIED UNDER THEIR APPROPRIATE CAUSAL CATEGORIES AND ARE INCLUDED IN THE TOTALS

# CAUSE/FACTOR TABLE

FIXED-WING AIRCRAFT
ENGINE FAILURE AS FIRST ACCIDENT TYPE DNLY
U. S. GENERAL AVIATION
1965 - 1969

EXCLUDES ACCIDENTS WITH CAUSE UNDETERMINED, HOMEBUILT AND EXPERIMENTAL AIRCRAFT, AND ACCIDENTS INVOLVING SIMULATED ENGINE FAILURES

INVOLVES 3312 TOTAL ACCIDENTS INVOLVES 220 FATAL ACCIDENTS

| INVOLVES | LVES 220 FATAL ACCIDENTS                 |              |                 |              |                    |            |               |               |               |               |
|----------|--|--------------|-----------------|--------------|--------------------|------------|---------------|---------------|---------------|---------------|
|          |  | CATA! A(     | EATA! ACCIDENTS |              | NONFATAL ACCIDENTS | CC I DEN   |               | ALL ACCIDENTS | ALL ACCIDENTS | 1             |
|          |  |              |                 |              | CAIRSE FACTOR      | TO:        |               |               | FACTOR TO     | TOTAL*        |
| BRO      | BROAD CAUSE/FACTOR                       | CAUSE FACTOR | TOR 101AL       | _            |                    |            |               |               |               |               |
| ļ        |  |              |                 |              |                    |            | 1980          | 2127          | 77            | 2130          |
|          |  | 150          | 11<br>5,00 6    | 150<br>68.18 | 63.94              | 2.13       |               | 77*49         |               |               |
| P11.0T   | 11                                       | 38           |                 | 44.00        | 393<br>12.71       | 31         | 423<br>13.68  | 431<br>13.01  | 37            | 14.10         |
| PER      | PERSONNEL                                | 17.27        |                 | <u>.</u>     | -                  | ć          | 1             | 2<br>90.      | 60.           | - 0°          |
| 914      | 11 3 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 | .45          | 00•             | .45          | •03                | 3          | } .           | -             |               | ,             |
|          |  | Ş            | 00.             | 00.          | 1<br>•03           | ۰ <b>0</b> | , 0°          | •03           | 00.           | 6             |
| LAN      | LANDING GEAR                             | . 22<br>72   |                 | <b>*</b>     | 950                | 68<br>2,20 | 1013<br>32.76 | 1022<br>30.86 | 71<br>2.14    | 1087<br>32.82 |
| ě        | POWERPLANT                               | 32+73        |                 | *o*e         | 3 9                | -          | 17            | 16,           | 296           | 18            |
|          |  | 00*          | 4.5             | 4.5          | .52                | •03        | . 55          | •             |               | Ξ             |
| Š        | SYSTEMS SYSTEMS                          | 1<br>45      | %               | 1<br>• 45    | 5<br>•16           | 5<br>•16   | 10<br>.32     | •18           | .15           | 33            |
| <u> </u> | STRUMENTS/ EGO I PREST                   |              |                 | ,            | ş                  | Ş          | 00.           | • 00          | 00.           | 00.           |
| 2        | ROTORCRAFT                               | 00.          | 8               | 8            |                    |            | 2,2           | 1,03          | 1,03          | ۶.<br>م       |
| I        | AIRPORTS/AIRWAYS/FACILITIES              | 00.          | 00.             | 00.          | •03                |            | 102           | 155           | 181           | 331           |
| i 1      | GUILL                                    | 12 5.45      | 20<br>9•09      | 30<br>13.64  | 143                | 5.21       | 9.13          | 4.68          | 5.46          |               |
| Š        |  |              | Ş               | S            | 00.                | 00.        | • 00          | 00 <b>•</b>   | 6             | • 00          |
| F        | TERRAIN                                  | 8            | 90.             |              | ÷                  | œ          | 122           | 124           | œ `           | 132           |
| 7        | MISCELLANEOUS                            | 10           | • 00            | 10           | 3.69               | .26        |               |               |               | 1             |
| . 5      | UNDETERMINED                             | • 00         | 00•             | 80.          | 00.                | 00.        | 00.           | 00.           | 8             | 80.           |
|          |  |              |                 |              |                    |            |               |               |               |               |

138

THE FIGURES OPPOSITE EACH CAUSAL CATEGORY REPRESENT THE NUMBER AND PERCENT OF ACCIDENTS IN WHICH THAT PARTICULAR CAUSAL CATEGORY WAS ASSIGNED OF ACCIDENTS IN WHICH THAT PARTICULAR CAUSAL

OF ACCIDENTS AN THE SAME CAUSE AND RELATED FACTOR IN THE SAME CAUSAL
\* IF AN ACCIDENT INCLUDES BOTH A CAUSE ONCE UNDER THE TOTAL FOR THAT CATEGORY
CATEGORY, THE ACCIDENT IS REPRESENTED ONCE UNDER THE

TABLE A-11

#### CAUSE/FACTOR TABLE

APPENDIX A

# FIXED-WING AIRCRAFT ENGINE FAILURE AS FIRST ACCIDENT TYPE ONLY U. S. GENERAL AVIATION 1965 ~ 1969

EXCLUDES ACCIDENTS WITH CAUSE UNDETERMINED. HOMEBUILT AND EXPERIMENTAL AIRCRAFT, AND ACCIDENTS INVOLVING SIMULATED ENGINE FAILURES

INVOLVES 3312 TOTAL ACCIDENTS 220 FATAL ACCIDENTS

| DETAILED CAUSE/FACTOR  |               | TAL ACCI |          | NONF.        | ATAL ACC | CIDENTS  | At       | L ACCID | ENTS      |
|--|---------------|----------|----------|--------------|----------|----------|----------|---------|-----------|
|  | CAUSE         | FACTOR   | TOTAL    |              |          | TOTAL    | CAUSE    | FACTOR  | TOTAL     |
| ** PILOT **  |               |          |          |              |          |          |          |         |           |
| PILOT IN COMMAND ATTEMPTED OPERATION W/KNOWN DEFICIENCIES IN EQUIPMENT ATTEMPTED OPERATION BEYOND EXPERIENCE/AMILITY LEVEL CONTINUED VER ELICHT TO THE PROPERTY OF THE PROPERT | 6             | 1        | 7        | 22<br>8      | . 5      | 27       | 28       | 6       | •         |
| CONTINUED VER FLIGHT INTO ADVERSE MEATHER CONDITIONS DELAYED IN INITIATING GO-ARDUND   | 8<br>9        |          | 8        | 82           | 11       | 9<br>93  | 11<br>90 | 1       | 34<br>12  |
| EXCEEDED DESIGN STRESS LIMITS OF AIRCRAFT  |               |          | ,        | 28<br>2<br>3 | 4 2      | 32<br>2  | 37<br>2  | 11<br>4 | 101<br>41 |
| FAILED TO DO   | 2             |          | 2        | 1            | •        | 5<br>1   | 3<br>1   | 2       | 5         |
| IMPROPER DECLATION COCCOUNCES UIRFOTINES FAS   | <b>2</b><br>1 |          | 2        | 7            |          | 1 7      | 3        |         | 1 3       |
| IMPROPER TER CONTROLS  | 25            |          | 1<br>25  | 23<br>442    | 4        | 27       | 9<br>24  | 4       | 9         |
| IMPROPER TALES TOUR TON  | 1             |          |          | 777          |          | 442<br>7 | 467      | 7       | 28<br>467 |
| INADEQUATE PRESITONS   | 13            |          | 13       | 3<br>104     | _        | 3        | 7        |         | 7         |
| INADEQUATE SUBSECTION AND/OR PLANATUR  | 61            | 1        |          | ĭ            | 7        | 111      | 117      | 7       | 124       |
| MISMANAGEMENT OF THE AIRCRAFT  | 4             | _        | 62       | 861<br>44    | 5        | 866      | 922      | 6       | 928       |
| EACKLISED POOR HIDOURING   | 59            | 6        | 10<br>59 | 28           | 22       | 44<br>50 | 44<br>32 |         | 44        |
| OPERATED CARELESSLY SELECTED UNSUITABLE TERRAIN  | 2             |          | 2        | 553<br>17    | 1        | 554      | . 915    | 28<br>1 | 60<br>613 |
|  |               |          |          | 1            | 1        | 17<br>2  | 19<br>1  | _       | 19        |
| SPONTANEOUS IMPRODES DEATHER CONDITIONS  | 1             |          | 1        | 3<br>2       |          | 3        | 3        | 1       | 2         |
| MISJUDGED DISTANCE CONTRACT  |               |          |          | , Ī          |          | 2<br>1   | 3<br>1   |         | 3         |
| MISJUDGED DISTANCE   |               | _        |          | 12<br>1      |          | 12       | 12       |         | 1<br>12   |
| MISJUDGED SPEED AND ALTITUDE<br>MISJUDGED SPEED  |               | 1        | 1        | _            |          | 1        | 1        |         | ī         |
| INADEQUATE TRAINING  |               |          |          | 1            | 1        | 1        |          | i<br>1  | 1         |
| INCAPACITATION OF ORDERS OR INSTRUCTIONS   |               |          |          | į            |          | 1<br>1   | l<br>1   |         | i         |
| MYSICAL IMPATOMENT   |               |          |          | 1            |          | 1        | ī        |         | 1         |
| PATIAL DISORIENTATION SYCHOLOGICAL CONDITION   | 5             | 1        | 6        | ì<br>3       |          | i        | 1        |         | į         |
|  | 1             | 1        | i        | 2            |          | 3        | 8        | 1       | 9         |
| AILED TO ABOUT TAKEN PELATIVE TO EXISTING WIND   |               | •        | •        |              | 1<br>2   | ī        | •        | 2       | 3<br>2    |
| AILED TO INITIATE GO-AROUND IRECT ENTRIES  | 3             |          | . 3      |              | ī        | 2<br>1   |          | 2       | 2         |
|  | 1             |          |          | 1<br>1       |          | 1        | 4        | 1       | 1         |
| SUBTOTAL   |               |          | ì        | 11           |          | ıi       | 15       |         | . 1       |
| ILOT   | 207           | 11       | 218      | 2280         | 68       | 2348     | 2487     |         | 12        |
| AILED TO OBTAIN/MAINTAIN FLYING SPEED<br>PROPER OPERATION OF POWERPLANT + POWERPLANT CONTROLS<br>MADEGUATE PREFLIGHT PREPARATION AND/OR PLANNING<br>RECT ENTRIES   |               |          |          | 1            |          |          | 2401     | 79 ;    | 566       |
| RECT ENTRIES PEANNING  |               |          |          | i            |          | 1        | i<br>i   |         | 1         |
| SUBTOTAL   |               |          |          | i            |          | l<br>l   | 1<br>1   |         | i         |
| STUDENT  |               |          |          | 4            |          | 4        |          |         | 1         |
| LAYED ACTION IN ABORTING TAKEOFF<br>ILED TO OBTAIN/MAINTAIN FLYING SPEED   |               |          |          |              |          | •        | 4        |         | 4         |
| -3. THE SPEED  |               |          |          | 1            |          | 1        |          |         |           |
|  |               |          |          | 1            |          | i        | 1<br>1   |         | 1         |

| CAU  | ISE/FACT | IOK INDE | •     |        |         |          |       |            |          |         |       |         |
|--|----------|----------|-------|--------|---------|----------|-------|------------|----------|---------|-------|---------|
| TABLE A-11 CONTINUED   | FA       | TAL ACCI | DENTS |        | NONFA   | TAL ACCI | DENTS | - <b>-</b> | AL       | L ACCID | NTS   |         |
| DUAL STUDENT (CONTINUED)   |          | FACTOR   | TOTA  | <br>L  |         | FACTOR   | TOTA  | L          | CAUSE    | FACTOR  | TOT A | L<br>   |
|  |          |          |       |        |         |          |       |            |          |         |       |         |
|  |          |          |       |        |         |          | ,     | 17         | 17       |         | !     | 17      |
|  |          |          |       |        | 17      |          |       | 5          | 5        |         |       | 5<br>1  |
| IMPROPER OPERATION OF POWERPLANT + POWERPLANT CONTROLS   |          |          |       |        | 5       | 1        |       | 1          |          | 1<br>1  |       | 11      |
| IMPROPER OPERATION OF POMERPLANT + PUMERPLANT<br>INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING<br>INADEQUATE PREFLIGHT AIRCRAFT   |          |          |       |        | 10      | 1        |       | 11         | 10<br>1  | -       |       | 1       |
| INADEQUATE PREFIGHT WITH AIRCRAFT  |          |          |       |        | ì       |          |       | 1          |          | _       |       | 37      |
| MISMANAGMENT OF FUEL SPONTANEOUS-IMPROPER ACTION   |          |          |       |        | 35      | 2        |       | 37         | 35       | 2       |       | 21      |
| SPONTANEOUS-INPROPER ASSESSMENT  |          |          |       |        | 33      | _        |       |            |          |         |       |         |
| SUBTOTAL   |          |          |       |        |         |          |       |            |          |         |       | _       |
| ** PERSONNEL **  |          |          |       |        | 2       | 1        |       | 3          | 2<br>7   | 1       |       | 3<br>10 |
| FLIGHT INSTRUCTOR  |          |          |       |        | 7       | 3        | '     | 10         |          |         |       | 46      |
| INADEQUATE SUPERVISION OF STUDENT  |          |          |       |        | 41      |          |       | 41         | 46       |         | 2     | 22      |
| INADEDUALE IRAIN TO THE PROPERTY ON  | 9        |          |       | 5<br>3 | 17      | Z        |       | 19         | 20<br>9  |         | 2     | 11      |
|  | 1        | 3        |       | -      | 9       | ž        | 2     | 11<br>25   | 24       |         | 2     | 26      |
| IMPROPER HAINTENANCED AIRCRAFT (GROUND CREW)   |          | 1        |       | 1      | 23<br>9 |          |       | 9          | 11       |         | 1     | 11      |
| IMPROPERLY SERVICED AIRCRAFT (OWNER-PILOT)   | L)       | 2        |       | 2<br>1 | 3       |          | _     | 3          | 3<br>284 |         | 6     | 300     |
| IMPROPERLY SERVICED AIRCRAFT(ONNER-PILOT) IMPROPERLY SERVICED AIRCRAFT(MAINTENANCE PERSONNE) INADEQUATE INSPECTION OF ACTIONNER-PILOT PERSONNEL)   | ,        | .5       | 1     | 29     | 259     |          | 2     | 271<br>2   | 207      |         |       | 2       |
| INADEQUATE INSPECTION OF AIRCRAFT(MAINTENANCE) INADEQUATE INSPECTION OF ACFT(OWNER-PILOT PERSONNEL) INADEQUATE MAINTENANCE AND INSPECTION  | 2        |          |       |        | 2       | :        |       | -          | 1        | l       |       | 1       |
| INADEQUATE MATRICE   |          | 1        |       | 1      |         |          |       |            |          |         | 1     | 1       |
| OTHER UNK/NR UNK/NR  |          |          | 1     | 1      |         | _        |       | ı          | 1        | ı       |       | 1       |
|  |          |          | -     |        |         | l<br>l   | ı     | ž          |          | 1       | 1     | 2       |
|  | ,        |          |       |        |         | 1        | •     |            |          | 1       | 1     | 2       |
|  |          | _        |       | 1      |         |          | ì     | 1          |          | 1       | •     | 1       |
| WEATHER PERSONNEL  |          | 1        |       | ĭ      |         |          |       | 1          |          | 1       |       | 1       |
| INCORRECT WEATHER FORMAT   |          | •        |       |        |         | 1        |       | -          |          |         |       | 1       |
|  |          |          |       |        |         | 1        |       | 1          |          | 1       |       |         |
| TRAFFIC CONTROL PERSONNEL TRAFFIC CONTROL PERSONNEL  |          |          |       |        |         | _        |       | •          |          | 2       |       |         |
| FAILURE TO ADVISE OF TRANSPORT   |          |          |       |        |         | 2        | 1     | 2          |          | -       | 1     |         |
| ATRONKI SUPERVISOR CACILITIES  |          |          |       |        |         | i        | î     | 2          |          | 1       | 1     |         |
| IMPROPER MAINTENANCE-AIRPORT FACILITIES  |          |          |       |        |         | •        | 1     | 1          |          |         |       |         |
| FAILURE TO NOTIFY OF SKELLITTES IMPROPER INSPECTION OF FACILITIES  |          |          |       |        |         |          |       |            |          |         |       |         |
|  |          |          |       |        |         |          |       | 5          |          | 6       | 2     |         |
| OTHER AIRMAYS FACILITIES PERSONNEL PRODUCTION-DESIGN PRODUCTION-DE |          | 1        |       | 1      |         | 5        | 2     | 8          |          | 7       | í     |         |
|  |          | 1        |       | i      |         | 3        | l     | 4          |          | 7       | _     |         |
| POOR/ INADEQUATE DESCON  |          | 1        |       |        |         | 4        | 1     | 5          | j        | 4       | 1     |         |
| OTHER<br>MISCELLANEOUS-PERSONNEL   |          |          |       |        |         | ĭ        | -     | ı          |          | 1<br>2  |       |         |
| PASSENGER  |          |          |       |        |         | 2        |       | 2          |          | -       |       |         |
| OTHER  |          |          |       |        |         |          |       |            |          |         |       |         |
| DIRECT ENTRIES THIRD PILOT   |          |          |       |        |         |          |       |            |          |         |       |         |
| FLIGHT ENGINEER  |          |          |       |        |         |          | 31    | 43         | 1        | 442     | 37    | 4       |
| DISPATCHING  |          | 42       | 6     | 4      | 8       | 400      | 31    | 77.        | •        |         |       |         |
| SUBTOTAL   |          |          |       |        |         |          |       |            |          |         |       |         |
| ** AIRFRAME **   |          |          |       |        |         |          |       |            |          | 1       |       |         |
|  |          | 1        |       |        | 1       |          |       |            |          |         |       |         |
| WINGS<br>Bracing wires, struts   |          | -        |       |        |         | 1        |       |            | 1        | 1       |       |         |
| FUSELAGE CANDOTES  |          |          |       |        |         | •        |       |            |          | 1       |       |         |
| WINDSHIELDS, WINDOWS, CAROLICE   |          |          |       |        |         | 1        |       |            | 1        | •       |       |         |
| LANDING GEAR NORMAL RETRACTION/EXTENSION ASSEMBLY  |          |          |       |        | _       |          |       |            |          | 1       |       |         |
| NORMAL RETRACTIONIZATES  |          | 1        |       |        | 1       |          |       |            |          | 4       |       |         |
| FLIGHT CONTROL SURFACES ATTACHMENTS  |          | •        |       |        | 2       | 2        |       |            | Ż        | -       |       |         |
| SUBTOTAL   |          | 2        |       |        | _       |          |       |            |          |         |       |         |
|  |          |          |       |        |         |          |       |            |          |         |       |         |
| ** POWERPLANT **   |          |          |       |        |         | 6        | 1     | ı          | 6<br>55  | 6<br>56 | 1     |         |
| ENGINE STRUCTURE   |          | 2        |       |        | 2       | 54<br>80 | 1     | •          | 80       | 86      |       |         |
| CRANKGASE_   |          | 6        |       |        | 6       | 30       |       |            |          |         |       |         |
| CRANKSHAFT<br>Master and connecting rods   |          |          |       |        |         |          |       |            |          |         |       |         |
| MAN STATE ST |          |          |       |        |         |          |       |            |          |         |       |         |

#### TABLE A-11 CONTINUED

#### POWERPLANT (CONTINUED)

#### CAUSE/FACTOR TABLE

|   | EATAL ACCOUNTS |        |        |          |          |           |           | APPENDIX A |          |  |  |  |
|---|----------------|--------|--------|----------|----------|-----------|-----------|------------|----------|--|--|--|
|   |                |        |        | NONE.    | ATAL ACC | IDENTS    | A(        | L ACCID    |          |  |  |  |
|   | CAUSE          | FACTOR | TOTAL  | CAUSE    | FACTOR   | TOTAL     | CAUSE     | FACTOR     | TOTAL    |  |  |  |
| CYLINDER ASSEMBLY   |                |        |        |          |          |           |           |            |          |  |  |  |
| PISTON PISTON RINGS   | 3              | 1      | 4      |          |          |           |           |            |          |  |  |  |
|   | 6              | ī      | 7      | 67<br>62 | _        | 67        | 70        | 1          | 71       |  |  |  |
| BLOWER, IMPELLER ASSEMBLY<br>MOUNT AND VIBRATION ISOLATORS<br>OTHER | 6              |        | 6      | 123      | 1<br>1   | 63        | 68        | 2          | 70       |  |  |  |
|   |                |        |        | 14       | •        | 124<br>14 | 129<br>14 | 1          | 130      |  |  |  |
| IGNITION SYSTEM MAGNETOES   | 5              |        | 5      | 1<br>36  |          | ī         | 1         |            | 14       |  |  |  |
| DISTRIBUTOR   | 6              |        |        | 36       |          | 36        | 41        |            | 1<br>41  |  |  |  |
| SPARK PLUG  | 0<br>1         | 1      | 7      | 55       | 1        | 56        |           |            | •        |  |  |  |
| COILS<br>LOW TENSION WIRING   | ě              | 1      | 1<br>9 | 1        |          | 1         | 61<br>2   | 2          | 63       |  |  |  |
| MIGH TENSION OTRING   |                |        | •      | 41<br>1  | 3        | 44        | 49        | 4          | 2<br>53  |  |  |  |
| IGHT (UN MARNECS, CUTCLETO,   |                |        |        | ž        |          | 1 2       | 1 2       |            | ĩ        |  |  |  |
| SWITCHES SHIELDING  |                |        |        | 1        |          | ī         | 1         |            | 2        |  |  |  |
| OTHER   |                |        |        | 7        | 1        | 8         | 7         | 1          | 1<br>6   |  |  |  |
| FUEL SYSTEM   | 1              |        | 1      | 3        |          | 3<br>3    | 3         |            | 3        |  |  |  |
| TANKS<br>LINES AND FITTINGS   |                |        |        | 2        |          | ž         | 2         |            | 4        |  |  |  |
| SELFILIER VALUES  |                |        |        | 11       | 4        |           |           |            | 2        |  |  |  |
| FILIERS STRATMENT CONS  | 3 4            |        | 3      | 29       | ž        | 15<br>31  | 11        | 4          | 15       |  |  |  |
| PRIMING SYSTEM CARBURETOR   | 2              |        | 4 2    | 21<br>14 | 2        | 23        | 32<br>25  | 2          | 34       |  |  |  |
| PUMPS   | 2              |        | 5      | 14       | 1        | 15        | 16        | í          | 27<br>17 |  |  |  |
| FUEL INJECTION CVCTCA   | 10<br>6        |        | 10     | 89       | 1        | 90        | 4         |            | 4        |  |  |  |
| TENTISH DRAIMS. TANK game   | ă ă            |        | 6      | 21       | -        | 21        | 99<br>27  | 1          | 100      |  |  |  |
| RAM AIR ASSEMBLY  | 1              |        | ì      | 12<br>38 | 1        | 13        | 16        | 1          | 27       |  |  |  |
| LUBRICATING SYCTEM  | •              |        |        | 6        | 8        | 46        | 39        | ė          | 17<br>47 |  |  |  |
| LINES, HOSES, FITTINGS  | 1              |        | 1      | 6        |          | 6<br>6    | 6         |            | 6        |  |  |  |
|   |                |        |        |          |          | •         | 7         |            | 7        |  |  |  |
| FILTERS, SCREENS<br>PUMP-PRESSURE                                   |                |        |        | 18<br>2  | 1        | 19        | 18        | 1          | 19       |  |  |  |
| PUMPS-SCAVENGED   |                |        |        | ě        |          | 8         | 2         | -          | 2        |  |  |  |
| DIC COULERS   |                |        |        | 5        |          | 5         | . 5       |            | 8        |  |  |  |
| MAGNETIC PLUGS<br>SEALS AND GASKETS                                 |                |        |        | 2        |          | 2         | . 2       |            | 5        |  |  |  |
| UINEK   |                |        |        | ī        |          | 4         | 4         |            | 2<br>4   |  |  |  |
| COOLING SYSTEM  |                |        |        | 11       |          | 11        | 1<br>11   |            | 1        |  |  |  |
| BAFFLES<br>OTHER  |                |        |        | 13       | 1        | 14        | 13        | 1          | 11       |  |  |  |
| PROPELLER AND ACCESSORIES   |                |        |        | 1        |          |           |           | •          | 14       |  |  |  |
|   |                |        |        | ī        |          | 1         | 1<br>1    |            | 1        |  |  |  |
| HYDRAULIC PITCH CONTROL MECHANISM                                   |                |        |        |          |          | -         | •         |            | 1        |  |  |  |
| EXHAUST SYSTEM  | ı              |        |        | 1<br>1   |          | 1         | 1         |            | 1        |  |  |  |
| MANIFOLDS   | •              |        | 1      | ž        |          | 1 2       | 1<br>3    |            | 1        |  |  |  |
| MUFFLERS<br>Gaskets   |                |        |        | •        |          |           | •         |            | 3        |  |  |  |
| STACKS  | 1              |        | 1      | 3<br>14  | 1        | 3         | 3         |            | 3        |  |  |  |
| BAFFLES   |                |        |        | 1        | •        | 15<br>1   | 15        | 1          | 16       |  |  |  |
| ENGINE ACCESSORIES  |                |        |        | 6        |          | 6         | 1<br>6    |            | 1        |  |  |  |
| STARTERS<br>OTHER   |                |        |        | 3        |          | 3         | 3         |            | 6<br>3   |  |  |  |
| ENGINE CONTROLS COCKO   |                |        |        | 1        |          | 1         |           |            | 3        |  |  |  |
|   |                |        |        | 1        |          | 1         | 1<br>1    |            | 1        |  |  |  |
| MIXTURE CONTROL ASSEMBLIES  | 1              |        | 1      | 28       |          |           | •         |            | 1        |  |  |  |
| INDUCTION AIR, PREHEAT CONTROLS                                     | 1              |        | ī      | 15       | ı        | 29        | 29        | 1          | 30       |  |  |  |
| OHERPLANT-INSTRUMENTS   |                |        |        | 6        |          | 15<br>6   | 16        |            | 16       |  |  |  |
| FUEL QUANTITY GAUGE   |                |        |        | 1        |          | ĭ         | 6<br>1    |            | 6        |  |  |  |
| BIRD INGESTION  |                | 1      | 1      | 4        | 40       |           |           |            | 1        |  |  |  |
| FUREIGN DRIECT DANAGE   |                |        |        |          | 70       | 44        | 4         | 41         | 45       |  |  |  |
| COMPRESSOR STALLS<br>DETONATION                                     |                |        |        | 2        |          | 2         | ż         |            |          |  |  |  |
| OTHER   |                |        |        | 1        |          | 1         | 1         |            | 2<br>1   |  |  |  |
| DIRECT ENTRIES  | 1              |        |        | 6        |          | 1         | 1         |            | i        |  |  |  |
| DUCTION GEAR ACCEMBLY   | ż              |        | 1<br>2 | 1        |          | 1         | 6 2       |            | 6        |  |  |  |
| GEARS, ACCESSORY DRIVE  |                |        | -      | 40       | 1 4      | <b>+1</b> | , 1       | 1 4        | 3        |  |  |  |
|   |                |        |        | 4        |          | 4         |           | 7          | -        |  |  |  |
|   |                |        |        | 1        |          | ĭ         | 4         |            | 4        |  |  |  |
|   |                |        |        |          |          | -         | 1         | 1          |          |  |  |  |

TABLE A-11 CONTINUED

#### CAUSE/FACTOR TABLE

| TABLE A-11 CONTINUED  | CAUSERIA | -         |       |         |            |           |             |           | 4 <b>T</b> C |
|---|----------|-----------|-------|---------|------------|-----------|-------------|-----------|--------------|
| POWERPLANT (CONTINUED)  |          | FAL ACCIO | DENTS |         | TAL ACCIO  |           |             | L ACCIDEN |              |
|   | CAUSE    | FACTOR    | TOTAL | CAUSE   | FACTOR     | TOTAL     | CAUSE       | FACTOR    | TOTAL        |
| COMPRESSOR ASSEMBLY .<br>OTHER  | 1        |           | ı     |         |            |           | 1           |           | 1            |
| COMBUSTION ASSEMBLY TURBINE ASSEMBLY ACCESSORY DAIVE ASSEMBLY LUBRICATING SYSTEM FUEL SYSTEM  |          |           |       | 1       |            | ı         | 1           |           | 1            |
| OTHER SAFETY SYSTEM IGNITION SYSTEM TORQUEMETER AIR BLEED   |          |           |       |         |            |           |             |           |              |
| EXHAUST SYSTEM<br>Thrust reverser   |          |           |       | 1       |            | 1         | 1           |           | 1            |
| OTHER<br>PROPELLER SYSTEM   |          |           |       | 1       |            | 1         | 1           |           | 1            |
| GOVERNOR<br>CONSTANT SPEED DRIVE  |          |           |       | 1       |            | 1         | 1           |           | 1            |
| GOVERNOR VALVE POWER LEVER CABLE PROPELLER LEVER  |          |           |       | 1       |            | 1         | 1           |           | 1            |
| REVERSE THRUST LEVER ENGINE INDICATING EQUIPMENT TACHDHETER ENGINE INSTALLATION   |          |           |       | 1       |            | 1         | 1 1108      | 77        | 1<br>1185    |
| SUBTOTAL  | 85       | 5         | 90    | 1023    | 72         | 1095      | 1108        | а         | 3107         |
| ** SYSTEMS **   |          |           |       |         |            |           |             |           |              |
| ELECTRICAL SYSTEM BATTERIES GENERATORS/ALTERNATORS HUMBAULIC SYSTEM   |          |           |       | 1       | 1          | 1         | 1           | ı         | 1            |
| FLIGHT CONTROL SYSTEMS ANTI-ICHMG, DE-ICHMG SYSTEMS CARBURETOR DE-ICHMG SYSTEM  |          |           |       | 14<br>1 | ,          | 14<br>1   | 14<br>1     |           | 14<br>1      |
| AIR CONDITION, HEATING AND PRESSURIZATION CABIN TEMP CONTROL AND TEMP INDICATING SYSTEM AUTO PILOT FIRE WARNING SYSTEM FIRE EXTINGUISHER SYSTEM |          |           | 1 1   |         |            |           |             | 1         | . 1          |
| DYGEN SYSTEM<br>OTHER SYSTEMS   |          |           | 1 1   | 16      | 6 l        | 17        | 16          | s 2       | 2 18         |
| SUBTOTAL  ** INSTRUMENTS/EQUIPMENT AND ACCESSORIES **   |          |           |       |         |            |           |             |           |              |
| ## INSTRUMENTS/EQUIPMENT AND ACCESSIONED FLIGHT AND NAVIGATION INSTRUMENTS  |          |           |       |         | 1          | , 1       | 1           | l.        | 1            |
| COMPASS COMPANDATIONS AND NAVIGATION EQUIPMENT  |          |           |       |         | 1 3        | 3 4       | 1           | 1 3       | 3 4          |
| TRANSMITTERS AND/OR RELEIVERS<br>VOR RECEIVERS<br>Compass receivers   |          | 1         | 1     | , ;     | i 3<br>i 1 | 3 4<br>1  | 1<br>2<br>1 | 2         | 3 4<br>1 2   |
| OTHER MISCELLANEOUS EQUIPMENT SPRAY, DUSTING EQUIPMENT  |          |           |       |         | 1          | 1<br>7 13 |             | 1<br>7    | 1<br>7 14    |
| SUBTOTAL  |          | 1         | 1     | 1       | 6 7        | 7 13      |             |           | 4.           |
| ** AIRPORTS/AIRWAYS/FACILITIES **   |          |           |       |         |            |           |             |           |              |
| AIRPORT FACILITIES AIRPORT CONDITIONS   |          |           |       |         | 1          | 1 2       |             | 1         | 1 4          |
| SNOW ON RUNMAY AIRMAYS FACILITIES SUBTOTAL  |          |           |       |         | ı          | 1 2       | · ·         | 1         | 1            |
| gwa, 94 m   |          |           |       |         |            |           |             |           |              |

# TABLE A-11 CONTINUED WEATHER (CONTINUED)

#### CAUSE/FACTOR TABLE

| ASSESSED TO THOSE OF THE PARTY | FAT     | TAL ACCI | DENTS   | Norm    |          |           |           | AF        | PENDTX A  |
|---|---------|----------|---------|---------|----------|-----------|-----------|-----------|-----------|
|   |         |          |         | NUNF    | ATAL ACC | IDENTS    | At        | L ACCID   | NTS       |
|   | CAUSE   | FACTOR   | TOTAL   | CAUSE   | FACTOR   | TOTAL     | CAUSE     | FACTOR    | TOTAL     |
| ** WEATHER **   |         |          |         |         |          |           |           |           |           |
| LOW CEILING<br>Rain   |         |          |         |         |          |           |           |           |           |
| FDG<br>Sndw   | 1       | 11<br>4  | 12<br>4 | 2<br>2  | 24       | 26        | 3         | 35        | 38        |
| ICING CONDITIONS that were  | 1<br>2  | 3<br>3   | 4 5     | 3       | 15       | 11<br>18  | 2<br>4    | 13<br>18  | 15<br>22  |
| UNFAVORABLE WIND COMPLETE THOUGHTON SYSTEM ICING  | 4       | 2        | 6       | 8       | 6<br>13  | 6<br>21   | 2         | 9         | 11        |
| TURBULENCE, ASSOCIATED MACIDIDE   | ,       | 8<br>1   | 17<br>1 | 131     | 98<br>8  | 229       | 12<br>140 | 15<br>106 | 27<br>245 |
| ADVERSE HINDS ALOST   |         | 1        | 1       |         | i        | 8<br>1    |           | 9         | 9         |
| HIGH TEMPERATURE OBSTRUCTIONS TO VISION   |         | _        |         | 1       | 4        | 1 4       | 1         | _         | 1         |
| MICH DENSITY ALTITUME   |         | 2<br>1   | 2<br>1  |         |          |           |           | 4<br>2    | 4<br>2    |
| THUNDERSTORM ACTIVITY OTHER   |         | 1        | 1       | 1       | · 6      | 6         | 1         | 7         | 7         |
| FURTOTAL  |         | 1        | 1       |         | 4        | 4         | •         | 6<br>5    | 7<br>5    |
| SUBTOTAL  | 17      | 38       | 55      |         |          | 1         |           | 1         | 1         |
| ** MISCELLANEOUS **   |         |          | ,,      | 148     | 194      | 342       | 165       | 232       | 397       |
| BIRD COLLISION  |         |          |         |         |          |           |           |           |           |
| EVASIVE MANEUVER TO AVOID COLLISION<br>UNQUALIFIED PERSON OPERATED AIRCRAFT   |         |          |         | 1       |          | 1         | 1         |           | _         |
| SABOTAGE FOREIGN MATERIAL AFFECTING NORMAL OPERATIONS DIRECT ENTRIES  |         |          |         | 1<br>5  | 4        | 1<br>9    | i         |           | 1         |
| DIRECT ENTRIES  | 9       |          | 9       | 102     | 4        | 1         | ī         | 4         | 9<br>1    |
| SUBTOTAL  | 1       |          | 1       | 5       | 7        | 106<br>5  | 111       | 4         | 115       |
|   | 10      |          | 10      | 115     | 8        | 123       | 125       | •         | -         |
| GRAND TOTAL   | 744     |          |         |         |          |           | 123       | 8         | 133       |
| ** MISCELLANEOUS ACTS, CONDITIONS **  | 364     | 61       | 425     | 4030    | 384      | 4414      | 4394      | 445       | 4839      |
| ANTI-ICING/DEICING EQUIP-IMPROPER OPER. OF/FAILED TO USE  |         |          |         |         |          |           | •         |           |           |
| CREW COORD INAT TON-DOOR  | 16<br>1 | 1        | 16      | 388     | 4        | 392       | 404       | 4         | 400       |
| VIONEGARD DE GOOD OBERATIVA   | i       | •        | 2<br>1  | 4       | 10       | 14        | 5         | ıĭ        | 408<br>16 |
| IMPROPER EMERGENCY PROCEDURES FEATHERED WRONG ENGINE  | 6       | 2        | 8       | 1       | 1        | 2         | 1<br>1    | 1         | 1 2       |
| INSTRUMENTS-MISREAD OR FAILED TO READ   | 1       | _        | ĭ       | 8       | 12       | 20        | 14<br>1   | 14        | 28        |
| NO! ALLIGNED WITH DEPURANCE   |         |          |         |         | 2<br>1   | 2         |           | 2         | . 1       |
| INATTENTIVE TO SUS  |         |          |         |         | 2        | 1<br>2    |           | 1 2       | 1 2       |
| POORLY PLANNED APPROACH MISCALCULATED FUEL CONSUMPTION  | 13      | 1        | 14      | 115     | 4<br>26  | 4<br>141  | 140       | 4         | 4         |
|   | 3       | 2        | 5       | 1<br>70 | 6<br>17  | 7<br>87   | 128<br>1  | 27<br>6   | 155<br>7  |
| STOLEN OR UNAUTHORIZED USE OF AIRCRAFT IMPROPERLY SECURED   | 1       | 2        | 3       |         | 8        | 87        | 73        | 19<br>8   | 92<br>8   |
| BUGUS PART<br>ELECTRICAL FAILURE  | 4       | -        | 4       | 37      | 5<br>3   | 5<br>40   | 41        | 7         | ā         |
| ENGINE LDADED UP<br>FATIGUE FRACTURE  |         |          |         | 3<br>4  | 3        | 3         | 3         | 3         | 44        |
| FUEL GRADE-INDROGED   | 1<br>5  |          | 1<br>5  | 96      | 14       | 110       | 4<br>97   | 3<br>14   | 7<br>111  |
| RPM-UNCONTROLLABLE CONTROLLABLE SYSTEM  |         |          | •       | 44<br>7 | 1        | 45<br>7   | 49<br>7   | ì         | 50        |
| WINDSHIELD, DIRTY, FOGGY, ETC-RESTRICTED VISION WRONG PART  |         |          |         | 2       | 2        | 2         | ź         |           | 7<br>2    |
| IMPROPER ALIGNMENT (AC MISTURE)   |         | 1        | 1       | _       | 2        | 2         |           | 2<br>3    | 2         |
| FAILURE OF TWO OR MORE ENGINES SEPARATION IN FLIGHT   | 4       | _        | 4       | 1<br>18 | 1        | 1<br>19   | 1<br>22   | 1         | 2         |
| FIRE IN ENGINE  | •       | 8<br>1   | 15<br>1 | 21<br>1 | 53<br>11 | 74        | 28        | 1<br>61   | 23<br>89  |
| CORRODED/CORROSION<br>CONGESTED TRAFFIC-PATTERN   | 1       |          | i       | 2       | 11<br>2  | 12<br>4   | 1         | 12<br>2   | 13        |
| PILOT FATIGUE<br>FUEL EXHAUSTION  | -       | 2        | 1<br>2  | 6       | 1        | 7         | 7         | 1         | .5<br>8   |
| FUEL CONTAMINATION SUSTINATION  | 1<br>44 | 1        | 1<br>45 | 766     | 3        | 1<br>3    | 1         | 2<br>3    | 3         |
| ALCOHOLIC IMPAIRMENT OF EFFICIENCY AND JUDGMENT<br>CARBON MONOXIDE POISDNING  | 1<br>5  |          | 1       | 60      | 2        | 766<br>62 | 810<br>61 | 1         | 811       |
|   | -       | 2<br>1   | 7       | 4       |          | 4         | 9         | 2<br>2    | 63<br>11  |
|   |         |          |         |         |          |           |           | 1         | 1         |

CAUSE/FACTOR TABLE

APPENDIX À

| •  | CAUSE/FACT | OR TABLE |    |          |          |         |          |          |            | •          |
|--|------------|----------|----|----------|----------|---------|----------|----------|------------|------------|
| TABLE A-11 CONTINUED MISCELLANEOUS ACTS, CONDITIONS (CONTINUED)  |            | AL ACCID |    | <u>.</u> | NONFAT   | AL ACCI | DENTS    |          |            |            |
| MISCELLANEOUS ROTO, COM  |            | FACTOR   |    |          | AUSE     | FACTOR  | TOTAL    | CAUSE    | FACTOR     | TOTAL      |
|  |            |          |    |          | 10       | 2       | 12       | 11       | 2          | 13<br>6    |
|  | 1          |          | 1  |          | 5        |         | 5<br>331 | 6<br>340 | 7          | 347        |
| ICE-IN FUEL .  | 1<br>16    |          | 16 |          | 324<br>1 | 7       | î        | 1        | 4          | 9          |
| tec_ENGINE   | ••         |          |    |          | 5        | 4       | 9        | 5<br>1   | -          | 1          |
| ICE-CARBURETOR<br>ICE-PROPELLER  |            |          |    |          | ĩ        | _       | 1 2      | ì        | 5          | 6          |
| . TREDAME ICE  | 1          | 3        | 4  | 4        |          | 2       | 11       | 11       | 1          | 12         |
| tre-windsmittu uetcut-and/OR CG  | i          | -        |    | 1        | 10<br>54 | 1 2     | 56       | 58       | 2          | 60<br>2    |
| IMPROPERLY LOADED AIRCRAFT TO PART, NOT SYSTEM LACK OF LUBRICATION SPECIFIC PART, NOT SYSTEM                                     | 4          |          | •  | 4        | 2        | _       | 2        | 5        |            | 5          |
| LACK OF LUCKING LURRICATION SYSTEM   |            |          |    |          | 5        |         | 5<br>4   | 3        |            | . 4        |
| ATI EXHAUSTION-FROM  |            |          |    |          | 3        | 1 5     | 187      | 189      | ,          |            |
| OIL CONTAMINALIUM  | 7          |          |    | 7        | 182      | 19      | - : -    |          | 23         | , 23       |
| FUEL SIPHONING   | •          | 4        |    | 4        | 4        |         | 4        | 1        | •          | 5 20       |
| WATER IN FUEL AIRCRAFT CAME TO REST IN WATER   |            |          | ,  | 3        | 14       | 3       |          |          |            | 6          |
| FROZEN, MOISTURE   | 1          | . 2      | •  | í        |          | 5       | . 5<br>1 |          | 1.         | 1<br>2 493 |
|  |            |          |    |          | 1<br>463 | 11      | 474      | , 48     |            | 2 822      |
| TOUCH AND GO LANDING   | 1          | -        |    | 19<br>75 | 747      |         | 747      |          |            | 1 41       |
| OVERLOAD FAILURE<br>HATERIAL FAILURE   | 7          | 3<br>5   | 2  | 5        | 35       |         | 1 1      | , 2      | 1          | 7 45       |
| FUEL STARVALIUM  |            | 3        |    | .3       | 18<br>30 |         | 5 3      | 5 3      | 18<br>1    | í i        |
| DIL STARVALION COANCE  |            | В        | 2  | 10       | ĩ        |         |          | 1<br>7   | 5          | 2 7        |
| IMPROPER CLEARANCE-TULERANCE IMPROPER CLEARANCE TOLERANCE FUEL SELECTOR POSITIONED BETWEEN TANKS FUEL SELECTOR POSITIONED ORIGIN |            |          |    |          | 5        |         |          | 8        | 5          | 3 8<br>1 1 |
|  |            |          |    |          | 5        |         |          | 1        |            | 1 1        |
| FIRE OF UNDERSIGNATION UNAPPROVED MODIFICATION IMPROPER/INADEQUATE VENTING   |            |          |    |          | 2        |         |          | 2        | 2<br>5     | 3 8        |
| ACTION, LACK OF  |            |          |    |          | 5        |         | 3        | 8<br>26  | <b>2</b> 5 | 4 29       |
| PROB MELD  |            | 3        |    | 3        | 22       | •       | 2        | 2        |            | 2 2        |
| PREVIOUS DAMAGE  |            | •        |    | _        |          |         | •        |          | 1          | ż          |
| LEAK/LEAKAGE<br>Low fluid level  |            | 1        |    | ı        | 7        | 7       |          | 7        | 7          | 5 5        |
| ARC ING  |            |          | 1  | 1        |          |         | 4        | 4<br>27  | 29         | 4 33       |
| LOW COMPRESSION  |            | 5        | î  | 6        | 2        |         | 3        | i        | l          | ,<br>1     |
| naunu 1ND  |            | •        |    |          |          | 1<br>1  |          | 1        | 1<br>33    | 3 30       |
| CARBON DEPOSITS OVER TORQUED   |            |          |    | 6        | 2        |         | 3        | 30<br>3  | 3          |            |
| THE TRECHED  |            | 6        |    |          |          | 3       | 1        | 6        | В          | 1 1        |
| LOOSE, PART/FITTING  |            | 3        |    | 3        |          | 5<br>11 | ż        | 13       | 11         | 3 1        |
| BENT   |            |          | 1  | 1        |          | 2       | 2        | 6        | 6          | 1          |
| BINDING<br>Burned  |            | ì        |    | ī        |          | 5       | 1        |          | 1          | •          |
| CHAFFED  |            | i        |    | 1        |          | 4       | 1        | 5        | .5         | 2<br>2 1   |
| COLLAPSED  |            | ì        | 1  | 2<br>1   |          | 13      | 1        | 14<br>5  | 13         |            |
| CROSSED<br>Deteriorated  |            | 1        | 1  | ī        |          | 5       | 14       | 16       | 2          | 14         |
| DISCONNECTED   |            | •        |    |          |          | 2<br>1  | 14       | 1        | 1<br>5     |            |
| EXCESSIVE  |            |          |    |          |          | 5       |          | 5<br>1   | í          |            |
| ERRATIC<br>Friction, excessive   |            |          |    |          |          | 1       | 3        | 29       | 27         | 4          |
|  |            | ì        | 1  | 2        |          | 26<br>4 | •        | 4        | 4          | 1          |
| GROUNDED<br>HIGH VOLTAGE BREAKDOWN<br>IMPROPERLY INSTALLED   |            |          |    | 1        |          | 21      |          | 21       | 21         | i          |
| JAMMED   |            |          | 1  | •        |          |         | 1        | 1        | 1          | 2          |
| OBSTRUCTED   |            |          |    |          |          | 1       | 2<br>1   | 15       | 14         | 1          |
| GPEN   |            |          |    |          |          | 14<br>1 | •        | 1        | 1          |            |
| OUT OF BALANCE   |            |          |    |          |          | 4       |          | . 4      | 11         | 1          |
| OVERHEATED<br>PINCHED  |            |          |    |          |          | 11      | 1        | 12<br>11 | 9          | 2          |
| POPERETVE PRESSURE   |            |          |    |          | _        | 9       | 2        | 2        | 4          |            |
| PRESSURE TOO FOW   |            | 2        |    |          | 2        | 2<br>6  |          | 6        | 8<br>8     | 2          |
| PRESSURE: NUNE   |            | 2        |    | 4        | 2        | 8       | 2        | 10<br>1  | î          |            |
| SCORED<br>SHEARED  |            |          |    |          |          | 1       | 3        | 13       | 11         | 3          |
| STICKING   |            | 1        |    |          | 1        | 10<br>4 | 4        | 8        | 6          | 4          |
| STRIPPED   |            | 2        |    |          | 2        | 4       | 4        | 6<br>1   | i i        | •          |
| STUCK<br>EXCESSIVE TEMPERATURE   |            |          |    |          |          | 1       |          | i        | 2          |            |
| VIBRATION, EXCESSIVE   |            | 1        |    |          | 1        | 1       |          |          |            |            |
| WARPED<br>ICE-INDUCTION  |            |          |    |          |          |         |          |          |            |            |
| IPE-TUDOC LESS.  |            | 144      |    |          |          |         |          |          |            |            |

DIRECT ENTRY CAUSES (CONTINUED)

#### DIRECT ENTRY CAUSES

PMR PLT-LEFT ENGINE COUNTERWEIGHT ATTACHMENT FAILD COPILOT-INADVERTENTLY MOVD PMR LVRS TO CUTOFF. PMR PLT-FUEL EXHAUSTION FOR UNK CAUSE. PMR PLT-FUEL PRESSURE DROPPED TO ZERO, CAUSE UNDITED PMR PLT-FUEL PRESSURE DROPPED TO ZERO, CAUSE UNDITED PMR PLT-FUEL STARVATION FOR UNDETERMINED CAUSE. PMR PLT-FUEL STARVATION FOR UNDETERMINED CAUSE. PMR PLT-FUEL STARVATION FOR UNDETERMINED CAUSE UNDITED PMR PLT-FUEL STARVATION FOR UNDETERMINED CAUSE. PMR PLT-EVEL STARVATION FOR UNDETERMINED CAUSE UNDITED PMR PLT-CAM REDUCTION GEAR FAILED. PLOT INADVERTENTLY TURNED OFF FUEL. PLOT INDEX SEVENT FOR ANY OFF FUEL. PLOT INDEX SEVENT FOR ANY OF FUEL. PLOT INDEX SEVENT FUEL CONSUMPTION. CAUSE UNDETERN PMR PLT-NO GASKET, NO. 3. CYLINDER ROCKER BOX COVER. PMR PLT-POSITIONED MITTURE CONTROL TO IDLE-CUT-OFF. PMR PLT-HORTITLE HOUSING BROKE FORWARD OF FIREWALL PMR PLT-FUEL SIPHONED OUT FROM DEFORMED TANK VENT. PMR PLT-SUSH ENTERED CARBURETOR AIR INTAKE SCOOP. PMR PLT-CARB FLOAT IPPROPERLY INSTALLED. STICKING. PMR PLT-ACELERATOR PUMP JAMMED BY DUST COVER. MISC. DESCENT WAS TOO STEEP PRECLUDING FUEL FLOW PILOT-INADVERTENTLY ACTUATED MIXTURE CONTROL PLOT INSTALLED. PMR PLT-FUEL SALVE FUEL CONSUMPTION. PMR PLT-ACTION FOR AIR STORMS FOR THE STORMS FOR THE STORMS FOR THE STORM FUEL SALVE FUEL CONSUMPTION. PMR PLT-EACESSIVE FUEL CONSUMPTION CAUSE UNDETERMINED. PMR PLT-EACH AND AND AIR STORMS FOR THE STORMS FO PILOT-INADVERTENTLY TURNED MAGNETO SWITCH OFF PWR PLT-CARBURETOR NEEDLE VALVE STUCK. PWR PLT-INTAKE MANIFOLD CRACKED. PWP PLT-INTAKE MANIFOLD CRACKED. PWP PLT-IMPROPERLY RIGGED MIXTURE CONTROL. PWR PLT-OIL STARVATION FOR UNDETERMINED REASON PILOT-INADVERTENTLY TURNED ENG OFF.

DIRECT ENTRY CAUSES ARE CARRIED UNDER THEIR APPROPRIATE CAUSAL CATEGORIES AND ARE INCLUDED IN THE TOTALS

#### APPENDIX B

# SINGLE-ENGINE FIXED-WING AIRCRAFT U. S. GENERAL AVIATION

ACCIDENTS, INJURIES
ENGINE FAILURE OR MALFUNCTION
AS A FIRST ACCIDENT TYPE
SINGLE ENGINE FIXED-WING AIRCRAFT
U. S. GENERAL AVIATION
1965 - 1969

INJURIES

A TOTAL ST

|       | 3855<br>29<br>267<br>5   | 3<br>14<br>2996                      | ABOARD 7169 | 3<br>15                          |  |
|-------|--|--------------------------------------|-------------|----------------------------------|--|
|       | 2480<br>13<br>176<br>4   | 3<br>6<br>1992                       | 4674        | N 60                             |  |
| MINOR | 848<br>4<br>52   | 3 566                                | 1473        | 1 6                              |  |
|       | 351<br>1<br>24   | 3<br>268                             | 647         | 2                                |  |
| FATAL | 176<br>11<br>15<br>1   | 2<br>170                             | 375         |                                  |  |
| ;     | PILOT<br>COPILOT<br>DUAL STUDENT<br>CHECK PILOT<br>FLIGHT ENGINEER | CABIN STENDANT EXTRA CREW PASSENGERS | TOTAL       | * OTHER AIRCRAFT<br>OTHER GROUND |  |

INVOLVES 3855 TOTAL ACCIDENTS
INVOLVES 208 FATAL ACCIDENTS

INJURIES CARRIED OPPOSITE OTHER-AIRCRAFT ARE INJURIES OCCURRING IN AIRCRAFT THAT ARE NOT PART OF THIS SUBJECT TABULATION, BUT WERE PART OF THE TOTAL INJURIES INVOLVED IN COLLISIONS BETWEEN AIRCRAFT.

149

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7187

CONSTRUCTION WORK

SCHEDULED PASSENGER SERVICE
SCHEDULED CARGO SERVICE
NONSCHEDULED/CHARTER REVENUE
MILITARY CONTRACT-PASSENGER
MILITARY CONTRACT-CARGO
CONTRACT/CHARTER-CARGO-DOMFST
CONTRACT/CHARTER-PASSENGER-DO
CONTRACT/CHARTER-CARGO-INTERN

KIND OF FLYING VS AIRCRAFT DAMAGE ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE SINGLE ENGINE, FIXED-WING AIRCRAFT U. S. GENERAL AVIATION 1965 - 1969

| KIND OF FLYING                | AIRCRAFT DAMAGE | RECORDS | ACCIDENTS |
|-------------------------------|-----------------|---------|-----------|
| INSTRUCTIONAL                 |                 | 270     | 270       |
| BUAL                          | 46 224          | 113     | 113       |
| SOLO                          | 10 103          | . 6     | 6         |
| CHECK                         | 1 5             | 166     | 166       |
| TRAINING                      | 16 150          |         |           |
| NONCOMMERCIAL                 |                 | 1898    | 1898      |
| PLEASURE                      | 361 1537        | 200     | 200       |
| PRACTICE                      | 19 181          | 429     | 429       |
| BUSINESS                      | 6) 368          | 7       | 7         |
| CORPORATE/EXECUTIVE           | 2 5             | 4       | , 4       |
| AERIAL SURVEY                 | 4               |         |           |
| COMPANY FLIGHT                |                 | 3       | 3         |
| OTHER                         | 1 2             |         |           |
| COMMERC IAL                   |                 | 210     | 210       |
| AERIAL APPLICATION            | 27 183          | 209     | 5 205     |
| ASSOCIATED CROP CONTROL ACTIV | 36 169          |         | 1 1       |
| FIRE CONTROL                  | 1               | •       | 4 4       |
| ASSOCIATED FIRE CONTROL ACTIV | 4               |         | 6 6       |
| AERIAL MAPPING/PHOTOGRAPHY    | 1 5             |         | 2 2       |
| AERIAL ADVERTISING            | i 1             |         | 7 7       |
| POWER AND PIPELINE PATROL     | 1 6             |         | 2 2       |
| FISH SPUTTING                 | 1 1             | •       | 64 64     |
| AIR TAXI-PASSENGER OPERATIONS | 12 52           | 1       | 15 15     |
| AIR TAX1-CARGO OPERATIONS     | 2 13            |         |           |

#### TABLE B-2 CONTINUED

#### ANALYTIC TABLE

|                               |        | THE TABLE      |         | A Province - |
|-------------------------------|--------|----------------|---------|--------------|
| KIND OF FLYING                | DEST   | RAFT DAMAGE    |         | APPENDIX B   |
| CONTRACT/CHARTER-PASSENGER-IN | ***    | 当生的是 化苯胺 化二甲基甲 | RECORDS |              |
| OTHER                         |        |                | WCC0W03 | ACCIDENTS.   |
| UNKNOWN/NOT REPORTED          | 3      | 7              |         |              |
| MISCELLANEOUS                 |        |                | 10      | 10           |
| EXPERIMENTATION               |        |                |         |              |
| TEST                          |        | 1              |         |              |
| DEMONSTRATION                 | 16     | 50             | 1       | 1            |
| FEKRY                         | 5      | 14             | 66      | 66           |
| SEARCH AND RESCUE             | 19     | 90             | 19      | 19           |
| ATR SHOW/AIR RACING           | 1      | 3              | 109     | 109          |
|                               | 2      | 7              | 4       | 4            |
| PARACHUTE JUMP                | 2      | 10             | 9       | 9            |
| PARACHUTE JUMP IN CONNECTION  |        | 1              | 12      | 12           |
| TOWING GLIDERS                |        | 2              | 1       | 1            |
| SEEDING CLOUDS                |        |                | 2       | 2            |
| HUNT ING                      |        |                |         | •            |
| POLICE PATROL                 |        |                |         |              |
| HIGHWAY TRAFFIC ADVISORY      |        | 1              | 1       |              |
| ALL OTHER PUBLIC FLYING       |        |                |         | 1            |
| OTHER                         |        | 2              |         |              |
| UNKNOWN/NOT REPORTED          | 2      |                | 2       | 2            |
|                               | 2      |                | 5       | 5            |
|                               |        |                | 5       | 2            |
| RECORDS                       | 650 32 |                |         |              |
| ACCIDENTS                     | 650 32 |                | 3855    |              |
|                               | JZ     | •              |         | 3855         |
|                               |        |                |         | 2023         |

#### TABLE 8-3 ANALYTIC TABLE APPENDIX B

AIRPORT PROXIMITY VS INJURY INDEX ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE SINGLE ENGINE, FIXEO-WING AIRCRAFT U.S. GENERAL AVIATION 1965 - 1969

|                  | 11    | NJURY | INDE  | X<br>===== | RECUROS   |
|------------------|-------|-------|-------|------------|-----------|
| PROXIMITY        | FATAL | SER   | MIN   | NONE       | 587       |
| RT               | 34    | 48    | 114   | 391        | 1         |
| ANE BASE         |       |       |       | 1          |           |
| PORT             |       |       |       |            |           |
| E/SH1P/PLATFORM  |       |       |       |            | 586       |
| FIC PATTERN      | 35    | 76    | 158   | 317        | 196       |
| 1/4 MILE         | 18    | 32    | 48    | 98         |           |
| 1/2 MILE         | 12    | 19    | 31    | 73         | 135<br>42 |
| ¥ 3/4 MILE       | 4     | 8     | 13    | 17         |           |
| N 1 MILE         | 9     | 15    | 29    | 76         | 179       |
| N 2 MILES        | 16    | 33    | 68    | 129        | 246       |
| N 3 MILES        | y     | 14    | 41    | 107        | 171       |
| IN 4 MILES       | 6     | 12    | 28    | 72         | 118       |
| IN 5 MILES       | 3     | 6     | , 7   | 24         | 40        |
| ND 5 MILES       | 62    | 129   | 335   | 1041       | 1567      |
| OWN/NOT REPORTED |       | 3     | 1 16  | 20         | 31        |
| *****            |       |       |       |            |           |
|                  |       |       |       |            | 345'      |
| s                | 201   | 393   | _     | 3 2366     |           |
| NTS              | 208   | 39    | 3 R81 | 3 2366     |           |

#### TABLE B-4

HOVERING
POWER-ON DESCENT
AUTOROTATIVE DESCENT

#### ANALYTIC TABLE

APPENDIX B

1

FIRST PHASE OF OPERATION VS AIRCRAFT DAMAGE ACCIDENTS INVOLVING ENGINE FAILUME OR MALFUNCTION AS A FIRST ACCIDENT TYPE SINGLE ENGINE, FIXED-MING AIRCRAFT U. S. GENERAL AVIATION 1965 - 1969

| FIRST PHASE OF OPERATION     | AIRCRAFT DAMAGE     | RECORDS ACCI |
|------------------------------|---------------------|--------------|
|                              | OEST SUBST MIN NONE | TOO NOT THE  |
| STATIC                       |                     |              |
| STARTING ENGINE/S            |                     | •            |
| IDLING ENGINE/S              |                     |              |
| ENGINE RUNUP                 |                     |              |
| IDLING ROTORS                |                     |              |
| PARKED-ENGINES NOT OPERATING |                     |              |
| DTHER                        |                     |              |
| <u> </u>                     |                     |              |
| TO TAKEOFF                   |                     |              |
| FRUM LANDING                 |                     |              |
| OTHER                        |                     |              |
| GROUND TAXI TO TAKEDEF       |                     |              |
| GROUND TAXI FROM LANDING     |                     |              |
| GROUND TAXI, OTHER           |                     |              |
| AERIAL TAXI TO TAKEOFF       |                     |              |
| AERIAL TAXI TO/FROM LANDING  |                     |              |
| AERIAL TAXI, OTHER           |                     |              |
| TAKEOFF                      |                     |              |
| RUN                          | 11 24               |              |
| INITIAL CLIMB                | 185 736             | 35           |
| VERT I CAL                   |                     | 921          |
| RUNN I N G                   | ·                   |              |
| ABORTED                      | ı                   |              |
| ABURTED                      | •                   | 1            |
| ABORTED                      |                     |              |
| OTHE R                       |                     |              |
| INFLIGHT                     |                     |              |
| CLIMA TO CRUISE              | 17 81               |              |
| IORMAL CRUISE                | 255 1306            | 98           |
| ESCENDING                    | 18 169              | 1561 156     |
| BLDING                       | 1                   | . 187 18     |
|                              | •                   | n            |

| TABLE B-4 CONTINUED           |        |          | ANALYTIC TABLE                        |         |           |
|-------------------------------|--------|----------|---------------------------------------|---------|-----------|
|                               | AIRC   | RAFT DAI | AGE                                   |         |           |
| FIRST PHASE OF OPERATION      | DEST S | ubst MI  | NONE                                  | RECORDS | ACCIDENTS |
| FIRST PHASE OF OFFICE 1200    | ****   |          | ************************************* | 11      | 11        |
| ACROBATICS                    | 4      | 7        |                                       | 3       | 3         |
| AUZZING                       | 2      | 1        |                                       | 1       | 1         |
| UNCONTROLLED DESCENT          |        | 1        |                                       |         |           |
| EMERGENCY DESCENT             |        |          |                                       | 62      | 62        |
| LOW PASS                      | 15     | 47       |                                       | 78      | 7.8       |
| ЭТНЕЙ                         | 18     | 60       |                                       | 36      | 36        |
| EN ROUTE TO TREAT CROP        | 4      | 32       |                                       | 16      | 16        |
| EN ROUTE TO RELOADING AREA    | 2      | 14       |                                       | 7       | 7         |
| SURVEY FIELD/AREA             |        | 7        |                                       | 15      | 15        |
| STARTING SWATH RUN            |        | 15       |                                       | 58      | 58        |
| SWATH RUN                     | 4      | 54       | •                                     | 2       | 2         |
| FLAREOUT FOR SWATH RUN        |        | 2        |                                       | 36      | 36        |
| PULLUP FROM SWATH RUN         | 5      | 31       |                                       | 97      | 97        |
| PROCEDURE TURNAROUND          | 19     | 78       |                                       | ;       | 3 3       |
| CLEANUP SWATH                 |        | 3        |                                       |         |           |
| MANEUVER TO AVOID ORSTRUCTION |        |          |                                       | . 1     | 5 15      |
| RETURN TO STRIP               | 2      | 13       |                                       |         |           |
| <u>LANDING</u>                |        |          |                                       | 21      | 7 717     |
| TRAFFIC PATTERN-CIRCLING      |        | 182      |                                       | 76      | 2 262     |
| FINAL APPROACH                |        | 231      |                                       |         | 4 4       |
| INITIAL APPROACH              | 1      | . 3      |                                       |         | 6 6       |
| FINAL APPROACH                |        | 6        |                                       |         | 4         |
| LEVEL DEF/TOUCHDOWN           |        | 4        |                                       |         |           |
| ROLL                          |        |          |                                       |         |           |
| ROLL-ON/KUN-ON                |        |          |                                       |         |           |
| POWER-ON LANDING              |        |          |                                       |         |           |
| POWER-OFF AUTOROTATIVE LANDIN |        |          |                                       | 1       | 13 11     |
| GO-AROUND                     | 1      | 7 96     |                                       |         | 1         |
| MISSED APPROACH               |        | 1        |                                       |         | 2         |
| OTHER                         |        | 1 1      |                                       |         | 2.        |
| UNKNOWN/NOT REPORTED          |        | 2        |                                       |         |           |
|                               |        |          |                                       |         |           |
|                               | ,      | co 3305  |                                       | 3       | 855       |

3855

650 3205

650 3205

RECORDS

ACCIDENTS

SECOND ACCIDENT TYPE VS INJURY INDEX ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE SINGLE ENGINE, FIXED-WING AIRCRAFT U. S. GENERAL AVIATION 1965 - 1969

| FATAL SER MIN NONE  GROUND-WATER LOOP-SHERVE  DRAGGED WINGTIP, POD, OK FLOA  WHEELS-UP LANDING  WHEELS-DOWN LANDING IN WATER  GEAR COLLAPSED  GEAR KETRACTED  HAKD LANDING  2 18 51 125  NOSE OVEK/DOWN  1 27 134 418  KOLL OVEK  CVERSHOOT  UNDERSHOOT  UNDERSHOOT  ONE AIRBORNE  BOTH ON GROUND  COLLISION WITH GROUND/WATER  CONTROLLED  UNCONTROLLED  13 12 17 14  UNCONTROLLED  ONE AIRBORNE  COLLISCON WITH GROUND/WATER  COULISCON WATER  COU |   | RECORDS |           |
|--|---|---------|-----------|
| DRAGGED WINGTIP, POD, OR FLOA  WHEELS-UP LANDING  WHEELS-DOWN LANDING IN WATER  GEAR COLLAPSED  GEAR RETRACTED  HAKD LANDING  NOSE OVER/DOWN  CVERSHOOT  UNDERSHOOT  UNDERSHOOT  COLLISION WITH AIRCRAFT  BOTH IN FLIGHT  ONE AIRBORNE  BOTH ON GROUND  COLLISION WITH GROUND/WATER  CONTROLLED  UNCONTROLLED  13 12 17 14  UNCONTROLLED   |   | RECORDS |           |
| DRAGGED WINGTIP, POD, OR FLOA  MHEELS-UP LANDING  MHEELS-DOWN LANDING IN WATER  GEAR COLLAPSED  GEAR RETRACTED  HARD LANDING  NOSE OVER/DOWN  LOVER  CVERSHOOT  UNDERSHOOT  UNDERSHOOT  I 6 6 19  COLLISION WITH AIRCRAFT  BOTH IN FLIGHT  ONE AIRBORNE  BOTH ON GROUND  COLLISION WITH GROUND/WATER  CONTROLLED  UNCONTROLLED  13 12 17 14  UNCONTROLLED  |   |         | ACCIDENTS |
| #HEELS-UP LANDING 1 18 18 141  #HEELS-DOWN LANDING IN WATER 1  GEAR COLLAPSED 1 35 177 640  GEAR KETRACTED 1 2  HAKD LANDING 2 18 51 125  NOSE OVER/DOWN 1 27 134 418  KOLL OVER 1 6 6 19  UNDERSHOOT 1 6 6 19  COLLISION WITH AIRCRAFT 1  ONE AIRBORNE 80TH ON GROUND  COLLISION WITH GROUND/WATER CONTROLLED 1 1 2 17 14  UNCONTROLLED 1 3 12 17 14  |   |         |           |
| ##EELS-DOWN LANDING IN WATER  GEAR COLLAPSED  GEAR KETRACTED  HAKD LANDING  NOSE OVER/DOWN  KOLL OVER  CVERSHOOT  UNDERSHOOT  UNDERSHOOT  GOLLISION WITH AIRCRAFT  BOTH IN FLIGHT  ONE AIRBORNE  BOTH ON GROUND  COLLISION WITH GROUND/WATER  CONTROLLED  UNCONTROLLED  13 12 17 14  UNCONTROLLED  |   | 33      | 33        |
| GEAR COLLAPSED  GEAR RETRACTED  HAKD LANDING  NOSE OVEK/DOWN  KOLL OVER  CVERSHOOT  UNDERSHOOT  UNDERSHOOT  1 6 6 19  COLLISION WITH AIRCRAFT  BOTH IN FLIGHT  ONE AIRBORNE  BOTH ON GROUND  COLLISION WITH GROUND/WATER  CONTROLLED  13 12 17 14  UNCONTROLLED  |   | 4       | 4         |
| ### STANDING   |   | 178     | 178       |
| ### LANDING 1 2  NOSE OVER/DOWN 1 27 134 418  ###################################  |   | Ţ       | 1         |
| ## NOSE OVER/DOWN  ## 1 27 134 418  ## NOSE OVER/DOWN  ## 1 27 134 418  ## NOSE OVER/DOWN  ## 1 27 134 418  ## 1 6 6 19  ## COLLISION WITH AIRCRAFT  ## NOSE OVER/DOWN  ## 1 27 134 418  ## NOSE OVER/DOWN  ## |   | 853     | 853       |
| 1 27 134 418   |   | 3       | 3         |
| UNDERSHOOT  1 6 6 19  1 5 15 25  COLLISION WITH AIRCRAFT  ROTH IN FLIGHT  ONE AIRBORNE  BOTH ON GROUND  COLLISION WITH GROUND/WATER  CONTROLLED  UNCONTROLLED  13 12 17 14   |   | 196     | 196       |
| COLLISION WITH AIRCRAFT  ROTH IN FLIGHT  ONE AIRBORNE  BOTH ON GROUND  COLLISION WITH GROUND/WATER  CONTROLLED  UNCONTROLLED  13 12 17 14  |   | 580     | 580       |
| COLLISION WITH AIRCRAFT  BOTH IN FLIGHT  ONE AIRBORNE  BOTH ON GROUND  COLLISION WITH GROUND/WATER  CONTROLLED  13 12 17 14  |   |         |           |
| ROTH IN FLIGHT  ONE AIRBORNE  BOTH ON GROUND  COLLISION WITH GROUND/WATER  CONTROLLED  13 12 17 14  UNCONTROLLED   |   | 38      | 32        |
| ONE AIRBORNE  BOTH ON GROUND  COLLISION WITH GROUND/WATER  CONTROLLED  13 12 17 14  UNCONTROLLED   |   | 46      | 46        |
| BOTH ON GROUND  COLLISION WITH GROUND/WATER  CONTROLLED  13 12 17 14  UNCONTROLLED   |   |         |           |
| COLLISION WITH GROUND/WATER  CONTROLLED  13 12 17 14  UNCONTROLLED   |   | ì       | 1         |
| CONTROLLED  13 12 17 14  |   |         |           |
| UNCONTROLLED   |   | 1       | ì         |
| n .  |   |         |           |
| COLLIDED WITH  |   | 56      | 56        |
| WIRES/POLES  |   | 22      | 22        |
| TREES 13 36 63 81  |   |         |           |
| RESIDENCE/S 34 95 146 277  |   | 193     | 193       |
| RUILDING/S 2   |   | 552     | 552       |
| FENCE, FENCEPOSTS 2 6 4 4  |   | 5       | 5         |
| ELECTRONIC TOWERS  |   | 16      | 16        |
| RUNNAY OR APPROACH LIGHTS  |   | 216     | 216       |
| AIRPORT HAZARD   |   | 1       | 1         |
| ANIMALS  |   | 3       | 3         |
| CRUP 2   |   |         |           |
| FLAGMAN LOADER   |   | 2       | 2         |
| DITCHES  | • | 11      | 11        |
| SNOWBANK   |   |         |           |
| PAKKED AIRCRAFT  |   | 186     | 186       |
| AUTOMORILE 1 I   |   | 10      | 10        |
| 3 5 7  |   | 2       | 2         |
| 255  |   |         | •         |

| TABLE B-5 CONTINUED           |                       |      | ,   | ANALYT | IC TAPLE |     | APPENDIX B |
|-------------------------------|-----------------------|------|-----|--------|----------|-----|------------|
|                               | IN<br>DEFERE<br>FATAL |      | ,,, | NONE   |          |     | ACCIDENTS  |
| TYPE OF ACCIDENT              | rezer<br>l            | 10   | 21  | 60     |          | 92  |            |
| DIKTBANK                      | 3                     | 12   | 21  | 79     |          | 115 | 115        |
| ORJECT                        |                       | 1-   |     |        |          |     | 107        |
| BIND STRIKE                   |                       | 42   | 43  | 40     |          | 187 | 187        |
| STALL                         | 62<br>37              |      |     |        |          | 55  | 55         |
| SPIN                          | -                     |      |     | 2      |          | 16  | 16         |
| SPIRAL                        | 1                     |      |     |        |          | ห5  | 85         |
| MUSH                          | 4                     | . 21 | 23  | 2,     |          |     |            |
| FIRE OR EXPLOSION             |                       |      |     | . 3    |          | 5   |            |
| IN FLIGHT                     | 1                     |      | 1   |        |          | 1   | 1          |
| ON GROUND                     |                       |      |     | 1      | ·        |     |            |
| AIRFRAME FAILURE              |                       |      |     |        |          | 1   | 1          |
| IN FLIGHT                     |                       | 1    |     |        |          |     |            |
| ON GROUND                     |                       |      |     |        |          |     |            |
| ENGINE TEARAWAY               |                       |      |     |        |          |     |            |
| ENGINE FAILURE OR MALFUNCTION |                       |      |     |        |          |     |            |
| PROPELLER/ROTOR FAILURE       |                       |      |     |        |          |     | 3          |
| PROPELLER                     |                       |      | 1   |        | 2        |     |            |
| TAIL ROTOR                    |                       |      |     |        |          |     |            |
| MAIN RUTOR                    |                       |      |     |        |          |     |            |
| PROPELLER/ROTOR ACCIDENT TO P |                       |      |     |        |          |     |            |
| JET INTAKE/EXHAUST ACCIDENT T |                       |      |     |        |          |     |            |
| PROPELLER/JET/ROTOR BLAST     |                       |      |     |        | •        |     |            |
| TURBULENCE                    |                       |      |     |        |          |     |            |
| HAIL DAMAGE TO AIRCRAFT       |                       |      |     |        |          |     |            |
| LIGHTNING STRIKE              |                       |      |     |        |          |     |            |
| EVASIVE MANEUVER              |                       |      |     |        |          |     |            |
| UNCONTROLLED ALTITUDE DEVIATI |                       |      |     |        |          |     | 71 71      |
| DITCHING                      |                       | 7    |     | 19     | 45       |     |            |
| MISSING AIRCRAFT NOT RECOVERE |                       |      |     |        | _        |     | 4          |
| MISCELLANEOUS, OTHER          |                       |      |     | 1      | 3        |     | 2          |
| UNDETERMINED                  |                       |      | 1   |        | 1        |     |            |
| <b>U</b>                      |                       |      |     |        |          |     |            |
|                               |                       |      |     |        | 244      | •   | 3 H 5 5    |

3855

208 393 888 2366

208 393 888 2366

Q

RECORDS

ACCIDENTS

CAUSE/FACTOR TABLE

ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE SINGLE ENGINE FIXED-WING AIRCRAFT U. S. GENERAL AVIATION 1965 CAUSES DISPLAYED RELATE TO FIRST ACCIDENT TYPE ONLY

APPENDIX B

INVOLVES 3855 TOTAL ACCIDENTS INVOLVES 208 FATAL ACCIDENTS

|          | BRDAD CAUSE/FACTOR                                     | FATA         | FATAL ACCIDENTS | ENTS         | NONFA         | NONFATAL ACCIDENTS | DENTS.        | ALI         | ALL ACCIDENTS      | NTS                   |
|----------|--|--------------|-----------------|--------------|---------------|--------------------|---------------|-------------|--------------------|-----------------------|
|          |  | CAUSE        | FACTOR          | TOTAL*       | CAUSE         | FACTOR             | TOTAL*        | CAUSE       | FACTOR             | TOTAL*                |
|          | PILOT  |              |                 |              |               |                    |               |             |                    |                       |
|          | PERSONNEL  | 112<br>53.85 | 5.29            | 114<br>54.81 | 1896<br>51.99 | 57<br>1.56         | 1900<br>52.10 | 2008        | 68                 | 2014                  |
|          | AIRFRAME   | 29<br>13.94  | 3               | 32<br>15,38  | 374<br>10.26  | 29<br>•80          | 403<br>11.05  | 403         | 32 .83             | 52.24<br>435<br>11.28 |
| •        | LANDING GEAR   | .48          | • 00            | 1<br>•48     | .03           | • 00               | .03           | 2.05        | 0.                 | 2.00                  |
| 157      | POWERPLANT   | • 00         | 00.             | 00•          | .03           | • 00               | 1.03          | 1<br>•03    | 00.                |                       |
|          | SYSTEMS  | 94<br>45•19  | .96             | 96<br>46.15  | 1553<br>42,58 | 60<br>1.65         | 1607<br>44.06 | 1647        | 62<br>1.61         | 1703                  |
|          | INSTRUMENTS/EQUIPMENT AND ACCESSORIES                  | 00*          | 00.             | 00.          | 15            | 1.03               | 16            | 15          | 1.03               | 16                    |
|          | ROTORCRAFT   | 00•          | 00•             | 00•          | 3<br>• 08     | 5<br>• 1 4         | 8<br>• 22     | 3<br>• 08   | 5<br>• 13          | . 82                  |
|          | AIRPORTS/AIRWAYS/FACILITIES                            | • 00         | 00•             | 00•          | 00•           | 00•                | 00•           | <b>.</b>    | 00•                | 5                     |
|          | <b>W</b> ЕАТНЕЯ  | 00•          | 00•             | • 00         | 1.03          | 1<br>•03           | 2<br>•05      | 103         | 1                  | 2                     |
| <b>←</b> | TERRAIN  | 3,37         | 17<br>8.17      | 22<br>10.58  | 134<br>3.67   | 157<br>4.30        | 288<br>7.90   |             | .03<br>174<br>4.51 | .05<br>310<br>8.04    |
| -2       | MISCELLANEOUS  | 00.          | 00•             | 00•          | 00•           | ٥ <b>٠</b>         | 00•           | 00•         | o c                | S                     |
| Ω        | UNDETERMINED   | 10<br>4.81   | 00.             | 10<br>4.8i   | 112<br>3.07   | 6<br>•16           | 118<br>3.24   | 122<br>3.16 |                    | 128                   |
|          | THE FIGURES OPPOSITE FACH CAUSAL CATEGORY REDECENT THE | 3            | 00•             | 3            | 00•           | ٠٥٠                | 00•           | 3<br>• 0 &  |                    | 3 3 9 0 8             |

THE FIGURES OPPOSITE FACH CAUSAL CATEGORY REPRESENT THE NUMRER AND PERCENT OF ACCIDENTS IN WHICH THAT PARTICULAR CAUSAL CATEGORY WAS ASSIGNED

\* IF AN ACCIDENT INCLUDES BOTH A CAUSE AND RELATED FACTOR IN THE SAME CAUSAL CATEGORY, THE ACCIDENT IS REPRESENTED ONCE UNDER THE TOTAL FOR THAT CATEGORY

#### CAUSE/FACTOR TABLE

TABLE B-7

# ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE SINGLE ENGINE FIXED-WING AIRCRAFT U. S. GENERAL AVIATION 1965 - 1969 CAUSES DISPLAYED RELATE TO FIRST ACCIDENT TYPE ONLY

INVOLVES 3855 TOTAL ACCIDENTS INVOLVES 208 FATAL ACCIDENTS

|  | FAT     | AL ACCID | ENTS    | NONFA     | TAL ACCI | DENTS    | AL       | L ACCIDE | NTS           |
|--|---------|----------|---------|-----------|----------|----------|----------|----------|---------------|
| CALLET VE ACTOR  | CAUSE   | FACTOR   |         | CAUSE     | FACTOR   |          | CAUSE    | FACTOR   | TOTAL         |
| DETAILED CAUSE/FACTOR  |         |          |         |           |          | "        |          |          |               |
| ** PilOT **  |         |          |         |           |          |          |          |          |               |
| PILOT IN COMMAND ATTEMPTED OPERATION W/KNOWN DEFICIENCIES IN EQUIPMENT   | 3       | 1        | 4       | 20<br>8   | . 4<br>1 | 24       | 23<br>10 | 5<br>1   | 28<br>11      |
| ATTEMPTED OPERATION BEYOND EXPERIENCE/ABILLITY CETEL   | 2       |          | 2<br>6  | 80        | 9        | 89       | 86       | . 9      | 95<br>41      |
| RECAME LOST/DISORIENTED CONTINUED VER FLIGHT INTO ADVERSE WEATHER CONDITIONS   | 6       | ı        | 9       | 28<br>3   | 4        | 32<br>3  | 36<br>3  | 5        | 3             |
| OF AMED IN INITIATING GO-AKOUNU  |         |          |         | 2         | 1        | 3        | 2        | 1        | 3             |
| DIVERTED ATTENTION FROM OPERATION OF AINCRAFT FAILED TO OBTAIN/MAINTAIN FLYING SPEED   | 3       |          | 3       | 3         |          | 3<br>7   | 6        |          | <i>6</i><br>9 |
| TATE TO USE OF INCORRECTLY USED MISE ENVIRAGED   | 2       |          | 2       | 7<br>18   | 3        | 21       | 18       | 3        | 21            |
| FAILED TO FOLLOW APPROVED PROCEDURES, DIRECTIVES ETC<br>IMPROPER OPERATION OF POWERPLANT + POWERPLANT CONTROLS                                 | 15      |          | 15      | 454       |          | 454<br>6 | 469<br>7 |          | 469<br>7      |
| IMPROPER OPERATION OF FLIGHT CONTROLS  | 1       |          | 1       | 6<br>1    |          | ī        | i        |          | 1             |
| IMPROPER IFR OPERATION IMPROPER IN-FLIGHT DECISIONS OR PLANNING  | 9       |          | 9       | 93        | 5        | 98<br>1  | 102      | 5        | 107<br>1      |
| AMERICA COMPENSATION FOR WIND CONDITIONS   | 45      | 2        | 47      | 803       | 4        | 807      | 848      | 6        | 854           |
| IMPROPER COMPENSATION AND FOR PLANNING INADEQUATE PREFILIGHT PREPARATION AND/OR PLANNING INADEQUATE SUPERVISION OF FLIGHT                      |         |          |         | 51        | 19       | 51<br>46 | 51<br>31 | 23       | 51<br>54      |
| LACK OF FAMILIARITY WITH AIRCRAFT  | 4<br>41 | 4        | 8<br>41 | 27<br>500 | 1        | 501      | 541      | 1        | 542           |
| MISMANAGEMENT OF FUEL EXERCISED POOR JUDGMENT  | 4       |          | 4       | 27        | ,        | 27<br>2  | 31<br>1  | 1        | 31<br>2       |
| OPERATED CARELESSLY  |         |          |         | 1 3       | 1        | 3        | 3        | _        | 3             |
| SELECTED UNSUITABLE TERRAIN  |         |          |         | 2         |          | 2<br>1   | ' 2<br>1 |          | 2<br>1        |
| IMPROPER STARTING PROCEDURES INITIATED FLIGHT IN ADVERSE WEATHER CONDITIONS  |         |          |         | 1<br>14   |          | 14       | 14       |          | 14            |
| SPONTANEOUS-IMPROPER ACTION  |         | 1        | 1       | • '       |          |          |          | 1        | 1             |
| MISJUDGED DISTANCE AND SPEED MISJUDGED DISTANCE  |         |          |         | 1         | 1        | 1        | 1        | 1        | ī             |
| MISJUDGED DISTANCE AND ALTITUDE  |         |          |         | 1         | *        | 1        | 1        |          | 1             |
| MISJUOGEO SPEED AND ALTITUDE MISJUOGEO SPEED   |         |          | _       | 1         |          | 1        | 1        |          | 1             |
| MIS HINGED ALTITUDE  | 1       |          | 1       | 1         |          | 1        | ì        |          | 1             |
| MISUNDERSTANDING OF ORDERS OR INSTRUCTIONS INCAPACITATION  |         |          |         | 1         |          | 1        | 1 8      | 1        | 9             |
| PHYSICAL IMPAIRMENT  | 5<br>1  | 1        | 6       | 3<br>1    |          | ĩ        | 2        |          | 2             |
| SPATIAL DISCRIENTATION PSYCHOLOGICAL CONDITION   |         | 1        | î       | •         | 1        | 1<br>2   |          | 2        | 2             |
| MISUSED OR FAILED TO USE FLAPS   | 4       |          | 4       | 1         | ٤.       | ī        | 5        |          | 5             |
| FAILED TO ABORT TAKEOFF FAILED TO INITIATE GO-ARDUND   | •       |          |         | 1<br>9    |          | 1 9      | 10       |          | 1<br>10       |
| DIRECT ENTHIES   | 1       |          | 1       | ,         |          | -        |          |          | 2395          |
| SUBTOTAL   | 155     | 11       | 166     | 2173      | 56       | 2229     | 2328     | 67       | 2373          |
| COPILOT  |         |          |         | 1         |          | 1        | 1        |          | 1             |
| FALLED TO OBTAIN/MAINTAIN FLYING SPEED IMPROPER OPERATION OF POWERPLANT + POMERPLANT CONTROLS INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING |         |          |         | 1         |          | 1        | 1<br>1   |          | í             |
| SUBTOTAL   |         |          |         | 3         |          | 3        | 3        |          | 3             |
| DUAL STUDENT   |         |          |         | . 1       |          | 1        | 1        |          | 1<br>1        |
| DELAYED IN INJIJATING GO-AROUND FAILED TO GREATING MAINTAIN FLYING SPEED IMPROPER OPERATION OF POWERFLANT * PUMERPLANT CONTROLS                |         |          |         | 1<br>21   |          | )<br>21  | 21       |          | 21            |
| IMPROPER LEVEL OFF   |         |          |         | 1         |          | 1        | 1        |          | _/            |
| INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING<br>LACK OF FAMILIARITY WITH AIRCRAFT  |         |          |         | 5         | 1        | 5<br>1   | 5        | 1        | 5<br>1        |
| MISMANAGEMENT OF FUFL  |         |          |         | 11        | ī        | 12       | 11       | ì        | 12            |
| SPONTANEOUS-IMPROPER ACTION  |         |          |         | 1         |          | 1        | 1        |          | 1             |

#### TABLE B-7 CONTINUED

#### CAUSE/FACTOR TABLE

DUAL STUDENT (CONTINUED)

|  | FA1    | FAL ACCIO | ENTS   | NONFA       | TAL ACCI | DENTS       | Αį          | L ACCIDE | NTS       |
|--|--------|-----------|--------|-------------|----------|-------------|-------------|----------|-----------|
|  | CAUSE  | FACTOR    | TOTAL  | CAUSE       | FACTOR   | TOTAL       | CAUSE       | FACTOR   | TOTAL     |
| MISUNDERSTANDING OF ORDERS OR INSTRUCTIONS   |        |           |        |             |          |             |             |          |           |
| SUBTOTAL   |        |           |        | 1           |          | 1           | 1           |          | 1         |
| ** PERSONNEL **  |        |           |        | 42          | 2        | 44          | 42          | 5        | 44        |
| FLIGHT INSTRUCTOR INADEQUATE SUPERVISION OF FLIGHT INADEQUATE TRAINING OF STUDENT MAINTENANCE, SERVICING, INSPECTION                           |        |           |        | 2<br>7      | 1<br>3   | 3<br>10     | 2<br>7      | <u>1</u> | 3         |
| IMPROPER MAINTENANCE (MAINTENANCE OCCUPANCE)   | . 5    |           | 5      | 39          |          |             |             | 3        | 10        |
| IMPROPER MAINTENANCE TOWNER PERSONNEL) IMPROPERLY SERVICED AIRCRAFT(GROUND CREH)   | 3      |           | 3      | 16          | 5        | 39<br>18    | 44<br>19    | 2        | 44<br>21  |
| INADEQUATE INSPECTION OF AIRCRAFT (OWNER-PILOT)  | 1      |           | 1      | 6<br>21     | 2<br>2   | 8<br>23     | 6<br>22     | 2<br>2   | 8<br>24   |
| INADEQUATE INSPECTION OF ACETIONAL PERSONNEL) INADEQUATE MAINTENANCE AND INSPECTION  | 2      | 1         | 2<br>1 | 3           |          | 9<br>3      | 31          | 1        | 11        |
| OTHER<br>UNK/NR  | 17     | 2         | 19     | 24B<br>2    | 11       | 259         | 265         | 13       | 4<br>278  |
| OPERATIONAL SUPERVISORY PERSONNEL FAILURE TO PROVIDE ADED DIRECTIVES, MANUALS, EQUIPMENT DEFICIENCY, COMPANY MAINTAINED FORT, SERV. RESULTIONS | 1      |           | 1      | ı           |          | 2           | 2<br>1<br>1 |          | 2         |
| INCORRECT WEATHER FORECAST   |        |           |        | 1           | 1        | ž           | î           | 1        | 1<br>2    |
| INADEQUATE/INCORRECT HEATHER BRIEFING TRAFFIC CONTROL PERSONNEL AIRPORT SUPERVISORY PERSONNEL  | 1      |           | 1      | 1           | ì        | 1<br>1      | 1           | 1        | 2<br>1    |
| IMPROPER MAINTENANCE-AIRPORT FACILITIES IMPROPER INSPECTION OF FACILITIES OTHER  |        |           |        | 2<br>1      | 1        | 2<br>2      | 2           | 1        | ?<br>2    |
| AIRWAYS FACILITIES PERSONNEL<br>PRODUCTION-DESIGN<br>SUBSTANDARD QUALITY CONTROL   |        |           |        |             | 1        | 1           |             | ì        | ī         |
| INCORRECT FACTORY INSTALLATION POOR/INADEQUATE DESIGN OTHER  | 1      |           | 1      | 1<br>5<br>6 | 2        | 1<br>5<br>8 | 1.<br>6     | _        | 1<br>6    |
| MISCELLANEOUS-PERSONNEL PASSENGER OTHER  | 1      |           | 1      | 3           | 1        | 5           | 6<br>4      | 2        | 8<br>5    |
| DIRECT ENTRIES THIRD PILOT   |        |           |        | i<br>2      | 1        | 1           | 1           | 1        | 5<br>1    |
| FLIGHT ENGINEER<br>DISPATCHING   |        |           |        | 2           |          | 2           | 2           |          | 2         |
| SUBTOTAL   | 32     | 3         | 35     | 381         | 29       | 410         | 413         | 2.2      |           |
| ** AIRFRAME **   |        |           |        |             | 2,       | 410         | 413         | 32       | 445       |
| WINGS  |        |           |        |             |          |             |             |          |           |
| BRACING WIRES, STRUTS<br>FUSELAGE  | 1      |           | 1      |             |          |             | 1           |          | 1         |
| WINDSHIELDS, WINDOWS, CANOPIES<br>LANDING GEAR   |        |           |        | 1           |          | 1           | 1           |          |           |
| NORMAL RETRACTION/EXTENSION ASSEMBLY FLIGHT CONTROL SURFACES   |        |           |        | 1           |          |             |             |          | 1         |
| AILERON: SURFACES ATTACHMENTS  | 1      |           | ,      | •           |          | 1           | 1           |          | 1         |
| SUBTOTAL   | 2      |           | 1<br>2 |             |          |             | 1           |          | 1         |
| ** POWERPLANT **   | -      |           | Z      | 2           |          | 2           | 4           |          | 4         |
| ENGINE STRUCTURE<br>CRANKCASE  |        |           |        |             |          |             |             |          |           |
| CRANKSHAFT MASTER AND CONNECTING RODS  | 2      |           | 2      | 53          | 1        | 4<br>54     | 4<br>55     | 1        | 4         |
| CYLINDER ASSEMBLY PISTON, PISTON RINGS   | 3<br>3 | 1         | 3<br>4 | 72<br>58    |          | 72<br>58    | 75<br>61    |          | 56<br>75  |
| VALVE ASSEMBLIES<br>BLONER, IMPELLER ASSEMBLY  | 3      | 1         | 4<br>3 | 59<br>122   | 1        | 60          | 62          | 1<br>2   | 62<br>64  |
| MOUNT AND VIBRATION ISDLATORS OTHER  |        |           | -      | 13          | 1        | 123<br>13   | 125<br>13   | 1        | 126<br>13 |
| IGNITION SYSTEM  | 5      |           | 5      | 1<br>31     |          | 31          | 1<br>36     |          | 1<br>36   |

TABLE 8-7 CONTINUED

CAUSE/FACTOR TABLE

APPENDIX B

| POWERPLANT (CONTINUED)   | FAT                        | AL ACCIO | ENTS                       |   | TAL ACCI              |  | A L   | L ACCIDEN             | 4T S   |
|--|----------------------------|----------|----------------------------|---|-----------------------|--|---|-----------------------|--|
|  | CAUSE                      | FACTOR   | TOTAL                      | CAUSE   | FACTOR                | TOTAL  | CAUSE   | FACTOR                | TOTAL  |
| MAGNETOES DISTRIBUTOR SPARK PLUG COILS LOW TENSION WIRING HIGH TENSION WIRING IGNITION HARNESS, SHIELDING SWITCHES LEADS   | 5<br>1<br>5                | 1        | 5<br>1<br>6                | 52<br>1<br>37<br>1<br>2<br>1<br>6                     | 2 3                   | 54<br>1<br>40<br>1<br>2<br>1<br>7<br>3<br>3            | 57<br>2<br>42<br>1<br>2<br>1<br>6<br>3<br>3           | 2 4                   | 59<br>2<br>46<br>1<br>2<br>1<br>7<br>3                 |
| OTHER FUEL SYSTEM TANKS LINES AND FITTINGS SELECTOR VALVES FILTERS, STRAINERS, SCREENS PRIMING SYSTEM CARBURETOR PUMPS FUEL INJECTION SYSTEM VENTS, DRAINS, TANK CAPS RAM AIR ASSEMBLY | 2<br>1<br>2<br>2<br>9<br>5 |          | 2<br>1<br>2<br>2<br>9<br>5 | 9<br>25<br>20<br>13<br>2<br>89<br>19<br>11<br>34<br>5 | 4<br>2<br>2<br>1<br>1 | 13<br>27<br>22<br>14<br>2<br>90<br>19<br>11<br>42<br>5 | 9<br>27<br>21<br>15<br>4<br>98<br>24<br>11<br>34<br>5 | 4<br>2<br>2<br>1<br>1 | 13<br>29<br>23<br>16<br>4<br>99<br>24<br>11<br>42<br>5 |
| OTHER LUBRICATING SYSTEM LINES, HOSES, FITTINGS VALVES FILTERS, SCREENS PUMP-PRESSURE PUMPS-SCAVENGER OIL COOLERS MAGNETIC PLUGS SEALS AND GASKETS                                     |                            |          |                            | 11<br>2<br>8<br>5<br>2<br>4<br>1<br>10                | 1                     | 11<br>2<br>8<br>5<br>2<br>4<br>1<br>10                 | 11<br>2<br>8<br>5<br>2<br>4<br>1<br>10                | 1                     | 11<br>2<br>8<br>5<br>2<br>4<br>1<br>10                 |
| OTHER COOLING SYSTEM OTHER PROPELLER AND ACCESSORIES ALADES HYDRAULIC PITCH CONTROL MECHANISM  | . 1                        |          | 1                          | 1<br>1<br>1   |                       | 1<br>1<br>1  | , 1<br>1<br>1<br>2                                    |                       | 1<br>1<br>1<br>2                                       |
| OTHER EXHAUST SYSTEM MANIFOLOS MUFFLERS GASKETS STACKS   | 1                          |          | ı                          | 2<br>14<br>1<br>5<br>3                                |                       | 2  | 2<br>15<br>1<br>5<br>3                                |                       | 2<br>16<br>1<br>5<br>3                                 |
| BAFFLES ENGINE ACCESSORIES STARTERS OTHER  |                            |          |                            | 1   |                       | 1  | 1<br>1  | l                     | 1  |
| ENGINE CONTROLS-COCKPIT THROTTLE-POWER LEVER ASSEMBLIES MIXTURE CONTROL ASSEMBLIES INDUCTION AIR, PREHEAT CONTROLS OTHER   |                            | 1<br>1   | 1                          | 27<br>15<br>6<br>1                                    | i<br>•                | 28<br>15<br>6<br>1                                     | 28<br>16<br>6<br>1                                    | <b>,</b>              | 29<br>16<br>6<br>1                                     |
| POWERPLANT-INSTRUMENTS   |                            |          | 1 1                        | 4   | , 3:                  | 3 37   | 4   | 4 34                  | . 38   |
| FUEL QUANTITY GAUGE MISCELLANEOUS POWERPLANT FAILURE FOR UNDETERMINED REASONS BIRD INGESTION FOREIGN OBJECT DAMAGE COMPRESSOR STALLS DETONATION  | 4                          | 1        | 45                         |   | l<br>l<br>l<br>5      | 677<br>1<br>1<br>1<br>5                                | ;   | 1<br>1<br>1<br>5<br>1 | 722<br>1<br>1<br>1<br>5<br>1<br>38                     |
| OTHER DIRECT ENTRIES REDUCTION GEAR ASSEMBLY GEARS, ACCESSORY DRIVE OTHER COMPRESSOR ASSEMBLY COMBUSTION ASSEMBLY TURBINE ASSEMBLY ACCESSORY DRIVE ASSEMBLY                            |                            | 1        | 1                          | :   | 6<br>3<br>1           | 1 37<br>3<br>1   |   | 7<br>3<br>1           | 3 1  |
| ACCESSION UNIVERSITY ASSESSED FUEL SYSTEM OTHER  |                            |          |                            |   | 1                     | 1  |   | 1                     | 1  |

#### TABLE B-7 CONTINUED

#### CAUSE/FACTOR TABLE

APPENDIX B POWERPLANT (CONTINUED)

| POWERPLANT TOURITMOEDY   | FAT         | AL ACCID          | ENTS                                  | NONFA                   | TAL ACCI                                 | DENTS  | AL                           | L ACCIDE                                   | NT S  |
|--|-------------|-------------------|---------------------------------------|-------------------------|--|--|------------------------------|--|---|
|  | CAUSE       | FACTOR            | TOTAL                                 | CAUSE                   | FACTOR                                   | TOTAL  | CAUSE                        | FACTOR                                     | TOTAL   |
| SAFETY SYSTEM IGNITION SYSTEM TOROUGMETER AIR BLEED EXHAUST SYSTEM THRUST REVERSER PROPELLER SYSTEM CONSTANT SPEED DRIVE POWER LEVER CABLE   |             |                   |                                       | 1                       |  | 1  | 1                            |  | 1   |
| PROPELLER LEVER REVERSE THRUST LEVER ENGINE INDICATING EQUIPMENT TACHOMETER ENGINE INSTALLATION  |             |                   |                                       | 1                       |  | 1  | 1                            |  | 1   |
| SUBTOTAL   | 103         | 4                 | 107                                   | 1619                    | 64                                       | 1683   | 1722                         | 68   | 1790  |
| ** SYSTEMS **  |             |                   |                                       |                         |  |  |                              |  |   |
| ELECTRICAL SYSTEM BAYTERIES GENERATORS/ALTERNATORS HYDRAULIC SYSTEM FLIGHT CONTROL SYSTEMS   |             |                   |                                       | 1                       | 1  | 1  | 1                            | 1  | 1   |
| ANTI-ICING, DE-ICING SYSTEMS CARBURETOR DE-ICING SYSTEM AIR CONDITION, HEATING AND PRESSURIZATION AUTO PILOT FIRE HARNING SYSTEM FIRE EXTINGUISHER SYSTEM OXYGEN SYSTEM OTHER SYSTEMS  |             |                   |                                       | 14                      |  | 14   | 14                           |  | 14  |
| SUBTOTAL   |             |                   |                                       | 15                      | ,  | 14   | 15                           |  | .,  |
| ** INSTRUMENTS/EQUIPMENT AND ACCESSORIES **  |             |                   |                                       | 15                      | 1  | 16   | 12                           | 1  | 16  |
| FLIGHT AND NAVIGATION INSTRUMENTS COMPASS  |             |                   |                                       | 1                       |  | 1  | 1                            |  | 1   |
| COMMUNICATIONS AND NAVIGATION EQUIPMENT TRANSMITTERS AND/OR RECEIVERS VOR RECEIVERS OTHER  |             |                   |                                       | 1                       | 3  | 3  | 1                            | 3  | 3<br>4  |
| MISCELLANEOUS EQUIPMENT<br>SPRAY, DUSTING EQUIPMENT  |             |                   |                                       | 1                       | 1  | 1  | 1                            | 1  | 1   |
| SUBTOTAL   |             |                   |                                       | 3                       | 7  | 10   | 3                            | 7  | 10  |
| ** AIRPORTS/AIRWAYS/FACILITIES **  |             |                   |                                       | •                       | •  | 20   | ,                            | ,  | 10  |
| AIRPORT FACILITIES AIRPORT CONDITIONS SNOW ON RUNWAY AIRWAYS FACILITIES  |             |                   |                                       | 1                       | 1  | 2  | 1                            | 1  | 2   |
| SUBTOTAL   |             |                   |                                       | 1                       | 1  | 2  | 1                            | 1  | 2   |
| ** WEATHER **  |             |                   |                                       | -                       | -  | -  | -                            | -  | -   |
| LDW CEILING RAIN FOG SNOW ICING CONDITIONS-INCLUDES SLEET, FREEZING RAIN, ETC CONDITIONS CONDUCIVE TO CARR/INDUCTION SYSTEM ICING UNFAVORABLE WIND CONDITIONS TURBULENCE, ASSOCIATED W/CLOUDS, THUNDERSTORMS LOCAL WHIRLWIND ADVERSE WINDS ALOFT HIGH TEMPERATURE OBSTRUCTIONS TO VISION | 1<br>1<br>7 | 7 4 2 1 2 9 1 1 1 | 7<br>4<br>2<br>2<br>3<br>16<br>1<br>1 | 1<br>1<br>2<br>4<br>126 | 22<br>9<br>13<br>7<br>8<br>100<br>8<br>1 | 23<br>10<br>15<br>7<br>12<br>226<br>8<br>1<br>1<br>4 | 1<br>1<br>2<br>1<br>5<br>133 | 29<br>13<br>15<br>8<br>10<br>109<br>9<br>2 | 30<br>14<br>17<br>9<br>15<br>242<br>9<br>2<br>1<br>4<br>3 |

| TABLE B-7 CUNTINUED   | AUSELLAC    | IUK TABLE |              |                         |             |                          |                              | AP               | PENDIX B                     |
|---|-------------|-----------|--------------|-------------------------|-------------|--------------------------|------------------------------|------------------|------------------------------|
| WEATHER (CONTINUED)   | FA          | TAL ACC I | ENTS         |                         | TAL ACCI    |                          | Αι                           | LL ACCIDE        | ENTS                         |
|   | CAUSE       | FACTOR    | TOTAL        |                         | FACTOR      |                          | CAUSE                        | FACTOR           | TOTAL                        |
| HIGH DENSITY ALTITUDE THUNDERSTORM ACTIVITY OTHER   |             | 2         | 2            | 1                       | 3<br>4<br>1 | 4<br>4<br>1              | 1                            | 5<br>4<br>1      | 6<br>4<br>1                  |
| SUBTOTAL  | 9           | 30        | 39           | 136                     | 188         | 324                      | 145                          | 216              | 363                          |
| ** MISCELLANEOUS **   |             |           |              |                         |             |                          |                              |                  |                              |
| BIRO COLLISION EVASIVE MANEUVER TO AVOID COLLISION UNQUALIFIED PERSON OPERATED AIRCRAFT SABOTAGE FOREIGN MATERIAL AFFECTING NORMAL OPERATIONS UNDETERMINED DIRECT ENTRIES | 9<br>3<br>1 |           | 9<br>3<br>1  | 1<br>1<br>5<br>1<br>100 | 3           | 1<br>8<br>1<br>103       | 1<br>5<br>1<br>109<br>3<br>6 | 3                | 1<br>8<br>1<br>112<br>3<br>6 |
| SUBTOTAL  | 13          |           | 13           | 113                     | 6           | 119                      | 126                          | 6                | 132                          |
|   | 1,          |           | 1,5          | 113                     | ٥           | 114                      | 126                          | •                | 132                          |
| GRAND TOTAL   | 314         | 48        | 362          | 4488                    | 354         | 4842                     | 4802                         | 402              | 5204                         |
| ** MISCELLANEOUS ACTS, CONDITIONS **  |             |           |              |                         |             |                          |                              |                  |                              |
| ANTI-ICING/DEICING EQUIP-IMPROPER OPER. DF/FAILED TO US<br>CHECKLIST-FAILED TO USE<br>DISREGARD OF GOOD OPERATING PRACTICE<br>IMPROPER EMERGENCY PROCEDURES               | SE 12       | 1         | 13<br>1<br>2 | 379<br>2<br>1<br>5      | 6<br>5<br>8 | 385<br>7<br>1            | 391<br>2<br>1                | 7<br>5<br>1      | 398<br>7<br>2                |
| INSTRUMENTS-MISREAD OR FAILED TO READ SEAT BELT NOT FASTENED NOT ALLIGNED WITH RUNWAY/INTENDED LANDING AREA UNWARRANTED LOW FLYING  | -           |           |              | Ź                       | 1<br>1<br>2 | 13<br>1<br>1<br>2        | 7                            | 8<br>1<br>1<br>2 | 15<br>1<br>1<br>2            |
| INATTENTIVE TO FUEL SUPPLY  | 9           | 1         | 10           | 107                     | 5<br>22     | 5<br>129                 | 116                          | 5<br>23          | 5<br>139                     |
| POORLY PLANNED APPROACH MISCALCULATED FUEL CONSUMPTION  | 2           | 2         | 4            | 1<br>66                 | 4<br>15     | 5<br>81                  | 1<br>68                      | 4<br>17          | 5<br>85                      |
| JETTISONED LOAD<br>STOLEN OR UNAUTHORIZED USE OF AIRCRAFT   |             | 2         | 2            |                         | 13<br>5     | 13<br>5                  |                              | 13<br>7          | 13<br>7                      |
| LANDED ON FOAMED RUNWAY<br>Improperly Secured<br>Rogus Part   | 2           |           | 2            | 32<br>3                 | 1<br>3      | 1<br>35<br>3             | 34<br>3                      | 1                | 1<br>37<br>3                 |
| ELECTRICAL FAILURE<br>ENGINE LOADED UP  | 1           |           | 1            | 3<br>109                | 3<br>17     | 6<br>126                 | 3<br>110                     | 3<br>17          | 6<br>127                     |
| FATIGUE FRACTURE FUEL GRADE-IMPROPER IMPROPER GRADE OIL-LUBRICATING SYSTEM RPM-UNCONTROLLABLE-OVERSPEED   | 2           |           | 2            | 43<br>6<br>2            | 1 2         | 44<br>6<br>2<br>2        | 45<br>6<br>2                 | 1 2              | 46<br>6<br>2                 |
| WINDSHIELD, DIRTY, FOGGY, ETC-RESTRICTED VISION WRONG PART  |             | 1         | 1            | 1                       | 2           | 2                        | ,                            | 3                | 2<br>3<br>1                  |
| IMPROPER ALIGNMENT/ADJUSTMENT<br>SEPARATION IN FLIGHT   | 3           | 1         | 3<br>1       | 16<br>1                 | 1<br>11     | 17<br>12                 | 19<br>1                      | 1<br>12          | 20<br>13                     |
| FIRE IN ENGINE CORRODED/CORROSION CONGESTED TRAFFIC-PATTERN PILOT FATIGUE   | 1           | 2         | 1 2          | 2<br>6<br>1             | 1           | 3<br>7<br>1              | 2<br>7<br>1                  | 1<br>1<br>2      | 3<br>8<br>3                  |
| FUEL EXHAUSTION FUEL CONTAMINATION-EXCLUSIVE OF WATER IN FUEL   | 34          | 1         | 35           | 724                     | 2           | 724                      | 758                          | 2                | 759                          |
| ALCOHOLIC IMPAIRMENT OF EFFICIENCY AND JUDGMENT<br>HYPOXIA<br>ICE-IN FUEL   | 1<br>6      | 2         | 8            | 55<br>4<br>9            | 2<br>1<br>2 | 57<br>4<br>1             | 56<br>10<br>9                | 2<br>2<br>1      | 58<br>12<br>1                |
| ICE-ENGINE ICE-CARBURETOR ICE-PROPELLER AIRFRAME ICE  | 12          |           | 12           | 316<br>1<br>2           | 7           | 11<br>1<br>323<br>1<br>5 | 1<br>32 fl<br>1<br>2         | 2<br>7<br>3      | 11<br>335<br>1<br>5          |
| ICE-WINDSHIELD<br>IMPROPERLY LOADED AIRCRAFT-WEIGHT-AND/OR CG   | 1           | 2         | 3            | 1                       | 1           | 1<br>1                   | 1<br>1                       | 3                | 1                            |
| LACK OF LUBRICATION-SPECIFIC PART, NOT SYSTEM OIL EXHAUSTION-ENGINE LUBRICATION SYSTEM OIL EXHAUSTI(M-PROPELLER SYSTEM  | 3           |           | 3            | 9<br>53<br>2            | 1 2         | 10<br>55<br>2            | 9<br>56<br>2                 | 1 2              | 10<br>58<br>2                |
| OIL CONTAMINATION<br>SIMULATED CONDITIONS<br>FUEL SIPHONING<br>MATER IN FUEL  | 6           | 1         | 7            | 65<br>3                 | 50<br>1     | 115<br>4                 | 71<br>3                      | 51<br>1          | 1 2 2<br>4                   |
| TRIES IN FUEL   | 5           |           | 5            | 171                     | 5           | 176                      | 176                          | 5                | 181                          |

#### TABLE B-7 CONTINUED

#### CAUSE/FACTOR TABLE

MISCELLANEOUS ACTS, CONDITIONS (CONTINUED)

AIRCRAFT CAME TO REST IN WATER

AIRCRAFT CAME TO REST IN WATER
FROZEN, MOISTURE
MISSING
TOUCH AND GO LANDING
OVERLOAD FAILURE
MATERIAL FAILURE
FUEL STARVATION
OIL STARVATION
OIL STARVATION
HAPROPER CLEARANCE-TOLERANCE
FUEL SELECTOR POSITIONED RETHEEN TANKS
FIRE OF UNDETERMINED DRIGIN
UNAPPROVED MODIFICATION
IMPROPER/INADEQUATE VENTING
ACTION, LACK OF
POOR WELD
PREVIOUS DAMAGE
LEAK/LEAKAGE
LOW FLUID LEVEL
ARCING
LOW COMPRESSION
DOWNNIND
CARBON DEPOSITS
LANDED IN CONSTRUCTION AREA
OVER TORQUED
UNDER TORQUED
LOSSE, PART/FITTING
MENT

LOOSE, PART/FITTING

FRICTION, EXCESSIVE GROUNDED IMPROPERLY INSTALLED

OPEN
OUT OF BALANCE
OVERHEATED
EXCESSIVE PRESSURE
PRESSURE TOO LOW
PRESSURE, NONE
SCORED

EXCESSIVE TEMPERATURE VIBRATION, EXCESSIVE

BENT BINDING BURNED CHAFFED

JAMMED OBSTRUCTED DPEN

SHEARED STICKING STRIPPED STUCK

COLLAPSED CROSSED DETERIDRATED DISCONNECTED EXCESSIVE ERRATIC

| FAT         | AL ACCID | ENTS        | NONFA           | TAL ACCI    | DENTS           | AL              | L ACCIDE    | NTS             |
|-------------|----------|-------------|-----------------|-------------|-----------------|-----------------|-------------|-----------------|
| CAUSE       | FACTOR   | TOTAL       | CAUSE           | FACTOR      | TOTAL           | CAUSE           | FACTOR      | TOTAL           |
|             | 3        | 3           |                 | 33          | 33              |                 | 36          | 36              |
| 1           | 2<br>1   | 3<br>1      | 4<br>14         | 3<br>7      | 4<br>17<br>7    | 4<br>15         | 5<br>8      | 20<br>20<br>8   |
| 10<br>51    | 2        | 10<br>53    | 1<br>422<br>701 | 11          | 1<br>433<br>701 | 1<br>432<br>752 | 11<br>2     | 1<br>443<br>754 |
| 2<br>3<br>8 | 1        | 2<br>3      | 33<br>17        | 1           | 34<br>17        | 35<br>20        | 1           | 36<br>20        |
| •           | 1        | 1           | 28<br>1<br>5    | 4 2         | 32<br>1<br>7    | 36<br>1         | 5           | 41<br>1         |
|             | *        | •           | 4               | 3<br>1      | 7<br>1          | 5<br>4          | 3<br>3<br>1 | 8<br>7<br>1     |
| 2           |          | 2           | 2<br>5<br>20    | 3           | 2<br>8<br>23    | 2<br>5<br>22    | 3           | 2<br>8<br>25    |
| 1           |          | 1           | 6               | 2           | 2               | 1               | 5           | 2               |
| 3           | 1        | 1 4         | 22              | 4<br>3      | 6<br>4<br>25    | 6<br>25         | 5<br>4      | 6<br>5<br>29    |
|             |          |             | 1               | 1           | 1<br>1<br>1     | 1               | 1           | 1 1             |
| 4 2         |          | 4           | 26<br>3         | 3           | 29<br>3         | 3n<br>3         | 3           | 33<br>3         |
|             |          | 5           | 5<br>11<br>2    | 1<br>2<br>2 | 6<br>13<br>4    | . 7<br>11<br>2  | 1<br>2<br>2 | 8<br>13<br>4    |
| 1           |          | 1           | 4               | ī           | 5               | 5<br>1          | 1           | 6               |
| 1           | 1        | ?<br>1<br>1 | 2<br>13<br>5    |             | 2<br>13<br>5    | 3<br>13         | 1           | 4<br>14         |
|             |          | •           | 2<br>1          | 11          | 13              | 6<br>2<br>1     | 11          | 6<br>13<br>1    |
|             | 1        | 1           | 5<br>24<br>3    | 3           | 5<br>27<br>3    | 5<br>24<br>3    | 4           | 5<br>28         |
|             | 1        | 1           | 19              | 1           | 19<br>1         | 19              | 1           | 3<br>20<br>1    |
|             |          |             | 1<br>13<br>3    | 2<br>1      | 3<br>14<br>3    | 1<br>13<br>3    | 2<br>1      | 3<br>14<br>3    |
| 1           |          | 1           | 10<br>5<br>2    | 2<br>2      | 12<br>7         | 10<br>5         | 2           | 12<br>7         |
| Ž           |          | ž           | 5<br>8          | 2           | 2<br>5<br>10    | 3<br>7<br>8     | 2           | 3<br>7<br>10    |
| 1           |          | 1           | 1<br>10<br>3    | 3<br>4      | 1<br>13<br>7    | 10              | 3           | 1<br>13         |
|             |          | •           | 2<br>1          | 3           | 5<br>1          | 4<br>?<br>1     | 4<br>3      | 8<br>5<br>1     |

APPENDIX B

#### DIRECT ENTRY CAUSES

PILOT-IMPROPERLY EXECUTED EMERGENCY LANDING PILOT-INCAPACITATION CAUSED BY DRUGS PAR PLT-LEFT CRANKSHAFT IDLER GEAR CAP SCREW FAILD PHR PLT-OIL STARVATION FOR UNDETERMINED REASON MISC-WATER FROZE IN FUEL SELECTOR BLOCKING FLOW PILOT-INADVERTENTLY TURNED MAGNETIS SWITCH DFF PWR PLT-ENGINE CRANKCASE RREATHER PLUGGED BY ICE PERSONNEL-IMPROPERLY SECURED OIL FILLER CAP. PWR PLT-RE-INGESTION OF EXHAUST GAS PWR PLT-SLUSH ENTERED CARBURETOR AIR INTAKE SCOOP. PWR PLT-FUEL SIPHONED OUT FROM DEFORMED TANK VENT.

DIRECT ENTRY CAUSES (CONTINUED)

PMR PLT-CARB.FLOAT IMPROPERLY INSTALLED, STICKING. PMR PLT-IMPROPER CARBURETOR INSTALLED. PMR PLT-IMPROPER FUEL GAUGE INSTALLED. PMR PLT-SEAL ON OIL FILTER IMPROPERLY INSTALLED. PILOT-INADVENTENTLY ACTUATED MIXTURE CONTROL PWR PLT-IMPROPER FUEL GAUGE INSTALLED.
PHR PLT-SEAL ON OIL FILTER IMPROPERLY INSTALLED.
PHR PLT-SEAL ON OIL FILTER IMPROPERLY INSTALLED.
PHR PLT-ACELERATOR PUMP JAMMED BY DUST COVER.
PHP PLT-IMPROPERLY RIGGED MIXTURE CONTROL.
PHR PLT-ACELERATOR PUMP JAMMED BY DUST COVER.
PHP PLT-IMPROPERLY RIGGED MIXTURE CONTROL.
PHR PLT-ACELERATOR FUMP JAMMED BY DUST COVER.
PHR PLT-FATIGUE FAILURE OF CARB HEAT CONTROL.
PHR PLT-MATERIAL FAILURE, CAM REDUCTION GEAR ASSEMB PHR PLT-CARBURETOR NEEDLE VALVE STUCK.
PHR PLT-EXCESSIVE CARBON DEPOSITS ON SPARK PLUGS.
MISC-FUEL SELECTOR MOVED OFF FULL OPEN POSITION
PHR PLT-FATIGUE FAILURE OF NUMBER 1 CYLINDER.
PHR PLT-CAMBURETOR NEEDLE VALVE STUCK.
PHR PLT-CAM REDUCTION GEAR FAILED.
MISC-CARBURETOR HEAT CONTROL BRACKET FAILED
PHR PLT-FUEL STRAVATION FOR UNDETERMINED REASON
PHR PLT-FUEL STRAVATION FOR UNDETERMINED REASON
PHR PLT-FUEL STRAVATION FOR UNDETERMINED REASON
PHR PLT-FUEL STRAVATION FOR AN UNDETERMINED REASON
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PHR PLT-FUEL STRAVATION FOR AN UNDETERMINED REASON
PHR PLT-FUEL STRAVATION FOR UNDETERMINED REASON
PHR PLT-FUEL STRAVATION FOR UNDETERMINED REASON
PHR PLT-CAMBHAFT ORTVE GEAR BOLTS FAILED.
PHR PLT-CAMBHAFT ORTVE GEAR BOLTS FAILED.
PHR PLT-POSITIONED MIXTURE CONTROL TO IDLE-CUT-OFF.
PHR PLT-DESTITIONED MIXTURE CONTROL TO IDLE-CUT-OFF.
PHR PLT-FUEL STRAVATION FOR UNDETERMINED CAUSE.
PHR PLT-EXCESSIVE FUEL CONSUMPTION-CAUSE UNDETERMIN
PLT-FUEL STRAVATION FOR UNDETERMINED CAUSE.
PHR PLT-FUEL STRAVATION FOR UNDETERMINED CAUSE UNDTRMNO.
PHR PLT-FUEL PRESSURE DROPPED TO ZERO-CAUSE UNDTRMNO.
PHR PLT-FUEL PRESSURE UNDETERMINED.
PHR PLT-HORD FUEL CONSUMPTION-CAUSE UNDTRMNO.
PHR PLT-HUEL STRAVSTON FOR UNK CAUSE.
PHR PLT-EXCESSIVE FUEL CONSUMPTION CAUSE NOT ORRMD
PILOT-LANDVERTERMILY TURNED GER GERE SATURATED.
PHR PLT-FUEL EXHAUSTION FOR U

DIRECT ENTRY CAUSES ARE CARRIED UNDER THEIR APPROPRIATE CAUSAL CATEGORIES AND ARE INCLUDED IN THE TOTALS

APPENDIX B

ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE SINGLE ENGINE FIXED-WING AIRCRAFT U. S. GENERAL AVIATION 1965 — 1969 CAUSES DISPLAYED RELATE TO FIRST AND SECOND ACCIDENT TYPES CAUSE/FACTOR TABLE

3855 TOTAL ACCIDENTS 208 FATAL ACCIDENTS INVOLVES INVOLVES

| BROAD CAHCE/CACTOR                    | FAT          | FATAL ACCIDENTS | ENTS         | NONFA         | NONFATAL ACCIDENTS | DENTS         | AL           | ALL ACCIDENTS | NTS          |
|---------------------------------------|--------------|-----------------|--------------|---------------|--------------------|---------------|--------------|---------------|--------------|
|                                       | CAUSE        | FACTOR          | TOTAL*       | CAUSE         | FACTOR             | TOTAL*        | CAUSE        | FACTOR        | TOTAL#       |
| P1L0T                                 |              |                 |              |               |                    |               |              |               |              |
| PERSONNEL                             | 171<br>82.21 | 15              | 173<br>83.17 | 2163<br>59.31 | 72<br>1.97         | 2169<br>59.47 | 2334 60.54   | 87            | 2342         |
| AIRFRAME                              | 29<br>13•94  | 3 1 + 44        | 32<br>15•38  | 377<br>10.34  | 33<br>•90          | 411           | 406<br>10.53 | 36            |              |
| LANDING GEAR                          | 1<br>• 48    | 00•             | 1.48         | 1.03          | 1.03               | 2.05          | 2<br>•05     | 1.03          | 80           |
| POWERPLANT                            | . 00•        | 00              | • 00         | 5<br>•14      | 00•                | 5             | 5<br>• 13    | 00.           | 13           |
| SYSTEMS                               | 94<br>45.19  | 2<br>•96        | 96<br>46.15  | 1553<br>42.58 | 61<br>1•67         | 1608<br>44.09 | 1647         | 63            | 1704         |
| INSTRUMENTS/EQUIPMENT AND ACCESSORIES | 00•          | 00•             | 00•          | 16            | 2<br>• 05          | 18<br>•49     | 16<br>•42    | 2<br>•05      | 18           |
| ROTORCRAFT                            | 00•          | 00•             | 00.          | • 11          | 5<br>•14           | 9.25          | .10          | 5<br>• 13     | 9.23         |
| AIRPORTS/AIRWAYS/FACILITIES           | 00•          | • 00            | 00•          | • 00          | 60.                | 00*           | 00•          | 00•           | 00•          |
| WEATHER                               | • 00         | 1.48            | 1<br>• 48    | 8<br>•22      | 21                 | 29            | 8<br>•21     | 22<br>•57     | 30           |
| TERRAIN                               | 11<br>5,29   | 25<br>12•02     | 33<br>15•87  | 149<br>4.09   | 183<br>5.02        | 328<br>8.99   | 160<br>4.15  | 208<br>5.40   | 361<br>9•36  |
| MISCELLANEDUS                         | 12<br>5.77   | 16<br>7.69      | 28<br>13.46  | 301<br>8,25   | 517<br>14.18       | 818<br>22•43  | 313<br>8•12  | 533<br>13•83  | 846<br>21•95 |
| UNDETERMINED                          | . 11<br>5.29 | 00•             | 11<br>5.29   | 141<br>3.87   | 8                  | 149<br>4.09   | 152<br>3.94  | 8<br>•21      | 160<br>4.15  |
|                                       | 3<br>1.44    | 00.             | 3            | 00•           | 00•                | 00•           | 3<br>•08     | 00•           | 80•          |
| THE FIGURES DEPOSITE TAKE             |              |                 |              |               |                    |               |              |               |              |

THE FIGURES OPPOSITE EACH CAUSAL CATEGORY REPRESENT THE NUMBER AND PERCENT OF ACCIDENTS IN WHICH THAT PARTICULAR CAUSAL CATEGORY WAS ASSIGNED

<sup>\*</sup> IF AN ACCIDENT INCLUDES BOTH A CAUSE AND RELATED FACTOR IN THE SAME CAUSAL CATEGORY, THE ACCIDENT IS REPRESENTED ONCE UNDER THE TOTAL FOR THAT CATEGORY

#### APPENDIX B CAUSE/FACTOR TABLE TABLE B-9

ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE SINGLE ENGINE FIXED-WING AIRCRAFT
U. S. GENERAL AVIATION
1965 - 1969
CAUSES DISPLAYED RELATE TO FIRST AND SECOND ACCIDENT TYPES

INVOLVES 3855 TOTAL ACCIDENTS INVOLVES 208 FATAL ACCIDENTS

| NVOLVES 208 FATAL ACCIDENTS  | FAT    | AL ACCID | ENTS  | NON     | SFATA     | L ACCI  | DENTS | <u>s</u>  |          | L ACCIDE     | NTS      |
|--|--------|----------|-------|---------|-----------|---------|-------|-----------|----------|--------------|----------|
|  | -      | FACTOR   | TOTAL |         | SE 1      | FACTOR  |       | AL        | CAUSE    | FACTOR       | TOTAL    |
| DETAILED CAUSE/FACTOR  |        |          |       |         |           |         |       |           |          |              |          |
|  |        |          |       |         |           |         |       |           |          |              |          |
|  |        |          |       |         |           |         |       |           |          |              |          |
| ** PILOT **  |        |          | 4     | 2       | 21        | . 4     |       | 25        | 24       | 5<br>2       | 29<br>13 |
| PILOT IN COMMAND  ATTEMPTED OPERATION M/KNOWN DEFICIENCE IN EQUIPMENT  ATTEMPTED OPERATION BEYOND EXPERIENCE/ABILITY LEVEL   | 3<br>2 | 1        | 2     |         | 9         | 2       |       | 11<br>90  | 11<br>86 | 10           | 96       |
|  | 6      |          | 6     | _       | 90        | 10<br>4 |       | 35        | 40       | 5            | 45       |
| BECAME LOST/DISORIENTED ADVERSE WEATHER CONDITIONS   | 9      | 1        | 10    | -       | 31<br>8   | •       |       | 8         | В        | 1            | 8<br>12  |
| CONTINUED VER FLIGHT IN ABORTING TAKEOFF   |        |          |       | !       | 11        | 1       |       | 12        | 11       | î            | 4        |
| DELAYED IN INITIATING GO-AROUND DELAYED IN INITIATING GO-AROUND  |        |          | ,     |         | 3         | 1       |       | -         | 1        |              | 1 4      |
| DELAYED IN INITIATING GU-ARADONO DELAYED ATTENTION FROM OPERATION OF AIRCRAFT EXCEEDED DESIGN STRESS LIMITS OF AIRCRAFT EXCEEDED DESIGN STRESS LIMITS OF AIRCRAFT  | 1      |          | 1     |         | 4         |         |       | 4<br>1    | 4        |              | i        |
| EXCEEDED DESIGN STRESS DESIGNATION OF THE PROPERTY OF THE PROP |        |          |       |         | 1<br>1    |         |       | i         | ī        |              | i.<br>1  |
|  |        |          |       |         | 1         |         |       | 1         | 1        |              | i        |
| RETRACTED GEAR PREMATED CEAR   | 1      |          |       |         |           |         |       | 21        | 22       |              | 22       |
| INADVERTENTLY RETRACTED GLARAFT FAILED TO SEE AND AVOID OTHER AIRCRAFT FAILED TO SEE AND AVOID DBJECTS OR OBSTRUCTIONS   | 1      |          |       | 1       | 21<br>167 |         |       | 167       | 252      | 1            | 253      |
| FAILED TO SEE AND RECTION SPEED  | 85     | 1        |       | 2       | 8         | _       |       | В<br>22   | 10<br>20 |              | 3 2      |
| FAILED TO OPTAINTHE THE HERO MISC FOITT PMENT  | 2<br>1 |          |       | 1       | 19<br>456 | 3       |       | 456       | 471      |              | 47<br>1  |
| EATIFD TO PULLUM MET TO THE CONTROL AND CONTROLS   | 15     |          | 1     | 5 '     | 12        |         |       | 12        | 12       |              | i        |
| IMPROPER OPERATION OF PRAKES AND/OR FLIGHT CONTROLS  | 3      |          |       | 3       | 10        |         |       | 10<br>78  | 13<br>80 |              | 8        |
| IMPROPER OPERATION OF FLIGHT CONTROLS  | ź      |          |       | 2       | 78<br>1   |         |       | 1         | . ,      |              | 5 12     |
| THROUDER 1 FVEL UFF  |        |          | ,     | .4      | 104       |         | 5     | 109       | 118      | •            | 5 1      |
| IMPROPER 1FR OPERATIONS OR PLANNING  | 14     |          |       |         | 2         |         | ,     | 2<br>810  | 850      |              | 8 8      |
| IMPROPER IN-FLIGHT DECISIONS IMPROPER COMPENSATION FOR WIND CONDITIONS IMPROPER COMPENSATION FOR PLANNING  | 46     | ,        | 2 4   |         | 804<br>75 | ,       | 6     | 75        | 71       |              | 9 1      |
|  | 3      |          | 6     | 3<br>13 | 28        | 2       | 3     | 51        | 39<br>54 |              | 1 5      |
| INADEQUATE SUPERVISION OF FLIGHT<br>INADEQUATE SUPERVISION OF FLIGHT<br>LACK OF FAMILIARITY WITH AIRCRAFT  | 4      |          |       | 41      | 501       |         | 1     | 502<br>32 | 3        |              | - 1      |
|  |        |          |       | 5       | 32<br>1   |         | 2     | 3         |          | 1            | 2        |
| FXFRCISED POOK JODGMENT  |        | 2        |       | 2       | 34        |         |       | 34        | 3        | 6<br>2       |          |
| OPERATED CARELESSE! TERRAIN  |        | 2        |       |         | 2<br>8    |         |       | 8         |          | ä            |          |
| IMPROPER STARTING PROPERTY OF A DOWN AND LOCKED  |        |          |       |         | 1         |         | 1     | . 2       |          | 1            | ì        |
| MARROPER STARTING PROCEDURES FAILED TO ASSURE THE GEAR WAS DOWN AND LOCKED FAILED TO ASSURE THE GEAR WAS DOWN AND LOCKED INITIATED FLIGHT IN ADVERSE MEATHER CONDITIONS INITIATED FLIGHT IN ADVERSE WEATHER INITIATED FLIGHT AND ACTION  |        |          |       | •       | 16        |         |       | 16<br>7   |          | 8            |          |
| SPONTANEOUS-IMPROPER ACTION  |        | 1        | _     | 1<br>3  | 7<br>41   |         |       | 41        | 4        | •3           | 1        |
|  |        | 2        | 1     | 3       | 1         |         |       | 1<br>26   | :        | 1<br>27      | 1        |
| MISJUDGED DISTANCE AND STATE   |        | 2        |       | 2       | 25        |         | 1     | 2         |          | 3            |          |
|  |        | 1        |       | 1       | 2         |         |       | 4         |          | 3            |          |
| MISJUDGED SPEED AND ACTION   |        |          |       |         | 3         | 3       |       | 3         |          | 12           |          |
| MISJUDGED SPEED MISJUDGED ALTITUDE AND CLEARANCE   |        | 3        |       | 3       |           | 7<br>4  |       | 4         |          | 4            |          |
| MISJUDGED ALIHOUE  |        |          |       |         |           | 1       |       | 1 4       |          | 1            |          |
| MISJUDGED CLEARANCE OPDERS OR INSTRUCTIONS   |        |          |       |         |           | 4<br>1  |       | i         |          | 1            |          |
| IMPROPER RECOVERY FROM TOOTTOOL  |        | _        | ,     | 8       |           | 4       |       | 4         |          | 11           | 1        |
| TNCAPACITATION   |        | 7<br>2   | 1     | 2       |           | 3       |       | 3<br>1    |          | 5            | 2        |
| PHYSICAL IMPAIRMENT<br>SPATIAL DISORIENTATION  |        | _        | 1     | 1       |           | 1       | 1     | 5         |          | 1            | 4        |
|  |        |          |       |         |           | 8       |       | В         |          | 8<br>5       | 1        |
| MISUSED OR FAILED TO THE CONTROL   |        |          |       |         |           | 5       | 1     | 6<br>8    |          | 12           | -        |
| EL COTON MENNIS KUNNAT NECHTATO  |        | 4        |       | 4       |           | 8       |       | 2         |          | 2            |          |
|  |        | •        |       | 3       | :         | 12      |       | 12        |          | 15           |          |
| FAILED TO INITIATE GD-AROUND   |        | 3        |       | -       |           |         |       |           |          | 969          | 84       |
| OTHER ENTRIES  |        |          |       |         | ~ ~ .     | 0.5     | 70    | 2 (6)     | , .      | 70 7         |          |
| DIRECT ENTRIES   |        | 274      | 14    | 288     | 26        | 95      | 70    | 2765      | , ,      | <b>7</b> 0 7 | •        |

## TABLE B-9 CONTINUED COPILOT (CONTINUED)

#### CAUSE/FACTOR TABLE

|   |             |          |              |                     |             |                             |                   | AP          | PENDIX B                    |   |
|---|-------------|----------|--------------|---------------------|-------------|-----------------------------|-------------------|-------------|-----------------------------|---|
|   |             | TAL ACCI |              | NONE A              | TAL ACC     | I DENTS                     | AL                | L ACCIDE    | ENTS                        |   |
|   | CAUSE       | FACTOR   | TOTAL        | CAUSE               | FACTOR      | TOTAL                       |                   | FACTOR      | TOTAL                       |   |
| COPILAT   |             |          |              |                     |             |                             |                   |             |                             |   |
| FAILED TO OBTAIN/MAINTAIN FLYING SPEED IMPROPER OPERATION OF POWERPLANT + POWERPLANT CONTROLS IMADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING SUBTOTAL   |             |          |              | 1                   |             | 1 1                         | 1                 |             | 1                           |   |
|   |             |          |              | 1                   |             | 1                           | i                 |             | 1<br>1                      |   |
| OUAL STUDENT DELAYED IN INITIATING GO-AROUND FAILED TO SEE THE TOTAL  |             |          |              | 3                   |             | 3                           | 3                 |             | 3                           |   |
| FAILED TO OBTAIN/MAINTAIN FLYING SPEED IMPROPER OPERATION OF POWERPLANT + POWERPLANT CONTROLS IMPROPER OPERATION OF BRAKES AND/OR FLIGHT CONTROLS IMPROPER OPERATION OF BRAKES AND/OR FLIGHT CONTROLS IMPROPER OPERATION OF BRAKES AND/OR FLIGHT CONTROLS | 1<br>4      |          | 1<br>4       | 1<br>2<br>13<br>21  |             | 1<br>2<br>13                | 1<br>3<br>17      |             | 1<br>3<br>17                | ነ |
| INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING LACK OF FAMILIARITY WITH AIRCRAFT MISMANAGEMENT OF FUEL FAILURE TO SELVINOR  |             |          |              | 1<br>5<br>5<br>1    |             | 21<br>1<br>5<br>5<br>1      | 21<br>1<br>5<br>5 |             | 21<br>1<br>5<br>5           |   |
| SPONTANEOUS-IMPROPER ACTION MISJUDGED DISTANCE AND ALTITUDE MISJUDGED SPEED TO USE FLAPS FAILED TO ABORT TAKEOFF                      |             |          |              | 11<br>1<br>2<br>2   | 1 1         | 1<br>12<br>2<br>2<br>2<br>1 | 11<br>2<br>2      | 1<br>1<br>1 | 1<br>12<br>2<br>2<br>2<br>2 |   |
| SUBTOTAL  |             | 1        | 1            | 1<br>1              |             | 1                           | ì                 | 1           | 1                           |   |
| ** PERSONNEL **   | 5           | 1        | 6            | 68                  | 3           | 1                           | 1                 | •           | 1<br>1                      |   |
| FLIGHT INSTRUCTOR INADEQUATE SUPERVISION OF FLIGHT INADEQUATE TRAINING OF STUDENT URECT ENTRIES   |             |          |              |                     |             | 71                          | 73                | 4           | 77                          |   |
| MAINTENANCE, SERVICING, INSPECTION IMPROPER MAINTENANCE (MAINTENANCE PERSONNE)  | 5           |          |              | 2<br>7<br>1         | 3           | 3<br>10<br>1                | ?<br>7<br>1       | 1<br>3      | 3<br>10<br>1                |   |
| IMPROPERLY SERVICED AIRCRAFT(GROUND CREW) IMADEQUATE INSPECTION OF AIRCRAFT(MAINTENANCE DEDICATION IMADEQUATE INSPECTION OF AIRCRAFT(MAINTENANCE DEDICATION)  | 3<br>1<br>2 |          | 5<br>3<br>1  | 39<br>16<br>6<br>21 | 2<br>2<br>2 | 39<br>18<br>8               | 44<br>19<br>6     | 2           | 44<br>21<br>8               |   |
| OTHER   | 17          | 1        | 2<br>1<br>19 | 9<br>3<br>248       |             | 23<br>9<br>3                | 22<br>11<br>3     | 2<br>1      | 24<br>11                    |   |
| ONLYNK  PERATIONAL SUPERVISORY PERSONNEL  FAILURE TO PROVIDE ADEO DIRECTIVES, MANUALS, EQUIPMENT  BEFICIENCY, COMPANY MAINTAINED EOMT, SERV, REGULATIONS  LINCORPER PERSONNEL   | 1           |          | ı            | 1                   | 11          | 259                         | 265<br>2<br>1     | - 7         | 278<br>2<br>1               |   |
| INADEQUATE/INCORRECT WEATHER BRIEFING RAFFIC CONTOL PERSONNEL REPORT SUPERVISORS  | 1           |          | 1            | 1                   | 1           | 1<br>2<br>1<br>1            | 1                 | 1           | 1<br>2<br>2                 |   |
| IMPROPER INSPECTION OF FACILITIES OTHER   |             |          |              | 2                   | 1           |                             | ì                 |             | 1                           |   |
| RMAYS FACILITIES PERSONNEL  BOULTION-DESIGN SUBSTANDARD QUALITY CONTROL  WECORRECT FACTORY INSTALLATION   |             |          |              | ĭ                   | 1 1         | 3<br>2<br>1                 | 2                 | 1<br>1<br>1 | 3<br>2<br>1                 |   |
| OTHER   | 1           |          | 1            | 1<br>5              |             | 1<br>5                      | 1                 |             | ì                           |   |
| SCELLANEOUS-PERSONNEL<br>PLOT OF OTHER AIRCRAFT<br>PASSENGER  | 1           |          | 1            | 6                   | 2           | 8                           | 6<br>6<br>4       | 2<br>1      | 6<br>B<br>5                 |   |
| DRIVER OF VEHICLE<br>DINER<br>DIRECT ENTRIES  |             |          |              | 5                   | 1 2         | 2<br>7                      | 1                 | 1 2         | 2                           |   |
| RO PILOT<br>GHT ENGINEER<br>Spatching   |             |          |              | 1<br>1<br>2         | ,1          | 2<br>1<br>2                 | -                 | 1           | 7<br>2<br>1<br>2            |   |
|   |             |          |              |                     |             |                             |                   |             | -                           |   |

#### CAUSE/FACTOR TABLE

| ### ACCIDENTS   MONFATAL ACCIDENTS   ACCID | TABLE B-9 CONTINUED  | CAUSE/FACT | OR TABLE |      |     |          |         |      |       |          |         |          |      |                |
|--|--|------------|----------|------|-----|----------|---------|------|-------|----------|---------|----------|------|----------------|
| SUBTOTAL  *** AIRFRAME ***  ** AIRFRAME ***  *** |  |            | AL ACCIO | SENT | s   | NONFA    | TAL     | ACCI | DENTS |          | ALL     | , ACCID  | ENTS |                |
| SUBTOTAL  ***********************************  |  | CAUSE      | FACTOR   | TO   | TAL |          | FA      | CTOR | TOTAL | CAU      | ISE     | FACTOR   | T0   | TAL            |
| SUBTOTAL  ** AIRFRAME ***  ** AIRFRAME * |  |            |          |      |     | 105      |         | 33   | 418   | 41       | 17      | 36       |      | 453            |
| NOTE   | SUBTOTAL   | 32         | 3        |      | 35  | 505      |         |      |       |          |         |          |      |                |
| INDESTRUCTURE  | ** AIRFRAME **   |            |          |      |     |          |         |      |       |          | ,       |          |      | 1              |
| DITECT   | WINGS<br>RRACING WIRES, STRUTS   | 1          |          |      | 1   |          |         | 1    | 1     |          |         | 1        |      |                |
| LANDING GERRACTION/EXTENSION ASSEMBLY  MIDSEARED, ASSEMBLES  RAKACHO SYSTEM KNORMALL  DIRECT ENDREMAN  DIRECT ENDREMAN  DIRECT ENDREMAN  DIRECT ENDREMAN  SUBTOTAL  ### POCEMPLANT #**  ## | OTHER  |            |          |      |     | 1        |         |      |       |          |         |          |      |                |
| NASSENEELY SYSTEM INDOMALS)  **COLOR TO THE CONTROL SUMPACES** **COLOR TO THE COLOR | WINDSHIELDS, WINDOWS, CANOFILE LANDING GEAR DOGMAL RETRACTION/EXTENSION ASSEMBLY |            |          |      |     | 1        |         |      | 1     | l        | 1       |          |      | 1<br>1         |
| DIRECT ENTRIES SURFACES   1  | NOSEWHEEL ASSEMBLIES<br>BRAKING SYSTEM (NORMAL)                                  |            |          |      |     | 1        |         |      |       |          | 1       |          |      |                |
| SUBSTITUTAL  *** PONCERPLANT ***  ENCINE STRUCTURE  CRANKSHAFT  CRANKSHAFT  ASSTRUCTURE  CRANKSHAFT  3 1 4 59 1 60 62 2 6 7 15 17 18 18 18 18 18 18 18 18 18 18 18 18 18   | DIRECT ENTRIES FLIGHT CONTROL SURFACES FLIGHT CONTROL SURFACES ATTACHMENTS       | 1          |          |      | 1   |          |         | 1    |       | 1        | 1       |          |      | 1              |
| ENGINE STEUCTURE  CANKASSE  CANCASSE  CANCASSE | HORIZONTAL STABILITERY ATTACHMENT  | 2          |          |      | 2   | 6        |         | 2    |       | 8        | A       | :        | 2    | 10             |
| ENGINE STRUCTURE  CRANKCASE  CRANKCASE  3 3 72 77 75 1 6  MASTER AND CONNECTING RODS  3 1 4 58 1 59 6 1 1 6  CASTER AND CONNECTING RODS  3 1 4 58 1 59 6 1 1 6  CASTER AND CONNECTING RODS  3 1 4 58 1 123 125 1 12  PISTON, PISTON RIMOS  3 3 3 122 1 123 125 1 12  PISTON, PISTON RIMOS  3 3 3 122 1 123 125 1 12  PISTON, PISTON RIMOS  3 1 4 58 1 103 125 1 12  PISTON, PISTON RIMOS  3 1 4 58 1 103 125 1 12  PISTON, PISTON RIMOS  3 1 4 58 1 103 125 1 12  PISTON, PISTON RIMOS  3 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1  |  |            |          |      |     |          |         |      |       |          |         |          |      |                |
| CRANKCASE CRANKSAMOT CONNECTING RODS 3 1 4 58 59 61 1 60 62 2 6 72 72 75 1 60 60 61 1 60 62 7 60 61 1 60 62 7 60 61 1 60 61 7 60 61 1 60 61 7 61 61 61 61 61 61 61 61 61 61 61 61 61   | ENGINE STRUCTURE   |            |          |      | _   |          |         | 1    | _     |          | 55      |          | 1    | 56             |
| CYLINGER ASSEMBLY PISTON, PISTON RINGS 3 3 5 13 1 13 13 13 13 13 13 13 13 13 13 13 1   | CDAMKSHAFT   | :          | 3        | 1    | 3   | 72<br>58 | 2       |      | 7     | 58       | 61      |          |      | 62<br>64       |
| VALVE ASSEMBLIES 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1   | AVI INDER ASSEMBLY   |            | 3        |      |     | 127      | 2       |      | 17    | 23       | 125     |          |      | 126<br>13      |
| MOUNT AND VIREARITOR 100 MERCHANISM OTHER STRIBUTOR OTHER MAGNETOES DISTRIBUTOR STRIBUTOR STRIBU | VALVE ASSEMBLIES   |            | _        |      | 5   |          | 1       |      |       | 1        |         |          |      | 1<br>36        |
| MAGNÈTOES  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1   | OTHER  |            | -        |      |     |          |         | ;    | 2     |          |         |          |      | 59<br>2        |
| COILS LOW TENSION WIRING HIGH TENSION WIRING JAMPANESS, SHIELDING SWITCHES SWITCHES SWITCHES JAMPANESS OFFICE OTHER  FUEL SYSTEM JAMPANESS JAMPANE | MAGNETOES<br>Distributor   |            |          | 1    |     |          |         | :    | 3     | 40<br>1  | 42<br>1 | 2<br>L   | 4    | 46<br>1<br>2   |
| HIGH TENSION WIRLNESS, SHIELDING  IGNITION HARNESS, SHIELDING  SWITCHES  CLADS OTHER  FUEL SYSTEM  FUEL SYSTEM  LINES AND FITTINGS  LINES AND FITT | CDILS  |            |          |      |     |          | 1       |      | 1     | 1        | 1       | l .      | 1    | 1              |
| LEADS OTHER FUEL SYSTEM FUEL SYSTEM FUEL SYSTEM FUEL SYSTEM FUEL SYSTEM FUEL SYSTEM  FUEL SYSTEM  2 2 2 5 2 27 27 27 27 27 27 27 27 27 27 27 27 2  | HIGH TENSION WIRING<br>IGNITION HARNESS, SHIELDING                               |            |          |      |     |          | 3       |      | -     | 3<br>3   | 3       | 3        |      | 3<br>3<br>2    |
| FUEL SYSTEM TANKS  1   | LEADS  |            |          |      |     |          |         |      | 4     |          |         | 9        |      | 13             |
| SELECTOR VALVES   2   13   1   1   1   1   1   1   1   1   | FUEL SYSTEM  |            |          |      |     |          | 25      |      | 2     | 27<br>22 | 2       | 1        | 2    | 29<br>23<br>16 |
| PRIMING SYSTEM CARRURETOR 5 19 19 24  PUMPS PUEL INJECTION SYSTEM FUEL INJECTION SYSTEM  |  |            | 2        |      | 2   | !        | 2       |      | -     | 2        |         | 4        |      | 4<br>99        |
| PUMPS FUEL INJECTION SYSTEM VENTS, DRAINS, TANK CAPS VENTS, DRAINS, TANK CAPS RAM AIR ASSEMBLY OTHER USBRICATING SYSTEM LURGS, HOSES, FITTINGS VALVES FILTERS, SCREENS VALVES FILTERS, SCREENS FILTERS, SCREENS FILTERS, SCREENS FILTERS, CREENS FILTERS, CREENS FILTERS, SCREENS FILT | PRIMING SYSTEM CARAURETOR  |            | 9        |      |     | 3        | 19      |      | 1     | 19       | 2<br>1  | 24<br>11 |      | 24<br>11<br>43 |
| RAM AIR ASSEMBLY OTHER OTHER  UJBRICATING SYSTEM  UJBRICATING SYSTEM  VALVES  FILTERS, SCREENS  FILTERS, SCREENS  FILTERS, SCREENS  PUMP-PRESSURE  PUMPS-SCAVENGER  OIL COOLERS  MAGNETIC PUGS  SEALS AND GASKETS  OTHER  OTHER  PROPELLER AND ACCESSORIES  HYDRAULIC PITCH CONTROL MECHANISM  OTHER  OTHER  OTHER  OTHER  POPELLER AND ACCESSORIES  HYDRAULIC PITCH CONTROL MECHANISM  OTHER  OTHER   | SHEL INJECTION SYSTEM  |            |          |      |     |          | 34<br>5 |      | В     | 5        |         | 5        | 8    |                |
| LUBRICATING SYSTEM LINES; HOSES, FITTINGS  VALVES  FILTERS, SCREENS FILTER | RAM AIR ASSEMBLY<br>OTHER  |            | 1        |      | :   | 1        |         |      |       |          |         | 11       |      | 1:             |
| FILTERS, SCREENS FILTER | LUBRICATING SYSTEM<br>LINES, HOSES, FITTINGS                                     |            |          |      |     |          | 2<br>8  |      |       | 2<br>8   |         | 8        |      | ;              |
| PUMPS-SCAVENGER  OIL COOLERS  MAGNETIC PLUGS  SEALS AND GASKETS  OTHER  COOLING SYSTEM  OTHER  OTHER  OTHER  ADDES  HYDRAULIC PITCH CONTROL MECHANISM  OTHER  OTHER  OTHER  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1  | FILTERS. SCREENS   |            |          |      |     |          | 2       |      |       | 2        |         | 2        |      |                |
| SEALS AND GASKETS  | PUMPS-SCAVENGER<br>D1L COOLERS   |            |          |      |     |          | 1       |      |       | 1<br>10  |         | 10       | ,    | 1              |
| COOLING SYSTEM OTHER OTHER PROPELLER AND ACCESSORIES 1 1 1 6LADES HYDRAULIC PITCH CONTROL MECHANISM 1 1 1 0THER 2 2 2  | SEALS AND GASKETS  |            |          |      |     |          |         |      | 1     |          |         |          |      |                |
| PROPELLER AND ACCESSURIES  BLADES HYDRAULIC PITCH CONTROL MECHANISM  OTHER  2 2 2  | COOLING SYSTEM   |            |          |      |     |          |         |      |       | 1        |         | 1        |      |                |
| OTHER 2 2  | PROPELLER AND ACCESSORIES  |            | 1        |      |     | 1        | 1       |      |       |          |         |          |      |                |
|  | OTHER<br>EXMAUST SYSTEM  |            |          |      |     | =        |         |      |       | 2        |         | . 5      |      |                |
| MANIFOLDS  | MANIFOLDS  |            |          |      |     |          |         |      |       |          |         |          |      |                |

#### TABLE B-9 CONTINUED

POWERPLANT (CONTINUED)

#### CAUSE/FACTOR TABLE

| MERPEANT (CUNTINUED)   |       |            |       |         |         |              |            |          |        |
|--|-------|------------|-------|---------|---------|--------------|------------|----------|--------|
|  | FA1   | TAL ACC IO | ENTS  | NONEA   | TAL ACC | DENTS        | - <b>-</b> | L ACCIDE | ENTS   |
|  | CAUSE | FACTOR     | TOTAL | CAUSE   | FACTOR  | TOTAL        | CAUSE      | FACTOR   | TOTAL  |
| MUFFLERS<br>GASKETS  | 1     |            | •     |         |         |              |            |          |        |
| STACKS   | •     |            | 1     | 14<br>1 | 1       | 15<br>1      | 15         | 1        | 16     |
| BAFFLES  |       |            |       | 5       |         | 5            | 1<br>5     |          | 1<br>5 |
| GINE ACCESSORIES<br>STARTERS   |       |            |       | 3       |         | 3            | 3          |          | 3      |
| DTHER  |       |            |       | ı       |         | 1            | 1          |          | 1      |
| GINE CONTROLS-COCKPIT<br>THROTTLE-POWER LEVER ASSEMBLIES                 |       |            |       | 1       |         | 1            | 1          |          | i      |
| MIXTURE CONTROL ASSEMBLIES   | 1     |            | 1     | 27      | 1       | 28           | 28         | 1        | 29     |
| MIXTURE CONTROL ASSEMBLIES<br>IMBUCTION AIR, PREHEAT CONTROLS<br>OTHER   | •     |            | 1     | 15<br>6 |         | 15           | 16         | •        | 16     |
| HEKPLANT-INSTRUMENTS   |       |            |       | ì       |         | 6<br>1       | 6<br>1     |          | 6      |
| FUEL QUANTITY GAUGE<br>SCELLANEOUS                                       |       | 1          | 1     | 4       | 22      |              |            |          | 1      |
| POWERPLANT FAILURE FOR UNDETERMINED REASONS                              |       | •          |       | 4       | 33      | 37           | 4          | 34       | 38     |
| DIVO TUREZITUM   | 45    |            | 45    | 677     |         | 677          | 722        |          | 722    |
| FOREIGN OBJECT DAMAGE<br>COMPRESSOR STALLS                               |       |            |       | 1<br>1  |         | 1<br>1       | 1          |          | 1      |
| DETONAT ION  |       |            |       | 1       |         | i            | !<br>1     |          | 1      |
| OTHER<br>Direct entries  | 1     |            | ı     | 5       |         | 5            | 5          |          | 5      |
| DUCTION GEAR ASSEMBLY<br>BEARS, ACCESSORY DRIVE                          | 1     |            | i     | 36      | 1       | 37           | 1<br>37    | 1        | 1      |
| GEARS, ACCESSORY DRIVE<br>DTHER  |       |            |       | _       |         |              |            | 1        | 38     |
| PRESSOR ASSEMBLY<br>BUSTION ASSEMBLY                                     |       |            |       | 3<br>1  |         | 3<br>1       | 3          |          | 3      |
|  |       |            |       | •       |         |              | 1          |          | 1      |
| RBINE ASSEMBLY<br>Zessory Drive Assembly<br>RBICATING System             |       |            |       |         |         |              |            |          |        |
|  |       |            |       |         |         |              |            |          |        |
| EL SYSTEM<br>OTHER   |       |            |       |         |         |              |            |          |        |
| PETY SYSTEM<br>FITION SYSTEM   |       |            |       | 1       |         | 1            | 1          |          |        |
| FITION SYSTEM<br>Queneter  |       |            |       |         |         | •            | ,          |          | ì      |
| R BLEED  |       |            |       |         |         |              |            |          |        |
| MUST SYSTEM  |       |            |       |         |         |              |            |          |        |
| RUST REVERSER<br>Peller system   |       |            |       |         |         |              |            |          |        |
| PELLER SYSTEM<br>ISTANT SPEED DRIVE<br>IER LEVER                         |       |            |       |         |         |              |            |          |        |
| ABLE   |       |            |       |         |         |              |            |          |        |
| PELLER LEVER   |       |            |       | 1       |         | ì            | 1          |          | ,      |
| RERSE THRUST LEVER<br>THE INDICATING EQUIPMENT                           |       |            |       |         |         | -            | •          |          | 1      |
| AUNUMETER  |       |            |       |         |         |              |            |          |        |
| INE INSTALLATION   |       |            |       | 1       |         | 1            | 1          |          | 1      |
| SUBTOTAL   |       |            |       |         |         |              |            |          | •      |
| SYSTEMS **   | 103   | 4          | 107   | 1619    | 64      | 1683         | 1722       | 68       | 1790   |
|  |       |            |       |         |         |              |            | 0.,      | 1170   |
| CTRICAL SYSTEM   |       |            |       |         |         |              |            |          |        |
| ATTERIES<br>ENERATORS/ALTERNATORS  |       |            |       |         | ,       |              |            |          |        |
| MAULIC SYSTEM  |       |            |       | 1       | 1       | 1            | 1          | 1        | 1      |
| BHT CONTROL SYSTEMS  |       |            |       |         |         | <del>-</del> | •          |          | 1      |
| ING FLAP CONTROL SYSTEM (ELECTRICAL) UNG FLAP CONTROL SYSTEM (HYDRAULIC) |       |            |       |         | 1       | 1            |            |          |        |
| B-tornot De-toling SYSTEMS   |       |            |       | 1       |         | î            | 1          | 1        | 1<br>1 |
| RBURETOR DE-ICING SYSTEM CONDITION, HEATING AND PRESSURIZATION           |       |            |       | 14      |         | 14           | 14         |          |        |
| 2 FILUI  |       |            |       |         |         | *-1          | 1.4        |          | 14     |
| MARNING SYSTEM<br>Extinguisher system                                    |       |            |       |         |         |              |            |          |        |
| EN SYSTEM  |       |            |       |         |         |              |            |          |        |
| N SYSTEMS  |       |            |       |         |         |              |            |          |        |
| SUBTOTAL   |       |            |       |         |         |              |            |          |        |
| INSTRUMENTS (FOUTDWEAT THE   |       |            |       | 16      | 2       | 18           | 16         | 2        | 18     |
| INSTRUMENTS/EQUIPMENT AND ACCESSORIES **                                 |       |            |       |         |         | •            |            |          | *-     |
| <b>B</b>   |       |            |       |         |         |              |            |          |        |

|                     | ·                  |               |
|---------------------|--------------------|---------------|
|                     |                    | APPENDIX B    |
|                     | CAUSE/FACTOR TABLE |               |
| TABLE B-9 CONTINUED |                    | ALL ACCIDENTS |

|  | CAUSE/FACT | UR TABL               | E                     |                             |       |                     |                           |                            |      |                    |                            |
|--|------------|-----------------------|-----------------------|-----------------------------|-------|---------------------|---------------------------|----------------------------|------|--------------------|----------------------------|
| TABLE B-9 CONTINUED INSTRUMENTS/EQUIPMENT AND ACCESSORIES (CONTINUED)  | FAT        | AL ACCI               | DENTS                 |                             | NONFA | TAL ACC             | IDENTS                    |                            | ALI  | ACCID              | ENTS                       |
| INSTRUMENTATION  |            | FACTOR                | TOTAL                 |                             |       | FACTOR              | TOT :                     | AL (                       | AUSE | FACTOR             | TOTAL                      |
|  |            |                       |                       |                             | 1     |                     |                           | 1                          | ı    |                    | 1                          |
| FLIGHT AND NAVIGATION INSTRUMENTS  |            |                       |                       |                             | •     | 3                   |                           | 3                          |      | 3                  |                            |
| COMPASS COMMUNICATIONS AND NAVIGATION EQUIPMENT TRANSMITTERS AND/OR RECEIVERS VOR RECEIVERS  |            |                       |                       |                             | 1     | 3                   |                           | 1                          | 1 2  | 3                  |                            |
| OTHER MISCELLANEOUS EQUIPMENT SPRAY, DUSTING EQUIPMENT   |            |                       |                       |                             | 2     | 7                   | 7                         | 2<br>11                    | 4    | 7                  | , i                        |
| SURTOTAL   |            |                       |                       |                             |       |                     |                           |                            |      |                    |                            |
| ** AIRPORTS/AIRWAYS/FACILITIES **  |            |                       |                       |                             |       |                     |                           |                            |      |                    | _                          |
| AIRPORT FACILITIES AIRPORT CONDITIONS WET RUNWAY ICE/SLUSH ON RUNWAY   |            |                       |                       |                             | 5     |                     | 5<br>1<br>3<br>3          | 5<br>1<br>8<br>3           | 5    |                    | 5<br>1<br>3<br>3           |
| SNOW ON RUNWAY SOFT SHOULDERS (RUNWAY) HIGH VEGETATION   |            |                       | 1                     | 1                           | 3     |                     | 1<br>8                    | 11                         | 3    |                    | 2<br>8 I                   |
| OTHER<br>AIRWAYS FACILITIES  |            |                       | 1                     | 1                           | 8     | , ;                 | 21                        | 29                         | 8    | ;                  | 22                         |
| SUBTOTAL   |            |                       |                       |                             |       |                     |                           |                            |      |                    | 42                         |
| ** WEATHER **  |            | 2                     | 13                    | 15                          |       |                     | 29<br>10                  | 32<br>11                   | 9    | 2                  | 15                         |
| LOW CEILING  RAIN FOG SNOW ICING CONDITIONS-INCLUDES SLEET, FREEZING RAIN, ETG ICING CONDITIONS-INCLUDES SLEET, FREEZING RAIN, ETG             |            | 1<br>4<br>1<br>1<br>7 | 5<br>2<br>2<br>9<br>3 | 6<br>9<br>3<br>3<br>16<br>3 | . 12  | 4<br>4 .            | 19<br>8<br>9<br>100<br>15 | 23<br>8<br>13<br>226<br>22 | 13   | i<br>5<br>3 1      | 24<br>10<br>11<br>09<br>18 |
| CONDITIONS CONDUCTOR OF THE CONDITIONS SUDDEN WINDSHIFT TURBULENCE IN FLIGHT, CLEAR AIR TURBULENCE, ASSOCIATED W/CLOUDS, THUNDERSTORMS         |            |                       | 1                     | 1                           |       | 1<br>1<br>4<br>2    | 1 2                       | 1<br>1<br>6<br>2           |      | 1<br>4<br>2        | 2<br>2<br>4                |
| DOWNDRAFTS, UPDRAFTS<br>LOCAL WEIRLWIND<br>ANYERSE WINDS ALOFT   |            |                       | 1                     | 1                           |       |                     | 4<br>4<br>6               | 4<br>4<br>6                |      | 1                  | 5<br>6<br>11               |
| HIGH TEMPERATURE OBSTRUCTIONS TO VISION HIGH DENSITY ALTITUDE THUNDERSTORM ACTIVITY  |            | 1                     | 3                     | 3                           |       | 1                   | 8<br>6<br>1               | 9<br>6<br>1                |      | 1                  | 6<br>1<br>266              |
| OTHER  |            | 17                    | 44                    | 61                          | 1     | 54                  | 222                       | 376                        | 1    | 71                 | 200                        |
| SUBTOTAL   |            |                       |                       |                             |       |                     |                           |                            |      |                    | 178                        |
| ** TERRA1N ** WET+ SOFT_GROUND   |            |                       | 2                     | 2                           |       | 77<br>8<br>1        | 176<br>12<br>1            | 253<br>20<br>2<br>83       |      | 77<br>8<br>1<br>22 | 12<br>1<br>61              |
| SNOM-COVERED  ICY HIGH VEGETATION HIDDEN OBSTRUCTIONS  |            | 1                     | 5                     | 1                           | ò     | 22<br>9<br>110      | 61<br>4<br>189<br>1       | 13<br>299<br>2             | :    | 10<br>111<br>1     | 194<br>2                   |
| ROUGH/UNEVEN   |            | 9                     | 1<br>9                | 16                          |       | 1<br>58             | 53<br>1                   | 111                        |      | 67                 | 62<br>1                    |
| ROUGH WATER<br>HIGH UBSTRUCTIONS<br>LOOSE GRAVEL   |            | ı                     |                       |                             | 1     | 13<br>10            | 14<br>13                  | 27<br>23                   |      | 13<br>11           | 14<br>13                   |
| SANDY<br>OTHER   |            | 12                    | 17                    | 2                           | 9     | 309                 | 525                       | 834                        |      | 321                | 542                        |
| SUBTOTAL   |            | A ==                  | •                     |                             |       |                     |                           |                            |      |                    |                            |
| ** MISCELLANEOUS **  |            |                       |                       |                             |       | 1                   | 2                         | 1<br>34                    |      | 1<br>32            | 2                          |
| SIRD COLLISION  EVASIVE MANEUVER TO AVOID COLLISION UNCUALIFIED PERSON OPERATED AIRCRAFT SABOTAGE FOREIGN MATERIAL AFFECTING NORMAL OPERATIONS |            | 9<br>3                |                       |                             | 9 3   | 32<br>5<br>1<br>100 | 3                         | 103                        |      | 5<br>1<br>109<br>3 | 3                          |
| UNDETERMINED   |            |                       | 0                     |                             |       |                     |                           |                            |      |                    |                            |

# TABLE B-9 CONTINUED MISCELLANEOUS (CONTINUED)

#### CAUSE/FACTOR TABLE

| · · · · · · · · · · · · · · · · · · ·   |          |       | IMBL     | E       |           |            |          |                |              |           |
|---|----------|-------|----------|---------|-----------|------------|----------|----------------|--------------|-----------|
|   |          |       | L ACC 11 |         | NONF      | ATAL ACC   | IDENTS   |                | ALL ACCID    | PPENDIX   |
|   | CAU      | JSE : | ACTOR    | TOTAL   |           |            |          |                |              | ENTS      |
| DIRECT ENTRIES  |          | •     |          |         |           | FACTOR     | TOTAL    |                | E FACTOR     | TOTAL     |
|   |          |       |          |         |           |            |          |                |              |           |
| SUBTOTAL  |          | 2     |          | 2       | 5         |            |          |                |              |           |
| CRAND D.  | 14       | 4     |          | 14      |           |            | 5        | 7              |              |           |
| GRAND TOTAL   |          |       |          | 14      | 144       | 8          | 152      | 158            |              | 7         |
| ** MISCELLANEOUS ACTS, CONDITIONS **  | 459      | •     | 84       | 543     | ****      |            |          | 130            | 8            | 166       |
| ANTI-ICING/DEICING EQUIP-IMPROPER OPER. OF/FAILED TO USE DISREGARD OF GOOD DEFORTING              |          |       |          | 5       | 5411      | 957        | 6368     | 5870           | 1041         |           |
| DISREGARD OF COLOR TO USE   | SE 12    |       |          |         |           |            |          |                | 1011         | 6911      |
| IMPRODED FURNATION OF ENALTHER  | 12       |       | 1        | 13      | 379       | 6          | 385      |                |              |           |
| SFAT ACIT CALL ON FAILED TO CALL  | 2        |       | 1        | ı       | 2<br>1    | 9          | 11       | 391<br>2       | 7            | 398       |
|   |          |       | 1        | 3       | 12        | 8          | 1<br>20  | 1              | 9<br>1       | 11        |
| WHARRANTED LOW FLYING FAILED TO EXTEND THE LANDING FLAPS  | 1        |       | 1        | 2       |           | 1 2        | 1        | 14             | 9            | 23        |
|   | 2        |       |          | 2       | 3         | 4          | 2<br>7   | 1              | 1<br>3       | 1         |
|   |          |       | 2        |         | S         | ਲ<br>1     | 10       | 3<br>4         | 4<br>8       | 7         |
| MISCALCIN ATED SUST   | 9        |       | ī        | 2<br>10 | 107       | 3          | 1 3      |                | 1            | 12        |
| JETTISONED LOAD   | 3        |       | 1        | 1       |           | 22         | 129      | 116            | 5<br>23      | 139       |
| TOLEN OR UNAUTHORIZED USE OF AIRCRAFT ANDED ON FOAMED RUNNAY                                      | 2        |       | 2        | 4       | 6<br>66   | 14<br>17   | 20       | 1<br>9         | 15           | 1         |
| OGUS PART SECURED   |          |       | 2        | 2       |           | 19         | 83<br>19 | 68             | 19           | 24<br>87  |
| LECTRICAL CAR.  | 2        |       |          |         |           | 5<br>1     | 5        |                | 19<br>7      | 19        |
| ATIGUE ERACTURA   |          |       |          | 2       | 32<br>3   | 3          | 1<br>35  | 34             | i            | 7<br>1    |
|   | 1        |       |          | 1       | 4         | 4          | 3<br>8   | 3              | 3            | 37        |
| PH-INCOMPRO   | 2        |       |          | 2       | 109<br>43 | 17         | 126      | 4<br>110       | 4            | 8         |
| INDSHIELD, DIRTY, FOGGY, ETC-RESTRICTED VISION PROPER ALLOWARDS                                   |          |       |          |         | 6         | ı          | 44<br>6  | 45             | 17<br>1      | 127<br>46 |
| PROPER ALIGNMENT/ADJUSTMENT   |          |       |          |         | 2         | 2          | 2        | 6<br>2         |              | 6         |
| PARATION IN FLIGHT RE IN ENGINE   | _        | 1     | L        | 1       |           | 4          | 2        | -              | 2            | 2         |
| #RODED / CORD DO NO.  | 3        | 2     |          | 3       | 1<br>16   | 2          | 1        | 1              | 5            | 5         |
| LOT FATICHE   | ,        |       | :        | 2       | 1         | 13         | 18<br>14 | 19             | 2            | 21<br>1   |
| EL FYHAUST ION  | 1        | 2     |          | 1       | 3<br>6    | 2<br>1     | 5        | 1<br>3         | 15<br>2      | 16        |
| EL CONTANTION - EXCLUSIVE OF WATER IN FUEL<br>DHOLIC IMPAIRMENT OF EFFICIENCY AND THE             | 34       |       |          | 2       | 1         | 2          | 7<br>3   | 7<br>1         | 1            | 5<br>8    |
| COMBINATION-EXCLUSIVE OF WATER IN FUEL  ONE OF THE STATE OF EFFICIENCY AND JUDGMENT  THE PUEL     | 1        | ı     |          | 35<br>1 | 724       | 2 7        | 24       |                | 4<br>2       | 5         |
| -ENGINE   | 7        | 5     |          | ģ       | 55<br>5   |            | 57       | 758<br>56      | 1 7          | 59        |
| -CARBURETOR<br>-PROPELLER   |          |       |          |         | _         | 1          | 5<br>1   | 12             | 2            | 58<br>14  |
| -PROPELLER<br>Frame ICE<br>-MINOSHIELD  | 12       |       | 1        | , .     | i         | 2          | 11       | 9              | 1            | 1         |
| COPERTY LOADS   | 1        |       |          | -       | 316<br>1  | 7 32       | 23       | 1<br>328       | _            | 1         |
| MOPERLY LOADED AIRCRAFT-WEIGHT-AND/OR CG<br>RFERENCE WITH FLIGHY CONTROLS                         |          |       | 1        | 1       | 2         | 4          | 1        | 1              | 73           | 15        |
| A ADC   | 2        | 3     | 5        | 5       |           | ,          | 2        | 3<br>1         | 4            | 7         |
| OF LUBRICATION-SPECIFIC PART, NOT SYSTEM EXHAUSTION-ENGINE LUBRICATION SYSTEM                     |          |       |          |         | 1         |            | 6<br>1   | 4<br>1         | 7            | 2<br>1    |
| XHAUSTION-ENGINE LUBRICATION SYSTEM XHAUSTION-ENGINE LUBRICATION SYSTEM ONTAMINATION ONTAMINATION |          | 1     | 1        |         | 1         | -          | 1<br>3   |                |              | 1         |
| ONTAMINATION ATED CONDITIONS  | 3        |       | 3        |         | 9 1       | 1          | 0        | Q              | 4 4          | 4         |
| STERON ING  |          |       |          |         | 2 .       | ٠.         |          | 56             | 1 10<br>2 5H |           |
| IN FUEL & AFT CAME TO REST IN WATER N. MOISTURE   | 6        | 1     | 7        |         | 4<br>5 50 |            | •        | 2              | 5            | •         |
|   | 5        |       | 5        |         | .3 î      |            |          | 71 5           | 1 122        |           |
| AND CO  |          | 14    | 14       | 17      | 1 5       | 176        | ,        |                | 1 4          |           |
| IAI FALLURE   | 1        | 2     | 3        | 1       | 4         | 104<br>4   |          | 111            | _ 101        |           |
|   | 1        | 1     | 1        |         | 9         | 17         |          | 15             | 5 20         |           |
| TARVATION   | 10<br>51 | 2     | 2<br>10  | 42      | 2 771     | 773        |          | 3 772          | 0 10         |           |
|   | 2        | c     | 53<br>2  | 70      | 1 12      | 435<br>701 |          | 34 11          |              |           |
|   |          |       |          | 33      | 3 1       | 34         |          | 52 - 2<br>35 1 | 754          |           |
|   | 171      |       |          |         |           |            |          | 1              | 36           |           |
|   |          |       |          |         |           |            |          |                |              |           |

| CAUSE FACTOR TOTAL CAUSE FACTOR TOTAL CAUSE FACTOR TOTAL   | TABLE B-9CONTINUED                      | <b>9</b> ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,, |          |      | MONEA | TAL ACCI | DENTS |       | LACCIDE | NT S       |
|--|---|---|----------|------|-------|----------|-------|-------|---------|------------|
| IMPROPER CLEARANCE-TOLERANCE   3   3   17   4   17   20   20   20   20   20   20   20   2  | MISCELLANEOUS ACTS: CONDITIONS WORTHOUS | FAT   | AL ACCID | FN12 |       |          | ~     |       |         |            |
| IMPRIORER CLEARANCE—TOLERANCE FIFE, SELECTOR POSITIONED RETWEEN TANKS FIRE OF UNDETERMINED ORIGIN  1 1 5 7 7 5 3 FIRE OF UNDETERMINED ORIGIN  1 1 5 9 7 7 4 3 UNAPPROVED MIDIFICATION  1 1 5 9 7 7 4 3 UNAPPROVED MIDIFICATION  1 1 5 9 7 7 4 3 UNAPPROVED MIDIFICATION  1 1 5 9 7 7 4 3 UNAPPROVED MIDIFICATION  1 1 1 1 1 1 1 1  ACTION, LACK CF 9 6 3 9 6 6 3 PREVIOUS DAMAGE  2 2 20 3 32 32 22 2 PREVIOUS DAMAGE  3 1 1 1 1 1 1  CIRCUIT BREAKER POPPED  ARCING  LOW COMPRESSION  4 4 2 30 32 2 2 4  CARRON DEPOSITS  3 1 4 2 2 30 32 2 2 4  CARRON DEPOSITS  3 1 4 2 2 2 4 1 1  CARRON DEPOSITS  4 4 4 2 30 32 2 2 4  CARRON DEPOSITS  3 1 4 2 2 3 3 2 2 2 2  CARRON DEPOSITS  4 4 4 2 30 32 2 2 4  CARRON DEPOSITS  3 1 4 2 2 3 3 2 2 2 2  CARRON DEPOSITS  4 4 4 2 30 32 2 2 5  CARRON DEPOSITS  4 4 4 2 30 32 2 2 5  CARRON DEPOSITS  5 1 1 1 1 1 1 1 1  COURSE TOROUGO  4 4 6 3 2 9 30  UNDER TOROUGO  4 4 6 3 2 9 30  UNDER TOROUGO  5 1 1 1 1 1 1 1 1  COURSE TOROUGO  6 1 1 1 1 1 1 1  COURSE TOROUGO  9 2 5 1 1 6 1 2  CARRON DEPOSITS  1 1 1 2 2 2 3 1  COURSE TOROUGO  9 2 5 1 1 6 1 2  CARRON DEPOSITS  1 1 1 1 1 1 1 1  COURSE TOROUGO  1 1 1 1 1 1 1 1 1  COURSE TOROUGO  1 1 1 1 1 1 1 1 1  COURSE TOROUGO  1 1 1 1 1 1 1 1 1  COURSE TOROUGO  1 1 1 1 1 1 1 1 1  COURSE TOROUGO  1 1 1 1 1 1 1 1 1  COURSE TOROUGO  1 1 1 1 1 1 1 1 1 1  COURSE TOROUGO  1 1 1 1 1 1 1 1 1 1  COURSE TOROUGO  1 1 1 1 1 1 1 1 1 1 1  COURSE TOROUGO  1 1 1 1 1 1 1 1 1 1 1  COURSE TOROUGO  1 1 1 1 1 1 1 1 1 1 1 1  COURSE TOROUGO  1 1 1 1 1 1 1 1 1 1 1 1 1 1  COURSE TOROUGO  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1   |   |   |          |      |       | FACTOR   | TOTAL | CAUSE | FACTOR  | T01AL      |
| IMPROPER ILLEARANCE-TOLERANCE  |   | -   |          | 3    | 17    |          |       |       | 5       | 21         |
| FIRE OF UNDETERMINED OR INCIN.  1 1 4 3 7 4 1  UNAPPROVED MIDD FOR TACHN  PROVIDED MIDD FOR TACHN  PREVIOUS DAMAGE  LEAK/LEAKAGE  LEAK/LEAKAGE  LEAK/LEAKAGE  LEAK/LEAKAGE  LEAK/LEAKAGE  LOW FLUID LEVEL  LINGUIT BREAKER POPPED  ACCION FLUID  LOW FLUID LEVEL  LINGUIT BREAKER POPPED  ACCION FOR TACHN  ACCION FOR TACHN  ACCION FOR TACHN  LOW FOR TACHN  LANDED IN CONSTRUCTION AREA  LANDED IN CONSTRUCTION AR | THOROGER CLEARANCE-TOLERANCE            |   | 1        | 9    |       | 4        |       |       |         |            |
| FIRE OF UNDELENMANEUR OF MICH FLOAT JON 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1  | -ugi cricetop postituneo permeen inime  |   |          |      |       | 2        |       |       |         |            |
| ORDER TI MODEQUATE VENTING  ACTION. LACK CF  POOR WELD  PREVIOUS DAMAGE  2 2 2 2 0 3 23 22 3 POOR WELD  PREVIOUS DAMAGE  2 2 2 2 0 3 23 22 3 POOR WELD  1 1 1 1  CIRCUIT REAKER POPPED  1 1 6 6 6 ACTING  ARCING  ACTING  ACTION  ACTI | CIDE OF UNDETERMINED OFFICE             |   | 1        |      |       | 3        |       | 4     |         |            |
| ACTION, LACK CF POOR MED 2 2 20 3 23 22 2 PREVIOUS DAMAGE LEANCEARAGUEL LOW FRUIDEN 1 1 1 1 1 LACK COMPRESSION LOW COMPRESSION LOW COMPRESSION 3 1 4 22 30 32 2 34 LOW COMPRESSION 3 1 4 22 3 25 25 4 LOW COMPRESSION 3 1 4 22 3 25 25 4 LOW COMPRESSION 3 1 4 22 3 25 25 4 LOW COMPRESSION 3 1 4 22 3 25 25 4 LOW COMPRESSION 3 1 4 22 3 25 25 4 LOW COMPRESSION 3 1 4 22 3 25 25 4 LOW COMPRESSION 3 1 4 22 3 25 25 4 LOW COMPRESSION 3 1 4 22 3 22 4 2 2 LOW COMPRESSION 4 4 26 3 29 30 32 LOW COMPRESSION 4 6 6 6 6 LOW COMPRESSION 5 1 1 1 1 1 1 LOW COMPRESSION 5 1 1 1 1 1 1 LOW COMPRESSION 5 1 1 1 1 1 1 LOW COMPRESSION 5 1 1 1 1 1 1 LOW COMPRESSION 5 1 1 1 1 1 1 1 LOW COMPRESSION 5 1 1 1 1 1 1 1 LOW COMPRESSION 5 1 1 1 1 1 1 1 LOW COMPRESSION 5 1 1 1 2 2 2 4 2 2 LOW COMPRESSION 5 1 1 1 2 2 2 4 2 2 LOW COMPRESSION 5 1 1 1 2 2 2 3 1 LOW COMPRESSION 5 1 1 1 2 2 2 3 1 LOW COMPRESSION 5 1 1 1 2 2 2 2 3 1 LOW COMPRESSION 5 1 1 1 2 2 2 2 3 1 LOW COMPRESSION 5 1 1 1 1 1 1 1 1 1 1 1 1 LOW COMPRESSION 5 1 1 1 2 2 2 2 3 1 LOW COMPRESSION 5 1 1 1 2 3 1 1 1 LOW COMPRESSION 5 1 1 2 3 1 1 1 1 LOW COMPRESSION 5 1 1 2 3 1 1 1 1 LOW COMPRESSION 5 1 1 2 3 1 1 1 LOW COMPRESSION 5 1 1 2 3 1 1 1 LOW COMPRESSION 5 1 1 2 3 1 1 1 LOW COMPRESSION 5 1 1 2 3 1 1 1 LOW COMPRESSION 5 1 1 2 3 1 1 1 LOW COMPRESSION 5 1 1 2 3 1 1 1 LOW COMPRESSION 5 1 1 1 1 1 1 1 LOW COMPRESSION 5 1 1 1 1 1 1 1 LOW COMPRESSION 5 1 1 1 1 1 1 1 LOW COMPRESSION 5 1 1 1 1 1 1 LOW COMPRESSION  | UNAPPROVED MODIFICATION                 |   |          |      |       | ì        |       | ,     |         |            |
| PROFINED PREVIOUS DAMAGE PREVIOUS DAMAGE PREVIOUS DAMAGE  LEAR/LEAKAGE LOW FLUID LEVEL CIRCUIT BREAKER POPPED  ARCING LOW GUMPRESSION  LOW COMPRESSION  RUNNAY CLUSED  ARCING  ARCING  ARCING  LOW COMPRESSION  ARCING  ARCING | IMPROPER/INADENDATE VEHICLE             |   |          |      |       | _        |       |       | 3       |            |
| PREVIOUS DAMAGE LEAN/LEAKAGE LEAN/LEAKAGE LOW FLUID LEVEL CIRCUIT BREAKER POPPED  1  |   |   |          | _    |       |          |       |       | 3       | 2          |
| LEAYLEARAGE LOM FLUID LEYEL CINCUIT BREAKER POPPED 1 1 6 6 6 ARCING ACLING LOW COMPRESSION 3 1 4 22 30 32 25 34 DOWNKIND 3 1 4 22 33 25 25 4 DOWNKIND CARRON DEPOSITS LANGED 1 1 1 1 1 LANGED 1 1 1 1 1 LANGED IN CONSTRUCTION AREA 1 1 1 1 1 LANGED IN CONSTRUCTION AREA 1 1 1 1 1 LANGED IN CONSTRUCTION AREA 1 1 1 1 1 LANGED IN CONSTRUCTION AREA 1 1 1 1 1 LANGED IN CONSTRUCTION AREA 1 1 1 1 1 LANGED IN CONSTRUCTION AREA 1 1 1 1 1 LANGED IN CONSTRUCTION AREA 1 1 2 2 3 3 3 LODISE, PART/FITTING 2 2 1 1 2 1 3 11 2 RAINDING 1 1 1 2 1 1 2 1 3 11 2 RAINDING 1 1 1 2 1 1 2 1 3 11 2 RAINDING 1 1 1 2 2 3 1 1 RAINDING 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1  |   | 2   |          | 2    | 20    |          |       |       |         |            |
| CIRCUIT BREAKER POPPED  ACCING  ACCING  ACCING  ACCING  ACCING  ACCING  CARRON COMPRESSION  A 4 2 30 32 2 34  ACCINGED  ACCINGED  A 4 2 2 30 32 2 2 34  ACCINGED  CARRON DEPOSITS  LANDED IN CONSTRUCTION AREA  OVER TERRORED  A 4 2 2 3 2 4 2 2  A 2 2 4 2 2  A 2 2 4 2 2  ACCINGREGORY  ACCINGRATE  LANDED IN CONSTRUCTION AREA  OVER TERRORED  UNDER TORROUED  A 2 2 5 1 6 7 1  ACCINGRATE  AINDING  ACCINGRATE  ACCI | LEAK/LEAKAGE                            |   |          |      |       | 1        | 1     |       | 1       |            |
| ARCING COMPRESSION ARCING 1 3 2 2 3 4 2 30 32 2 2 34 4 2 30 32 2 2 34 4 3 3 3 3 3 3 3 3 3 3 3 3 3 3  | LOW FLUID LEVEL                         |   |          | 1    |       |          |       |       |         |            |
| LOW COMPRESSION RINHAY CLOSED  A 4 4 22 33 25 25 45  DONNHIND  CARRON DEPOSITS  LANGED IN CONSTRUCTION AREA  LANGED IN CONSTRUCTION AREA  LOWER TORQUEED  UNDER TORQUEED  LOOSE, PART/FITTING  RENT RINHAY CLOSED  LOOSE, PART/FITTING  RENT RINHORD  RINHAY RINHORD  LOOSE, PART/FITTING  RENT RINHORD  LOOSE, PART/FITTING RENT RINHORD  LOOSE, PART/FITTING RENT RINHORD  LOOSE, PART/FITTING RENT RINHORD  LOOSE, PART/FITTING RENT RINHORD  LOOSE, PART/FITTING RENT RINHORD  LOOSE, PART/FITTING RENT RINHORD  LOOSE, PART/FITTING RENT RINHORD  LOOSE, PART/FITTING RENT RINHORD  LOOSE, PART/FITTING RENT RINHORD  LOOSE, PART/FITTING RENT RINHORD  LOOSE, PART/FITTING RENT RINHORD  LOOSE, PART/FITTING RENT RINHORD  LOOSE, PART/FITTING RENT RINHORD  LOOSE, PART/FITTING RENT RINHORD RINHORD RINHOR | CIRCUIT BREAKER PUPPED                  |   |          | _    | 6     | _        |       | · ·   | 1       |            |
| RUNNAY CLOSED ODMNIND ODMNIND ODMNIND ODMNIND CARRON DEPOSITS CARRON  | LOW COMPRESSION                         |   |          |      | •     |          |       | 2     |         | 3          |
| ODMINION CARBON DEPOSITS LANGED IN CONSTRUCTION AREA  OVER TORQUEED  UNDER TOR | RINWAY CLOSED                           | •   |          |      |       |          |       |       |         |            |
| CARBON DEPUSITS LANDED IN CONSTRUCTION AREA  OVER TORQUED  UNDER BALANCE  UNDER TORQUED  UNDER T | nnwww.IND                               | 3   | 1        | •    |       |          |       |       | 2       |            |
| OVER TOROUGHO UNDER TOROUGHO UNDER TOROUGHO UNDER TOROUGHO UNDER TOROUGHO UNDER TOROUGHO 1   | CARBON DEPOSITS                         |   |          |      |       |          |       |       |         |            |
| UNDER TOROUSED UNDER  | LANDED IN CONSTRUCTION MALE             |   |          |      |       |          |       |       |         |            |
| LOOSE, PART/FITTING  BENT  RINDING  RENT  RINDING  RINDIN | UMDER TOROUED                           | 4   |          | 4    |       | 5        |       |       |         |            |
| RENT BINDING BURNED COLLAPSED COLLAP | LOOSE PART/FITTING                      |   |          | •    |       | 1        |       |       |         |            |
| A JANDING RURNED CHAFFED CHAFFED COLLAPSED CROSSED CRO |   | 2   |          | 2    |       |          |       |       | _       |            |
| NUNNED CHAFFED CALLAPSED C |   |   |          |      |       |          | 4     |       |         |            |
| CHAPFED COLLAPSED COLLAPSE |   | •   |          | 1    |       |          | . 5   |       |         |            |
| CRISSED 1 1 2 2 13 13 13 1 1   |   |   |          |      |       |          |       |       |         | L .        |
| DETERIORATED DISCONNECTED DISCONNECTED  EXCESSIVE ERRATIC  FRICTION, EXCESSIVE GRUUNDED JAMMED  OBSTRUCTED  OBSTRUCTED  OPEN  OUT OF BALANCE  OVERHEATED  OVERHEATED  EXCESSIVE PRESSURE PRESSURE PRESSURE TON LOW PRESSURE, NONE  SCHEAD  STICKING STRICTED  STICKING STRICTED  1 1 2 3 1 2 1 2 3 1 2 1 2 1 1 2 1 1 1 1   |   |   |          |      |       |          |       |       |         | i ·        |
| DISCONNECTED  EXERSIVE ERRATIC  FRICTION, EXCESSIVE GROUNDED INSTALLED IMPROPERLY INSTALLED INST | DETERIORATED                            | ·   |          |      |       |          |       |       | 5       |            |
| EXCESSIVE ERRATIC FRICTION, EXCESSIVE GRUMORD IMPROPERLY INSTALLED JAMMED OBSTRUCTED OPEN OUT OF BALANCE OVERHATED EXCESSIVE PRESSURE PRESSURE TON LOW PRESSURE, NONE SUBJECT OF STICKING STICKING STICKING STICKING STICKING STICK TEMPERATURE VIBRATION, EXCESSIVE WARPED UNITED STUCK RECESSIVE TEMPERATURE VIBRATION, EXCESSIVE WARPED UNITED STORM STOR | DISCONNECTED                            |   | ì        | j    |       |          |       |       |         | 1 .        |
| ERRATIC FRICTION, EXCESSIVE GRUMDED GRUMDED 1 1 24 3 27 24 4  GRUMDED 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1  | EXCESSIVE                               |   |          |      |       | -        | 1     |       |         | - 1        |
| FRICTION ENGREPSIVE FRICTION F | ERRATIC THE THE TANK THE                |   |          |      |       | 5        |       | _     |         | 4          |
| RINDROPERLY INSTALLED  JAMMED  OBSTRUCTED  OBSTRUCTED  OFF BALANCE  OVERHEATED  OVERHEATED  EXCESSIVE TOOLOM  PRESSURE TOOLOM  PRESSURE, NONE  SIZE  S |   |   |          | 1 1  |       | •        |       |       | •       | `          |
| JAMMED  OBSTRUCTED  OBSTRUCTED  OPEN  DUT OF BALANCE  OVERHEATED  EXCESSIVE PRESSURE  PRESSURE TO LOW  PRESSURE, NONE  SIZE  SHEARED  STICKING  STICKING  STICKING  STUCK  EXCESSIVE TEMPERATURE  EXCESSIVE TEMPERATURE  VIARATION, EXCESSIVE  MARPED  INTERNICAL GROUND—MATER LOOP—SMERVE  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1  | THEREOGERS Y INSTALLED                  |   |          |      |       |          |       | • .   | 9       |            |
| DBSTRUCTED   |   |   |          | 1 1  | . 1   | 9        |       |       |         |            |
| OPEN         13         1         14         13         1         10         2         12         10         2         2         10         2         12         10         2         2         10         2         12         10         2         2         10         2         2         10         2         2         3         2         2         3         2         2         3         2         2         3         2         2         3         2         2         3         2         1         3         2         1         3         2         1         3         4         7         7         4         4         4         4         7         4         4         4         4         7         4   |   |   |          |      |       |          | 2 3   |       | •       |            |
| DOT OF REALBOOK  OVERHEATED  EXCESSIVE PRESSURE  PRESSURE TOO LOW  PRESSURE, NONE  1 1 2 2 3  PRESSURE, NONE  1 2 5 5 7  SCHRED  STICKING  STICKING  STICKING  STRIPPED  STUCK  EXCESSIVE TEMPERATURE  VIBRATION, EXCESSIVE  MARPED  INTERNITIONAL GROUND-MATER LOOP-SMERVE  1 1 6 2 18 17 2   | NPEN                                    |   |          |      |       |          |       |       |         | ١.,        |
| OVERHEAD 10 2 1 5 2 PRESSURE TOR LOW 5 2 7 5 2 PRESSURE, NONE 1 1 2 2 3 PRESSURE, NONE 2 5 5 7 SCORED 2 5 5 7 SCORED 1 1 1 1 STICKING 1 1 1 1 1 STICKING 1 1 3 4 7 4 4 STRIPPED 10 3 13 10 3 STRIPPED 10 3 13 10 3 STRIPPED 10 3 13 10 3 STRIPPED 1 1 3 4 7 4 4 STUCK EXCESSIVE TEMPERATURE 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1  |   |   |          |      |       |          |       | ,     |         | 2 4        |
| PRESSURE, TON LOW PRESSURE, NONE 1 1 2 5 5 7 SCHARED 2 8 2 10 8 2 SHEARED 1 1 1 1 STICKING STRIPPED STICK ING STRIPPED STUCK EXCESSIVE TEMPERATURE VIBRATION, EXCESSIVE HARPED INTERNITIONAL GROUND-WATER LOOP-SMERVE 1 1 6 2 18 17 2  | OVERHEATED<br>FYCESTIVE PRESSURE        |   |          |      |       |          |       | -     |         | 2          |
| PRESSURE, NONE SCHARD SCHARD STICKING STICKING STRIPPED STUCK STUC | PRESSURE TOO LOW                        |   |          |      |       |          |       |       |         | - 1        |
| SCHRED SHEARED SHEARED STICKING STRIPPED STUCK STRIPPED STUCK EXCESSIVE TEMPERATURE VIARATION, EXCESSIVE MARPED INTERNICIONAL GROUND-MATER LOOP-SMERVE 1 1 1 2 1 3 2 1 1 2 1 1 6 2 1 1 7 2   | PRESSURE, NONE                          |   |          |      |       |          |       |       |         | ,          |
| STICKING STICKING STICKING STICKING STICKING STICKING STRIPPED STUCK 1 3 4 7 4 4 5TUCK STUCK 1 2 3 5 2 3 1 1 1 VIBRATION, EXCESSIVE VIBRATION, EXCESSIVE VIBRATION, EXCESSIVE VIBRATIONAL GROUND-WATER LOOP-SMERVE 1 1 16 2 18 17 2  |   |   | 2        |      | _     | 8        |       |       |         | <b>'</b> ] |
| STRIPPED 10 3 4 4 4 5 5 7 4 4 5 5 7 5 7 5 7 5 7 5 7 5  |   |   |          |      |       |          |       |       |         | 3          |
| STUCK 1 1 2 3 5 2 3 EXCESSIVE TEMPERATURE 2 3 5 2 3 EXCESSIVE TEMPERATURE 1 1 1 1 VIGRATION, EXCESSIVE 2 1 3 2 1 MARPEO 2 1 3 2 1 INTERNICONAL GROUND-WATER LOOP-SHERVE 1 16 2 18 17 2   |   |   |          |      |       |          | -     | -     | 4       |            |
| EXCESSIVE TEMPERATURE VIBRATION, EXCESSIVE  WARPED INTENTIONAL GROUND-MATER LOOP-SMERVE  1 1 1 1 1 2 1 1 1 2 1 1 1 1 1 1 1 1 1   | ETHEN                                   |   | 1        |      | 1     |          | -     |       |         | 3          |
| VIBRATION, EXCESSIVE  WARPED  INTENTIONAL GROUND-WATER LOOP-SMERVE  1 16 2 18 17 2   | EVACCOUNT TEMPERATURE                   |   |          |      |       |          |       |       |         | . 1        |
| MARPED INTERNAL GROUND-MATER LOOP-SMERVE 1 1 16 2 18 17 2  | VIBRATION: EXCESSIVE                    |   |          |      |       |          |       |       |         |            |
| INTENTIONAL WHEELS UP  |   |   | ,        |      | 1     |          |       | .6    | 1.6     | 2          |
|  | INTENTIONAL WHEELS UP                   |   | ı        |      | -     |          |       |       |         |            |

#### DIRECT ENTRY CAUSES

PILOT-IMPROPERLY EXECUTED EMERGENCY LANDING
PILOT-IMCAPACITATION CAUSED BY DRUGS
PWR PLT-LEFT CRANKSHAFT IDLER GEAR CAP SCREW FAILD
PWR PLT-CIL STARVATION FOR UNDETERMINED REASON
PWL POLT-OIL STARVATION FOR UNDETERMINED REASON
PILOT-DID NOT SEE MIRES IN TIME-EVASIVE ACT,N STAL
PILOT-INADVERTENTLY TURNED NAGNETO SMITCH OFF
PHLOT-INADVERTENTLY TURNED NAGNETO SMITCH OFF
PWR PLT-ENGINE CRANKCASE BREATHER PLUGGED BY ICE
PWR PLT-ENGINE CRANKCASE BREATHER PLUGGED BY ICE
PWR PLT-RE-INGESTION OF EXHAUST GAS
PWR PLT-SLUSH ENTERED CARRURETOR AIR INTAKE SCOOPPWR PLT-CARR-FLOAT IMPROPERLY INSTALLED.
PWR PLT-CARR-FLOAT IMPROPERLY INSTALLED.
PWR PLT-IMPROPER FUEL GAUGE INSTALLED.
PWR PLT-IMPROPER FUEL GAUGE INSTALLED.

#### TABLE B-9 CONTINUED

DIRECT ENTRY CAUSES (CONTINUED)

CAUSE/FACTOR TABLE

APPENDIX B

PWR PLT-SEAL ON OIL FILTER IMPROPERLY INSTALLED.

PILOT-IMADVERTENTLY ACTUATED MIXTURE CONTROL

PMR PLT-ACELERATOR PUMP JAMMED BY DUST COVER.

PMR PLT-IMPROPERLY RIGGED MIXTURE CONTROL.

PMR PLT-FATIGUE FAILURE OF CARB HEAT CONTROL.

PMR PLT-FATIGUE FAILURE, CAM REDUCTION GEAR ASSEMB

PMR PLT-CARBURETOR NEEDLE VALVE STUCK.

PMR PLT-CARBURETOR NEEDLE VALVE STUCK.

PMR PLT-EXCESSIVE CARBON DEPOSITS ON SPAKK PLUGS.

PMR PLT-FATIGUE FAILURE OF NUMBER 1 CYLINDER.

PMR PLT-CARBURETOR NEEDLE VALVE STUCK.

PMR PLT-CAM REDUCTION GEAR FAILED.

PMR PLT-CAM STANWAITION FOR AN UNDETERMINED REASON

PMR PLT-FUEL STANWAITION FOR AND SEEPLE SYPHOMISMS

MISC-DESCENT WAS TOO STEEP PRECLUDING FUEL FLOW

PMR PLT-CAMSHAFT DRIVE GEAR BOLTS FAILED.

PMR PLT-CAMSHAFT DRIVE GEAR BOLTS FAILED.

PMR PLT-DACES OWNERS HANDBOOK INADEOUATE.

PMR PLT-NO GASKET.NO.3 CYLINDERS.

PMR PLT-NO GASKET.NO.3 CYLINDERS.

PMR PLT-NO GASKET.NO.3 CYLINDERS.

PMR PLT-EXCESSIVE FUEL CONSUMPTION.CAUSE UNDETERMIN

PMR PLT-DESTITIONED MIXTURE CONTROL TO IDLE-CUT-OFF.

PMR PLT-INTAKE MANIFOLD CRACKED.

PMR PLT-EXCESSIVE FUEL CONSUMPTION.CAUSE UNDETERMIN

PMR PLT-ENC ROUGH, CAUSE UNDETERMINED CAUSE.

PMR PLT-ENC ROUGH, COUSE UNDETERMINED CAUSE.

PMR PLT-ENC ROUGH, COUSE UNDETERMINED CAUSE.

PMR PLT-ENC ROUGH, COUSE UNDETERMINED CAUSE UNDTHOD

PMR PLT-HONT THE HOUSING BROKE FORWARD OF FIREHALL

PMR PLT-HON THE HOUSING BROKE FORWARD OF FIREHALL

PMR PLT-HON TO JUTIES OF TO UNDETERMINED CAUSE.

PMR PLT-ENCESSIVE FUEL CONSUMPTION CAUSE UNDTHOD

PMR PLT-ENCESSIVE FUEL CONSUMPTION CAUSE UNDTHOD

PMR PLT-EVEL PRESSURE BROMPPED TO ZERO, CAUSE UNDTHOD

P

DIRECT ENTRY CAUSES ARE CARRIED UNDER THEIR APPROPRIATE CAUSAL CATEGORIES AND ARE INCLUDED IN THE TOTALS

# TABLE B-10

# CAUSE/FACTOR TABLE

SINGLE ENGINE FIXED-WING AIRCRAFT ENGINE FAILURE AS FIRST ACCIDENT TYPE ONLY U. S. GENERAL AVIATION 1965 - 1969

EXCLUDES ACCIDENTS WITH CAUSE UNDETERMINED, HOMERUILI AND EXPERIMENTAL AIRCRAFT, AND ACCIDENTS INVOLVING SIMULATED ENGINE FAILURES

INVOLVES 3015 TOTAL ACCIDENTS INVOLVES 153 FATAL ACCIDENTS

|                                       | FATA        | FATAL ACCIDENTS | 1TS          | NDNFATAL ACCIDENTS | L ACCIDI    | CIDENTS       | ALL           | ALE ACCIDENTS     | S             |
|---------------------------------------|-------------|-----------------|--------------|--------------------|-------------|---------------|---------------|-------------------|---------------|
| BROAD CAUSE/FACTOR                    | CAUSE       | FACTOR 1        | 10TAL*       | CAUSE              | FACTOR      | T0TAL*        | CAUSE         | FACTOR            | TOTAL*        |
| PILOT                                 | 104 67.97   | 9<br>5.88       | 104<br>67.97 | 1836<br>64.15      | 54          | 1838<br>64.22 | 1940<br>64.34 | 63<br>2.09        | 1942<br>64.41 |
| PERSONNEL                             | 29<br>18.95 | 3<br>1.96       | 32<br>20•92  | 369<br>12.89       | 29<br>1.01  | 398<br>13.91  | 398<br>13•20  | 32<br>1.06        | 430<br>14.26  |
| AIRFRAME                              | 1.          | 00.             | 1.65         | 1.03               | • 00        | 1.03          | 2<br>•07      | 00.               | 2<br>.07      |
| LANDING GEAR                          | 00.         | 00•             | 00•          | 1.03               |             | .03           | 1.03          | 00•               | .03           |
| POWERPLANT                            | 49          | 2<br>1•31       | 51<br>33•33  | 872<br>30•47       | 59<br>2.06  | 926<br>32•35  | 921<br>30.55  | <b>61</b><br>2.02 | 977<br>32.40  |
| SYSTEMS                               | 8           | 00•             | 00.          | 14                 | 1.03        | 15<br>•52     | 14            | 1<br>• 03         | 15<br>.50     |
| INSTRUMENTS/EQUIPMENT AND ACCESSORIES | 00•         | 00•             | 00.          | 3                  | 5.17        | 8<br>• 28     | 3<br>•10      | 5.17              | .27           |
| ROTORCRAFT                            | • 00        | • 00            | 00•          | 00.                | .00         | 00.           | 00.           | 00•               | 00.           |
| AIRPORTS/AIRWAYS/FACILITIES           | 00•         | • 00            | • 00         | .03                | 1.03        | 2<br>•07      | 1.03          | 1.03              | 2<br>•07      |
| WEATHER                               | 4.58        | 13<br>8.50      | 18<br>11•76  | 132                | 142<br>4.96 | 9.47          | 139<br>4.61   | 155<br>5.14       | 289<br>9•59   |
| TERRAIN                               | 00•         | • 00            | 00.          | 00.                | 00.         | 00•           | .00           | 00.               | 00•           |
| MISCELLANEDUS                         | 10<br>6.54  | 00•             | 10<br>6.54   | 112<br>3.91        | 6<br>•21    | 118           | 122           | •20               | 128<br>4•25   |
| UNDETERMINED                          | 00•         | 00•             | 00.          | 00•                | • 00        | • 00          | 00.           | 00•               | • 00          |

PRESENTED FACTOR IN THE SAME CAUSAL

THE FIGURES DPPDSITE EACH CAUSAL CATEGORY REPRESENT THE NUMBER AND PERCENT OF ACCIDENTS IN WHICH THAT PARTICULAR CAUSAL CATEGORY WAS ASSIGNED

#### TABLE B-11

#### CAUSE/FACTOR TABLE

APPENDIX B

SINGLE ENGINE FIXED-WING AIRCRAFT
ENGINE FAILURE AS FIRST ACCIDENT TYPE DNLY
U.S. GENERAL AVIATION
1965 — 1969

EXCLUDES ACCIDENTS WITH CAUSE UNDETERMINED, MOMEBUILT AND EXPERIMENTAL AIRCRAFT, AND ACCIDENTS INVOLVING SIMULATED ENGINE FAILURES

INVOLVES 3015 TOTAL ACCIDENTS
INVOLVES 153 FATAL ACCIDENTS

| DEFAILED CAUSE/FACTOR  |   |        |       |   | ATAL ACC  | IDENTS  | AI   | LL ACCID  | ENTS   |
|--|---|--------|-------|---|---|---|--|---|--|
| ** PILOT **  | CAUSE   | FACTOR | TOTAL |   | FACTOR  | TOTAL   | CAUSE  | FACTOR  | <br>TOTA   |
|  |   |        |       |   |   |   |  |   |  |
| PILOT IN COMMAND  ATTEMPTED OPERATION W/KNOWN DEFICIENCIES IN EQUIPMENT ATTEMPTED OPERATION BEYOND EXPERIENCE/ABILITY LEVEL BECAME LOST/DISORIENTED CONTINUED VER FLIGHT INTO ADVERSE WEATHER CONDITIONS DELAYED IN INITIATING GO-ARDUND DIVERTED ATTEMPTON FROM OPERATION OF AIRCRAFT FAILED TO DETAIN/MAINTAIN FLYING SPEED FAILED TO USE OR INCORRECTLY USED MISC EQUIPMENT FAILED TO PERATION OF POWERPLANT + POWERPLANT CONTROLS IMPROPER OPERATION OF POWERPLANT + POWERPLANT CONTROLS IMPROPER IN-FLIGHT CONTROLS IMPROPER IN-FLIGHT CONTROLS IMPROPER IN-FLIGHT DECISIONS OR PLANNING IMPROPER IN-FLIGHT DECISIONS OR PLANNING IMADEQUATE SUPERVISION OF FLIGHT MISMANAGEMENT OF FUEL LACK OF FAMILIARITY WITH AIRCRAFT MISMANAGEMENT OF FUEL EXERCISED POOR JUDGMENT DERAFED CARELESSLY SELECTED UNSUITABLE TERRAIN INFOPER STARTING PROCEDURES INITIATED FLIGHT IN ADVERSE WEATHER CONDITIONS MISJUDGED DISTANCE AND SPEED ISJUDGED SPEED AND ALTITUDE ISJUDGED SPEED AND ALTITUDE ISJUDGED SPEED AND ALTITUDE ISJUDGED SPEED AND ALTITUDE | 2<br>2<br>6<br>8<br>2<br>2<br>14<br>9<br>45<br>4<br>41<br>2 | 1 4    | 3     | 18<br>8<br>80<br>27<br>2<br>2<br>2<br>6<br>15<br>422<br>6<br>1<br>93<br>1<br>800<br>41<br>27<br>499<br>17<br>1<br>1<br>2<br>1<br>1<br>2<br>1<br>1<br>2<br>1<br>1<br>2<br>1<br>1<br>1<br>1<br>1<br>1 | 4<br>1<br>9<br>4<br>1<br>2<br>5<br>4<br>18<br>1 | 22<br>989<br>31<br>23<br>6<br>172<br>6<br>1<br>98<br>1<br>804<br>445<br>500<br>17<br>2<br>3<br>2<br>1<br>12 | 20<br>10<br>86<br>35<br>2<br>2<br>8<br>15<br>436<br>1<br>102<br>1<br>845<br>41<br>31<br>540<br>19<br>1<br>3<br>2 | 5<br>1<br>9<br>4<br>1<br>2<br>5<br>5<br>5<br>22<br>1<br>1 | 2:<br>99<br>39<br>39<br>2 2 8<br>17<br>43<br>6 6<br>6 10<br>7<br>1 10<br>19<br>2 2 3<br>2 2 1<br>1 2 1 |
| PATIAL INPAIRMENT<br>PATIAL DISORIENTATION<br>SYCHOLOGICAL CONDITION   | <b>4</b><br>1   | 1      | 5     | 1<br>1<br>1<br>3  |   | 1 1 1   | 1<br>1<br>1  |   | 1<br>1<br>1  |
| ISUSED OR FAILED TO USE FLAPS<br>ILED TO ABORT TAKEOFF<br>ILED TO INITIATE GO-AROUND<br>RECT ENTRIES   | 2   | 1      | 1 1 2 | i   | 1<br>1  | 3<br>1<br>1   | 7 2  | 1 2   | 1<br>8<br>2<br>2   |
| SUBTOTAL   | 1   |        | 1     | 1   | -   | i<br>1  | 3  | ī   | 1 3  |
| LOT  | 145   | 9      |       | 9   |   | 9   | 1<br>10  |   | ī  |
| ILED TO OBTAIN/MAINTAIN FLYING SPEED PROPER DPERATION OF POWERPLANT + POWERPLANT CONTROLS DAGGUATE PREFLIGHT PREPARATION AND/OR PLANNING SHATOTAL  |   |        | 154   | 2103  | 53 2  | 156   | 224B   | 62 23   | 10   |
| SUBTOTAL SUBTOTAL  |   |        |       | 1   |   | 1   | 1  |   | 1  |
| STUDENT  |   |        |       | 1   |   | 1   | 1<br>1   |   | 1<br>1   |
| LED TO OBTAIN/MAINTAIN FLYING SPEED  DEQUATE PREFLIGHT PREPARATION AND/DR PLANT CONTROLS  K OF FAHLLIARITY WITH AIRCRAFT   |   |        |       | 3   |   | 3   | 3  |   | 3  |
| ANAGEMENT OF WITH AIRCRAFT   |   |        |       | 1<br>16   |   | 1   | 1  |   | 1  |
| NTANEOUS-IMPROPER ACTION   |   |        |       | 5   | 1   | 5   | 16<br>5  | 1   | 6  |
|  |   |        |       |   | -   | 1   |  |   | 5<br>1   |

#### CAUSE/FACTOR TABLE

APPENDIX B

24 11

TABLE B-11 CONTINUED ALL ACCIDENTS DUAL STUDENT (CONTINUED) NONFATAL ACCIDENTS FATAL ACCIDENTS FACTOR TOTAL TOTAL CAUSE CAUSE FACTOR CAUSE FACTOR TOTAL SUBTOTAL \*\* PERSONNEL \*\* FLIGHT INSTRUCTOR
INADEQUATE SUPERVISION OF FLIGHT
INADEQUATE TRAINING OF STUDENT
MAINTENANCE, SERVICING, INSPECTION
IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL)
IMPROPER MAINTENANCE (OWNER PERSONNEL)
IMPROPERLY SERVICED AIRCRAFT(GROUND CREW)
IMPROPERLY SERVICED AIRCRAFT(OWNER-PPILOT)
INADEQUATE INSPECTION OF AIRCRAFT(MAINTENANCE PERSONNEL)
INADEQUATE INSPECTION OF AIRCRAFT(MAINTENANCE PERSONNEL)
INADEQUATE MAINTENANCE AND INSPECTION
OTHER 16 3 6 21 245 2 DIBER UNK/NK

OPERATIONAL SUPERVISORY PERSONNEL
FAILURE TO PROVIDE ADEQ DIRECTIVES, MANUALS, EQUIPMENT
OFFICIENCY, COMPANY MAINTAINED EQMT, SERV, REGULATIONS
WEATHER PERSONNEL
INCORPECT VERYUED FORCAGE ı ı INCORRECT WEATHER FORECAST INCURRECT MEATHER FURECAS!
INADEQUATE/INCORRECT MEATHER BRIEFING
TRAFFIC CONTROL PERSONNEL
AIRPORT SUPERVISORY PERSONNEL
IMPROPER MAINTENANCE-AIRPORT FACILITIES
IMPROPER INSPECTION OF FACILITIES
OTHER ı ī OTHER AIRWAYS FACILITIES PERSONNEL
PRODUCTION-DESIGN
INCORRECT FACTORY INSTALLATION 5 3 1 POOR/INADEQUATE DESIGN ŀ OTHER MISCELLANEOUS-PERSONNEL PASSENGER DIRECT ENTRIES THIRD PILOT FLIGHT ENGINEER DISPATCHING SUBTOTAL \*\* AIRFRAME \*\* WINGS BRACING WIRES. STRUTS ı FUSELAGE WINDSHIELDS, WINDOWS, CANOPIES LANDING GEAR NORMAL RETRACTION/EXTENSION ASSEMBLY FLIGHT CONTROL SURFACES
ALLERON: SURFACES ATTACHMENTS SUBTOTAL \*\* POWERPLANT \*\* ENGINE STRUCTURE 75 72 CRANKCASE 72 CRANKSHAFT MASTER AND CONNECTING RODS 59 125 13 CYLINDER ASSEMBLY
PISTON, PISTON RINGS 13 VALVE ASSEMBLIES BLOWER, IMPELLER ASSEMBLY 36 MOUNT AND VIBRATION ISOLATORS OTHER IGNITION SYSTEM MAGNETOES 42 1 37 DISTRIBUTOR SPARK PLUG ı

## TABLE B-11 CONTINUED POWERPLANT (CONTINUED)

#### CAUSE/FACTOR TABLE

|   | F.41   | <b>-</b> 44 |        |          |          |          |          | AF      | PENDIX B |
|---|--------|-------------|--------|----------|----------|----------|----------|---------|----------|
|   |        |             |        | NONF.    | ATAL ACC | IDENTS   | ΑL       | L ACCID | ENTS     |
|   | CAUSE  | FACTOR      | TOTAL  |          | FACTOR   |          |          | FACTOR  |          |
| LOW TENSION WIRING  |        |             |        |          |          |          |          |         |          |
| SWITCHES SHIELDING  |        |             |        | 2        |          | 2        | 2        |         |          |
| LEADS<br>OTHER  |        |             |        | 6        | 1        | 1 7      | î<br>6   |         | 2<br>1   |
| FUEL SYSTEM TANKS   |        |             |        | 3        |          | 3        | 3        | Į       | 7<br>3   |
| LINES AND FITTINGS<br>SELECTOR VALVES   |        |             |        | 2        |          | 2        | 2        |         | 3<br>2   |
| FILTERS, STRAINERS, SCREEKS<br>PRIMING SYSTEM   | 2<br>1 |             | 2      | 9<br>25  | 4 2      | 13<br>27 | 9        | 4       | 13       |
| CARBURETOR<br>PUMPS   | 2 2    |             | 2      | 20<br>13 | 2        | 22       | 27<br>21 | 2       | 29<br>23 |
| FUEL IN ISCATON AND   | 9<br>5 |             | 2<br>9 | 2<br>87  | 1        | 14<br>2  | 15<br>4  | 1       | 16       |
| VENTS, DRAINS, TANK CAPS RAM AIR ASSEMBLY OTHER                                       | ,      |             | 5      | 19<br>11 | •        | 88<br>19 | 96<br>24 | 1       | 97       |
| LUBRICATING EVEN  | ,      |             |        | 33<br>5  | 8        | 11<br>41 | 11<br>33 | 8       | 24<br>11 |
| VALVES FITTINGS   | 1      |             | 1      | 6        | •        | 5<br>6   | 5<br>7   | ū       | 41<br>5  |
| FILTERS, SCREENS<br>PUMP-PRESSURE   |        |             |        | 11       |          | 11       | 11       |         | 7        |
| OIL COOLERS   |        |             |        | 2<br>8   |          | 2<br>8   | 2        |         | 11<br>2  |
| MEGNETIC PLUGS<br>SEALS AND GASKETS   |        |             |        | 5<br>2   |          | 5 2      | 5        |         | 8<br>5   |
| OTHER COLING SYSTEM   |        |             |        | 4        |          | 4        | 2        |         | 2        |
| DTHER   |        |             |        | 10<br>10 | 1        | 10       | 1<br>10  |         | 10       |
| ROPELLER AND ACCESSORIES<br>BLADES  |        |             |        | 1        | •        | 11       | 10       | ì       | 11       |
| HYDRAULIC PITCH CONTROL MECHANISM   |        |             |        | 1        |          | 1        | 1        |         | 1        |
| XMAUST SYSTEM<br>  Manifolds  | 1      |             | 1      | 1        |          | 1        | 1        |         | 1        |
| MUFFLERS<br>GASKETS   |        |             | -      |          |          | 1        | ż        |         | 1 2      |
| STACKS<br>BAFFLES   | 1      |             | 1      | 2<br>14  | 1        | 2<br>15  | 2<br>15  |         | 2        |
| IGINE ACCESSORIES<br>Starters   |        |             |        | 1<br>5   |          | 1 5      | 1 5      | 1       | 16<br>1  |
| OTHER<br>BINE CONTROL & TOTAL   |        |             |        | 3        |          | š        | 3        |         | 5<br>3   |
| THROTTLE-POWER LEVER ASSEMBLIES MIXTURE CONTROL ASSEMBLIES MIXTURE CONTROL ASSEMBLIES |        |             |        | 1        |          | 1<br>1   | 1        |         | 1        |
| MOUCTION AIR, PREMEAT CONTROLS  OTHER   | 1      |             | 1      | 27       | 1        | 28       | 1        |         | i        |
| WERPLANT - THE T DIMETER  | -      |             | 1      | 14<br>6  | •        | 14       | 28<br>15 | 1       | 29<br>15 |
| SCELLANFOUR   |        |             |        | 1        |          | 6        | 6<br>1   |         | 6        |
| DIRD INGESTION OREIGN OBJECT DAMAGE   |        | 1           | ı      | 4        | 33       | 37       | 4 :      | 34      |          |
| PETONATION STALLS   |        |             |        | 1        |          | 1        | ,        |         | 38       |
| NTHER<br>NRECT ENTRICE  |        |             |        | 1        |          | 1        | 1        |         | 1<br>1   |
| ULION GEAR ACCEMENT   | 1<br>1 | ]           |        | 5        |          | 5        | 5        |         | 1<br>5   |
| EARS, ACCESSORY DRIVE THER PRESSOR ASSEMBLY   |        | i           | •      | 36       | 1 :      | 37       | 1<br>3 7 | 1 2     | 1 38     |
| USTION ASSEMBLY<br>DINE ASSEMBLY  |        |             |        | 3<br>1   |          | 3        | 3        |         | 3        |
| ASSORY DRIVE ASSESS   |        |             |        |          |          |          | 1        |         | í        |
| LICATING SYSTEM<br>LSYSTEM<br>NER   |        |             |        |          |          |          |          |         |          |
| TY SYSTEM   |        |             |        |          |          |          |          |         |          |
| TION SYSTEM<br>WEMETER  |        |             |        | ì        |          | 1        | 1        |         |          |
| NLEED<br>UST SYSTEM   |        |             |        |          |          |          |          | 1       | 1        |
|   |        |             |        |          |          |          |          |         |          |

APPENDIX B CAUSE/FACTOR TABLE TABLE B-11 CONTINUED

| TABLE B-11 CONTINUED   | CAUSE/FACT | UK TABLE    |   |                |          |                            |               |        |            |  |
|--|------------|-------------|---|----------------|----------|----------------------------|---------------|--------|------------|--|
| POWERPLANT (CONTINUED)   | FAT        | AL ACCIE    | ENTS                                    |                | TAL ACCI | DENTS                      | ALL ACCIDENTS |        |            |  |
|  | CAUSE      | FACTOR      | TOTAL                                   | CAUSE          | FACTOR   | TOTAL                      |               | FACTOR | TOTAL      |  |
| THRUST REVERSER PROPELLER SYSTEM CONSTANT SPEED DRIVE POWER LEVER CABLE PROPELLER LEVER  |            |             |   | 1              |          | 1                          | 1             |        | 1          |  |
| REVERSE THRUST LEVER ENGINE INDICATING EQUIPMENT TACHOMETER ENGINE INSTALLATION  |            |             |   | 1              |          | 1                          | 1             |        | 1          |  |
| SUBTOTAL   | 58         | 4           | 62                                      | 938            | 63       | 1001                       | 996           | 67     | 1063       |  |
| ** SYSTEMS **  |            |             |   |                |          |                            |               |        |            |  |
| ELECTRICAL SYSTEM BATTERIES GENERATORS/ALTERNATORS HYDRAULIC SYSTEM  |            |             |   | ı              | 1        | 1                          | 1             | 1      | . <u>1</u> |  |
| FLIGHT CONTROL SYSTEMS ANTI-ICING, DE-ICING SYSTEMS CARBURETOR DE-ICING SYSTEM AIR CONDITION, HEATING AND PRESSURIZATION AUTO PILOT FIRE WARNING SYSTEM  |            |             |   | 13             |          | 13                         | 13            |        | 13         |  |
| FIRE EXTINGUISHER SYSTEM<br>OXYGEN SYSTEM<br>OTHER SYSTEMS   |            |             |   | 14             | 1        | 15                         | 14            | 1      | 11         |  |
| SUBTOTAL   |            |             |   |                |          |                            |               |        |            |  |
| ** INSTRUMENTS/EQUIPMENT AND ACCESSORIES ** FLIGHT AND NAVIGATION INSTRUMENTS  |            |             |   | _              |          |                            | . 1           |        | 1          |  |
| COMPASS COMMUNICATIONS AND NAVIGATION EQUIPMENT TRANSMITTERS AND/OR RECEIVERS YOR RECEIVERS  |            |             |   | 1              |          | 4                          | 1             | 3      |            |  |
| OTHER<br>HISCELLANEOUS EQUIPMENT   |            |             |   | 1              | 1        | 1                          | 1             | _      | 1          |  |
| SPRAY, DUSTING EQUIPMENT   |            |             |   | 3              | . 7      | 10                         | 3             | 7      |            |  |
| SUBTOTAL  ** AIRPORTS/AIRWAYS/FACILITIES **  |            |             |   |                |          |                            |               |        | . 0        |  |
| AIRPORT FACILITIES   |            |             |   |                |          |                            |               |        | 1          |  |
| AIRPORT CONDITIONS SOMM ON RUNWAY AIRWAYS FACILITIES   |            |             |   | 1              | . 1      | . 2                        | 1             | 1      |            |  |
| SUBTOTAL   |            |             |   | 1              | . 3      | . 2                        | 1             | 1      | į          |  |
| ** WEATHER **  |            |             |   |                |          |                            |               |        |            |  |
| LOW CEILING RAIN FOG SNOW ICING CONDITIONS-INCLUDES SLEET, FREEZING RAIN, ETC COMDITIONS CONDUCIVE TO CARB/INDUCTION SYSTEM ICING UNFAYORABLE WIND CONDITIONS TURBULENCE, ASSOCIATED W/CLOUDS, THUNDERSTORMS LOCAL WHIRLWIND ADVERSE WINDS ALOFT HIGH TEMPERATURE OBSTRUCTIONS TO VISION HIGH DENSITY ALTITUDE THUNDERSTORM ACTIVITY |            | 1<br>1<br>7 | 2 2 1 1 1 1 5 1 1 1 1 1 1 1 1 1 1 1 1 1 | 2 2 12 1 1 1 1 | 1 1      | 8 9<br>3 15<br>5 5<br>8 12 | 13            | 1      |            |  |

### TABLE B-11 CONTINUED WEATHER (CONTINUED)

#### CAUSE/FACTOR TABLE

|   | FA       | TAL ACCI | DENTS   | NON F            | ATAL ACC    | IDENTS      |               |             | LEUNIY B     |
|---|----------|----------|---------|------------------|-------------|-------------|---------------|-------------|--------------|
|   | CAUSE    | FACTOR   | TOTAL   | CAUSE            | FACTOR      |             |               | LL ACCID    |              |
|   |          |          |         |                  |             | TOTAL       | CAUSE         | FACTOR      | TOTAL        |
| SUBTOTAL  |          |          |         |                  |             |             |               |             |              |
| ** MISCELLANEOUS **   | 9        | 23       | 32      | 134              | 171         | 305         | 143           | 194         |              |
| BIRD COLLISION EVASIVE MANEUVER TO AVDID COLLISION UNQUALIFIED PERSON OPERATED AIRCRAFT SABOTAGE                            |          |          |         | 1<br>1           |             | 1           | 1             | 194         | 337          |
| FOREIGN MATERIAL AFFECTING NORMAL OPERATIONS DIRECT ENTRIES   | 9        |          |         | 5<br>1           | 3           | 1<br>8<br>1 | 1 5           | 3           | 1 8          |
| SUBTOTAL  | í        |          | 1       | 10 <b>0</b><br>5 | 3           | 103<br>5    | 1<br>109<br>6 | 3           | 112          |
| 20110   | 10       |          | 10      | 113              | 6           | 119         | 123           | 6           | 6            |
| GRAND TOTAL   | 256      | 39       |         |                  |             |             |               | 0           | 129          |
| ** MISCELLANEOUS ACTS, CONDITIONS **  | 270      | 39       | 295     | 3720             | 333         | 4053        | 3976          | 372         | 4348         |
| ANTI-ICING/DEICING EQUIP-IMPROPER DPER. OF/FAILED TO USE<br>CHECKLIST-FAILED TO USE<br>DISREGARD DE GODO DPERATING PRACTICE | 12       |          | 12      | 370              | 4           | 27.         |               |             |              |
| IMPROPER EMERGENCY PROCEDURES   |          |          |         | 2                | 5           | 374<br>7    | 382<br>2      | 4<br>5      | 386          |
| SEAT BELT NOT CASTELLED TO READ   | 2        |          | 2       | 1<br>5           | 7           | 1<br>12     | 1<br>7        |             | 7            |
| UNNARRANTED LOW FLYING HATTENTIVE TO BELL!  |          |          |         |                  | 1<br>1<br>2 | 1<br>1<br>2 | •             | 7<br>1<br>1 | 14<br>1<br>1 |
| POORLY PLANNED APPROACH MISCALCULATED FUEL CONSUMPTION JETTISORD LODGE  | 9        | 1        | 10      | 107              | 4<br>22     | 4           |               | 2<br>4      | 2            |
| JETTISONED LOAD STOLEN OR LUMBURGESTON  | 2        | 2        | 4       | 1                | 4           | 129<br>5    | 116<br>1      | 23          | 139          |
| STOLEN OR UNAUTHORIZED USE OF AIRCRAFT  |          | 2        |         | 66               | 15<br>8     | 81<br>8     | 68            | 17          | 85           |
| ELECTRICAL FAILURE  | 2        | č        | 2<br>2  | 31               | 5<br>3      | 5           |               | 8<br>7      | 8<br>7       |
| ENGINE LOADED UP<br>FATIGUE FRACTURE  |          |          |         | 3                |             | 34<br>3     | 33<br>3       | 3           | 36<br>3      |
| FVtL GRADE-IMPRODES   | 2        |          | 2       | 92               | 3<br>14     | 6<br>106    | 3<br>92       | 3<br>14     | 6            |
| IMPROPER GRADE OIL-LUBRICATING SYSTEM RPM-UNCONTROLLABLE-OVERSPEED  |          |          | 2       | 43<br>6          | 1           | 44          | 45            | 1           | 106<br>46    |
| WINDSHIELD, DIRTY, FOGGY, ETC-RESTRICTED VISION   |          |          |         | 2                |             | 2           | 6<br>2        |             | 6<br>2       |
| INPROPER ALLGAMENT CAR HISTORY  |          | 1        | 1       |                  | 2           | 2<br>2      |               | . 2         | 2            |
| FIRE IN ENGINE  | 3        |          | 3       | 1<br>16          | 1           | 1           | 1             | 3           | 3<br>1       |
| CORRODED/CORROS TON   |          | ı        | 1       | 1                | 11          | 17<br>12    | 19<br>1       | 1<br>12     | 20           |
| CONGESTED TRAFFIC-PATTERN<br>PLOT FATIGUE   | 1        | 2        | 1       | 2<br>6           | 1           | 2<br>7      | 2             |             | 13           |
| FUEL CONTAMINATION-EXCLUSIVE OF WATER IN FUEL ALCOHOLIC IMPAIRMENT OF FETT OF WATER IN FUEL                                 | 34       | 1        | 2       | 1                | 2           | i<br>2      | í             | 5           | 8<br>3       |
| ICE-IN FUEL STREET OF EFFICIENCY AND JUDGMENT   | l        | -        | 35<br>1 | 724<br>55        | 2           | 724         | 758           | 2<br>1      | 2<br>759     |
| ICE-ENGINE<br>ICE-CARBURETOR  | 5        | 2        | 7       | 4                |             | 57<br>4     | 56<br>9       | 2           | 58           |
| NCE-PROPELLED   | 12       |          | 12      | i                | 2           | 11          | 9<br>1        | 2           | 11<br>11     |
| ATELNINGSHICE   |          |          | 12      | 307<br>1         | 7           | 314         | 319           | 7           | 1<br>326     |
| IMPROPERLY LOADED AIRCRAFT-WEIGHT-AND/OR CG   |          |          |         | 2<br>1           | 3           | 5           | 1 2           | 3           | 1 5          |
| DI FYHAUSTION THE THE PART, NOT SYSTEM  | 1        | 2        | 3       |                  | 1           | 1<br>1      | 1             | 3           | 1            |
| IL CONTAMINATION  | 3        |          | 3       | 9<br>53          | 1           | 10<br>55    | 9             | 1           | 10           |
| UEL SIPHONING<br>MATER IN FUEL  |          |          |         | 2                | -           | 2           | 56<br>2       | 2           | 58<br>2      |
| IRCRAFT CAME TO BEST THE MATTER   | 5        |          | 5       | 3                | 1           | 4<br>4      | 4<br>3        | 1           | 4            |
| BSSING  |          | 2        | 2       | 169              | 5<br>15     | 174<br>15   | 174           | 5 1         | 179          |
| DUCH AND GO LANDING<br>MERLOAD FAILURE  | 1        | 2        | 3       | 4<br>13          | 3           | 4           | 4             | 17          | 17           |
| MTERIAL FATILIDE  |          |          |         |                  | 3<br>5      | 16<br>5     | 14            | 5<br>5      | 19           |
| WEL STARVATION  | 10<br>51 |          | 10      | 1<br>421         | 11 4        | 1           | 1             |             | 5<br>1       |
| PROPER CLEAR ANCE-TOLER ANCE  | 2        | ۷        | 53<br>2 | 690<br>33        | . 6         | 90 .        | 741           | 2 7         | 42           |
|   | 3        |          | 3       | 17               | 1           | 34<br>17    | 35<br>20      | 1           | 36<br>20     |

| TABLE B-II CONTINUED   |             |          |             |              |          |               |              |             |          |
|--|-------------|----------|-------------|--------------|----------|---------------|--------------|-------------|----------|
| MISCELLANEOUS ACTS, CONDITIONS (CONTINUED)   | FAT         | AL ACCIO | ENTS        | NONFA        | TAL ACCI | DENTS         | A            | LL ACCID    | ENT      |
|  | CAUSE       | FACTOR   | TOTAL       | CAUSE        | FACTOR   | TOTAL         | CAUSE        | FACTOR      | T (      |
| DETUFFIN TANKS   | 8           | 1        | 9           | 28           | 4        | 32            | 36<br>1      | 5           |          |
| FUEL SELECTOR POSITIONED BETWEEN TANKS<br>FIRE OF UNDETERMINED ORIGIN<br>UNAPPROVED MODIFICATION |             |          |             | 1<br>5<br>4  | 2        | 1<br>7<br>7   | 5            | 2<br>3<br>1 |          |
| IMPROPER/INADEQUATE VENTING<br>ACTION, LACK OF<br>POOR WELD                                      |             |          |             | 2<br>5       | 1        | 1<br>2<br>8   | 2 5          | 3<br>3      |          |
| PREVIOUS DAMAGE<br>LEAK/LEAKAGE<br>LOW FLUID LEVEL   | 2           |          | 2<br>1      | 20           | 3<br>2   | 23<br>2       | 22           | 2           |          |
| ARCING<br>LOW COMPRESSION  | 1           | 1        | 1           | 6            | 4        | 6             | 6<br>25      | 5           |          |
| DOWNWIND  CARBON DEPOSITS  OVER TORQUED  | 3           | 1        | 4           | 22<br>1<br>1 | . 3      | 25<br>1<br>1  | l<br>i       | ·           |          |
| UNDER TORQUED<br>LOUSE, PART/FITTING<br>BENT   | 4           |          | 4 2         | 26<br>3<br>5 | 3        | 29<br>3<br>6  | 30<br>3<br>7 | 3           |          |
| BINDING<br>Burned  | 2           |          |             | 11 2         | 2<br>2   | 13<br>4<br>5  | 11<br>2<br>5 |             | <b>!</b> |
| CHAFFED<br>COLLAPSED<br>CROSSED  | 1<br>1<br>1 | 1        | 1<br>1<br>2 | 2            | 1        | 2             | 1            | . 1         | ı        |
| DETERIORATED<br>DISCONNECTED<br>EXCESSIVE  | 1           | 1        | 1           | 13<br>5<br>2 | 11       |               | 13           | 11          |          |
| ERRATIC<br>FRICTION, EXCESSIVE<br>GROUNDED   |             |          | 1           | 1<br>5<br>24 |          | 1<br>5<br>27  | :<br>2       | 3           | 4        |
| IMPROPERLY INSTALLED<br>Jammed   |             | 1        | 1           | 3<br>19      |          | 3<br>19       | 1            | •           | ı<br>I   |
| OBSTRUCTED<br>OPEN<br>DUT OF BALANCE   |             |          |             | 1<br>13      |          | 3<br>14       | 17           | 1 3         | 2<br>1   |
| OVERHEATED<br>EXCESSIVE PRESSURE<br>PRESSURE TOO LOW   |             |          |             | 10<br>5      | 1        |               | 1            |             | 1        |
| PRESSURE, NONE<br>Scored   | 1 2         |          | 1 2         | 2            |          | 2<br>5        |              | 3<br>7<br>8 | 2        |
| SHEARED<br>STICKING<br>STRIPPED  |             |          |             | 6<br>1<br>10 | ) 3      | 1<br>13       | 1            | 1<br>0      | 3        |
| STUCK<br>EXCESSIVE TEMPERATURE<br>VIBRATION, EXCESSIVE   | 1           |          | 1           |              |          | 7<br>3 5<br>1 |              |             | 3        |

#### DIRECT ENTRY CAUSES

DIRECT ENTRY CAUSES

PMR PLT-FUEL EXMAUSTION FOR UNK CAUSEPILOT-INCAPACITATION CAUSED BY DRUGS

PMR PLT-SEAL ON OIL FILTER IMPROPERLY INSTALLED.

PMR PLT-EXCESSIVE FUEL CONSUMPTION-CAUSE UNDTAMNO.

PMR PLT-EXCESSIVE FUEL CONSUMPTION-CAUSE UNDTAMNO.

PMR PLT-MATERIAL FAILURE.CAM REDUCTION GEAR ASSEMB

PMR PLT-CAM REDUCTION GEAR FAILED.

PILOT-IMADVERTENTLY TURNED OFF FUEL.

PILOT-IMPROPERLY EXECUTED EMERGENCY LANDING

PMR PLT-NO GASKET.NO.3 CYLINDER ROCKER BOX COVER.

PMR PLT-EXCESSIVE FUEL CONSUMPTION.CAUSE UNDETERMN

PILOT-DOSITIONED MIXTURE CONTROL TO IDLE-CUT-OFF.

PWR PLT-THROITLE MOUSING BROKE FORMARD OF FIREMALL

PMR PLT-FUEL SIPHONED OUT FROM DEFORMED TANK VENT.

PMR PLT-SLUSH ENTERED CARBURETOR AIR INTAKE SCOOP.

PMR PLT-CARB.FLOAT IMPROPERLY INSTALLED.

PHR PLT-CARB.FLOAT IMPROPERLY INSTALLED.

PMR PLT-ACELERATOR PUMP JAMMED BY OUST COVER.

PMR PLT-TATIGUE FAILURE OF NUMBER 1 CYLINDER.

MISC-DESCRNT WAS TOO STEEP PRECLUDING FUEL FLOW

#### TABLE 8-11 CONTINUED

DIRECT ENTRY CAUSES (CONTINUED)

CAUSE/FACTOR TABLE

APPENDIX B

PILOT-INADVERTENTLY ACTUATED MIXTURE CONTROL
PMR PLT-EXCESSIVE FUEL CONSUMPTION CAUSE NOT DTRMD
PMR PLT-IMPROPPER CARBURETOR INSTALLED.
PMR PLT-CAMSMAT DRIVE GEAR BOLTS FAILED.
PMR PLT-CAMSMAT DRIVE GEAR DOUGH FILLER CAP.
PMR PLT-GASKET BLOWN NO 3 CYL.
MISC-MATER CONTAMINATED FUEL SOURCE
PMR PLT-ENGINE CRANKCASE BREATHER PLUGGED BY ICE
MISC-GARBURETOR MEAT CONTROL BRACKET FAILED
PMR PLT-FATIGUE FAILURE OF CARB HEAT CONTROL.
PMR PLT-FATIGUE FAILURE OF CARB HEAT CONTROL.
PMR PLT-THARDITLE CONTROL BINDING IN CARLE HOUSING.
PHENDIT-LEGS STRUCK AND TURNED FUEL SELECTR VALVE OFF
PMR PLT-LEGS TRANKSMAFT IDLER GEAR CAP SCREW FAILD
PERSONNEL-TRI-PACER OWNERS HANDBOOK INADEQUATE.
PMR PLT-LEFI CRANKSMAFT IDLER GEAR CAP SCREW FAILD
PERSONNEL-TRI-PACER OWNERS HANDBOOK INADEQUATE.
PMR PLT-PUSH ROD SOCKETS NOT INSTALLED.
PMR PLT-BOTH MAIN FUEL CAPS LODSE-FUEL SYPHONING
MISC-MATER FROZE IN FUEL SELECTOR RLOCKING FLOW
PMR PLT-BOTH MAIN FUEL CAPS LODSE-FUEL SYPHONING
MISC-MATER FROZE IN FUEL SELECTOR RLOCKING FLOW
PMR PLT-FUEL STARVATION FOR UNDETERMINED CAUSE.
PMR PLT-FUEL STARVATION FOR UNDETERMINED REASON
PMR PLT-FUEL STARVATION FOR MODETERMINED REASON
PMR PLT-IMPROPERTY TURNED MAGNETO SWITCH OFF
PMR PLT-INTAKE MANIFOLD CRACKED.
PMP PLT-INDAKETENTLY TURNED MAGNETO SMITCH OFF
PMR PLT-INTAKE MANIFOLD CRACKED.
PMP PLT-INDAKETENTLY TURNED MAGNETO SMITCH OFF
PMR PLT-INTAKE MANIFOLD CRACKED.
PMP PLT-INDAKETENTLY TURNED MAGNETO INTOLE

DIRECT ENTRY CAUSES ARE CARRIED UNDE

DIRECT ENTRY CAUSES ARE CARRIED UNDER THEIR APPROPRIATE CAUSAL CATEGORIES AND ARE INCLUDED IN THE TOTALS

#### APPENDIX C

# MULTIENGINE FIXED WING AIRCRAFT U. S. GENERAL AVIATION

TABLE OF

ACCIDENTS, INJURIES
ENGINE FAILURE OR MALFUNCTION
AS A FIRST ACCIDENT TYPE
MULITIENGINE, FIXED-WING AIRCRAFT
U. S. GENERAL AVIATION
1965 - 1969

# INJURIES

|           | <br>TOTAL | 455<br>65<br>43<br>43                                     | 1<br>7<br>15<br>868                              | 1461   | <b>L</b>                       | 1468        |
|-----------|-----------|---|--|--------|--------------------------------|-------------|
|           |           |   |  | ABOARD |                                |             |
|           | UNKNOMN   | <br>  | ·  |        |                                |             |
| ***OOKILS |           | 234<br>42<br>22<br>3                                      | 1<br>7<br>8<br>509                               | 828    | ~                              | 830         |
|           | MINOR     | 61 8 8  | 104  | 179    | H                              | 180         |
|           | SERIOUS   | 6 5 5 5   | 110  | 190    | 2                              | 192         |
|           | FATAL     | 93  | 145  | 264    | ~                              | 266         |
|           | d.        | COPILOT<br>DUAL STUDENT<br>CHECK PILOT<br>FLIGHT ENGINEER | CABIN ATTENDANT<br>EXTRA ATTENDANT<br>PASSENGERS | TOTAL  | OTHER AIRCRAFT<br>OTHER GROUND | GRAND TOTAL |

INVOLVES INVOLVES

455 TOTAL ACCIDENTS 104 FATAL ACCIDENTS

KIND OF FLYING VS AIRCRAFT DAMAGE ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE MULTIENGINE, FIXED-WING AIRCRAFT U.S. GENERAL AVIATION 1965 - 1969

|                               |      |      | DAMAGE |         |         |
|-------------------------------|------|------|--------|---------|---------|
| KIND OF FLYING                | DEST |      | MIN N  | RECORDS | ACCIDEN |
| ***********                   |      |      |        |         |         |
| INSTRUCTIONAL                 |      |      |        |         |         |
| DUAŁ                          | 16   | 27   |        | 43      |         |
| SOLO                          |      |      |        |         |         |
| CHECK                         | 2    | 2    |        | 4       |         |
| TRAINING                      |      |      |        |         |         |
| NONCOMMERC IAL                |      |      |        |         | •       |
| PLEASURE                      | 49   | 51   |        | 100     | 1       |
| PRACTICE                      | 3    | 8    |        | 11      |         |
| BUSINESS                      | 41   | 64   |        | 105     | 14      |
| CORPORATE/EXECUTIVE           | 13   | 25   |        | 38      |         |
| AERIAŁ SURVEY                 |      |      |        |         |         |
| COMPANY FLIGHT                |      |      |        |         |         |
| OTHER                         |      |      |        |         |         |
| COMMERCIAL                    |      |      |        |         |         |
| AERIAL APPLICATION            |      | 1    |        | 1       |         |
| ASSOCIATED CROP CONTROL ACTIV | 2    | 1    |        | 3       |         |
| FIRE CONTROL                  | 1    |      |        | 1       |         |
| ASSOCIATED FIRE CONTROL ACTIV | 1    | . 3  |        | 4       |         |
| AERIAL MAPPING/PHOTOGRAPHY    |      |      |        |         |         |
| AERIAŁ ADVERTISING            |      |      |        |         |         |
| POWER AND PIPELINE PATROL     |      |      |        |         |         |
| FISH SPOTTING                 |      |      |        |         |         |
| AIR TAXI-PASSENGER OPERATIONS | 25   | 5 38 |        | 63      | 3       |
| AIR TAXI-CARGO OPERATIONS     | 1    | 4 12 |        | 26      | •       |
| CONSTRUCTION WORK             |      |      |        |         |         |
| SCHEOULED PASSENGER SERVICE   |      |      |        |         | •       |
| SCHEDULED CARGO SERVICE       |      | 1    |        | 1       |         |
| NONSCHEDULED/CHARTER REVENUE  |      |      |        |         |         |
| NONSCHEDULED/CHARTER REVENUE  |      |      |        |         |         |
| MILITARY CONTRACT-PASSENGER   |      |      |        | •       |         |
| MILITARY CONTRACT-CARGO       |      |      |        |         |         |
| CONTRACT/CHARTER-CARGO-DOMEST |      | 1 1  | l      |         | 2       |
| CUNTRACT/CHARTER-PASSENGER-DO |      | 1 :  | 1      | :       | ?       |
| CONTRACT/CHARTER-CARGO-INTERN |      |      |        |         |         |
|                               |      |      |        |         | 4       |

| TABLE | C-2 | CONTI | NUED |
|-------|-----|-------|------|
|-------|-----|-------|------|

#### ANALYTIC TABLE

|                               |                 |         | APPENDIX C |
|-------------------------------|-----------------|---------|------------|
| KIND OF FLYING                | AIRCRAFT DAMAGE |         |            |
| CONTRACT/CHARTER-PASSENGER-IN |                 | RECORDS | ACCIDENTS  |
| OTHER                         |                 |         |            |
| UNKNOWN/NOT REPORTED          |                 |         |            |
| MISCELLANEOUS                 |                 |         |            |
| EXPERIMENTATION               |                 |         |            |
| TEST                          | 7 7             |         |            |
| DEMONSTRATION                 | 11              | 14      | 14         |
| FERRY                         | 11 10           | 11      | 11         |
| SEARCH AND RESCUE             |                 | 21      | 21         |
| AIR SHOW/AIR RACING           | 1               |         |            |
| PARACHUTE JUMP                |                 | 1       | 1          |
| PARACHUTE JUMP IN CONNECTION  |                 |         |            |
| TOWING GLIDERS                |                 |         |            |
| SEEDING CLOUDS                | 1               |         |            |
| HUNT ING                      |                 | 1       | 1          |
| POLICE PATROL                 |                 |         |            |
| HIGHWAY TRAFFIC ADVISORY      |                 |         |            |
| ALL OTHER PUBLIC FLYING       | 1               | •       |            |
| OTHER                         |                 | 1       | 1          |
| UNKNOWN/NOT REPORTED          | 1 1             |         |            |
| •                             |                 | 2       | 2          |
| RECORDS                       |                 |         |            |
| ACCIDENTS                     | 191 264         | 455     |            |
|                               | 191 264         |         |            |

AIRPORT PROXIMITY VS INJURY INDEX ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE MULTIENGINE, FIXED-HING AIRCRAFT U.S. GENERAL AVIATION 1965 - 1969

|                        | 11    | NJURY | INDE | x    |
|------------------------|-------|-------|------|------|
| AIRPORT PROXIMITY      | FATAL |       | MIN  | NONE |
| ON AIRPORT             | 15    | 12    | 18   | 96   |
| ON SEAPLANE BASE       |       |       |      |      |
| ON HELIPORT            |       |       |      |      |
| ON BARGE/SHIP/PLATFORM |       |       |      |      |
| IN TRAFFIC PATTERN     | 22    | 16    | 10   | 32   |
| WITHIN 1/4 MILE        | 4     | 6     | 3    | 4    |
| WITHIN 1/2 MILE        | 3     | 4     | 4    | 3    |
| WITHIN 3/4 MILE        | 2     | 1     | 1    | 1    |
| WITHIN 1 MILE          | 4     | 3     | 2    | 4    |
| WITHIN 2 MILES         | 9     | 9     | 10   | 13   |
| WITHIN 3 MILES         | 11    | 1     | 1    | 8    |
| WITHIN 4 MILES         | 5     |       | 1    | 1    |
| WITHIN 5 MILES         | 4     |       |      | 1    |
| BEYOND 5 MILES         | 24    | 15    | 18   | 51   |
| UNKNOWN/NOT REPORTED   | 1     | 1     |      | 1    |
|                        |       |       |      |      |
|                        |       |       |      |      |
| RECORDS                | 104   | 68    | 68   |      |
| ACCIDENTS              | 104   | 68    | 68   | 215  |

FIRST PHASE OF OPERATION VS AIRCRAFT DAMAGE
ACCIDENTS INVOLVING ENGINE FAILURE
OR MALFUNCTION AS A FIRST ACCIDENT TYPE
MULTIENGINE, FIXED-WING AIRCRAFT
U.S. GENERAL AVIATION
1965 - 1969

FIRST PHASE OF OPERATION **国际国际区域区域区域区域共享共享基础区域** 

AIRCRAFT DAMAGE DEST SUBST MIN NONE

4 15

55 82

5

9

1

RECORDS ACCIDENTS

19

137

11

169

12

1

19

137

11

169

12

1

STAT 1C

STARTING ENGINE/S

IDLING ENGINE/S

ENGINE RUNUP

IDLING ROTORS

PARKED-ENGINES MOT OPERATING

OTHER

TAXI

TO TAKEOFF

FROM LANDING

DTHER

GROUND TAXI TO TAKEOFF

GROUND TAXI FROM LANDING

GROUND TAXI, OTHER

AERIAL TAXI TO TAKEOFF

AERIAL TAXI TO/FROM LANDING

AERIAL TAXI, OTHER

TAKEOFF

INITIAL CLIMB

VERT ICAL

RUNNING

ABORTED

BORTED

BORTED

HER

MFL 1GHT

LIMB TO CRUISE

RMAL CRUISE

6 71 98

SCEND ING

DING VERING

ER-ON DESCENT

DROTATIVE DESCENT

| ,                             |     |     | RECORDS | ACCIDE |
|-------------------------------|-----|-----|---------|--------|
| ACROBATICS                    |     |     |         |        |
| BUZZING                       |     |     |         |        |
| UNCONTROLLED DESCENT          |     |     |         |        |
| EMERGENCY DESCENT             |     |     |         |        |
| LOW PASS                      |     | 1   | 1       |        |
| OTHER                         | 5   | 3   | 8       |        |
| EN ROUTE TO TREAT CROP        |     |     |         |        |
| EN ROUTE TO RELOADING AREA    |     | 1   | 1       |        |
| SURVEY FIELD/AREA             |     |     |         |        |
| STARTING SWATH RUN            |     |     |         |        |
| SWATH RUN                     |     |     |         |        |
| FLAREOUT FOR SWATH RUN        |     |     |         |        |
| PULLUP FROM SWATH RUN         | 1   |     |         | l      |
| PROCEDURE TURNAROUND          | 1   |     |         | 1      |
| CLEANUP SWATH                 |     |     |         |        |
| MANEUVER TO AVOID OBSTRUCTION |     |     |         |        |
| RETURN TO STRIP               |     |     |         |        |
| LANDING                       |     |     |         |        |
| TRAFFIC PATTERN-CIRCLING      | 7   | 11  | 1       | В      |
| FINAL APPROACH                | 18  | 22  | 4       | 0      |
| INITIAL APPROACH              | 3   | 3   |         | 6      |
| FINAL APPROACH                | 3   | 1   |         | 4      |
| LEVEL OFF/TOUCHDOWN           |     | 2   |         | 2      |
| ROLL                          |     | 1   |         | 1      |
| ROLL-ON/RUN-ON                |     |     |         |        |
| POWER-ON LANDING              |     |     |         |        |
| POWER-OFF AUTUROTATIVE LANDIN |     |     |         |        |
| GO-AROUND                     | 9   | 9   | 1       | R      |
| MISSED APPROACH               | 3   |     |         | 3      |
| OTHER                         | 2   |     |         | 2      |
| UNKNOWN/NOT REPORTED          |     |     |         |        |
| arcount                       | 191 | 264 | 45      | .5     |
| RECORDS ACCIDENTS             |     | 264 |         | 4      |

SECOND ACCIDENT TYPE VS INJURY INDEX
ACCIDENTS INVOLVING ENGINE FAILURE
OR MALFUNCTION AS A FIRST ACCIDENT TYPE
MULTIENGINE, FIXED-WING AIRCRAFT
U-S- GENERAL AVIATION
1965 - 1969

| TYPE OF ACCIDENT                      | INJURY INDEX       |         |            |
|---------------------------------------|--------------------|---------|------------|
|                                       | SER MIN NONE       | RECORDS | ACC IDENT: |
| GROUND-WATER LOOP-SWERVE              | 2 5                |         | ACCIDENT:  |
| DRAGGED WINGTIP, POD, OR FLOA         |                    | 7       |            |
| WHEELS-UP LANDING                     | 1 10 10 93         | ,       | 7          |
| WHEELS-DOWN LANDING IN WATER          | 40 75              | 114     |            |
| GEAR COLLAPSED                        | 4 12 27            | 114     | 114        |
| GEAR RETRACTED                        | -1 21              | 43      |            |
| HARD LANDING                          | 1                  |         | 43         |
| NOSE OVER/DOWN                        | 3 7                | 1       | 1          |
| ROLL OVER                             | 2 1                | 10      | 10         |
| OVERSHOOT                             |                    | 3       | 3          |
| INDERSHOOT                            | 1                  |         |            |
| OLLISION WITH AIRCRAFT                | 1 1 2              | 1       | 1          |
| OTH IN FLIGHT                         |                    | 4       | 4          |
| NE AIRBORNE                           |                    | •       |            |
| OTH ON GROUND                         |                    |         |            |
| OLLISION WITH GROUND/WATER            |                    |         |            |
| DNTROLLED                             |                    |         |            |
| CONTROLLED                            | 7 8 4 3            |         |            |
| LLIDED WITH                           | 15 3 <sub>2</sub>  | 22      | 22         |
| RES/POLES                             |                    | 20      | 20         |
| EES                                   | 1 4 <sub>2 2</sub> |         |            |
| SIDENCE/S                             | 10 15 9 9          | 9       | 9          |
| LDING/S                               | 2 1                | 43      | 43         |
| CE, FENCEPOSTS                        |                    | 3       | 3          |
| CTRONIC TOWERS                        | 1 10               |         | ,          |
|                                       |                    | 11      | 11         |
| MAY OR APPROACH LIGHTS<br>PURT HAZARD |                    |         | 11         |
| SALS                                  |                    |         |            |
| ,                                     |                    |         |            |
|                                       | 1 1                | •       |            |
| MAN LOADER<br>Mes                     | ı                  | 5       | _          |
|                                       | 2 2 3              | ٠.      | 2          |
| BANK                                  | - ,                | 7       |            |
| ED AIRCRAFT                           | 1                  |         | 7          |
| 081FE                                 | 1 1                | 1       | 1          |

|                               | 11    | NJURY             | IND | EX   |     |     |      |   |
|-------------------------------|-------|-------------------|-----|------|-----|-----|------|---|
| E OF ACCIDENT                 | FATAL |                   | MIN |      |     | REC | ตลกร |   |
| *                             |       | 1                 | 2   |      | 5   |     | 8    |   |
| RTBANK                        |       | •                 | 2   |      | •   |     | 3    |   |
| BJECT                         | 1     |                   | 2   |      |     |     |      |   |
| IRD STRIKE                    |       |                   | 3   |      | 3   |     | 40   |   |
| TALL                          | 26    | 8                 |     |      | ,   |     | 30   |   |
| PIN                           | 27    | 3                 |     |      |     |     | 4    |   |
| PIRAL                         | 3     | _                 |     |      | 1   |     | 24   |   |
| NUSH                          | 3     | 5                 | 2   | 2 1  | 4   |     |      |   |
| TRE OR EXPLOSION              |       |                   |     |      | _   |     | 5    |   |
| IN FLIGHT                     |       |                   |     |      | 5   |     | 3    |   |
| ON GROUND                     |       |                   | 1   | l    | 2   |     | _    |   |
| AIRFRAME FAILURE              |       |                   |     |      |     |     | 2    |   |
| IN FLIGHT                     | 1     |                   |     |      | 1   |     | 2.   |   |
| ON GROUND                     |       |                   |     |      |     |     |      |   |
| ENGINE TEARAWAY               |       |                   |     |      |     |     |      |   |
| ENGINE FAILURE OR MALFUNCTION |       |                   |     |      |     |     |      |   |
| PROPELLER/ROTOR FAILURE       |       |                   |     |      |     |     |      |   |
| PROPELLER                     |       |                   |     |      |     |     |      |   |
| AIL ROTOR                     |       |                   |     |      |     |     |      |   |
| MAIN ROTOR                    |       |                   |     |      |     |     |      |   |
| PROPELLER/ROTOR ACCIDENT TO P |       |                   |     |      |     |     |      |   |
| JET INTAKE/EXHAUST ACCIDENT T |       |                   |     |      |     |     |      |   |
| PROPELLER/JET/ROTOR BLAST     |       |                   |     |      |     |     |      |   |
| TURBULENCE                    |       |                   |     |      |     |     |      |   |
| HAIL DAMAGE TO AIRCRAFT       |       |                   |     |      |     |     |      |   |
| LIGHTNING STRIKE              |       |                   |     |      |     |     |      |   |
| EVASIVE MANEUVER              |       |                   |     |      |     |     |      |   |
| UNCONTROLLED ALTITUDE DEVIATI |       |                   |     |      |     |     |      |   |
| DITCHING                      | 4     | ,                 | 3   | 7    | 18  |     | 3    | 2 |
| MISSING AIRCRAFT NOT RECOVERE |       |                   |     |      |     |     |      |   |
| MISCELLANEOUS, OTHER          |       |                   |     |      | 1   |     |      | 1 |
| UNDETERMINED                  |       |                   |     |      |     |     |      |   |
|                               |       |                   |     |      |     |     |      |   |
| ECORDS                        | 10    | 4 6               | 8   | 68 2 | 215 |     | 45   | , |
| CC IDENTS                     | 104   | <b>4</b> <i>6</i> | 8   | 68 2 | 215 | •   |      |   |

ACCIDENTS INVOLVING ENGINE FAILURE OR NALFUNCTION AS A FIRST ACCIDENT TYPE CAUSE/FACTOR TABLE

MULTIENGINE, FIXED-WING AIRCRAFT U.S. GENERAL AVIATION 1965 - 1969

CAUSES DISPLAYED RELATE TO FIRST ACCIDENT TYPE ONLY

455 TOTAL ACCIDENTS 104 FATAL ACCIDENTS

INVOLVES INVOLVES

TOTAL\* 48.13 38 8.35 220 48.35 • 66 00• 00. 10.11 .22 46 ALL ACCIDENTS 18 3.96 1.32 FACTOR 00. 2.45 60. ç ø 00. 65.9 . 22 444 215 47.25 CAUSE 000 46.37 •66 99 00. ô 3.74 00. 44. 7.39 TOTAL\* 172 48•86 •57 00. 00 8.52 NONFATAL ACCIDENTS • **5**8 1.14 9 FACTOR 90 2.84 ွ 8 င့ ŝ 5.40 10 .57 00. 46.59 6.82 CAUSE ----900 46.31 00• 80 3.13 8 .57 85 12 11.65 TOTAL\* 0 8 09\*95 -97 .97 00. 00. 15.53 ŝ • 00 .97 FATAL ACCIDENTS 3 2.91 2.91 FACTOR 00. 8 97 - 64 00 ŝ 8 10.68 00. 00. 9 CAUSE 000 000 46.60 00 -97 8 σ 00. 5,83 8 8 .97 ø INSTRUMENTS/EQUIPMENT AND ACCESSORIES AIRPORTS/AIRWAYS/FACILITIES BROAD CAUSE/FACTOR LANDING GEAR MISCELLANEOUS POWERPLANT UNDETERMINED PERSONNEL ROTORCRAFT AIRFRAME SYSTEMS PILOT WEATHER TERRAIN

00.

<sup>\*</sup> IF AN ACCIDENT INCLUDES BOTH A CAUSE AND RELATED FACTOR IN THE SAME CAUSAL CATEGORY, THE ACCIDENT IS REPRESENTED ONCE UNDER THE TOTAL FOR THAT CATEGORY THE FIGURES OPPOSITE EACH CAUSAL CATEGORY REPRESENT THE NUMBER AND PERCENT OF ACCIDENTS IN WHICH THAT PARTICULAR CAUSAL CATEGORY WAS ASSIGNED

#### CAUSE/FACTOR TABLE

#### ACCIDENTS INVOLVING ENGINE FAILURE OR HALFUNCTION AS A FIRST ACCIDENT TYPE

MULTIENGINE, FIXED-HING AIRCRAFT

U.S. GENERAL AVIATION

1965 - 1969

CAUSES DISPLAYED RELATE TO FIRST ACCIDENT TYPE ONLY

INVOLVES 455 TOTAL ACCIDENTS INVOLVES 104 FATAL ACCIDENTS

|   | FATAL ACCIDENTS                                   |        |                       | NONFA  | TAL ACCI                        | DENTS   | ALL ACCIDENTS   |                                 |  |
|---|---|--------|-----------------------|--|---------------------------------|---|---|---------------------------------|--|
| DETAILED CAUSE/FACTOR   | CAUSE   | FACTOR | TOTAL                 | CAUSE  | FACTOR                          | TOTAL   | CAUSE   | FACTOR                          | TOTAL  |
| ** P!LOT **   |   |        |                       |  |                                 |   |   |                                 |  |
| PILOT IN COMMAND ATTEMPTED OPERATION W/KNOWN DEFICIENCIES IN EQUIPMENT ATTEMPTED OPERATION BEYOND EXPERIENCE/ABILITY LEVEL BECAME LOST/DISORIENTED CONTINUED VFR FLIGHT INTO ADVERSE WEATHER CONDITIONS DIVERTED ATTENTION FROM OPERATION OF AIRCRAFT EXCEEDED DESIGN STRESS LIMITS OF AIRCRAFT FAILED TO OBTAIN/MAINTAIN FLYING SPEED FAILED TO SEED OF INCORRECTLY USED MISC EQUIPMENT FAILED TO FOLLOW APPROVED PROCEDURES, DIRECTIVES ETC IMPROPER OPERATION OF POWERPLANT + POWERPLANT CONTROLS IMPROPER OPERATION OF FLIGHT CONTROLS IMPROPER IP DEFRATION IMPROPER IP-FLIGHT DECISIONS OR PLANNING INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING INADEQUATE SUPERVISION OF FLIGHT LACK OF FAMILIARITY WITH AIRCRAFT MISMANAGEMENT OF FUEL EXERCISED POOR JUNGMENT IMPROPER STARTING PROCEDURES MISJUDGED DISTANCE, SPEED, AND ALTITUDE MISJUDGED ALTITUDE INADEQUATE TRAINING OF STUDENT PHYSICAL IMPRIAMENT SPATIAL DISORIENTATION MISUSDO OR FAILED TO USE FLAPS SELECTED WRONG RUNNAY RELATIVE TO EXISTING WIND FAILED TO ABORT TAKEOFF OTRECT ENTRIES | 1<br>1<br>1<br>12<br>1<br>5<br>16<br>2<br>18<br>1 | 1 2    | 1 1 1 2 1 1 1 1 1 1 1 | 5<br>2<br>1<br>2<br>1<br>3<br>1<br>1<br>2<br>2<br>3<br>1<br>1<br>2<br>1<br>2<br>3<br>1<br>1<br>2<br>1<br>2 | 1<br>2<br>1<br>3<br>2<br>1<br>6 | 6 4 1 3 1 1 1 1 1 1 5 6 3 1 1 1 1 1 1 1 1 1 1 1 3 | 9 1 4 3 2 1 4 1 1 3 5 1 1 8 7 8 1 3 2 7 9 4 2 2 1 1 1 1 1 1 1 1 3 | 1<br>2<br>1<br>3<br>2<br>2<br>8 | 10<br>1<br>6<br>3<br>3<br>1<br>1<br>4<br>1<br>1<br>6<br>3<br>5<br>2<br>0<br>8<br>0<br>8<br>0<br>7<br>3<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1 |
| SUBTOTAL  | 69  | 3      | 72                    | 207  | 18                              | 225   | 276   | 81                              | 297  |
| COPILOT FAILED TO OBTAIN/MAINTAIN FLYING SPEED DIRECT ENTRIES SUBTOTAL  |   |        |                       | 5  |                                 | 1<br>1<br>2                                       | 1<br>1<br>2   |                                 | 1<br>1<br>2  |
| DUAL STUDENT  DELAYED ACTION IN ABORTING TAKEOFF  FAILED TO EXTEND LANDING GEAR  FAILED TO OBTANIAMAINTAIN FLYING SPEED  IMPROPER DEPRATION OF POWERPLANT + POWERPLANT CONTROLS  MISUNDERSTANDING OF ORDERS OR INSTRUCTIONS  FAILED TO MAINTAIN DIRECTIONAL CONTROL  SUBTOTAL   |   |        |                       | 1<br>1<br>1<br>1<br>1<br>2   |                                 | 1<br>1<br>1<br>1<br>2                             | 1<br>1<br>1<br>1<br>1<br>2  |                                 | 1<br>1<br>1<br>1<br>2  |
| CHECK PILOT   |   |        |                       |  |                                 |   |   |                                 |  |
| INADEQUATE SUPERVISION OF FLIGHT  |   |        |                       | 1  |                                 | 1   | 1   |                                 | 1  |
| SUBTOTAL  |   |        |                       | 1  |                                 | 1   |   |                                 | •  |
| ** PERSONNEL **   |   |        |                       |  |                                 | •   |   |                                 |  |
| FLIGHT INSTRUCTOR MAINTENANCE, SERVICING, INSPECTION IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL)   |   |        |                       | 5  |                                 | 2   | 2   |                                 | 2  |

#### CAUSE/FACTOR TABLE

APPENDIX C

| PERSONNEL (CONTINUED)  | FAT                   | AL ACCID | ENTS             | NONFA                            | TAL ACCI | DENTS                            | AL                                | ALL ACCIDENTS |                                   |   |
|--|-----------------------|----------|------------------|----------------------------------|----------|----------------------------------|-----------------------------------|---------------|-----------------------------------|---|
|  | CAUSE                 | FACTOR   | TOTAL            | CAUSE                            | FACTOR   | TOTAL                            | CAUSE                             | FACTOR        | TOTAL                             |   |
| IMPROPER MAINTENANCELOWNER PERSONNEL) IMPROPERLY SERVICED AIRCRAFTIGROUND CREW) IMPROPERLY SERVICED AIRCRAFTIGWHER-PILOT) IMADEGUATE MAINTENANCE AND INSPECTION      | . 8                   | 2        | 10               | 1<br>3<br>2<br>14                | 1        | 1<br>3<br>2<br>15                | 1<br>3<br>2<br>22                 | 3             | 1<br>3<br>2<br>25                 |   |
| OPERATIONAL SUPERVISORY PERSONNEL INADEQUATE FLIGHT TRAINING-PROCEDURES INADEQUATE SUPERVISION OF FLIGHT CREW FAILURE TO PROVIDE ADEO DIRECTIVES, MANUALS, EQUIPMENT |                       | 1        | 1                |                                  | 1<br>1   | 1<br>1                           |                                   | 1<br>1<br>1   | 1<br>1<br>1                       |   |
| WEATHER PERSONNEL INCOMPLETE WEATHER REPORT TRAFFIC CONTROL PERSONNEL FAILURE TO ADVISE OF UNSAFE AIRPORT CONDITION AIRPORT SUPERVISORY PERSONNEL                    | 1                     |          | 1                | 1                                | •        | 1                                | 1                                 | 1             | 1 1 1                             | • |
| FAILURE TO NOTIFY OF UNSAFE CUNDITION AIRWAYS FACILITIES PERSONNEL PRODUCTION-DESIGN POOR/INADEQUATE DESIGN MISCELLANEOUS-PERSONNEL                                  | 1                     |          | 1                | 1                                | 1        | 1                                | 2                                 | 1             | 2                                 |   |
| THIRD PILOT FLIGHT ENGINEER OISPATCHING SUBTOTAL   | 10                    | 3        | 13               | 24                               | 4        | 28                               | 34                                | 7             | 41                                |   |
| ** AIRFRAME **   |                       |          |                  |                                  |          |                                  |                                   |               |                                   |   |
| WINGS FUSELAGE DOORS, DOOR FRAMES LANDING GEAR LANDING GEAR WARNING AND INDICATING COMPONENTS FLIGHT CONTROL SURFACES  |                       |          |                  | 1                                | 1        | 1                                | 1 .                               | 1             | 1                                 |   |
| SUBTOTAL   |                       |          |                  | 1                                | 1        | 2                                | 1                                 | 1             | 2                                 |   |
| ** POWERPLANT **   |                       |          |                  |                                  |          |                                  |                                   |               |                                   |   |
| ENGINE STRUCTURE CRANKCASE CRANKSHAFT MASTER AND CONNECTING RODS CYLINDER ASSEMBLY PISTON, PISTON RINGS VALVE ASSEMBLIES BLOWER, IMPELLER ASSEMBLY OTHER             | 3<br>3<br>3           |          | 3<br>3<br>3      | 2<br>1<br>8<br>10<br>3<br>1<br>1 |          | 2<br>1<br>8<br>10<br>3<br>1<br>1 | 2<br>1<br>11<br>10<br>6<br>4<br>1 |               | 2<br>1<br>11<br>10<br>6<br>4<br>1 |   |
| IGNITION SYSTEM MAGNETUES SPARK PLUG IGNITION HARNESS, SHIELDING LEADS   | 1<br>3<br>1           | 1        | 2<br>3<br>1      | 3<br>4<br>1                      |          | 3<br>4<br>1                      | 4<br>7<br>1<br>1                  | . 1           | 5<br>7<br>1<br>1                  |   |
| FUEL SYSTEM TANKS LINES AND FITTINGS SELECTOR VALVES FILTERS, STRAINERS, SCREENS CARBURETOR PUMPS  | 1<br>3<br>1<br>1<br>4 |          | 1<br>3<br>1<br>1 | 2<br>4<br>1<br>1<br>2<br>2       | 1        | 2<br>4<br>1<br>1<br>2<br>3<br>2  | 2<br>5<br>4<br>1<br>3<br>3<br>5   | <u>i</u><br>1 | 2<br>5<br>4<br>1<br>3<br>4        |   |
| FUEL INJECTION SYSTEM VENTS, DARINS, TANK CAPS RAM AIR ASSEMBLY LUBRICATING SYSTEM LINES, HOSES, FITTINGS SEALS AND GASKETS OTHER                                    | i                     |          | 1                | 5<br>1<br>7<br>1<br>3            | 1        | 5<br>1<br>8<br>1<br>3            | 6<br>1<br>7<br>1<br>3             | 1             | 6<br>1<br>8<br>1<br>3             |   |
| COOLING SYSTEM BAFFLES PROPELLER AND ACCESSORIES OTHER EXHAUST SYSTEM MANIFOLOS STACKS   |                       |          |                  | 1<br>1<br>1<br>1                 |          | 1<br>1<br>1                      | 1<br>1<br>1                       |               | 1<br>1<br>1                       |   |

| TOLE OF CONTOURS  | ONO CET THE |           |       |              |         |              |               |        |        |  |  |
|---|-------------|-----------|-------|--------------|---------|--------------|---------------|--------|--------|--|--|
| POWERPLANT (CONTINUED)  | FA'         | TAL ACCIO | ENTS  |              | TAL ACC |              | ALL ACCIDENTS |        |        |  |  |
|   | CAUSE       | FACTOR    | TOTAL | CAUSE        | FACTOR  | TOTAL        | CAUSE         | FACTOR | T01    |  |  |
| ENGINE ACCESSORIES ENGINE CONTROLS-COCKPIT  |             |           |       | 1            |         | 1            | 1             |        |        |  |  |
| THROTTLE-POWER LEVER ASSEMBLIES MINTURE CONTROL ASSEMBLIES POWERPLANT-INSTRUMENTS FUEL QUANTITY GAUGE   |             |           |       | i            | 7       | i<br>7       | ī             | 7      |        |  |  |
| MISCELLANEOUS POWERPLANT FAILURE FOR UNDETERMINED REASONS BIRD INGESTION DETONATION   | 25          |           | 25    | 85<br>1<br>1 |         | 85<br>1<br>1 | 110<br>1<br>1 |        | :      |  |  |
| OTHER DIRECT ENTRIES REDUCTION GEAR ASSEMBLY GEARS, ACCESSORY ORIVE   | 2           |           | 2     | 1 4          |         | 1<br>4<br>1  | 1<br>6<br>1   |        |        |  |  |
| COMPRESSOR ASSEMBLY OTHER COMBUSTION ASSEMBLY TURBINE ASSEMBLY  | 1           |           | ı     |              |         |              | 1             |        |        |  |  |
| ACCESSORY DRIVE ASSEMBLY LUBRICATING SYSTEM FUEL SYSTEM SAFETY SYSTEM IGNITION SYSTEM TORQUEMETER   |             |           |       |              |         |              |               |        |        |  |  |
| AIR BLEED<br>Exhaust System<br>Thrust Reverser  |             |           |       | 1            |         | ı            | ι             |        |        |  |  |
| OTHER PROPELLER SYSTEM GOVERNOR CONSTANT SPEED DRIVE  |             | •         |       | 1            |         | 1            | 1             |        |        |  |  |
| GOYERNOR VALVE POMER LEVER PROPELLER LEVER REVERSE THRUST LEVER ENGINE INDICATING EQUIPMENT ENGINE INSTALLATION   |             |           |       | 1            |         | 1            | 1             |        |        |  |  |
| SUBTOTAL  | 53          | 1         | 54    | 171          | 10      | 181          | 224           | 11     |        |  |  |
| ** SYSTEMS **   |             |           |       |              |         |              |               |        |        |  |  |
| ELECTRICAL SYSTEM<br>Batteries<br>Generators/Alternators<br>Hydraulic System  |             |           |       | 1            |         | 1            | 1             |        |        |  |  |
| FLIGHT CONTROL SYSTEMS ANTI-ICING, DE-ICING SYSTEMS CARBURETOR DE-ICING SYSTEM OTHER  |             |           |       | 1<br>1       |         | 1            | 1             |        |        |  |  |
| AIR CONDITION, MEATING AND PRESSURIZATION CABIN TEMP CONTROL AND TEMP INDICATING SYSTEM AUTO PILOT FIRE MARNING SYSTEM FIRE EXTINGUISHER SYSTEM OXYGEN SYSTEM |             | 1         | 1     |              |         |              |               | 1      |        |  |  |
| OTHER SYSTEMS   |             |           |       | 4            |         | 4            | 4             | . 1    | 4      |  |  |
| SUBTOTAL  ** INSTRUMENTS/EQUIPMENT AND ACCESSORIES **   |             | 1         | 1     | 4            |         | 7            | 7             | •      | i<br>i |  |  |
| FLIGHT AND NAVIGATION INSTRUMENTS COMMUNICATIONS AND NAVIGATION EQUIPMENT TRANSMITTERS AND/OR RECEIVERS   |             |           |       | 1            |         | 1            | 1             |        |        |  |  |
| COMPASS RECEIVERS OTHER MISCELLANEOUS EQUIPMENT   | 1           |           | 1     | 1            |         | . 1          | 2             |        |        |  |  |
| SUBTOTAL  | 1           |           | 1     | 3            |         | 3            | 4             | ,      |        |  |  |
|   |             |           |       |              |         |              |               |        |        |  |  |

## TABLE C-7 CONTINUED WEATHER (CONTINUED)

#### CAUSE/FACTOR TABLE

| (COMITMOED)  |        | TABL     | . 6     |         |          |         |         |            |          |   |  |
|--|--------|----------|---------|---------|----------|---------|---------|------------|----------|---|--|
|  | FA     | TAL ACCI | DENTS   | NONF    | ATAL ACC | IDENTS  | ۵۱      | APPENDIX C |          |   |  |
|  | CAUSE  | FACTOR   | TOTAL   |         | FACTOR   | TOTAL   |         |            |          |   |  |
| ** WEATHER **  |        |          |         |         |          | ~       | =====   | FACTOR     | TOTAL    |   |  |
| LON CEILING  |        |          |         |         |          |         |         |            |          |   |  |
| RAIN   | 1      | _        |         |         |          |         |         |            |          |   |  |
| SNOW   |        | 8<br>1   | 9       | 1       | 3        | 4       | •       |            |          |   |  |
| ICING CONDITIONS-INCLUDES SLEET, FREEZING RAIN, ETC  | 1      | 3        | 4       | 1<br>1  | 1 2      | 2       | 2<br>1  | 11<br>2    | 13<br>3  |   |  |
| CONDITIONS CONDUCTE TO CARE/INDUCTION SYSTEM ICING TURBULENES. WIND CONDITIONS  UNROUGHERS. ASSESSED | 3      | ī        | 5<br>4  | 4       | 1        | 3<br>1  | 2<br>1  | 5          | 7        |   |  |
| DOWNDRASTS MASSOCIATED W/CLDUDS. THUMDERSTORMS   | 2      | 4        | 6       | 7       | 5<br>8   | 9       | 7       | 5<br>6     | 6<br>13  |   |  |
|  | 1      |          | 1       |         | i        | 15<br>1 | 9       | 12         | 21       | • |  |
| HIGH DENCIAL TO AIRION   | 1      | 1        | 1       |         |          |         | 1       | 1          | 1<br>1   |   |  |
| THUNDERSTORM ACTIVITY  |        | i        | 1       |         |          |         | 1       |            | 1        |   |  |
| SUBTOTAL   |        | 2        |         |         | 2        | 2       |         | 1<br>1     | 1.       |   |  |
|  |        |          | 2       |         | ~        | 2       |         | 2          | 2        |   |  |
| ## TERRAIN ##  | 10     | 25       | 35      | 14      | 23       | 37      |         | 2          | 2        |   |  |
| WET, SOFT GROUND   |        |          |         |         |          | 21      | 24      | 48         | 72       |   |  |
| SMOW-COVERED   |        |          |         |         |          |         |         |            |          |   |  |
| SUBTOTAL   |        |          |         |         | 1<br>1   | 1       |         | 1          |          |   |  |
| ** MISCELLANEOUS **  |        |          |         |         |          | 1       |         | ī          | 1<br>1   |   |  |
| UNQUALIFIED PERSON OPERATED AIRCRAFT<br>FOREIGN MATERIAL AFFECTING NORMAL OPERATIONS<br>UNDETERMINED |        |          |         |         | 2        | 2       |         | 5          | 2        |   |  |
| •  | 1      |          |         | 2       | 1        | 1       |         | 1          | 1        |   |  |
| SUBTOTAL   | -      |          | 1       | 3       | •        | 3<br>3  | 2<br>4  | ï          | 3        |   |  |
| GRAND TOTAL  | 1      |          | 1       | 5       | 2        | 7       |         |            | 4        |   |  |
| GRAND TOTAL  | 144    |          |         |         | -        | •       | 6       | 2.         | 8        |   |  |
| * MISCELLANEOUS ACTS, CONDITIONS **  | 144    | 33       | 177     | 439     | 60       | 499     | # O =   |            |          |   |  |
| ANT I-ICING (DE total  |        |          |         |         |          |         | 583     | 93         | 676      |   |  |
|  | 4      |          | 4       |         |          |         |         |            |          |   |  |
|  | 1<br>1 | 1        | 2       | 18<br>2 | 6        | 18      | 22      |            | 22       |   |  |
| FFATHERED UNDER TRUCETURES   | 1      |          | 1       | -       |          | 8       | 3       | 7          | 10       |   |  |
| INSTRUMENTS NOT ENGINE   | 6      | 2        | 8       | 7       | 2<br>7   | 2       | 1       | 5          | 1<br>2   |   |  |
| REMATURE CLAR SOFFET   | 1      |          | 1       |         | ,        | 14      | 13      | 9          | 22       |   |  |
| POORLY DE PLAN KETRACTION  | 4      |          | 4       | 1<br>8  | 1<br>4   | . 2     | 1<br>1  | 1          | ì<br>2   |   |  |
| FITTISONED FUEL CONSUMPTION  |        |          |         | ï       |          | 12<br>1 | 12      | 4          | 16       |   |  |
|  | 1      |          | 1       | 4       | 2        | . Ž     | _       | 2          | 1        |   |  |
| LECTRICAL FATURE   | 1      |          | 1       |         | ì        | 1       | 5       | 2          | 7        |   |  |
| ATIGUE EDACTURE  | 2      |          | â       | 6       |          | 6       | 1 0     | 1          | 1        |   |  |
| Utl GRADE-IMPRODES   | 1      |          | 1       | 1       |          | 1       | 8<br>1  |            | 8        | - |  |
|  | 3      |          | 3       | i       |          | 4       | 5<br>4  |            | 1<br>5   |   |  |
| PROPER ALIGNMENT/ADJUSTMENT<br>ALURE OF THO OR MORE ENGINES<br>INE IN FRANCING                       |        | 1        | 1       | 1       |          | 1       | ı<br>l  |            | 4        |   |  |
| RE IN ENGINE LOT FATIGUE   | 1<br>8 | 9        | 1       | 2       |          | 2       |         | 1          | 1        |   |  |
| IFI EYHALICT TOL.  | 1      | ,        | 17<br>1 | 27      | 61       | 88      | 3<br>35 | 70 1       | 3        |   |  |
| EL CIINTAMIMATIOS  | 10     |          | 1       |         | 2<br>1   | 2<br>1  | 1       | 2          | .05<br>3 |   |  |
| E-IN FREI  |        |          | 10      | 42<br>5 |          | 42      | 1<br>52 | 1          | 2        |   |  |
| E-ENG THE  | 1      | 1        | 1       |         |          | 5       | 5       |            | 52<br>5  |   |  |
| E-CARBURETOR<br>RFRAME ICE   | ï      |          | 1       | 1<br>4  |          | 1       | 2       | 1          | 1        |   |  |
|  | 4      |          | 4       | 17      |          | 4<br>17 | 5       |            | 2<br>5   |   |  |
| EXHAUST TON CHOSEN TO PARTY NOT SYSTEM   | _      | 2        | 2       | 3       | 1        | 4       | 21<br>3 | ,          | 21       |   |  |
| CONTAMINATION LUBRICATION SYSTEM   | 1      |          | 1       | 1       | 2        | 2<br>1  |         | 4          | 4        |   |  |
|  | •      |          | 1       | 1<br>1  |          | 1       | 2       |            | ź        |   |  |
|  |        |          |         |         |          | 1       | ÿ       |            | 2        |   |  |

| MISCELLANEOUS ACTS, CONDITIONS (CONTINUED)      | FAT   | TAL ACCID | ENTS  | NONFA  | TAL ACCI | DENTS    | AL       | L ACCIDE | NTS            |
|---|-------|-----------|-------|--------|----------|----------|----------|----------|----------------|
|   | CAUSE | FACTOR    | TOTAL | CAUSE  | FACTOR   | TOTAL    | CAUSE    | FACTOR   | TOTAL          |
| SIMULATED CONDITIONS                            | 9     | 1         | 10    | 32     | 6        | 36<br>13 | 41<br>15 | 7        | 48<br>15       |
| SIMULATED CONDITIONS                            | 2     |           | 2     | 13     |          |          | 17       | 8        | ĥ              |
| WATER IN FUEL<br>AIRCRAFT CAME TO REST IN WATER |       | 2         | 2     | _      | 6        | 6        | 1        |          | ĭ              |
|   |       |           |       | 1      |          | 1        | 1        | 1        | ī              |
| MISSING   |       | 1         | 1     |        |          | 43       | 51       | i        | 52             |
| TOUCH AND GO LANDING<br>MATERIAL FAILURE        | 8     | 1         | 9     | 43     |          | 57       | 79       | •        | 79             |
| FUEL STARVATION                                 | 22    |           | 22    | 57     |          |          | 5        |          | 5              |
| OIL STARVATION                                  | 3     |           | 3     | 2      | 1        | 2<br>2   | 1        | 1        | 2              |
| IMPROPER CLEARANCE-TOLERANCE                    |       |           |       | 1      | 1        | 3        | 2        | 2        | 4              |
| FUEL SELECTOR POSITIONED BETWEEN TANKS          |       | 1         | 1     | 2.     | 1        | ,        | 1        | _        | 1              |
| IMPROPER/INADEQUATE VENTING                     |       |           | _     | 1      | 1        | 3        | 3        | 1        | Ā              |
| EAK/LEAKAGE                                     | 1     |           | 1     | 2      | -        | í        | ī        | -        | . 1            |
| LOW COMPRESSION                                 |       |           |       | 1      |          | 2        | 4        |          | 4              |
| CARBON DEPOSITS                                 | 2     |           | 2     | 2<br>1 |          | ī        | 3        |          | 3              |
| LOOSE, PART/FITTING                             | 2     |           | 2     |        |          | -        | 1        |          | 1              |
| BINDING   | 1     | 1         | 1     |        |          |          |          | 1        | 1              |
| BURNED  | 1     |           | i     |        |          |          | 1        |          | 1              |
| CHAFFED   | •     |           | -     | 1      |          | 1        | 1        |          | Ī              |
| COLLAPSED                                       |       |           |       | 2      | 1        | 3        | 2        | 1        | 3              |
| DETERIORATED                                    |       |           |       |        | 1        | 1        |          | 1        | 1 2            |
| DISCONNECTED                                    |       |           |       |        | 3        | 3        |          | 3        | 1              |
| ERRATIC   |       |           |       | 1      |          | j        | 1<br>3   |          | ;              |
| HIGH VOLTAGE BREAKDOWN                          | 1     |           | 1     | 2      |          | 2        | 1        |          | ៍ <sup>1</sup> |
| IMPROPERLY INSTALLED                            |       |           |       | 1      |          | ŗ        | ,        |          | 2              |
| JAMMED<br>OBSTRUCTED                            |       |           |       | 2      |          | ۷ ا      | ۔<br>1   |          | 13             |
| OVERHEATED                                      |       |           |       | Ţ      |          | 1        | i        |          | i.             |
| PINCHED   |       |           |       | 1      |          | ;        | i        |          | ii             |
| EXCESSIVE PRESSURE                              |       |           |       | 1      |          | i        | ī        |          | Ú              |
| PRESSURE TOO LOW                                |       |           |       | 1      |          | 4        | . 4      |          | 4              |
| PRESSURE NONE                                   |       |           | ,     | - 7    |          | -        | 1        |          | £              |
| SCORED  | 1     |           | 1     | 1      |          | 1        | 1        |          | Ű              |
| SHEARED   | -     |           |       | •      |          | -        | 1        |          | 16             |
| STUCK   | 1     |           | 1     | 1      |          | 1        | 2        |          |                |
| EXCESSIVE TEMPERATURE                           | 1     |           | 1     | 2      |          |          | 2        | 1        |                |
| VIBRATION, EXCESSIVE                            |       |           | 1     | ī      |          | 1        | 2        |          |                |
| ICE-INDUCTION                                   | ì     |           | 1     |        |          | -        |          |          |                |
|   |       |           |       |        |          |          |          |          | <i>(4)</i>     |

#### DIRECT ENTRY CAUSES

PILOT-TOOK OFF WITH TURBO SUPERCHARGERS FULL BOOST PWR PLT-LEFT ENGINE COUNTERWEIGHT ATTACHMENT FAILD PWR PLT-PARTIAL PWR LOSS FRONT ENGINE CAUSE UNKNOW PWR PLT-ENGINES KOULDNT AIRSTART.REASON IS UNKNOWN PWR PLT-ENGINES KOULDNT AIRSTART.REASON IS UNKNOWN PWR PLT-FIGHT ENG. AIR FILTER BOX BLOCKED BY SNOW. PWR PLT-FUEL STARVATION FOR UNDETERMINED CAUSE. COPILOT-INADVERTENTLY MOVED PWR LYRS TO CUTOFF. PILOT-MISCALCULATED FUEL CONSUMPTION. PILOT-DID NOT MONITOR REAR ENG INSTRUMENTS.

DIRECT ENTRY CAUSES ARE CARRIED UNDER THEIR APPROPRIATE CAUSAL CATEGORIES AND ARE INCLUDED IN THE TOTALS

ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE NULTIENGINE, FIXED-WING AIRCRAFT U.S. GENERAL AVIATION CAUSES DISPLAYED RELATE TO FIRST AND SECOND ACCIDENT TYPES

455 TOTAL ACCIDENTS 104 FATAL ACCIDENTS

INVOLVES INVOLVES

CAUSES DISPLAYED RELATE TO FIRST AND SECOND ACCIDENT TYPES

TOTAL\* 73.19 9.89 1,98 222 48.79 45 888 99. 6 00 1.32 4 15,82 ALL ACCIDENTS 24 5.27 2.20 88 8 2.45 FACTOR 90 1.10 00 10,33 47 1:10 CAUSE 46.81 99• ć. 5.71 213 49.15 TOTAL 85 5. 00. 1.42 12,78 MONFATAL ACCIDENTS 173 45 6 1•70 5.11 FACTOR 9 1.14 10 2.84 00. e. 9 7.95 68.18 7.67 CAUSE .57 1.42 ----46.59 .85 .57 4.83 23 49 2 92 89•32 12.62 00 ိ့ 47.57 TOTAL\* -97 -97 26,21 49 FATAL ACCIDENTS 6 5.83 3.88 90. 80 -97 FACTOR 1 -97 900 ç. -97 18,45 86.41 8.74 90 00• CAUSE 00. 47.57 .97 000 00. 8.74 Φ 40 INSTRUMENTS/EQUIPMENT AND ACCESSORIES AIRPORTS/AIRWAYS/FACILITIES BRDAD CAUSE/FACTOR ###### **\*\*\*** LANDING GEAR POWERPLANT PERSONNEL ROTORCRAFT AIRFRAME SYSTEMS WEATHER TERRAIN PILOT

7.03

4.84

2.20

6.53

4.26

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1.94

MISCELLANEOUS

UNDETERMINED

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4. 88

00.

THE FIGURES OPPOSITE EACH CAUSAL CATEGORY REPRESENT THE NUMBER AND PERCENT OF ACCIDENTS IN WHICH THAT PARTICULAR CAUSAL CATEGORY MAS ASSIGNED

<sup>\*</sup> IF AM ACCIDENT INCLUDES BOTH A CAUSE AND RELATED FACTOR IN THE SAME CATEGORY, THE ACCIDENT IS REPRESENTED ONCE UNDER THE TOTAL FOR THAT CATEGORY

# CAUSES DISPLAYED RELATE TO FIRST AND SECOND ACCIDENT TYPES ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE MULTIENGINE, FIXED-WING AIRCRAFT U.S. GENERAL AVIATION 1965 - 1969 CAUSES DISPLAYED RELATE TO FIRST AND SECOND ACCIDENT TYPES

455 TOTAL ACCIDENTS 104 FATAL ACCIDENTS INVOLVES INVOLVES

|   |         | AL ACCIO |         |         | TAL ACC |          |         | LL ACCID |      |
|---|---------|----------|---------|---------|---------|----------|---------|----------|------|
| DETAILED CAUSE/FACTOR   | CAUSE   | FACTOR   | TOTAL   | CAUSE   | FACTOR  | TOTAL    | CAUSE   | FACTOR   | TOTA |
| ** PILOT **   |         |          |         |         |         |          |         |          |      |
| PILOT IN COMMAND ATTEMPTED OPERATION W/KNOWN DEFICIENCIES IN EQUIPMENT                                | 5       |          | 5       | 7       | ı       | 8        |         |          |      |
| ATTEMPTED OPERATION BYOND EXPERIENCE/ABILITY LEVEL  | 3       |          | 3       | ,       |         | 8        | 12<br>3 | 1        | 1    |
| RECAME LOST/DISORIENTED   | 2       | 1        | 3       | 2       | 2       | 4        | 4       | 3        |      |
| CONTINUED VER FLIGHT INTO ADVERSE WEATHER CONDITIONS DELAYED ACTION IN ABORTING TAKEOFF               | 3       |          | 3       | 1<br>3  |         | 1 3      | 4       |          |      |
| DIVERTED ATTENTION FROM OPERATION OF AIRCRAFT   | 1       |          | 1       | 3       | 1       | 4        | 4       | 1        |      |
| EXCEEDED DESIGN STRESS LIMITS OF AIRCRAFT   | 1       |          | 1       | 1       |         | 1        | 2       |          |      |
| FAILED TO EXTEND LANDING GEAR<br>RETRACTED GEAR PREMATURELY   |         |          |         | 9<br>1  |         | 9        | 9       |          |      |
| FAILED TO SEE AND AVOID OBJECTS OR OBSTRUCTIONS   |         |          |         | 1       |         | i        | i       |          |      |
| FAILED TO OBTAIN/MAINTAIN FLYING SPEED  | 44      |          | 44      | 40      |         | 40       | 84      |          | 8    |
| FAILED TO USE OR INCORRECTLY USED MISC EQUIPMENT FAILED TO FOLLOW APPROVED PROCEDURES, DIRECTIVES ETC | 1       |          | 1       | 4<br>16 | 4       | 4<br>20  | 17      | 4        | 2    |
| IMPROPER OPERATION OF POWERPLANT + POWERPLANT CONTROLS  | 14      |          | 14      | 24      | 7       | 24       | 38      | 7        | 3    |
| IMPROPER OPERATION OF BRAKES AND/OR FLIGHT CONTROLS IMPROPER OPERATION OF FLIGHT CONTROLS             | 3       |          | 7       | 2       |         | 2        | 2       |          |      |
| PREMATURE LIFT OFF  | ,       |          | 3       | 1<br>5  |         | 1<br>5   | 4<br>5  |          |      |
| IMPROPER LEVEL OFF  | _       |          | _       | 2       |         | 2        | 2       |          |      |
| IMPROPER IFR OPERATION IMPROPER IN-FLIGHT DECISIONS OR PLANNING                                       | 2<br>13 |          | 2<br>13 | 3<br>19 | 2       | 3<br>21  | 5<br>32 | 2        | 3    |
| INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING  | 18      | 2        | 20      | 63      | 2       | 65       | 81      | 4        | ě    |
| INADEGUATE SUPERVISION OF FLIGHT LACK OF FAMILIARITY WITH AIRCRAFT                                    | B<br>1  | 3        | 8<br>4  | 16<br>4 | 7       | 16       | 24      |          | 2    |
| MISMANAGEMENT OF FUEL   | 18      | ,        | 16      | 55      | ,       | 11<br>55 | 5<br>73 | 10       | 1 7  |
| EXERCISED POOR JUDGMENT   | 2       |          | 2       | 7       |         | 7        | 9       |          |      |
| SELECTED UNSUITABLE TERRAIN IMPROPER STARTING PROCEDURES  | 1       |          | 1       | 1       |         | 1        | 1       |          |      |
| FAILED TO ASSURE THE GEAR WAS DOWN AND LOCKED   |         |          | -       | 11      |         | 1<br>11  | 2<br>11 |          | . 1  |
| SPONTANEOUS-IMPROPER ACTION   |         |          |         | 2       |         | 2        | 2       |          |      |
| MISJUDGED DISTANCE, SPEED, AND ALTITUDE MISJUDGED DISTANCE AND SPEED                                  |         |          |         | 2       |         | 2        | 2       |          |      |
| MISJUDGED DISTANCE AND ALTITUDE   | 1       |          | 1       | 3       |         | 3        | 4       |          |      |
| MISJUDGED SPEED AND ALTITUDE  | _       |          | _       | 1       |         | 1        | 1       |          |      |
| MISJUDGED ALTITUDE AND CLEARANCE MISJUDGED ALTITUDE   | 1<br>1  |          | 1<br>1  |         |         |          | 1       |          |      |
| INADEQUATE TRAINING OF STUDENT  | -       |          | •       | 1       |         | 1        | i       |          |      |
| PHYSICAL IMPAIRMENT<br>SPATIAL DISORIENTATION   | 1       |          | 1       | ,       |         | ,        | 1       |          |      |
| MISUSED OR FAILED TO USE FLAPS  | 1       |          | 1       | 1       | 1       | 1        | 2<br>1  | 1        |      |
| FAILED TO MAINTAIN DIRECTIONAL CONTROL  | ī       |          | ĩ       | 6       |         | 6        | 7       |          |      |
| SELECTED WRONG RUMWAY RELATIVE TO EXISTING WIND FAILED TO ABORT TAKEOFF                               | 2       | 1        | 1 2     | 6       | 1       | 1        | 8       | 2        |      |
| DIRECT ENTRIES  | -       |          | •       | 3       |         | 3        | ž       |          |      |
| SUBTOTAL  | 149     | 7        | 156     | 330     | 21      | 351      | 479     | 28       | 50   |
| COPILOT   |         |          |         |         |         |          |         |          |      |
| FAILED TO OBTAIN/MAINTAIN FLYING SPEED  |         |          |         | 2       |         | 2        | S       |          |      |
| LACK OF FAMILIARITY WITH AIRCRAFT CONTROL INTERFERENCE  |         |          |         | 1       |         | 1        | 1       |          |      |
| DIRECT ENTRIES  |         |          |         | 1<br>1  |         | 1        | 1       |          |      |
| SUBTOTAL  |         |          |         | 5       |         | . 5      | 5       |          | ,    |
| OHAL CTUDENT  |         |          |         |         |         |          |         |          |      |
| DUAL STUDENT DELAYED ACTION IN ABORTING TAKEOFF   |         |          |         | 1       |         | 1        | 1       |          |      |
| FAILED TO EXTEND LANDING GEAR   |         |          |         | 4       |         | 4        | 4       |          |      |
|   |         |          |         | -       |         |          | •       |          | į.   |

#### TABLE C-9 CONTINUED

DUAL STUDENT (CONTINUED)

#### CAUSE/FACTOR TABLE

APPENDIX C

|  |       |          |       |         |         |         |          | APT      | ENDIX C |
|--|-------|----------|-------|---------|---------|---------|----------|----------|---------|
|  | FA'   | TAL ACCI | DENTS | NONF    | TAL ACC | IDENTS  | AL       | L ACCIDE | ENTS    |
|  | CAUSE | FACTOR   | TOTAL |         | FACTOR  |         | CAUSE    | FACTOR   |         |
| INADVERTENTLY RETRACTED GEAR   |       |          |       |         |         |         |          |          |         |
| FAILED TO DATAIN/MAINTAIN FLYING SPEED IMPROPER OPERATION OF POWERPLANT + POWERPLANT CONTROLS IMPROPER IN-FLIGHT DECISIONS OR PLANNING   |       |          |       |         |         |         |          |          |         |
| IMPROPER IN-FLIGHT DECISIONS OR PLANNING INADEQUATE SUPERVISION OF PLANNING  | 8     |          | 8     | 2<br>1  |         | 2<br>1  | 2        |          | . 2     |
| MISINDERSTANDING OF FLIGHT   |       |          |       | 1<br>1  |         | 1       | 9<br>1   |          | 9<br>1  |
| FAILED TO MAINTAIN DIRECTIONAL CONTROL   |       |          |       | 1       |         | 1<br>1  | 1        |          | 1       |
| FAILED TO ABORT TAKEOFF  |       |          |       | 1<br>5  |         | 1       | ĵ        |          | 1<br>1  |
| SUBTOTAL   |       |          |       | 1       |         | í       | 5<br>1   |          | 5<br>1  |
| CHECK PILOT  | 8     |          | 8     | 18      |         | 18      | 26       |          |         |
| INADEQUATE SUPERVISION OF FLIGHT   |       |          |       |         |         |         | 20       |          | 26      |
| SUBTOTAL   |       |          |       | 3       |         | 3       | 3.       |          | 3       |
| ** PERSONNEL **  |       |          |       | 3       |         | 3       | 3        |          |         |
| FLIGHT INSTRUCTOR  |       |          |       |         |         | -       | ,        |          | 3       |
| NAINTENANCE CORRESPONDE  |       |          |       |         |         |         |          |          |         |
| IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL)   |       |          |       |         |         |         |          |          |         |
| IMPRODEDLY SERVICED AIRCRAFTIGROUND CREWN  |       |          |       | 2<br>1  |         | 2       | 2        |          | 2       |
| INADEDITATE MATERIAL MATERIAL INTO THE PROPERTY OF THE PROPERT |       |          |       | 3       |         | 1 3     | 1<br>3   |          | 1       |
| INADEQUATE EL TOUT   | 8     | 2        | 10    | 2<br>17 | 2       | 19      | 2        |          | 3       |
| INADEQUATE SUPERVISION OF FLIGHT CREW  |       |          |       |         |         |         | 25       | 4        | 29      |
| WEATHER PERSONNEL ADEC DIRECTIVES, MANUALS, FOLLOWENE  |       | 1        | 1     |         | 1       | 1       |          | 1        | 1       |
| TRAFFIC CONTROL OCCUPANT   | 1     |          |       |         | 1       | 1       |          | 1        | 1       |
| ISSUED IMPRODED OF UNSAFE AIRPORT CONDITION  | -     |          | 1     |         |         |         | 1        |          | 1       |
| AIRPORT SUPERVISORY PROPERTY INSTRUCTIONS  |       | 1        | _     | 1       |         | 1       | t        |          |         |
| AIRMAYS FACILITIES DEPENDED  |       | •        | 1     |         |         |         | 1        | 1        | 1<br>1  |
|  |       |          |       |         | 1       | 1       |          | 1        |         |
| POOR/INADEQUATE DESIGN MISCELLANEOUS-PERSONNEL   | 1     |          |       |         |         |         |          | 1        | 1       |
| PILOT OF OTHER AIRCRAFT  | •     |          | 1     | 1       |         | 1       | 2        |          | 2       |
| THIRD PILOT  |       |          |       |         | 1       | 1       |          |          | -       |
| FLIGHT ENGINEER<br>Dispatching   |       |          |       |         | 1       | î       |          | 1<br>1   | 1<br>1  |
| SUBTOTAL   |       |          |       |         |         |         |          |          | _       |
| ** AIRFRAME **   | 10    | 4        | 14    | 27      | 7       | •       |          |          |         |
| WINGS  |       |          |       |         | •       | 34      | 37       | 11       | 48      |
| FUSELAGE   |       |          |       |         |         |         |          |          |         |
| DOORS, DOOR FRAMES LANDING GEAR  |       |          |       |         |         |         |          |          |         |
| NORMAL RETRACTION/EXTENSION ASSEMBLY EMERGENCY/EXTENSION ASSEMBLY NOSCHIEFE  |       |          |       | 1       |         | 1       | 1        |          | 1       |
|  |       |          |       | 3       | ı       | 4       | 3        | 1        | 4       |
| LANDING GEAR HARNING AND INDICATING COMPONENTS GEAR LOCKING MECHANISM  |       |          |       | 2       | 1       | 3<br>1  | Ž        | 1        | 3       |
| FLIGHT CONTROL SURFACES<br>FLAP ASSEMBLIES   |       |          |       | 1       | 2       | 2       |          | 1<br>2   | 1 2     |
| SUBTOTAL   |       |          |       | 1       |         | 1       | 1        |          | 1       |
| ** POWERPLANT **   |       |          |       | 8       | 5       | 1       | 1        |          | 1       |
| ENGINE STRUCTURE   |       |          |       |         | _       | • -     | А        | 5        | 13      |
| CRANKCASE<br>CRANKSHAFT  |       |          |       |         |         |         |          |          |         |
| MASTER AND CONNECTING ORDER  |       |          |       | 2       |         | 2       |          |          |         |
| CYLINDER ASSEMBLY  | 3     |          | 3     | 1<br>8  |         | 1       | 2<br>1   |          | 2<br>1  |
|  |       |          |       | 10      |         | 8<br>10 | 11<br>10 |          | 11      |
|  | 201   |          |       |         |         |         |          | ,        | 10      |

| TABLE C-9 CONTINUED   | CAUSE/FACT | OR TABLE | ŧ      |              |          |              |               | AP     | PENDIX |  |
|---|------------|----------|--------|--------------|----------|--------------|---------------|--------|--------|--|
| POWERPLANT (CONTINUED)  | FAT        | AL ACCIE | ENTS   |              | TAL ACCI |              | ALL ACCIDENTS |        |        |  |
|   | CAUSE      | FACTOR   | TOTAL  | CAUSE        | FACTOR   | TOTAL        | CAUSE         | FACTOR | 101    |  |
| PISTON, PISTON RINGS VALVE ASSEMBLIES   | 3<br>3     |          | 3<br>3 | 3            |          | 3            | 6             |        |        |  |
| BLOWER, IMPELLER ASSEMBLY<br>OTHER  |            |          |        | 1<br>5       |          | 1<br>5       | 1<br>5        |        |        |  |
| IGNITION SYSTEM MAGNETOES SPARK PLUG  | 1 3        | ı        | 2      | 3<br>4       |          | 3<br>4       | 4 7           | 1      |        |  |
| IGNITION HARMESS, SHIELDING<br>LEADS  | 1          |          | 1      | 1            |          | 1            | 1<br>1        |        |        |  |
| FUEL SYSTEM TANKS LINES AND FITTINGS  | 1          |          | 1      | 2<br>5       |          | 2<br>5       | 2             |        |        |  |
| SELECTOR VALVES FILTERS, STRAINERS, SCREENS   | 3          |          | 3      | 1<br>1       |          | 1            | 4             |        |        |  |
| CARBURETOR<br>PUMPS   | 1          |          | 1      | 2            | 1        | 2<br>3<br>2  | 3<br>3<br>5   | 1      |        |  |
| FUEL INJECTION SYSTEM VENTS, DRAINS, TANK CAPS RAM AIR ASSEMBLY LUBRICATING SYSTEM  | 1          |          | 1      | 1<br>5<br>1  |          | 5            | 6             | •      |        |  |
| LINES, HOSES, FITTINGS SEALS AND GASKETS OTHER  |            |          |        | 7<br>1<br>3  | 1        | 8<br>1<br>3  | 7<br>1<br>3   | 1      |        |  |
| COOLING SYSTEM<br>BAFFLES   |            |          |        | 1            |          | 1            | 1             |        |        |  |
| PROPELLER AND ACCESSORIES OTHER EXHAUST SYSTEM  |            |          |        | 2            |          | 2            | 5             |        |        |  |
| MANIFOLDS<br>STACKS   |            |          |        | 1<br>1       |          | 1<br>1       | 1             |        |        |  |
| ENGINE ACCESSORIES  VACUUM PUMPS  VACUUM PUMPS  | 1          |          | ı      |              |          |              | 1             |        |        |  |
| ENGINE CONTROLS-COCKPIT THROTTLE-POWER LEVER ASSEMBLIES MIXTURE CONTROL ASSEMBLIES OFFICE AND ANY |            |          |        | 1<br>1       |          | 1            | 1             |        |        |  |
| POWERPLANT-INSTRUMENTS FUEL QUANTITY GAUGE MISCELLANEOUS  |            |          |        |              | 7        | 7            |               | 7      | •      |  |
| POMERPLANT FAILURE FOR UNDETERMINED REASONS<br>BIRD INCESTION<br>DETONATION   | 25         |          | 25     | 85<br>1<br>1 |          | 85<br>1<br>1 | 110<br>1      |        | 11     |  |
| OTHER<br>DIRECT ENTRIES   | 2          |          | 2      | 1<br>4       |          | 1 4          | 6             |        |        |  |
| REDUCTION GEAR ASSEMBLY GEARS, ACCESSORY DRIVE COMPRESSOR ASSEMBLY  |            |          |        | 1            |          | 1            | 1             |        |        |  |
| OTHER<br>COMBUSTION ASSEMBLY  | 1          |          | 1      |              |          |              | 1             |        |        |  |
| TURBINE ASSEMBLY ACCESSORY DRIVE ASSEMBLY LUBRICATING SYSTEM FUEL SYSTEM  |            |          |        |              |          |              |               |        |        |  |
| SAFETY SYSTEM IGNITION SYSTEM TORQUEMETER   |            |          |        |              |          |              |               |        |        |  |
| AIR BLEED<br>EXHAUST SYSTEM   |            |          |        |              |          |              |               |        | 9      |  |
| THRUST REVERSER OTHER   |            |          |        | 1            |          | 1            | 1             | r      |        |  |
| PROPELLER SYSTEM GOVERNOR CONSTANT FORED DRIVE  |            |          |        | 1            |          | 1            | 1             |        | j      |  |
| CONSTANT SPEED DRIVE COVERNOR VALVE POWER LEYER PROPELLER LEVER   |            |          |        | 1            |          | 1            | 1             |        |        |  |
| PROPELLER LEVER REVERSE THRUST LEVER ENGINE INDICATING EQUIPMENT ENGINE INSTALLATION  |            |          |        |              |          | •            |               |        |        |  |
| SUBTOTAL  | 54         | 1        | 55     | 173          | 10       | 183          | 227           | 11     |        |  |
|   |            |          |        |              |          |              |               |        | *      |  |

## TABLE C-9 CONTINUED SYSTEMS (CONTINUED)

#### CAUSE/FACTOR TABLE

|   |                       |             |                       |                       |           |                        |                  | AF                | PENDIX C                 |
|---|-----------------------|-------------|-----------------------|-----------------------|-----------|------------------------|------------------|-------------------|--------------------------|
|   | <b></b>               | TAL ACCI    |                       | NONF.                 | ATAL ACCI | I DENTS                | _ Δ.             | LL ACCIDE         | ENTS                     |
|   | CAUSE                 | FACTOR      | TOTAL                 | CAUSE                 | FACTOR    |                        |                  | FACTOR            | TOTAL                    |
| ** SYSTEMS **   |                       |             |                       |                       |           |                        |                  |                   |                          |
| ELECTRICAL SYSTEM  BATTERIES GENERATORS/ALTERNATORS HYDRAULIC SYSTEM FLIGHT CONTROL SYSTEMS   |                       |             |                       | 1                     |           | I                      |                  |                   |                          |
| CARBURETOR DE-ICING SYSTEMS OTHER   |                       |             |                       | 1                     |           | i                      | 1                |                   | 1                        |
| AIR CONDITION, MEATING AND PRESSURIZATION CABIN TEMP CONTROL AND TEMP INDICATING SYSTEM AUTO PILOT FIRE MARNING SYSTEM FIRE EXTINGUISHER SYSTEM OXYGEN SYSTEM OTHER SYSTEMS |                       | 1           | 1                     | 1                     |           | 1                      | 1                | 1                 | 1 1 1                    |
| SUBTOTAL  |                       |             |                       |                       |           |                        |                  |                   |                          |
| ** INSTRUMENTS/EQUIPMENT AND ACCESSORIES **   |                       | 1           | 1                     | 4                     |           |                        |                  |                   |                          |
| CLIONI AND NAVIGATION INSTRUMENTS COMMUNICATIONS AND NAVIGATION EQUIPMENT TRANSMITTERS AND/OR RECEIVERS OTHER OTHER   |                       |             |                       |                       |           | 4                      | 4                | 1                 | 5                        |
| MISCELLANEOUS EQUIPMENT   | 1                     |             | 1                     | 1                     |           | l<br>1                 | 1<br>2           |                   | 1                        |
| SUBTOTAL  |                       |             |                       | 1                     |           | 1                      | ī                |                   | 2<br>1                   |
| ** AIRPORTS/AIRWAYS/FACILITIES **   | 1                     |             | 1                     | 3                     |           | 3                      | 4                |                   |                          |
| AIRPORT FACILITIES AIRPORT CONDITIONS SNOW ON RUNWAY OTHER  |                       |             |                       |                       |           | •                      | •                |                   | 4                        |
| AIRHAYS FACILITIES  |                       | 1           | 1                     | 1                     | 1<br>3    | 1 4                    |                  | 2                 | 2                        |
| SUBTOTAL  ** WEATHER **   |                       | 1           |                       |                       | -         | 7                      | 1                | 3                 | 4                        |
| LOW CEILING   |                       | •           | 1                     | 1                     | 4         | 5                      | 1                | 5                 | 6                        |
| RAIN<br>FOG   | 2                     | 13          | 15                    |                       |           |                        |                  |                   |                          |
| SNOW ICING CONDITIONS-INCLUDES SLEET, FREEZING RAIN, ETC CONDITIONS CONDUCIVE TO CARB/INDUCTION SYSTEM ICING UNFAVORABLE WIND CONDITIONS TURBULENCE                         | 1<br>1<br>3<br>2<br>1 | 6 4 2 4     | 2<br>7<br>5<br>5<br>6 | 3<br>2<br>3<br>7<br>7 |           | 7<br>3<br>5<br>2<br>13 | 5<br>2<br>4<br>1 | 17<br>3<br>8<br>6 | 22<br>5<br>12<br>7<br>18 |
|   | 1<br>1                | 1           | 1                     |                       | 3         | 3                      | 9<br>1           |                   | 21<br>4                  |
| OBSTRUCTIONS TO VISION HIGH DENSITY ALTITUDE  | <del>*</del>          | 1 1         | 2                     |                       | 1         | ı                      | 1                | 1                 | 1 2                      |
| THUNDERSTORM ACTIVITY OTHER SUBTOTAL  | 1                     | 1<br>2<br>1 | 1<br>2<br>2<br>1      | 1                     | 6         | 7                      | 2                | 2<br>1<br>7<br>2  | 2<br>1<br>9              |
| ** TERRAIN **   | 13                    | 38          | 51                    | 23                    | 33 5      |                        |                  | î                 | 2                        |
| HET, SOFT GROUND<br>SNOM-COVERED<br>HIGH VEGETATION<br>ROUGH/UNEVEN   |                       | ,           |                       | 4                     | 4         | 8<br>2                 | 4                | 71 10             | 8                        |
| FIGH OBSTRUCTIONS SUBTOTAL  | 2                     | 4           | 6                     | 2                     | _         | 0                      |                  | 1                 | 2                        |
| ** MISCELLANEOUS **   | 2                     | _           | 3<br>LO               | 1                     | 3 .       | 4                      |                  | 2 1               |                          |
|   |                       | 1           | .0                    | 8 1                   | 6 24      | 4                      | 10 2             | 4 3.              | 4                        |
| EVASIVE MANEUVER TO AVDID COLLISION   |                       | 1           | 1                     |                       |           |                        |                  |                   |                          |
|   |                       | -           | 1                     |                       |           |                        |                  | , ,               | 1                        |

| TABLE C-9 CONTINUED CA   | USE/FACT        | OR TABLE |         |         |         |               |         | A.      |    |
|--|-----------------|----------|---------|---------|---------|---------------|---------|---------|----|
| MISCELLANEOUS (CONTINUED)  | FATAL ACCIDENTS |          |         |         | TAL ACC | ALL ACCIDENTS |         |         |    |
| <u>.</u>   | CAUSE           | FACTOR   | TOTAL   | CAUSE   | FACTOR  | TOTAL         | CAUSE   | FACTOR  | TO |
| UNQUALIFIED PERSON OPERATED AIRCRAFT<br>FOREIGN MATERIAL AFFECTING NORMAL OPERATIONS<br>UNDOTERMINED | 1               |          | 1       | 3<br>3  | 1<br>2  | 1<br>5<br>3   | 3       | 1 2     |    |
| SUBTOTAL   | 1               | 1        | 2       | 6       | 3       | 9             | 7       | 4       |    |
| -  | 222             | ,,       | 222     |         | 99      | 708           | 847     | 160     | 1  |
| GRAND TOTAL  ** MISCELLANEOUS ACTS, CONDITIONS **  | 238             | 61       | 299     | 609     | 99      | 708           | 547     | 160     |    |
| ANTI-ICING/DEICING EQUIP-IMPROPER OPER. DE/FAILED TO USE   | = 4             | 1        | 5       | 18      |         | 18            | 22      | 1       |    |
| CHECKLIST-FAILED TO USE  | 1               | 1        | 2       | 3       | 9       | 12            | 4       | 10      |    |
| CREW COORDINATION-POOR DISREGARD OF GOOD OPERATING PRACTICE  | 1               | 1        | 1       |         | 2       | 2             | 1       | 2       |    |
| IMPROPER EMERGENCY PROCEDURES  | 25              | 3        | 28      | 35      | 14      | 49            | 60      | 17      |    |
| FEATHERED WRONG ENGINE<br>INSTRUMENTS-MISREAD OR FAILED TO READ                                      | 1               |          | 1       | 1 2     | 1       | 1<br>3        | 2       | 1       |    |
| NOT ALLIGNED WITH RUNWAY/INTENDED LANDING AREA   |                 |          |         | _       | ī       | í             |         | î       |    |
| UNWARRANTED LOW FLYING   | 1               |          | 1       |         | 2       | 2             | 1       | 2       |    |
| FAILED TO USE ALL AVAILABLE RUNWAY INATTENTIVE TO FUEL SUPPLY  | 4               |          | 4       | 8       | 2<br>4  | 12            | 12      | 4       |    |
| PREMATURE FLAP RETRACTION  |                 |          | _       | 1       |         | 1             | 1       |         |    |
| POORLY PLANNED APPROACH MISCALCULATED FUEL CONSUMPTION   | 1               | 1        | 1<br>1  | 4       | 2<br>2  | 6<br>6        | 4<br>5  | 3<br>2  |    |
| JETTISONED LOAD  | _               | 1        | ī       |         | 2       | 2             |         | 3       |    |
| STOLEN OR UNAUTHORIZED USE OF AIRCRAFT IMPROPERLY SECURED  | 1<br>2          |          | 1<br>2  | 6       |         | 6             | 1<br>8  |         |    |
| ELECTRICAL FAILURE   |                 |          |         | 1       | 1       | 2             | 1       | 1       |    |
| ENGINE LOADED UP<br>FATIGUE FRACTURE   | 1 3             |          | 1<br>3  | 4       |         | 4             | 5<br>4  |         |    |
| FUEL GRADE-IMPROPER  | ,               |          | ,       | î       |         | 1             | 1       |         |    |
| HYDRAULIC FAILURE<br>WRONG PART  |                 | 1        | 1       | 1       | 1       | 2             | 1       | 1<br>1  |    |
| IMPROPER ALIGNMENT/ADJUSTMENT  | 1               | _        | 1       | 2       |         | 2             | 3       |         |    |
| FAILURE OF TWO OR MORE ENGINES   | 8               | 11       | 19      | 28      | 68<br>6 | 96<br>7       | 36<br>2 | 79<br>6 |    |
| FIRE IN ENGINE ASYMETRICAL FLAPS   | 1               |          | 1       | 1       |         | 1             | 1       | U       |    |
| CONGESTED TRAFFIC-PATTERN  | _               |          |         |         | 1       | 1             |         | 1       |    |
| PILOT FATIGUE<br>FUEL EXHAUSTION   | 1 10            |          | 1<br>10 | 42      | 1       | 1<br>42       | 1<br>52 | 1       |    |
| FUEL CONTAMINATION-EXCLUSIVE OF WATER IN FUEL  |                 |          |         | 5       |         | 5             | 5       |         |    |
| CARBON MONOXIDE POISONING ICE-IN FUEL  | 1               | 1        | 1       | 1       |         | 1             | 2       | 1       |    |
| ICE-ENGINE   | î               |          | î       | 4       |         | 4             | 5       |         |    |
| ICE-CARBURETOR   | 4               | 1        | 5       | 17      |         | 17            | 21<br>1 | 1       |    |
| ICE-PROPELLER<br>AIRFRAME ICE  | 2               | 1        | 3       | 7       | 2       | 9             | 9       | 3       |    |
| ICE-WINDSHIELD   | _               |          |         | 1       | 1       | 2             | 1       | 1       |    |
| IMPROPERLY LOADED AIRCRAFT-WEIGHT-AND/OR CG<br>LACK OF LUBRICATION-SPECIFIC PART, NOT SYSTEM         | 2<br>1          | 6        | 8<br>1  | 1       | 4       | 4<br>1        | 2 2     | 10      |    |
| OIL EXHAUSTION-ENGINE LUBRICATION SYSTEM   | 1               |          | 1       | 1       |         | 1             | 2       |         |    |
| TIL CONTAMINATION SIMULATED CONDITIONS   | 9               | 1        | 10      | 2<br>32 | 6       | 2<br>38       | 2<br>41 | 7       |    |
| WATER IN FUEL  | ź               |          | 2       | 13      |         | 13            | 15      |         |    |
| AIRCRAFT CAME TO REST IN WATER MISSING   |                 | 6        | 6       | 1       | 26      | 26<br>1       | 1       | 32      |    |
| TOUCH AND GO LANDING   |                 | 1        | 1       |         | 1       | 1             |         | 2       |    |
| OVERLOAD FAILURE   | 8               | 1        | Q       | 1<br>43 | 35      | 36<br>43      | 1<br>51 | 35<br>1 |    |
| MATERIAL FAILURE<br>FUEL STARVATION  | 22              | 1        | 22      | 57      |         | 57            | 79      | •       |    |
| OIL STARVATION   | 3               |          | 3       | 2       |         | 2 2           | 5<br>1  | 1       |    |
| IMPROPER CLEARANCE-TOLERANCE<br>FUEL SELECTOR POSITIONED BETWEEN TANKS                               |                 | ı        | 1       | 1<br>2  | 1<br>1  | 3             | 2       | 5       |    |
| IMPROPER/INADEQUATE VENTING  |                 | •        |         | 1       |         | 1             | 1       |         |    |
| LEAK/LEAKAGE   | 1               |          | 1       | 2       | 1       | 3             | 3       | 1       |    |
| CIRCUIT BREAKER POPPED LOW COMPRESSION   |                 |          |         | 1       |         | . 1           | 1<br>1  |         | į  |
| DDMUMIND<br>FOM COMMESSION   |                 |          |         | 1       | 2       | 2             | 1       | 2       | 4  |
| CARBON DEPOSITS  | 2               |          | 2       | 2       |         | 2             | 4       |         | 2  |
| LOOSE, PART/FITTING  | 2               |          | 2       | 1       |         | 1             | 3       |         | 7  |

#### TABLE C-9 CONTINUED

#### CAUSE/FACTOR TARLE

APPENDIX C

MISCELLANEOUS ACTS, CONDITIONS (CONTINUED)

| NYERHEATED PINCHED EXCESSIVE PRESSURE PRESSURE TOO LOW PRESSURE, NONE SCORED   | <br>FATAL ACCIDENTS             |        |             |   | TAL ACCI | DENTS                                   | ALL ACCIDENTS  |         |   |  |
|--|---------------------------------|--------|-------------|---|----------|---|--|---------|---|--|
|  | CAUSE                           | FACTOR | TOTAL       | CAUSE   | FACTOR   | TOTAL                                   | CAUSE  | FACTOR  | TOTAL   |  |
| BURNED CHAFFED COLLAPSED DETERIORATED DISCONNECTED ERRATIC FIGH VOLTAGE BREAKDOWN IMPROPERLY INSTALLED JAMMED OBSTRUCTED OVERHEATED PINCHED EXCESSIVE PRESSURE PRESSURE TOO LDW PRESSURE, NONE | 1<br>1<br>1<br>1<br>1<br>1<br>1 | 1      | 1<br>1<br>1 | 1 2 1 2 1 1 1 2 2 4 4 1 2 2 1 1 1 1 2 1 1 1 1 | 1 1 2    | 1 3 1 2 1 2 1 1 1 3 4 4 1 2 1 3 3 1 1 7 | 1<br>1<br>1<br>2<br>1<br>3<br>1<br>2<br>1<br>1<br>2<br>4<br>1<br>1<br>3<br>2<br>2<br>1<br>1<br>2<br>2<br>2<br>1<br>1<br>2<br>2<br>2<br>2<br>2<br>2<br>2<br>2 | 1 1 2 3 | 1<br>1<br>1<br>3<br>1<br>3<br>1<br>3<br>1<br>2<br>1<br>1<br>3<br>4<br>1<br>1<br>3<br>2<br>3<br>4<br>1<br>1<br>3<br>2<br>3<br>2<br>4<br>1<br>1<br>3<br>2<br>3<br>2<br>3<br>2<br>3<br>2<br>3<br>2<br>3<br>2<br>3<br>2<br>3<br>2<br>3<br>2 |  |

#### DIRECT ENTRY CAUSES

PILOT-TOOK OFF WITH TURBO SUPERCHARGERS FULL BOOST PAR PLT-LEFT ENGINE COUNTERWEIGHT ATTACHMENT FAILD PAR PLT-LEFT ENGINE COUNTERWEIGHT ATTACHMENT FAILD PAR PLT-PARTIAL PAR LOSS FRONT ENGINE CAUSE UNKNOWN PAR PLT-ENGINES WOULDN'T AIRSTART.FRASON IS UNKNOWN PAR PLT-RIGHT ENG. AIR FILTER BOX BLOCKED BY SNOW. PAR PLT-FUEL STARVATION FOR UNDETERMINED CAUSE. COPILOT-INADVERTENTLY MOVO PAR LYRS TO CUTOFF. PILOT-HISCALCULATED FUEL CONSUMPTION. PILOT-DIO NOT MONITOR REAR ENG INSTRUMENTS.

DIRECT ENTRY CAUSES ARE CARRIED UNDER THEIR APPROPRIATE CAUSAL CATEGORIES AND ARE INCLUDED IN THE TOTALS

# CAUSE/FACTOR TABLE

TABLE C-10

ENGINE FAILURE AS FIRST ACCIDENT TYPE DNLY U. S. GENERAL AVIATION 1965 - 1969 MULTIENGINE FIXED-WING AIRCRAFT

EXCLUDES ACCIDENTS WITH CAUSE UNDETERMINED, HOMEBUILT AND EXPERIMENTAL AIRCRAFT, AND ACCIDENTS INVOLVING SIMULATED ENGINE FAILURES

|                                       | FATA        | FATAL ACCIDENTS | NTS         | NONFAT       | NONFATAL ACCIDENTS | ENTS         | ALL          | ALL ACCIDENTS | TS                   |
|---------------------------------------|-------------|-----------------|-------------|--------------|--------------------|--------------|--------------|---------------|----------------------|
| BROAD CAUSE/FACTOR                    | CAUSE       | FACTOR          | TOTAL#      | CAUSE        | FACTOR             | T01AL*       | CAUSE        | FACTOR        | TOTAL*               |
| PILOT                                 | 46<br>68,66 | 2.99            | 46<br>68.66 | 141<br>61•30 | 12<br>5.22         | 142<br>61.74 | 187<br>62.96 | 14            | 188<br><b>63.</b> 30 |
| PERSONNEL                             | 9<br>13.43  | 3               | 12<br>17.91 | 24<br>10.43  | 2.87               | 25<br>10.87  | 33<br>11•11  | 1.68          | 37                   |
| AIRFRAME                              | • 00        | • 00            | 00•         | • 00         | • 00               | • 00         | 00•          | • 00          | 00•                  |
| LANDING GEAR                          | 00          | 00•             | • 00        | 00•          | • 00               | 00           | 00*          | • 00          | 00•                  |
| POWERPLANT                            | 23<br>34.33 | 1,49            | 23<br>34•33 | 78<br>33.91  | 9<br>3.91          | 87<br>37.83  | 101<br>34.01 | 10<br>3.37    | 110<br>37.04         |
| SYSTEMS                               | 00.         | 1.49            | 1,49        | 2.87         | 00.                | 2.87         | 2.67         | 1<br>•34      | 3 1.01               |
| INSTRUMENTS/EQUIPMENT AND ACCESSORIES | 1.49        | 00•             | 1<br>1•49   | 2.87         | • 00               | 2.87         | 3<br>1•01    | .00           | 3                    |
| ROTORCRAFT                            | .00         | 8               | 00.         | 8            | 00.                | 00•          | 00*          | • 00          | 00*                  |
| AIRPORTS/AIRWAYS/FACILITIES           | 00.         | 8.              | 00•         | • 00         | 00•                | 00•          | 00•          | • 00          | 00•                  |
| WEATHER                               | 5<br>7.46   | 10.45           | 12<br>17.91 | 11<br>4.78   | 19<br>8.26         | 30<br>13.04  | 16<br>5.39   | 26<br>8.75    | 42<br>14.14          |
| TERRAIN                               | 00.         | 00•             | 90•         | • 00         | • 00               | 00•          | • 00         | • 00          | 00•                  |
| MISCELLANEOUS                         | • 00        | • 00            | 00•         | 2.87         | 2.87               | 4<br>1.74    | 2.67         | 2.67          | 1.35                 |
| UNDETERMINED                          | 00.         | 00•             | 00•         | 00.          | • 00               | 8            | 00•          | 00.           | 8.                   |

206

THE FIGURES OPPOSITE EACH CAUSAL CATEGORY REPRESENT THE NUMBER AND PERCENT OF ACCIDENTS IN WHICH THAT PARTICULAR CAUSAL CATEGORY WAS ASSIGNED

TATIONES BOTH A CAUSE AND RELATED FACTOR IN THE SAME CAUSAL BOTH A TOTAL ONCE UNDER THE TOTAL FOR THAT CATEGORY

297 TOTAL ACCIDENTS 67 FATAL ACCIDENTS

INVOLVES INVOLVES

#### CAUSE/FACTOR TABLE

APPENDIX C

MULTIENGINE FIXED-WING AIRCRAFT ENGINE FAILURE AS FIRST ACCIDENT TYPE ONLY U. S. GENERAL AVIATION 1965 - 1969

EXCLUDES ACCIDENTS WITH CAUSE UNDETERMINED,
HOMEBUILT AND EXPERIMENTAL AIRCRAFT,
AND ACCIDENTS INVOLVING SIMULATED ENGINE FAILURES

INVOLVES 297 TOTAL ACCIDENTS INVOLVES 67 FATAL ACCIDENTS

|  | FAT     | AL ACCIO | DENTS   | NONFA   | TAL ACCI | DENTS          | ΔL      | L ACCIDE | 2 T M    |
|--|---------|----------|---------|---------|----------|----------------|---------|----------|----------|
| DETAILED CAUSE/FACTOR  |         | FACTOR   |         |         | FACTOR   |                |         | FACTOR   |          |
| ** PILQT **  |         |          |         |         |          |                |         | _        |          |
| PILOT IN COMMAND   |         |          |         |         |          |                |         |          |          |
| ATTEMPTED OPERATION W/KNOWN DEFICIENCIES IN EQUIPMENT  | 4       |          |         |         |          |                |         |          |          |
| BECAME LOST/DISTRIBUTED  | ī       |          | 4       | 4       | 1        | 5              | 8       | 1        | 9        |
| CUNTINUED VER SITCUT THEO ADVANCES   | 2       |          | ż       | 2       | 2        |                | 1       | -        | í        |
| DIVERTED ATTENTION FROM OPERATION OF AIRCRAFT  | 1       |          | 1       | ī       | ۲        | 4              | 4 2     | 2        | 6        |
| FAILED TO OBTAIN MARKET TO THE AIRCRAFT  |         |          |         | 1       | 1        | ż              | 1       | 1        | 2        |
|  |         |          |         | 1       |          | 1              | ì       | •        | 2<br>1   |
| FAILED TO FOLLOW APPROVED PROCEDURES, DIRECTIVES ETC   |         |          |         | i       |          | 1              | 1       |          | ī        |
| IMPROPER OPERATION OF THE TANK THE PUNERPLANT CONTROLS   | 1<br>11 |          | , 1     | . 8     | 2        | 10             | ]<br>9  | 2        | . 1      |
| IMPROPER IFR OPERATION   |         |          | 11      | 20<br>1 |          | 20             | 31      |          | 11<br>31 |
| IMPKOPER IN-GUICHT DECLERAND   | 1       |          | 1       | ž       |          | 1 2            | 1       |          | ī        |
| INADEQUATE SUPERVISION OF STREET   | 4<br>16 |          | 4<br>16 | 11      | 2        | 13             | 3<br>15 | 2        | . 3      |
| LACK OF FAMILIARITY WITH AIRCRAST  |         |          | 10      | 61<br>3 | 1        | 62             | 77      | í        | 17<br>78 |
|  |         | 2        | 2       | 1       | 4        | 3<br>5         | 3       |          | 3        |
| IMPROPER STARTING PROCEDURES MISJUDGED DISTANCE, SPEED, AND ALTITUDE   | 18<br>1 |          | 18      | 54      | -        | 54             | 72      | 6        | 7        |
| THE CTIMENT  | •       |          | 1       |         |          | <del>-</del> ' | 1       |          | 72<br>1  |
| FOISICAL IMPAIRMENT  |         |          |         | · t     |          | 1              | 1       |          | î        |
| SPATIAL DISORIENTATION   | 1       |          | 1       | •       |          | 1              | 1       |          | 1        |
| MISUSED OR FAILED TO USE FLAPS   |         |          |         | 1       |          | 1              | 1       |          | 1        |
| SELECTED WRONG RUNWAY RELATIVE TO EXISTING WIND FAILED TO ABORT TAKEOFF  |         |          |         |         | 1        | ī              | •       | 1        | 1        |
| DIRECT ENTRIES   | 1       |          | 1       |         | 1        | 1              |         | ī        | i        |
| SUBTOTAL   |         |          |         | 2       |          | 2              | 1       |          | 1 2      |
| COPILOT  | 62      | 2        | 64      | 177     | 15       | 192            | 222     |          | _        |
| DIRECT ENTRIES   |         |          |         |         | ••       | 172            | 239     | 17       | 256      |
|  |         |          |         | 1       |          | _              |         |          |          |
| SUBTOTAL   |         |          |         | *       |          | 1              | 1       |          | 1        |
| BUAL STUDENT   |         |          |         | 1       |          | 1              | 1       |          |          |
| DELAYED ACTION IN ABORTING TAKEOFF   |         |          |         |         |          |                | -       |          | 1        |
| IMPROPER OPERATION OF POWERPLANT + POWERPLANT CONTROLS   |         |          |         | 1       |          | 1              | 1       |          |          |
| SUBTOTAL   |         |          |         | 1       |          | î              | ì       |          | 1        |
|  |         |          |         | 2       |          | 2              |         |          | 1        |
| ** PERSONNEL **  |         |          |         | -       |          | 2              | 5       |          | 2        |
| FLIGHT INSTRUCTOR  |         |          |         |         |          |                |         |          |          |
| MAINTENANCE. SERVICING. INCORPTION   |         |          |         |         |          |                |         |          |          |
| TOTAL PAINIFNANCE (MATNYENANCE CONC  |         |          |         |         |          |                |         |          |          |
| IMPROPER MAINTENANCE (OMNER PERSONNEL) IMPROPERLY SERVICED AIRCRAFT (GROUND CREW) IMPROPERLY SERVICED AIRCRAFT (GROUND CREW) |         |          |         | 2       |          | 2              | 2       |          | -        |
|  |         |          |         | 1<br>3  |          | 1              | 1       |          | 2<br>1   |
|  |         |          |         | 2       |          | 3<br>2         | 3       |          | 3        |
|  | 8       | 2        | 10      | 14      | 1        | 15             | 2<br>22 | 3        | 2        |
| INADEQUATE SUPERVISION OF FLIGHT CREW  |         | 1        | 1       |         |          | •              | e c     | ,        | 25       |
| INCOMPLETE WEATHER REPORT  |         | •        | 1       |         |          |                |         | 1        | 1        |
| MARKET BEAT HER REPURT   |         |          |         |         |          |                |         |          |          |
| MARKIC CONTROL PERSONNEL   | 1       |          | 1       |         |          |                | ,       |          |          |
| RAFFIC CONTROL PERSONNEL FAILURE TO ADVISE OF UNSAFE AIRPORT CONDITION   | 1       |          | 1       | 1       |          |                | 1       |          | 1        |

TABLE C-11 CONTINUED

| PERSONNEL (CONTINUED)  | FAT    | AL ACCID | ENT S  | NONFA  | TAL ACCI | DENTS  | AL.    | L ACCIDE | NTS    |
|--|--------|----------|--------|--------|----------|--------|--------|----------|--------|
|  | CAUSE  | FACTOR   | TOTAL  | CAUSE  | FACTOR   | TOTAL  | CAUSE  | FACTOR   | TOTAL  |
| AIRPORT SUPERVISORY PERSONNEL FAILURE TO NOTIFY OF UNSAFE CONDITION AIRWAYS FACILITIES PERSONNEL         |        |          |        |        | 1        | 1      |        | 1        | 1      |
| PRODUCTION-DESIGN POOR/INADEQUATE DESIGN MISCELLAMEOUS-PERSONNEL THIRD PILOT FLIGHT ENGINEER DISPATCHING | 1      |          | 1      | 1      |          | 1      | 2      |          | 2      |
| SUBTOTAL   | 10     | 3        | 13     | 24     | 2        | 26     | 34     | 5        | 39     |
| ** POWERPLANT **   |        |          |        |        |          |        |        |          |        |
| ENGINE STRUCTURE   |        |          |        | -      |          | 2      | 2      |          | 2      |
| CRANKCASE<br>CRANKSHAFT  | _      |          |        | 1      |          | 1      | 1      | •        | 1      |
| MASTER AND CONNECTING RODS CYLINDER ASSEMBLY   | 3      |          | 3      | 9      |          | 8<br>9 | 11     |          | 11     |
| PISTON, PISTON RINGS<br>VALVE ASSEMBLIES   | 3      |          | 3<br>3 | 3<br>1 |          | 3<br>1 | 6<br>4 |          | 6      |
| BLONER, IMPELLER ASSEMBLY  |        |          |        | 1<br>5 |          | 1<br>5 | 1<br>5 |          | 1<br>5 |
| IGNITION SYSTEM MAGNETOES  | 1      | 1        | 2      | 3      |          | 3      | 4      | 1        | 5      |
| SPARK PLUG   | 3      | •        | 3      | 4      |          | 4      | 7      |          | 7      |
| IGNITION HARNESS, SHIELDING<br>LEADS   | 1      |          | 1      | 1      |          | •      | î      |          | î      |
| FUEL SYSTEM TANKS  |        |          |        | 2      |          | 2      | 2      |          | 2      |
| LINES AND FITTINGS<br>Selector valves  | 1<br>3 |          | 1 3    | 4      |          | 4<br>1 | 5<br>4 |          | 5      |
| FILTERS, STRAINERS, SCREENS  |        |          | 1      | 1 2    |          | 1 2    | 1<br>3 |          | 1 3    |
| CARBURETOR<br>PUMPS  | 1<br>1 |          | ī      | 2      |          | 2      | . 3    |          | 3      |
| FUEL INJECTION SYSTEM VENTS, DRAINS, TANK CAPS   | 1      |          | 4<br>1 | 1<br>5 | 1        | 2<br>5 | 5<br>6 | 1        | 6<br>6 |
| RAM AIR ASSEMBLY   |        |          |        | 1      |          | 1      | 1      |          | 1      |
| LUBRICATING SYSTEM LINES, HOSES, FITTINGS  |        |          |        | 7<br>1 | 1        | 8<br>1 | 7<br>1 | 1        | 8<br>1 |
| SEALS AND GASKETS<br>OTHER   |        |          |        | 3      |          | 3      | 3      |          | 3      |
| COOLING SYSTEM BAFFLES   |        |          |        | 1      |          | 1      | 1      |          | 1      |
| PROPELLER AND ACCESSORIES OTHER  |        |          |        | 1      |          | 1      | 1      |          | ı      |
| EXHAUST SYSTEM MANIFOLDS   |        |          |        | 1      |          | 1      | 1      |          | 1      |
| STACKS<br>ENGINE ACCESSORIES   |        |          |        | 1      |          | 1      | 1      |          | 1      |
| ENGINE CONTROLS-COCKPIT THROTTLE-POWER LEVER ASSEMBLIES  |        |          |        | 1      |          | 1      | 1      |          | 1      |
| MIXTURE CONTROL ASSEMBLIES   |        |          |        | 1      |          | 1      | 1      |          | 1      |
| POWERPLANT-INSTRUMENTS<br>FUEL QUANTITY GAUGE  |        |          |        |        | 7        | 7      |        | 7        | 7      |
| MISCELLANEOUS<br>BIRD INGESTION  |        |          |        | 1      |          | 1      | 1      |          | 1      |
| DETONATION<br>OTHER  |        |          |        | 1<br>1 |          | 1<br>1 | 1      |          | 1      |
| DIRECT ENTRIES   | 1      |          | 1      | 4      |          | 4      | 5      |          | 5      |
| REDUCTION GEAR ASSEMBLY<br>GEARS, ACCESSORY DRIVE  |        |          |        | 1      |          | 1      | 1      |          | 1      |
| COMPRESSOR ASSEMBLY<br>OTHER   | 1      |          | 1      |        |          |        | 1      |          | 1      |
| COMBUSTION ASSEMBLY TURBINE ASSEMBLY   |        |          |        |        |          |        |        |          |        |
| ACCESSORY DRIVE ASSEMBLY LUBRICATING SYSTEM  |        |          |        |        |          |        |        |          |        |
| FUEL SYSTEM<br>SAFETY SYSTEM   |        |          |        |        |          |        |        |          |        |
| IGNITION SYSTEM TORQUEMETER  |        |          |        |        |          |        | •      |          |        |
|  |        |          |        |        |          |        |        |          | 3      |

### TABLE C-11 CONTINUED POWERPLANT (CONTINUED)

#### CAUSE/FACTOR TABLE

APPENDIX C

|  | FA     | TAL ACCI      | DENTS  | NONE   | TAL ACCI | DENTS   | Δį     | L ACCIDE | ENTS   |
|--|--------|---------------|--------|--------|----------|---------|--------|----------|--------|
|  | CAUSE  | FACTOR        | TOTAL  |        | FACTOR   |         | CAUSE  | FACTOR   |        |
| AIR BLEED<br>EXHAUST SYSTEM<br>THRUST REVERSER<br>OTHER  |        |               |        |        |          |         | 2-     |          |        |
| PROPELLER SYSTEM<br>GOVERNOR<br>CONSTANT SPEED DRIVE   |        |               |        | 1      |          | 1       | 1      |          | 1      |
| GDVERNOR VALVE<br>POWER LEVER  |        |               |        | 1      |          | 1       | 1      |          | 1      |
| PROPELLER LEVER REVERSE THRUST LEVER ENGINE INDICATING EQUIPMENT ENGINE INSTALLATION   |        |               |        | 1      |          | 1       | 1      |          | 1      |
| SUBTOTAL   |        |               |        |        |          |         |        |          |        |
| ** SYSTEMS **  | 27     | 1             | 28     | 85     | 9        | 94      | 112    | 10       | 122    |
| ELECTRICAL SYSTEM HYDRAULIC SYSTEM FLIGHT CONTROL SYSTEMS ANTI-ICING, DE-ICING SYSTEMS CARBURETOR DE-ICING SYSTEM OTHER  |        |               |        |        |          |         |        |          |        |
| AIR CONDITION, HEATING AND PRESSURIZATION CABIN TEMP CONTROL AND TEMP INDICATING SYSTEM AUTO PILOT FIRE WARNING SYSTEM FIRE EXTINGUISHER SYSTEM OXYGEN SYSTEM OTHER SYSTEM |        | ī             | ı      | 1      |          | 1<br>1  | 1      | 1        | 1      |
| SUBTOTAL   |        |               |        |        |          |         |        |          |        |
| ** INSTRUMENTS/EQUIPMENT AND ACCESSORIES **  |        | 1             | 1      | 2      |          | 2       | 2      | 1        | 3      |
| FLIGHT AND NAVIGATION INSTRUMENTS COMMUNICATIONS AND NAVIGATION EQUIPMENT TRANSMITTERS AND/OR RECEIVERS OTHER  |        |               |        | ı      |          |         |        | •        | 3      |
| HISCELLANEOUS EQUIPMENT  | 1      |               | 1      | i      |          | 1<br>1  | 1<br>2 |          | 1<br>2 |
| SUBTOTAL   |        |               |        | •      |          | 1       | 1      |          | 1      |
| ** WEATHER **  | 1      |               | 1      | 3      |          | 3       | 4      |          | 4      |
| LOW CEILING<br>Rain  |        |               |        |        |          |         |        |          |        |
| FOG<br>SNOW  | 1      | 5             | 6      | 1<br>1 | 3<br>1   | 4<br>2  | 2      | 8        | 10     |
| ICING CONDITIONS INCLUDES  | 1<br>1 | 1<br>2        | 2<br>3 | i      | 2        | 3       | 5<br>1 | 1<br>3   | 2<br>5 |
| UNFAVORABLE WIND CONDITIONS INDUCTION SYSTEM ICING   | 3<br>2 | 1<br><b>3</b> | 4      | 4<br>7 | 5        | 1<br>9  | 1<br>7 | 3<br>6   | 4      |
| OBSTRUCTIONS TO VICTOR   |        | 1             |        | ,      | 8<br>1   | 15<br>1 | 9      | 11       | 20     |
| HIGH DENSITY ALTITUDE THUNDERSTORM ACTIVITY  |        | i             | 1      |        |          |         |        | i        | 1      |
| SUBTOTAL   |        | 1             | 1      |        | 2        | 2       |        | 2        | 1<br>2 |
| ** MISCELLANEOUS **  | 8      | 15            | 23     | 14     | 23       | 37      | 22     | 38       | 1      |
| UNQUALIFIED PERSON DPERATED AIRCRAFT<br>FOREIGN MATERIAL AFFECTING NORMAL OPERATIONS   |        |               |        |        | •        | _       |        | 20       | 60     |
| SUBTOTAL   |        |               |        | 2      | 1<br>1   | 1<br>3  | 2      | 1        | 1 3    |
| CRAND TOTAL  |        |               |        | 2      | 2        | 4       | 2      | 2        | 4      |
| GRAND TOTAL  | 108    | 22            | 130    | 310    | 51       | 361 .   | 418    | 73       | 491    |

CAUSE/FACTOR TABLE

TABLE C-11 CONTINUED

| CHECKLIST-FAILED TO USE  OF SECRETOR OF GODD OPPRATING PRACTICE  OF SECRETOR OF GODD OPPRATING PRACTICE  OF SECRETOR OF GODD OPPRATING PRACTICE  I I I I I I I I I I I I I I I I I I I   | MISCELLANEOUS ACTS, CONDITIONS (CONTINUED)  |       | TAL ACCIO |       |       | TAL ACCI |       | AL    | L ACCIDE | NTS     |
|--|---|-------|-----------|-------|-------|----------|-------|-------|----------|---------|
| ANTI-CIMPODELCHN EQUIP-IMPROPER OPER, OF/FAILED TO USE  ACEKLISTS-ALBED TO USE  CREW CORDOLNATION-POOR  1  |   | CAUSE | FACTOR    | TOTAL | CAUSE | FACTOR   | TOTAL | CAUSE | FACTOR   | TOTAL   |
| CHECKLIST-FAILED TOUSE  CHEW CORDINATION—PROCEDURES  CHEW CORDINATION—PROC | ** MISCELLANEOUS ACTS, CONDITIONS **        |       |           |       |       |          |       |       |          |         |
| CREW CORNOL NATION-POORS   |   |       |           |       |       | _        |       |       |          | 22      |
| DISSEGNATION OF GODIO DEPARTING PRACTICE   1   1   1   1   1   1   1   1   1   |   | -     | 1         |       | 2     | 5        | 7     | _     | 6        | 9<br>1  |
| FEATHERED WRONE BROKENE HASTRUMENT—MISSEAD ON FAILED TO READ HASTRUMENT—MISSEAD ON FAILED TO READ PORCET—MISSEAD ON FAILED TO READ HASTRUMENT—MISSEAD ON FAILED TO READ HASTRUMENT—MISSEAD ON FAILED TO READ HISTALCULARE FULL OF THE CONTROL I 1 4 2 6 5 2 2 5 TO LINE OR UNAUTHORIZED USE OF AIRCRAFT I 1 1 4 2 6 5 2 2 5 TO LINE OR UNAUTHORIZED USE OF AIRCRAFT I 1 1 4 4 4 5 5 1 1 1 1 1 1 1 1 1 1 1 1 1  | DISREGARD OF GOOD OPERATING PRACTICE        | _     |           |       |       |          |       |       |          | ī       |
| INSTRUMENTS-MISRAD OR FAILED TO READ   1   | IMPROPER EMERGENCY PROCEDURES               |       | 2         |       | 3     | 5        | 8     |       | 7        | 14      |
| PODICY PLANNED APPROACH   SCALECULARE OF LICE ONSUMPTION   1   | INSTRUMENTS-MISREAD OR FAILED TO READ       | •     |           | _     |       | ı        | 1     |       | 1        | î       |
| MISCALCULATED FUEL COMSUMPTION  TOTAL FOR UNANTHORIZED USE OF AIRCRAFT  1 1 1 4 2 6 5 2  TOTAL FOR UNANTHORIZED USE OF AIRCRAFT  1 1 1 4 4 4 4 5 5 6 5 2  TOTAL FOR UNANTHORIZED USE OF AIRCRAFT  1 1 1 4 4 4 4 5 5 6 5 2  FATIGUE FRACTURE  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1   |   | 4     |           | 4     | 8     |          |       | 12    |          | 16<br>2 |
| IMPROPERLY SECURED   2   2   6   6   8   |   | 1     |           | 1     | 4     |          |       | 5     |          | 7       |
| ELECTRICAL FAILURE  HIGHEN LOADED UP  1 1 4 4 5 5 FATIGUE FRACTURE  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1  | STOLEN OR UNAUTHORIZED USE OF AIRCRAFT      | -     |           | 1     |       |          |       | 1     |          | 1       |
| EMGINE LOADED UP   |   | Z     |           | 2     |       |          |       |       |          | 8       |
| FUEL GRADE-IMPROPER #RONGO PART #RONGO PAR | ENGINE LOADED UP                            |       |           |       | 4     |          | 4     | 5     |          | Š       |
| MORNO PART   1   |   | 3     |           | 3     | -     |          |       |       |          | 4       |
| FAILURE OF TWO DR MORE ENGINES 7 8 15 21 53 74 28 61 1 1 1 2 2 2 1 2 2 1 2 2 1 2 2 1 2 2 1 2 2 1 2 2 1 2 2 1 2 2 1 2 2 1 2 2 1   |   |       | 1         | 1     | •     |          | •     | •     | 1        | i       |
| FIRE IN ENGINE  FILOT FATIGUE  FULCI EXHAUSTION  FUEL CONTRAINATION-EXCLUSIVE OF WATER IN FUEL  FUEL CARBON MONORIO  |   |       | _         |       |       |          |       |       |          | 3       |
| PILOT FATIGUE  |   | •     | 8         |       | 21    |          |       |       |          | 89<br>3 |
| FUEL CONTAMINATION—EXCLUSIVE OF MATER IN FUEL  CARBON MONOXIDE POISONING  1 1 1 1 1 2 1 1 1 1 1 1 1 1 1 1 1 1 1  | PILOT FATIGUE                               | 1     |           | 1     |       | _        | 1     | 1     |          | 2       |
| CARBON MONDXIDE POISONING   1  |   | 10    |           | 10    |       |          |       |       |          | 52<br>5 |
| ICE-IN FUEL  |   |       | 1         | 1     | ,     |          | ,     | ,     | 1        | 1       |
| ICE-CARBURETOR   | ICE-IN FUEL                                 | -     | -         | 1     | -     |          |       |       | _        | Ž       |
| Alaframe ICE   | ICE-CARRURETOR                              | _     |           | 7     |       |          |       | -     |          | 5<br>21 |
| LACK OF LUBRICATION—SPECIFIC PART, NOT SYSTEM  OIL EXHAUSTION—ENDEL LUBRICATION SYSTEM  OIL CONTAMINATION  MATER IN FUEL  2 2 1 3 13 15 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1  | AIRFRAME ICE                                | •     |           | •     |       | -        | 4     |       | -        | 4       |
| OIL EXHAUSTION-ENGINE LUBRICATION SYSTEM  OIL CONTAMINATION  ATTER 19 FUEL  ATTER 19 FUEL  ATTER 2 2 1 3 1 3 15 1 1 1 1 1 1 1 1 1 1 1 1 1 1  | IMPROPERLY LOADED AIRCRAFT-WEIGHT-AND/OR CG | 1     | 1         |       | ,     | 1        |       | ,     | 2        | 2       |
| MATER IN FUEL A IRCRAFT CAME TO REST IN MAYER  2 2 4 4 4 6 MISSING 1 1 1  TOUCH AND GO LANDING 1 1 1  MATERIAL FAILURE B 1 9 42 42 50 1  FUEL STARVATION 2 2 2 57 57 79  OIL STARVATION 3 3 2 2 2 57  OIL STARVATION 3 1 1 2 1 3 2 2  IMPROPER CLEARANCE—TOLERANCE FUEL SELECTOR POSITIONED RETMEEN TANKS 1 1 2 1 3 2 2 2  IMPROPER CLEARANCE—TOLERANCE FUEL SELECTOR POSITIONED RETMEEN TANKS 1 1 1 2 1 3 2 2 2  IMPROPER / INDEBUGUATE VENTING 1 1 1 1 1 1 1  LEAK/LEAKAGE 1 1 1 2 1 3 3 3 1  LOW COMPRESSION 2 2 2 2 2 2 2 2 2 4  LOOSE, PART/FITTING 2 2 2 2 1 1 1 1 1  EURNED 3 1 1 1 1 1 1  EURNED 4 1 1 1 1 1 1  COLLAPSED 5 1 1 1 1 1 1  EURNED 5 1 1 1 1 1 1  COLLAPSED 6 1 1 1 1 1 1  FUER RATIC 7 1 1 1 1 1  FUER RATIC 8 1 1 1 1 1 1  FUER RATIC 9 1 1 1 1 1 1  DETER LORAGE BREAKDOWN 1 1 1 2 2 2 3 3  IMPROPERLY INSTALLED 1 1 1 1 1 1  DBSTRUCTED 1 1 1 1 1 1  DBSTRUCTED 1 1 1 1 1 1  PRESSURE TOOLDW 1 1 1 1 1 1 1  PRESSURE TOOLDW 1 1 1 1 1 1 1  PRESSURE TOOLDW 1 1 1 1 1 1 1  PRESSURE TOOLDW 1 1 1 1 1 1 1 1  PRESSURE TOOLDW 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1   | OIL EXHAUSTION-ENGINE LUBRICATION SYSTEM    |       |           | i     | 1     |          | 1     | 2     |          | 2       |
| AIRCRAFT CAME TO REST IN MATER  AISSING  1 1 1 1 1  TOUCH AND GO LANDING  1 1 1 1 1  MATERIAL FAILURE  B 1 9 42 42 50 1 1  FUEL STARVATION  22 22 57 57 79  OIL STARVATION  3 3 2 2 2 5  IMPROPER CLEARANCE-TOLERANCE  1 1 1 2 1 3 2 2  IMPROPER CLEARANCE-TOLERANCE  IMPROPER CLEARANCE  IMPROPER CLEAR |   | •     |           | •     |       |          |       |       |          | 1       |
| TOUCH AND GO LANDING MATERIAL FAILURE B 1 9 42 50 1 FUEL STARVATION 22 22 57 57 79 OIL STARVATION 3 3 2 2 2 55 IMPROPER CLEARANCE-TOLERANCE FUEL SELECTOR POSITIONED RETWEEN TANKS 1 1 2 1 3 3 2 2 IMPROPER CLEARANCE-TOLERANCE FUEL SELECTOR POSITIONED RETWEEN TANKS 1 1 2 1 3 3 2 2 IMPROPER/INADEQUATE VENTING 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1   |   | 2     | 2         |       | 13    | 4        |       | 15    | 6        | 15<br>6 |
| MATERIAL FAILURE FUEL STARVATION 22 22 22 57 57 79 OIL STARVATION 3 3 3 2 2 5 5 1 7 7 9 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1  |   |       |           |       | 1     |          | 1     | 1     |          | 1       |
| FUEL STARVATION 3 3 2 2 57 79 79 11 11 1   |   | 6     |           |       | 42    |          | 42    | 50    | _        | 51      |
| IMPROPER CLEARANCE - TOLERANCE     1   2   1   1   2   1   1   2   1   1   |   |       | -         |       |       |          |       |       | _        | 79      |
| FUEL SELECTOR POSITIONED BETWEEN TANKS   1   |   | 3     |           | 3     |       | 1        |       |       | 1        | 5       |
| LEAK/LEAKAGE   | FUEL SELECTOR POSITIONED BETWEEN TANKS      |       | 1         | 1     |       |          |       | -     |          | - 4     |
| LOW COMPRESSION CARBON DEPOSITS 2 2 2 2 2 2 4 LOOSE, PART/FITTING 2 2 2 1 1 3 BINDING BURNED 1 1 1 1 1 1 CHAFFED 1 1 1 1 1 COLLAPSED 1 1 1 1 1 1 DETERIORATED DISCONNECTED ERRATIC HIGH VOLTAGE BREAKDOWN HIGH VOLTAGE BREAKDOWN 1 1 2 2 3 JAMMED 1 1 2 2 3 JAMMED 1 1 1 1 1 1 DESTRUCTED 1 1 1 1 1 DESTRUCTED 1 1 1 1 1 1 1 1 DESTRUCTED 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1   |   |       |           |       |       |          |       |       |          | 1       |
| LOOSE, PART/FITTING  BINDING  BINDING  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1   | LOW COMPRESSION                             | 1     |           | 1     |       |          |       |       |          | ï       |
| BINDING  |   |       |           |       |       |          |       |       |          | 4       |
| BURNED CHAFFED CHAFFED CHAFFED COLLAPSED COLLA |   | _     |           |       | 1     |          | 1     |       |          | 3       |
| COLLAPSED  DETERIORATED  DISCONNECTED  DISCONNECTED  1 1 3 2 1   | BURNED                                      | •     | 1         |       |       |          |       | •     | 1        | i       |
| DETER LORATEO DISCOMMECTED DISCOMMECTED SIGNAMECTED DISCOMMECTED DISCOMMENTATION DISCOMMEN |   | 1     |           | 1     |       |          | ,     |       |          | 1       |
| ERRATIC     3   3   3   3   3   3   3   3   3  | DETERIORATED                                |       |           |       |       | 1        |       |       | 1        | 3       |
| HIGH VOLTAGE BREAKDOWN IMPROPERLY INSTALLED 1 1 2 2 3 JAMMED 1 1 1 2 2 3 JAMMED 1  | DISCONNECTED                                |       |           |       |       |          |       |       | 1        | į       |
| IMPROPERLY INSTALLED   |   |       |           |       | 1     | 3        | 1     | 1     | ,        | 3       |
| OBSTRUCTED   2   2   2   2   2   2   2   2   2   | IMPROPERLY INSTALLED                        | 1     |           | 1     | 2     |          |       | 3     |          | 3       |
| DVERHEATED   |   |       |           |       | -     |          |       | -     |          | l<br>2  |
| EXCESSIVE PRESSURE   | DVERHEATED                                  |       |           |       | _     |          |       |       |          | ĩ       |
| PRESSURE TOO LOW       1       1       1         PRESSURE, NONE       4       4       4         SCORED       1       1       1         SHEARED       1       1       1       1         STUCK       1       1       1       1       1       1         EXCESSIVE TEMPERATURE       1       1       1       1       2       1       3       2       1         VIBRATION, EXCESSIVE       2       1       3       2       1  |   |       |           |       | 1     |          | _     | 1     |          | 1       |
| PRESSURE, NONE       4       4         SCOREO       1       1         SHEARED       1       1         STUCK       1       1         EXCESSIVE TEMPERATURE       1       1         VIBRATION, EXCESSIVE       2       1         3       2       1   | PRESSURE TOO LOW                            |       |           |       | i     |          |       | i     |          | 1       |
| SHEARED       1       1       1         STUCK       1       1       1         EXCESSIVE TEMPERATURE       1       1       1       1       2         VIBRATION, EXCESSIVE       2       1       3       2       1   | PRESSURE, NONE                              |       |           |       | 4     |          | 4     |       |          | 4       |
| STUCK     1     1     1       EXCESSIVE TEMPERATURE     1     1     1     1     2       VIBRATION, EXCESSIVE     2     1     3     2     1   |   | 1     |           | 1     | 1     |          | 1     |       |          | 1       |
| VIBRATION, EXCESSIVE 2 1 3 2 1   | STUCK                                       | 1     |           | 1     | •     |          |       | 1     |          | i       |
|  |   | 1     |           | 1     |       | ,        |       |       | •        | 2       |
| 1 1 1  | ICE-INDUCTION                               | 1     |           | 1     | 1     | •        | î     | . 2   |          | 2       |

TABLE C-11 CONTINUED

DIRECT ENTRY CAUSES (CONTINUED)

CAUSE/FACTOR TABLE

APPENDIX C

DIRECT ENTRY CAUSES

PHR PLT-LEFT ENGINE COUNTERHEIGHT ATTACHMENT FAILD COPILOT-INADVERTENTLY MOVD PHR LVRS TO CUTOFF. PHR PLT-FUEL STARVATION FOR UNDETERMINED CAUSE. PILOT-MISCALCULATED FUEL CONSUMPTION. PHR PLT-PARTIAL PHR LOSS FRONT ENGINE CAUSE UNKNOW PHR PLT-RIGHT ENG. AIR FILTER BOX BLOCKED BY SNOW. PILOT-TOOK OFF WITH TURBO SUPERCHARGERS FULL BOOST PHR PLT-UNWANTED FEATHER NO 1 PROP UNDET REASON.

DIRECT ENTRY CAUSES ARE CARRIED UNDER THEIR APPROPRIATE CAUSAL CATEGORIES AND ARE INCLUDED IN THE TOTALS