ANNEX 3

Copy of the statement of the only eyewitness.

Politie Maaseik

PRO JUSTITIA

PV nr. : TG 46 28.100532/2001
dd 11/04/2001

PROCES-VERBAAL VAN VERHOOR

Hoedanigheid van betrokkene : Melder

Wij, Hulsbosch Erik, Inspecteur van de politie te Maaseik verhoren ten huize op 10 april 2001 om 13:30 uur

Naam : **CHRAEGS Arnoldine Elisabeth**
Geboren te Neerocteren op 29/10/1933
Wonende te 3680 MAASEIK, KLOOSTERSTEEG 10
Nationaliteit : BELGIE
Burgerlijke stand : Echtgescheiden
Beroep : Gepensioneerde

die verklaart in het Nederlands.

"U deelt mij mee :

- *dat ik kan vragen dat alle vragen die mij worden gesteld en alle antwoorden die ik geef, worden genoteerd in de gebruikte bewoordingen*
  Ik wens hier geen gebruik van te maken.
- *dat ik kan vragen dat een bepaalde opsporingshandeling wordt verricht of een bepaald verhoor wordt afgenomen*
  Ik wens hier geen gebruik van te maken.
- *dat mijn verklaringen als bewijs in rechte kunnen worden gebruikt*
- *dat ik gebruik mag maken van de documenten in mijn bezit, zonder dat daardoor het verhoor wordt uitgesteld*
- *dat ik tijdens de ondervraging of later, mag eisen dat deze documenten bij het proces-verbaal van het verhoor worden gevoegd of ter griffie worden neergelegd*
  Ik wens hier geen gebruik van te maken.

Aangaande Uw onderzoek kan ik verklaren dat ik op 10.04.01 omstreeks 08.35 uur op de Grotlaan was, ca 100 meter verwijderd van het kruispunt Grotlaan met de Kloostersteeg (richting Neerocteren centrum) Ik hoorde plots een vliegtuig. Ik heb het vliegtuig eerst gehoord en dan pas gezien. Mijn aandacht werd getrokken door een slecht draaiende en sputterende motor. Toen ik opkeek zag ik het vliegtuig naderen. Het vliegtuig bevond zich toen rechts van de Grotlaan en vloog op mij toe. Mijn eerste gedachte was trouwens dat het vliegtuig op mij ging vallen. Het vliegtuig tolde. Ik wil hiermee zeggen dat de vleugels op en af gingen. Op dat ogenblik was er een erge rookontwikkeling rond het vliegtuig. De hoogte van het vliegtuig was laag, doch niet zo laag dat het een antenne of een dak zou kunnen raken. De snelheid was vrij laag. Ik ben dan beginnen te lopen over de Grotlaan in de richting van Neerocteren centrum. Dit was eigenlijk naar het vliegtuig toe. Enkele tellen later ben ik dan gestopt en heb achter mij gekeken. Het vliegtuig was mij toen gepasseerd en vloog ter hoogte van de Grot alhier. Tot op een bepaald moment heb ik het vliegtuig nog altijd horen sputteren en het vliegtuig tolde. Ik ben het blijven volgen. Op een bepaald ogenblik spatte het vliegtuig uit elkaar. Het vliegtuig is altijd op hoogte gebleven. Een knal heb ik niet gehoord. Gezien mijn standplaats viel er rechts van dit ontploffende vliegtuig dat zich van mij verwijderde een vrij groot brokstuk (een zwarte massa) recht naar beneden. Mijn eerste gedachte was dat dit een persoon was. Dit brokstuk viel recht naar beneden, andere stukken waren kleiner. De resterende brokstukken heb ik ook zien vallen. Ik ben dan naar de kinesiste gelopen en aldaar heb ik de hulpdiensten verwittigd. Op het ogenblik der feiten regende het, doch een tiental minuten voor ik het vliegtuig zag regende het pijpenstelen. Het waaide echter niet. Het was bijna een windbreuk. Gedurende de hele tijd heeft het niet geblikseind.

Ik neem er kennis van dat ik kosteloos een kopie van het proces-verbaal van mijn verhoor kan verkrijgen. Ik wens hier geen gebruik van te maken."

Geven aan de ondervraagde van het proces-verbaal van verhoor, en vragen of betrokkene de verklaringen wil verbeteren of daaraan iets toevoegen.

Ondervraagde tekent in minuut

Waarvan akte,

Hulsbosch Erik, Inspecteur

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ANNEX 4

Transcription of radio communications.

N°	Time	Agency	Communication	Rmk
01	06.27.27	PH-UBG	Brussels good morning – the PH-UBG 60 maintain inbound ONT.	
02	06.27.33	ACC	PH-UBG goeie morgen - …(unreadable) we have radar contact you are clear to proceed to ANT at FL 60.	
03	06.27.41	PH-UBG	ONT at 60.	
04	06.28.29	ACC	Brussels PBG report your heading	
05	06.28.32	PH-UBG	Zero…euh…320, sir.	
06	06.28.35	ACC	The approximate track to ONT…to ANT is 280.	
07	06.28.41	PH-UBG	… (unreadable).	
08	06.29.55	PH-UBG	Aaa we have … (unreadable) and …(unreadable) level problems PBG.	
09	06.30.02	ACC	PBG, say again?	
10	06.30.07	ACC	PH-UBG come in.	
11	06.30.16	ACC	PH-UBG Brussels?	

technics
sabena

Our Ref: 51/IP/02D14A
Your Ref: PH-UBG acc 10/4/01
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ATT.: Mr. R. Taverniers / BCAA

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H.R.B/R.C.B : 631415 B.T.W/T.V.A :
BE 465.150.137 GB : 210-0000714-87

ANNEX 5

SUBJECT: PH-UBG Investigation Report on aircraft structure

1- References

Accident SOCATA TB21, imm. PH-UBG, dated 10/04/2001 at Neeroeteren.

BCAA fax from R. Taverniers dated 19 April 2002 with request for investigation.

2- Problem description

Referenced aircraft crashed and both wings and the tail were individually found on the ground. Apparently the wings and tail separated from the fuselage before the ground impact. The wings are structurally connected to the fuselage by means of a steel I-beam.

Sabena Technics Materials Engineering was asked to investigate the I-beam fractures.

Additionally an investigation of the structure was carried out, in order to understand the fracture mechanisms and the loads applied to the structure during the failure. The aim of this investigation is to try to identify the cause and the chronology of the disintegration of the aircraft in flight.

3- Investigations

The investigation was carried out in the BCAA-Hangar at Haren on the wreckage.

The investigation was done by repositioning the different elements of the wreckage and analyzing the deformations and fractures, considering their loads on these elements during flight.

Four main areas have been investigated:

Central portion of the wing spar.
Left outer wing.
Right outer wing.
Horizontal stabilizer

Additionally, a fracture evaluation was made on the central I-beam, by visual observations, supported by magnifying glass.

4- Investigation results

4.1 Central portion of the wing spar

4.1.1 Description of structure

The wing spar consists of two I-beams. The fitting at the center of the aircraft joins the two beams at an angle, corresponding to the dihedral angle of the wing.

The main fitting of the fuselage to the wing is positioned near the sides of the fuselage. The front and aft fitting distribute the torsion loads of the wing in the fuselage. Hence, during normal level flight, the central portion of the wing spar is submitted to a pure bending moment. If the lift distribution is not identical on the wings (aileron deflection, unsymmetrical wind gusts), the central beam is solicited by a bending moment, combined with shear stress.

4.1.2 Findings

The web of both I-beams shows widespread inelastic buckling. This indicates the beams have been loaded beyond their design load. The deformations are organized in a regular buckling pattern, indicating an overload in shear stress.

The left-hand I-beam has failed at 18 cm from the center fitting.

In this area, the web has suffered a severe deformation and, after failure, the flanges of the beam are separated by only a few cm. This indicates the web of the beam has failed. After the web collapses, the compressive loads induced by the flanges will tend to bring both flanges together. A portion of approx. 40 mm is missing, corresponding to the area where the web has collapsed.

The flanges of the left wing, near the fractured zone, show a small offset with respect to the axis of the beam. This offset is small and is believed to be the result of secondary stresses during the collapse of the web.

The flanges of the beams show no permanent warpage due to torsion loads.

The top flange has suffered severe deformation and has been pushed towards the lower flange, indicating this flange was carrying a compressive load. This indicates the beam was loaded by a positive bending moment (positive G-forces).

Parts of the side panels of the cockpit remained attached to the wings and are bend over, lying almost parallel to the upper wing surface. This also indicates the wings have bend over to the top, confirming the positive bending of the wing at failure. This is confirmed again by the way the flaps control rod and some hydraulic tubes have been bend (and broken).

Pictures 1 and 2 show the central portion of the left and right wing. Note the position of the side panels of the fuselage, the buckling patterns on the spar web and the bended tubes and rods.

A more detailed analysis of the buckling patterns on the wing spar is given in appendix 1. This analysis indicates the orientation of the excessive shear stresses on the beam. The buckling patterns are compatible with an excessive load during a roll to the left.

4.1.3 Reason of failure

The center portion of the wing spar has failed due to an excessive positive bending moment, combined with excessive shear stress, due to an unsymmetrical and excessive wing loading. The buckling patterns indicate the right hand wing has produced a significantly higher lift than the left wing (right roll).

4.2 Left outer wing.

4.2.1 Description of structure

The outer wings are made up of a U-beam, the wing-skins (including leading edge) and an end spar made of a bend aluminum sheet. Several ribs stabilize the skins.

The aileron and flap loads are introduced via the ribs.

A structural fuel tank is situated in the center portion, at the flapped area.

4.2.2 Findings

The outer wing panels, from the end rib of the fuel tank to the wingtip, as well as the aileron have been torn apart from the main structure in flight. The main wing spar remains attached to the wing, but is bend towards the top and towards the rear side of the aircraft.

The aileron has suffered global buckling, pointing towards excessive compression loads in the direction of its axis. This indicates the aileron was still attached to the aircraft when the wing was suffering severe deformation.

Around the hinge at the wing tip, marks indicate the wing-skin and rib have impacted heavily against the top part of the aileron. This confirms the belief that the outer wing part was ripped off towards the top.

No proof of foreign object damage (birdstrike, . . .) was found on the debris.

Picture 3 shows the remains of the left hand wing.

4.2.3. Reason of failure

The outer portion of the left-hand wing has disintegrated following an excessive positive loading (positive lift on wingtip).

4.3 Right outer wing.

4.3.1 Description of structure

Cfr 4.2.1 : identical to left wing.

4.3.2 Findings

The area damaged on the right hand wing is similar to the one on the left wing. However, the deformation of the wing skins seems to have been more violent.

The central portion of the wing shows extensive damage. The structure is bend towards the top side of the wing and buckling patterns are clearly visible on the upper skin panels. It is not clear however if this damage has occurred in flight or on impact with the ground.

The outer wing panels, the aileron and part of the flaps are torn apart from the main structure. The main wing spar is broken at two points, between the center fuel tank and the wingtip. The fracture zone indicates clearly the debris was evacuated towards the top and, in first instance, towards the front of the aircraft.

The damage on the leading edge near the fuel tank and on the central wing spar indicates clearly the wingtip was "rolled-up", starting from the wingtip.

This is confirmed by the markings on the aileron near the tip hinge. The wing-skin and rib have violently impacted the aileron's top surface.

As for the left wing, the aileron has suffered global buckling, indicating the aileron was still attached to the aircraft when the wing was suffering severe deformation.

No proof of foreign object damage (birdstrike, . . .) was found on the debris.

Picture 4 and 5 show the remains of the right hand wing tip.

4.3.3. Reason of failure

The outer portion of the right hand wing has disintegrated following an excessive positive loading (positive lift on wingtip).

4.4 Horizontal stabilizer.

4.4.1 Description of structure

The horizontal stabilizer is of the monobloc type, i.e. the complete surface of the horizontal tail acts as a control surface. The structure is all aluminum, consisting of a central spar and wing-skins (including leading edge).

In this accident, the horizontal stabilizer was found separately, still attached to some remaining of the lower end part of the fuselage.

4.4.2 Findings

The upper and lower skin panels near the trailing edge around the central attachment show buckling patterns. The trim tab surfaces have buckled under compressive loads.

Furthermore the corners of the skins at the leading edges, neat the cutout for the attachment, have cracked under tensile stresses.

The main spar of the stabilizer is bend towards the rear of the aircraft.

The end part of the fuselage shows signs of compressive load on the top part of the fuselage and tensile forces on the lower part of the fuselage. These indicate a negative bending moment (negative G-loading) on the fuselage when this part was torn off.

Considering the very clear evidence of positive G-loads during the rupture of the wings, it is believed this rupture occurred after the wing failure.

Furthermore an object has damaged the left-hand side of the horizontal stabilizer, near the tip. This object has left a deep scar, ending in a hole. Around this scar traces remain of green paint.

This green was part of the paint scheme and was found on the aircraft's fuselage and wing tips.

Picture 6 clearly shows the buckled trim tab and the bended main spar. Note that the upper skin was cut during the investigation (search for the part which caused this damage).

4.4.3. Reason of failure

The damage on the horizontal stabilizer seems to have been caused by excessive drag forces on the control surface. Considering the form and function of this part, the most acceptable reason for this damage seems to be an excessive speed.

Considering the weight and form of the part that was torn of the wreckage, this speed build-up must have occurred while the part was still attached to the aircraft.

4.5 Fracture investigation

In order to reveal the fracture surface, the adhering mud and dirt was first washed off using a nylon brush and water, followed by compressed air drying.

Picture 7 reveals the RH wing. Picture 8 shows the failed structural I-beam. The fracture surface is typical of an overload failure.
Picture 9 reveals the LH wing. Picture 10 shows the failed structural I-beam. The fracture surface is typical of an overload failure. Note the heavier deformation of the LH-beam compared to the RH-beam.

4.6 Conclusion

The analysis of the wing spar indicates the aircraft was submitted to an excessive and unsymmetrical wing loading, leading to the complete disintegration of the aircraft in flight.

The reason of this unsymmetrical wing loading cannot be determined with certainty, but the typical damage and complete disintegration of both wingtips indicate an overspeed situation occurred, combined with an excessive unsymmetrical wing loading. The right hand wing generated substancially more lift than the left hand wing during the rupture of the main beam.

As the ailerons where still attached when the wingtips started disintegrating, a loss of aileron in flight must be excluded.

As the damage on the horizontal tail is caused by excessive speed, and debris from the aircraft's fuselage or wingtips damaged the horizontal tail, the loss of the tail structure in flight cannot be the cause of the accident.

The fact that several parts of the right-hand wingtip were found far away from the wing and fuselage wreckage, and the indication that the damage on the right-hand wingtip seem to have been more violent than the one on the left-hand wingtip, leads to the believe the right-hand wingtip had started to desintegrate before the wing finally collapsed under the excessive unsymmetrical wing loading.

Ir. Ivo Paulus

Ir. Pieter Steurbaut

July 30, 2002

Picture 1 : Top view of the right hand wing. Note the bent fuselage sides at the wing root.

Picture 2 : Right hand portion of main spar. Buckling patterns and parts orientation are highlighted. The bent hydraulic tubes and control rods are clearly visible.

Picture 3 : Remains of the left hand wing. The main spar is bent towards the top and the rear.

Picture 4 : Leading edge of the right hand wing tip. The nose of the leading edge shows clearly that the wing skin has been "rolled up" towards the top.