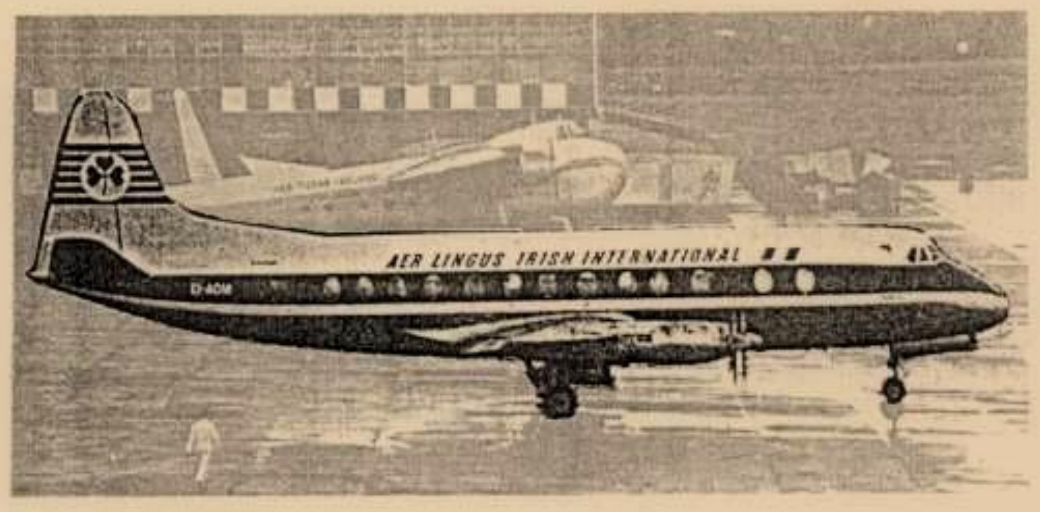
REPORT

Following the study
performed at the request of
The Minister in charge of the Department for Public Enterprise

on
the AER LINGUS VISCOUNT EI-AOM accident
occurred on March 24th, 1968
near TUSKAR ROCK
Ireland

VOLUME II : APPENDICES AND ANNEXES

TOME 3: COMMENTS TO THE REPORT



January 22, 2002

Yves LEMERCIER Manuel PECH Colin TORKINGTON

Vol II (T-3)

COMMENTS TO THE REPORT

The following organisations and individuals were provided with initial draft copies of the report and invited to submit comments.

- BAE Systems
- Dowty Rotol
- Rolls Royce
- Lucas
- Aer Lingus
- Irish Aviation Authority
- Supervisor and Controller acting at the time of the accident at the Air Traffic Control centre, Shannon
- Two members of the 1968 Investigation Commission
- Relatives of the EI-AOM crew members
- Experts elected by Air Accident Investigation Unit

An abstract of the report has been forwarded to an aeronautical expert advisor of the family of one of the victims.

Where considered appropriate, amendments have been made to this report.

The comments provided are attached. Any further comments which may be received will be included at a later stage.

Our Reference: 0084/RB/01
Your Ref: DL587.01

5 December, 2001
EXPAIR S.A.R.L.
Cabinet d'Expertise Aéronautique et Spatiale
36 Rue Alphonse Pallu
78110 LE VESINET
France

Dear Sirs

Study Report
Aer Lingus Viscount EI-AOM Accident
Tuskar Rock, Ireland, 24 March 1968

Further to your letter of 23 November (your reference DL587.01), we enclose our comments on the final draft of the Study Report for inclusion at Annex C.

We would be grateful if you would acknowledge receipt of these comments and advise us as to when you expect to publish the final report.

Yours faithfully

R. Bennett
Airworthiness Specialist Engineer – Flight Safety
For and on behalf of
BAE SYSTEMS PLC

Our Reference: 0084/RB/01a
Your Ref: DL587.01

5 December, 2001
EXPAIR S.A.R.L.
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36 Rue Alphonse Pallu
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Dear Sirs

Study Report
Aer Lingus Viscount EI-AOM Accident
Tuskar Rock, Ireland, 24 March 1968

BAE SYSTEMS has recently had the opportunity of reviewing the final draft of this report and has been asked to submit comments for inclusion in this Annex. This is the first opportunity BAE SYSTEMS has had to view the entire draft (an earlier request to do so produced no response from the Study Team). Aside from providing some comments on selected extracts from a previous draft (some of which are reflected in the final version but most of which are not), BAE SYSTEMS has not been involved in preparation of this Study Report.

BAE SYSTEMS fundamentally disagrees with the methodology employed by the Study Team and with the conclusions reached on the basis of that methodology. The Study Team's conclusions hypothesise an initial event affecting the tail of the aircraft at 10:42, followed by progressive degradation and loss of control and the final crash into the sea near Tuskar Rock some 30 minutes later. That reconstruction of events relies entirely on witness statements, some of these not even eye witnesses and some of which were given for the first time more than 30 years after the accident. It is well recognised by accident investigators that witness statements of this nature have a tendency to be inherently unreliable even when given contemporaneously. Statements testifying to events over 30 years previously must by definition be regarded with extreme caution. Despite this, the Study Team has chosen to place reliance on eye and ear witness evidence to hypothesise a flight path for the aircraft contemplated by neither the original accident investigation nor by the 2000 Review.

In reaching its conclusion, the Study Team has discounted the principal piece of contemporaneous and objective evidence which exists as to both the location of the aircraft and the time at which it first experienced a loss of control, namely the ATC transcript. That documentary record establishes that at 10:51:48 EI-AOM reported itself to be in level flight at Flight Level 170. Again at 10:57:07 EI-AOM reported itself by Bannow, level at Flight Level 170 and estimating Strumble at 03 (i.e. in 6 minutes). These exchanges are consistent only with normal flight and it is inconceivable that they would have been made if the aircraft had, on the Study Team's analysis, already undergone an uncontrolled dive and was experiencing a gradual structural failure at low altitude. These routine radio communications are in stark contrast to the message intercepted at 10:58.10 ("Five thousand feet descending spinning rapidly"); the latter message being the first and only objective and contemporaneous indication of a problem experienced by the aircraft.

The Study Team's inexplicable approach to this inconsistency is simply to assert that the ATC transcript must therefore (and for no other reason) be unreliable and is to be disregarded when set against the eye witness evidence. In the context of aircraft accident investigation, that conclusion is extraordinary.

Whilst the Study Report accepts that it can offer no more than conjecture in relation to the cause of the initiating event, it nevertheless postulates a sequence of events for which there is no objective support in the evidence. In particular, there is no evidence that flutter, fatigue or corrosion ever existed or was experienced in the tail plane. Certain aspects of the break-up scenario suggested by the Study Team are actually impossible: for instance the suggestion that the trim tab remained attached to the fuselage after the separation of the elevator (the trim tab is in fact attached to the elevator). BAE SYSTEMS considers that the only appropriate conclusion remains that set out in the original 1970 investigation, namely that there is insufficient evidence available to reach a conclusion as to the probable cause of the accident.

The Study Report appears, in the view of BAE SYSTEMS, to be based on a wholly selective interpretation of the evidence (particularly the eye witness evidence) designed to support a preconceived view of what happened to the aircraft, itself derived from a misconceived comparison with other Viscount accidents. Given the paucity of reliable evidence as to the circumstances in which EI-AOM crashed, BAE SYSTEMS questions the value of such a comparison.

Neither the 1970 Accident Investigation nor the 2000 Review was able to reach any firm conclusions as to the cause of the accident. In striving, pursuant to its instructions, to shed further light on the cause or causes, the Study Team has constructed a scenario for this accident which is wholly inconsistent with the available objective and contemporaneous evidence. BAE SYSTEMS does not consider this Report provides any assistance in ascertaining the cause of the accident and does not accept its conclusions.

Yours faithfully

R. Bennett
Airworthiness Specialist Engineer – Flight Safety
For and on behalf of
BAE SYSTEMS PLC

Your Reference: DL527.01 dated 09/08/01
Our Reference: 0062/RB/01

16 August 2001

EXP'AIR S.A.R.L.
Cabinet d'Expertise Aéronautique et Spatiale
36 Rue Alphonse Pallu
78110 LE VESINET
France.

For the Attention of Mon. Manual Pech

Dear Sir,

SUBJECT: Viscount 803 (EI-AOM) accident, Tuskar Rock, March 24 1968

Thank you for offering BAE SYSTEMS, AAR & Nimrod Business Unit, the opportunity to review and comment on Abstracts 1 and 5 of the Investigation report associated with your review of the above accident. Having now fully reviewed your draft bulletin BAE SYSTEMS would like to make the following comments.

General

The report as presented is poorly written, not based on all the evidence, indicating a pre-judged conclusion, validated by re-assessment and over reliance on inherently unreliable witness statements, some of these statements having been given for the first time 33 years after the event.

Abstract No 1 – Page 1, Paragraph 5 — *'...of several accidents considered as "relevant" since they presented...'*

It is unclear who consider the accidents "relevant". Given the reliance on information obtained from BAE SYSTEMS later in the report, it may seem to the reader that BAE SYSTEMS consider the accidents to the Convair 580, Avro 748, Boeing 747 and Vanguard relevant to this investigation which is not the case. In order to clarify the intent of this sentence, BAE SYSTEMS would suggest that the sentence be re-written to state:

'The team took advantage of a much longer service experience than existed in 1968, and carried out an analysis of several other accidents considered as relevant by EXP'AIR S.A.R.L. This resulted in the identification of a field of possible causal factors'

Abstract No 1 – Page 1, Paragraph 5 — *'This field was narrowed... based on personal experience...'*

The report does not explain what the *'personal experience'* is or, whose personal experience is being cited. BAE SYSTEMS suggest that this information be added to the report to support the claims made.

Abstract No 1 – Page 1, Paragraph 7/8 — *'A new call for witnesses...'*

Witness statements are acknowledged to be unreliable even close to the scene or time of an accident. The call for new witnesses at this protracted time (33 years) after the accident and the review teams reliance on those statements, is in the opinion of BAE SYSTEMS, unsafe and misguided. The conclusions drawn from these witnesses together with reinterpretation of the original statements to fit a prejudged scenario is flawed

e.g.

- On page 29 of abstract 1, paragraph 5.10, the report concludes that the 'strange' noise is consistent with the noise emitted by an aircraft suffering from flutter. BAE SYSTEMS cannot support this statement. It is inconceivable that this type of a vibration, in an aircraft of this type with at least two engines fully functional, would create enough noise to be identified by witnesses on the ground.
- The review team seems to have ignored that fact that an Irish Air Corps de Havilland Dove aircraft was documented (closely following the accident) to have been searching for the Viscount in the vicinity of the amended flight path. In fact, Conclusion 16 of the 1970 report states that the Dove aircraft's flight path matched exactly the flight path of the Viscount suggested by this report. This former type of aircraft is equipped with Gipsy Queen reciprocal Piston engines and it is considered likely by BAE SYSTEMS as the former design authority for de Havilland aircraft, that the 'strange' sound and, noise like a 'motor bike engine' emanated from the Dove aircraft and not EI-AOM.
- The report also appears to grant more credence to witness statements than to the evidence gained from the post crash examination of the wreckage. The original 1970 engineering report concluded that right hand wing exhibited evidence of first impact with the water whilst the left hand wing suffered downward bending over a large portion of the wing indicative of it being clear of the water at the point of impact. This contradicts the witness evidence that viewed over the last 3 metres of decent from a distance of 2 to 3 miles from the impact site.
- The report also concludes that the flight path originally reported in the 1970 report and 1999 review of files was incorrect. It is not stated whether this change is as a result of reanalysis of old witness statements or, as a result of new witness statements which (as explained above), should be treated as potentially unreliable, given the possibility of 'collective memory' caused by media coverage which this case has attracted over the years.

Abstract No 1 – Page 1, Paragraph 8, Line 1 — *'The Viscount has been heard...'*

BAE SYSTEMS suggest replacement of the word *'has'* with *'had'*.

Abstract No 1 – Page 1, Paragraph 8, Line 3 — *'...then flying in a more and more disabled condition...'*

BAE SYSTEMS are concerned that there is no evidence other than unreliable witness statements to support this conclusion. **The statement is conjectural and should be deleted.**

Abstract No 1 – Page 1, Paragraph 8, Line 5 — *'...crashing into the sea at Tuskar Rock.'*

BAE SYSTEMS suggest that the word 'at' be replaced with *'1.75 miles east of Tuskar Rock'* in order to clarify the relationship of Tuskar Rock to the accident site.

Abstract No 1 – Page 1, Paragraph 9, Line 1 — *'...examined in this report as it is evident that an impairment of the pitch control of the aircraft existed...'*

BAE SYSTEMS have analysed the 'number of possible causes' identified by this report and conclude that all scenarios suggested have basic flaws in their argument which will be extrapolated later in this discourse. It is suggested therefore that the word *'evident'* be replaced by *'assumed'*.

Abstract No 1 – Page 1, Paragraph 10 — *'On the balance of probabilities....'*

BAE SYSTEMS analysis of this scenario concludes that although excessive backlash within the elevator spring tab mechanism would cause vibrations liable to result in fatigue failure of the spigot fitting, detachment of the tab structure would effectively cancel any flutter tendency. A more likely scenario is discussed later.

BAE SYSTEMS suggewst the inclusion of the words *'may have'* following *'flutter'* on line 1 of this paragraph. **No evidence has been produced to prove that flutter existed or was experienced.**

Abstract No 1 – Page 1, Paragraph 10, Line 4 *'A contributing factor was presumably...'*

BAE SYSTEMS suggest that either the engines were a contributing factor or, they were not. The word *'presumably'* is meaningless and detracts from the authority of the report/statement. In addition, the report states that there have been no in service reports of Viscount aircraft or other multi-engined Dart equipped aircraft suffering from the symptoms described i.e. run down as a result of the application of negative 'G'.

As a result of the above comments, BAE SYSTEMS would **suggest that this paragraph in its entirety is deleted** or amended in line with the later suggestion.

Abstract No 1 – Page 1, Paragraph 11, Line 1 *'...forces and progressive loss of control.'*

The report in many places puts forward this scenario as fact, yet nowhere, validates the it with either evidence or, an explanation and description. BAE SYSTEMS suggest that this evidence and explanation/description is included in the report for reference or, in the event that the scenario is hypothetical, that the report identifies it as such. **Failing such evidence or, a rational and logical description of the break-up theory, then the paragraph should be deleted in entirety.**

Abstract No 1 – Page 1, Paragraph 12, Line 1 *'It is concluded that there was no...'*

In order to clarify the degree of research carried out, BAE SYSTEMS suggest that the words *'on the evidence researched...'* be added to this sentence following *'It is concluded..'*

Abstract No 2 – Page 2, Paragraph 2, Line 4 *'...structure is contra indicated and icing...'*

BAE SYSTEMS would suggest clarification of the words 'contra indicated'. If the report is meant to confer that the evidence does not support failure of the fuselage as a possible causal factor then, BAE SYSTEMS suggest that these words be used instead.

Abstract No 2 – Page 2, Paragraph 3 *'In conclusion 11...'*

Whilst conclusion 11 of the 1970 report states that *'The aircraft was substantially intact except for the probable loss of all or part of the elevator spring tab'*, subsequent reanalysis of the facts of this investigation together with the proposals put forward by the review team as part of this report indicate a possible alternative scenario.
Had the elevator tab become detached from the aircraft as has been suggested, the cause of the 'flutter' would have ceased to exist. *In addition, if the flutter had been as 'Severe' as has been suggested in this report and resulted in the loss of control at 10:42 over Old Parish, page 28, para 5.9; the first time the aircraft reportedly exhibited control problems, it is extremely unlikely that the tailplane structural problems surfaced this early in the sequence of events and yet the aircraft survived for possibly another 32 minutes.*

The flutter discussed in the investigation into the Indonesian accident (PK-IVS) did not result in departure or loss of control yet precipitated failure of the tailplane in only 24 minutes. EI-AOM reportedly went out of control, suffered at least 3 departures (pins or Spiral descents) and required major effort on the part of the crew to recover (at extremely low level) from at least one departure. And the 1999/2000 report stated that *'In fact there is only one known case in which this (a spin or spiral dive) was effectively accomplished during a test flight by expert test pilots. Even in that case the airframe suffered some distortion of the tail unit.'*

An alternative scenario is postulated in that:

Given that some degree of excessive backlash was present in the elevator spring tab mechanism which resulted in moderate to severe vibration being felt in the cabin or cockpit during climb out from Cork, the pilots may have reduced speed progressively to eliminate or reduce the vibration to an acceptable level.

This may account for the initial levelling out 'first step' of the Viscount as reported by witness 2.01.2.2 whilst the aircraft was over Old Parish.

Due to the progressive loss of speed the aircraft may then have entered a stall situation the recovery from which, resulted in overloading of the empennage together with possible deformation of the tailplane and control surfaces due to flight loads outside the design/certification envelope/requirements.

This would account for the subsequent statements regarding the aircraft's erratic flight path, weaving and climbing and descending. The scenario for continued flight with a deformed and critically damaged tailplane is not without precedent as evidenced by the HS 748 incident to D-AHSF on 23.6.87 in Cologne when excessive 'G' manoeuvres resulted in failure of the port stabiliser causing stuck elevator and high trim forces. On landing the stabiliser was found to almost touch the runway.

It is suggested that progressively over the next 30 or so minutes, vibration and aerodynamic loading acting upon the tailplane assembly, possibly exacerbated by the vibration eminating from the spring tab resulted in a fatigue failure of the port tailplane spar booms and separation of the tailplane assembly shortly prior to final impact. This may have been preceded immediately before separation of the tailplane by loss of the tab and elevator. However, a similar accident (PK-IVS), examined by the review team, culminated in failure of the tailplane and detachment of the elevator and tab during descent.

Whilst it cannot be denied that the section of the port spring tab was recovered some miles distant from the impact point, It can be argued that currents and tides may have deposited the tab on the beach. The tab was reported as being found entangled in seaweed and, as discussed above, had the tab departed from the aircraft some time prior to the accident the aircraft may have remained controllable if there was nothing else amiss with the structure.

It is suggested both in the 1970 and 1999/2000 review of files together with implications within this report that, the tail section of the aircraft (including tailplanes and elevators) was missing. BAE SYSTEMS question the word *'missing'* based on the fact that a major portion of the Fin and Rudder was recovered from the main wreckage site in the initial salvage operation. Had the tail section or major parts of the tail section separated from the fuselage earlier in the impact phase, not only may currents and tides carry a large relatively light component some distance from the impact site but no explanation is offered as to why the fin and rudder remained within the main wreckage site with damage indicative of impact failure. It is suggested that the 'missing' tail sections were not identified either visibly or acoustically due to the topography of the sea floor in the local area (as explained in the original 1970 report).

Abstract No 2 – Page 3, Paragraph 3 — *'Although civil experience with fuel control units appears to be satisfactory...'*

The sub paragraph implies that there is a question mark over the reliability of FCU's or their reaction to negative 'G' in civil usage. Either there was or was not reason to suspect that the FCU's may have reacted abnormally to a pitch over. BAE SYSTEMS would **suggest that the paragraph in entirety be deleted** and replaced with:

'Experience with a limited number of single engine Dart powered military aircraft (subject to much more rigorous flight envelopes) revealed some issues relating to fuel flow and excessive smoke following maladjustment or the application of unusual acceleration forces. Examination of the history of the multitude of civil Dart powered multi-engined airliners reveals that there is no evidence to suggest that similar problems were factors in this accident.'

Abstract No 2 – Page 3, Paragraph 4 *'...that all four engines were alight with the...*

In order to remove any possibility of misunderstanding of the word 'alight' BAE SYSTEMS suggest replacment with *'functioning correctly'.*

Abstract No 2 – Page 4, Paragraph 4 *'However, it was not possible to eliminate...'*

As the rudder and fin were attached at impact (para 2 of this page), paragraph 4 implies pre-determination of the causal factors involved in this accident. BAE SYSTEMS would suggest that some explanation/rationale of why the tailplane, elevators and tabs could not be eliminated as having contributed to the accident be included together with an explanation of why the tailcone and RPB together with the elevators, tabs and tailplanes remain missing.

Abstract No 2 – Page 4, Paragraph 6 *'A section of the starboard elevator...'*

BAE systems suggest that this paragraph be included in the rationale statement as suggested above in order to prevent over emphasis and imply prejudgement.

Abstract No 2 – Page 5, Paragraph 3/4 *'The electrical system was very carefully...'*

The point of these paragraphs is surely to report that a thorough investigation of the electrical system was carried out in 1970. The relevance of the British (Eagle) aircraft accident is uncertain. BAE SYSTEMS would suggest that the paragraph be rewritten as follows:

" The electrical system was very carefully evaluated during the original investigation as a result of a subsequent accident in August 1968 in which an aircraft was lost following total electrical failure. Sufficient material evidence was recovered from EI-AOM to establish that there was both AC and DC power on the aircraft at impact. This finding, together with the good visual weather conditions, make any electrical system causal factor extremely improbable."

Abstract No 2 – Page 5, Paragraph 7 *'The team believe that a qualified crew...'*

BAE SYSTEMS suggest that an explanation/justification of this statement is included in the report. At least one a/c has been seriously damaged in recent years through the crew unknowingly countermanding by physical input, a normal but engaged autopilot.

Abstract No 2 – Page 6, Paragraph 1, Line 1 *'...has had its share of door defects and separations.'*

BAE SYSTEMS suggest **deletion of the words** *'its share of.' These words are meaningless in the context of the whole sentence.*

Abstract No 2 – Page 6, Paragraph 1, Line 2 *'... which unfortunately only cover the last...'*

The source of these occurrence reports needs to be clarified in the report. BAE SYSTEMS offered assistance to the investigating team to search archival records for associated data but the offer was not taken up.

Abstract No 2 – Page 6, Paragraph 1, Line 3 *'... service, shows only some 20 reports of door problems, non-serious...'*

BAE SYSTEMS suggest that in order to avoid confusion as to the seriousness or otherwise of the reports identified by the team, the phrase above should be re-written to state:

'...service shows ~~some~~ 20 reports, all non-serious...'

Abstract No 2 – Page 6, Paragraph 1, Line 5 *'... that, reportedly, following early Viscount...'*

BAE SYSTEMS are concerned that the phraseology of this sentence is extremely misleading and casts doubt over the credence of its policy of active support to maintain the aircraft's airworthiness throughout its entire service until its formal removal from the civil register in 2000.

BAE SYSTEMS or its forerunner companies introduced many modifications and covering PTL's over the years to the aircraft, some as a result of incidents in service and others in order to introduce product improvements. The door operating and indicating systems are no different. BAE suggest therefore that the report be amended to **delete the word** *'reportedly'* and add the words *'and indicator flags'* to follow micro-switch contacts (line 6) in order to reflect more accurately the responsiveness of the company.

Abstract No 2 – Page 6, Paragraph 4 *'On the question of consequences of...'*

Under the Terms of Reference (ToR) of this enquiry (paragraph c – examine all available records in relation to investigations of incidents and accidents involving Vickers Viscount aircraft), BAE SYSTEMS would suggest that this paragraph falls outwith the ToR and **should therefore be deleted in its entirety**.

Abstract No 2 – Page 6, Paragraph 5 *'... Another reported incident concerned a Turkish...'*

Deletion of the previous paragraph will render the opening sentence of paragraph 6 obsolete. BAE SYSTEMS suggest that the opening sentence be rewritten as follows:

' There is little data regarding the effects of such a strike relevant to the Viscount. One reported incident however demonstrates that a Viscount aircraft, which lost a forward cabin door in flight, suffered damage to both propellers on one side and reportedly auto-feathered. It should be noted however that the sudden power loss on one side did not result in a loss of control and the aircraft recovered and landed safely.

Abstract No 2 – Page 6, Paragraph 6, Line 4 *'This is indicative of a port side...'*

The fact that the 18 inch section of the port elevator spring tab was found washed up on a beach, remote from the accident site may imply that there was some form of progressive failure of the empennage, however, it is not certain. The tab, whilst it could not float, was tangled in seaweed and extracts from the investigative notes from the original investigation make it clear that the strong currents and tides in the area are capable of carrying large and small components many miles from the scene of impact. It is feasible therefore, that the tab originated at the impact site and drifted, tangled in seaweed, to the beach over a significant period of time. The original accident files held by BAE SYSTEMS detail several searches of the beaches for wreckage in the immediate period following the crash. In all cases, nothing was found.

Abstract No 2 – Page 7, Paragraph 3, Line 4 *'This actually happened in the loss of a Convair...'*

See Abstract No 2 – Page 6, Paragraph 4 above regarding Terms of reference. BAE SYSTEMS suggest that reference to the Convair 580 **should be deleted in entirety** as it has no relevance to the Viscount.

The remainder of the paragraph **should also be deleted** as it is contradictory in that, the first sentence states that wing failure will occur if a major part of the Viscount empennage becomes separated from the aircraft whilst the last sentence reports that neither the Viscount involved in the 'birdstrike incident' nor EI-AOM suffered from this problem

Abstract No 2 – Page 7, Paragraph 4, Line 6 *'...over the Irish Sea in the month of July'*

July in which year?

Abstract No 2 – Page 8,

General comments.

Whilst reference to the Vanguard is strictly outside the ToR for this investigation, its common ancestry with the Viscount is allowable in this report. Reference to the Boeing 747 accident **is clearly irrelevant to this investigation and should be deleted**. One could question the relevance and purpose of detailing the number of souls lost in the Vanguard and other accidents detailed on this page. It has been stated earlier in the paragraph that the accident was fatal. This sort of detail clearly causes prejudice with regard to Vickers projects and is irrelevant in the context of an engineering investigation. BAE SYSTEMS recommend therefore that reference to the number of souls lost **should be deleted.**

Abstract No 2 – Page 8, Paragraph 3 *'A short message was received...'*

What is the relevance of this statement? Given that the summary to this section of the report states that 'It is difficult to connect a possible bulkhead failure with the loss of EI-AOM', BAE SYSTEMS fail to appreciate why reference to the communication is meaningful in this case.

Abstract No 2 – Page 8, Paragraph 4, Line 3 *'It appears that ... a blocked drain hole which...'*

Why was the drain hole blocked? An explanation of the cause may be helpful.

Abstract No 2 – Page 8, Paragraph 4, Line 4 *'The inspections carried out were clearly inadequate'*

Who carried out these inspections? Maintenance or manufacturing and what actions were put in place to prevent recurrence?

Abstract No 2 – Page 10, Paragraph 3 *'Tail plane spar including... and Tail plane centre section top...'*

This statement whilst correct in 1972 does not reflect that the mandatory life limits depended upoon the modification state of the aircraft as defined in PTL 182.

Abstract No 2 – Page 10, Paragraph 5 *'A life of 12000 hours was introduced in 1971 for...'*

In order to present a more complete picture with regard to the lifing of the subject area of the aircraft BAE SYSTEMS suggest the inclusion of the following words to follow '1971':

'...following an investigation into the failure of an elevator spring tab spigot on an Austrian Aircraft. Prior to the investigation, the spigot and associated torque tube did not have a retirement life limit but was subject to overhaul and inspection at 12,000 flying hour intervals. Subsequently, following an accident to an Indonesian Viscount in 1980, the life of the spigot was reduced further to 3000 flying hours. In addition to re-lifing of the spigot, NDT inspection of the tailplane spar top root end fittings was also mandated.'

Abstract No 2 – Page 10, Paragraph 6 *'Of more interest is an accident in...'*

See General Comments above (Abstract No 2 – Page 8,). Additionally no comparison of the modification states of the aircraft concerned has been carried out as part of this review. Any similarity between EI-AOM and the Columbian aircraft cannot therefore be assumed. In fact, BAE SYSTEMS have no knowledge of PTL127 (which addresses this particular problem) being carried out in Columbia. Whilst the information presented may be of interest to the investigators in suggesting possible routes of enquiry they are **irrelevant within the context of this accident and report and should be deleted.**

Abstract No 2 – Page 10, Paragraph 7 *'In February 1968, a large...'*

As stated above, no comparison may be drawn between EI-AOM and the aircraft discussed in this paragraph due to possible differences in the modification state. Whilst the information presented may be of interest to the investigators in suggesting possible routes of enquiry they are **irrelevant within the context of this accident and report and should be deleted.**

Abstract No 2 – Page 10, Paragraph 11 *'Four Viscounts are known to have been lost...'*

No explanation of this statement has been made. Which areas of the Viscount were subject to fatigue and at what modification state were the applicable aircraft?

Abstract No 2 – Page 11 *'With respect to EI-AOM...'*

The review team had the opportunity to review the files associated with the investigation into the PK-IVS accident in 1980. It is strange therefore that, failure of the tailplane spigot due to excessive usage beyond its overhaul/Inspection periodicity of the day (i.e 12000 hours) is not reported as a possible factor, nor, backlash and flutter (which the report details as a causal factor in this accident) due to maintenance as a factor in the fatigue mechanism. BAE SYSTEMS recommend for the sake of completeness that all possible factors and their causes be detailed.

Abstract No 2 – Page 12, Paragraph 6, Line 6 *'...would be sufficient to bold type C...'*

BAE SYSTEMS suggest the **deletion of the words** *'bold type C'*.

Abstract No 2 – Page 12, Paragraph 7 *'It is noted that Conclusion 7 of the 1970 report...'*

Clarification of the source of this statement should be given i.e. *'Conclusion 7 of the 1970 report into the accident to EI-AOM.'* Failure to provide this clarification may mislead the reader to think that the elevator and tab detached from the aircraft during Indonesian accident (PK-IVS) in a similar manner to that of EI-AOM. The separation sequence for PK-IVS may be reasonably certain from examination of the wreckage whereas, any separation scenario for EI-AOM must be mere conjecture given that the critical parts of the empennage were not recovered.

Abstract No 2 – Page 12, Paragraph 9 *'A tab free play inspection was unlikely to have...'*

Was the tab free play inspected by Scottish Aviation or, the previous owner KLM, and what was the result of the check?

Abstract No 2 – Page 12, Paragraph 10 *'...stressing the importance of backlash checks.'*

For completeness, BAE SYSTEMS suggest the inclusion of the following phrase to follow '...backlash checks':

'...together with reducing the life of the spigot to 3000 flying hours and the introduction of a specific NDT inspection of the tailplane spar top root end fittings.'

Abstract No 2 – Page 13, Paragraph 2 *'The spigot fitting is a small steel ¼ inch spindle...'*

BAE SYSTEMS suggest that the word *'small'* be **deleted from this sentence.** The fitting is normal in proportion to those fitted in other aircraft of a similar age and technology and the use of the word is misleading to the reader.

Abstract No 2 – Page 13, Paragraph 2 *'...pivot point in the drive mechanisms.'*

For completeness, BAE SYSTEMS recommend the inclusion of the following sentence after '... *mechanisms.'*

'Following the 1980 accident (PK-IVS) an Optional modification was introduced (FG2166) to increase the spigot diameter to 3/8 inch.'

Abstract No 2 – Page 13, Paragraph 3 *'Although only two spigot failures...'*

This paragraph is misleading in that whilst the report is correct in stating that from 1971 there was a 12000 hour retirement life in place for the spigot and associated torque tube, it does not report that prior to the introduction of the 12000 hour retirement life there was a clearly defined 12000 hour overhaul/inspection requirement. Post 1980, the spigot was allocated a revised life of 3000 hours.

The paragraph also states that for most of the service life of the Viscount, there was no official mandatory reporting system. Whilst this statement may be true, examination of the manufacturers service history and defect investigation files has failed to reveal further incidents of spigot failure. It is misleading therefore to connect within the report, the fact that the CAA did not have a mandatory reporting system in place for the Viscount and the fact that that reporting system only contains two reported cases of spigot failure.

Abstract No 2 – Page 14, Paragraph 4 *'A check of all the material available...'*

This paragraph is extremely misleading. The 1999/2000 Review of Files highlighted that only one card from the 2.04 maintenance check was found and that the content of the works cards could not be verified. The basis of all maintenance arguments was a recollection that 'no defects were carried forward.' And whilst this statement cannot be doubted, human error in maintenance are not unknown. The statement that a check of all material available provided no evidence, or even a suggestion that any omissions or errors ... could have contributed in any way to the accident... is clearly unsafe.

Abstract No 2 – Page 14, Paragraph 5 *'...system of the aircraft we cannot be even reasonably sure that non existed...'*

BAE SYSTEMS suggest that the words *'even reasonably'* are **superfluous and should be deleted.**

Abstract No 2 – Page 15, Paragraph 5 *'Service documents classified Mandatory...'*

This paragraph is misleading. It implies a difference in applicability between CAA Airworthiness Directives (AD's) and company issued/ CAA mandated Service Bulletins or Preliminary Technical Leaflet's. The CAA issued AD is only applicable to UK registered aircraft and is not considered Mandatory in other countries. It is usual nowadays however that an AD issued by the CAA will be mirrored by other aligned Airworthiness Authorities and similarly, an AD raised by a foreign Airworthiness Authority will be mirrored by the issue of a CAA AD.

Abstract No 2 – Page 15, Paragraph 6, Line 3 *'As an example, the Australian Dept...'*

This example is not relevant to this investigation and is prejudicial towards BAE SYSTEMS. BAE SYSTEMS request the **deletion of this example.** In addition the word *'forth'* should read *'fourth'*

Abstract No 2 – Page 15, Paragraph 7, Line 5 *'This should not surprise or alarm...'*

BAE SYSTEMS suggest the inclusion of *'modern'* between *'current'* and *'airline'*.

Additionally, BAE SYSTEMS suggest the inclusion of the following sub paragraph within paragraph 5:

'The CAA have actually underwritten the series 800 Life Extension report LER/VIS/800 conducted in 1988 which extends the aircraft's life to 75000 Full Stop Landings or 45 years with additional inspections modification embodiments and reduced fuselage pressures.

Abstract No 2 – Page 15, Paragraph 8 *'A significant number of PTLs and ADs on the...'*

BAE SYSTEMS consider that the number of PTL's and AD's issued against the Viscount aircraft were no more significant than the number of ADs etc issued against contemporary aircraft of the same design era.

This fact should be clearly detailed in the report in order to ensure that the reader receives a balanced and unbiased overview.

Abstract No 2 – Page 15, Paragraph 9 *'Significant inspection, retirement, modification...'*

The previous paragraph reports that there were a significant number of PTL's issued relative to structural problems with the Viscount wings, fuselage and tailplanes. Paragraph 9 only states that *'Significant inspection, retirement, modification and other action was taken with respect to the tailplane spar cap and attachment fittings and elevator spring tab control linkage.'* This statement is clearly misleading and should be amended to reflect that similar action was also introduced for the wings and fuselage together with all of its systems, and not the tail sections in isolation.

Abstract No 2 – Page 16, Paragraph 1 *'Other problems related to door...'*

See comment above relating to action taken to maintain the airworthiness of the aircraft and all its systems

Abstract No 2 – Page 16, Paragraph 2 *'It is impossible to be precise about...'*

The purpose and meaning of this paragraph is unclear. Is it attempting to state that no conclusions regarding the cause of the accident can be drawn or, that the actions were introduced by the manufacturer and the airworthiness authorities to rectify problems that revealed themselves during subsequent investigations sometimes years remote from the accident to EI-AOM.

Abstract No 2 – Page 17, Paragraph 1, Line 1 *'...evaluation of the circumstances sub providing...'*

Delete spurious word *'sub'*.

Abstract No 2 – Page 17, Table 1 *'Of more interest is an accident in...'*

The probability of a door strike, given that it was not unknown during the early service history of the type, cannot have a probability of *'Improbable'*. BAE SYSTEMS suggest that this probability should be amended to read *'Possible'*.

Both the original report and with the conclusion drawn on page 9 of this report state that *'There is no history of any such problem and nothing to suggest such a scenario'* and, *'It is difficult to connect a possible bulkhead failure with the loss of EI-AOM'*. In light of the apparent contradiction between these statements and the probability as detailed in the table, BAE SYSTEMS suggest that the probability of metal corrosion should be amended to read *'Improbable'*

Abstract No 2 – Page 19

BAE SYSTEMS request the inclusion of details of the life extension work carried out during 1987/88 which culminated in CAA approval for the Viscount life to be extended to 75000 Full Stop Landings or 45 years with the provision for additional inspections and modified and controlled flight profiles.

Abstract No 3 – Page 20, Paragraph 4/5/6 *'A manually controlled trim tab...'*

These paragraphs are repeated of paragraphs 1, 2 and 3 and **should be deleted.**

Abstract No 3 – Page 21, Paragraph 7 *'A section of the starboard elevator trim tab was...'*

The original 1970 report stated that the failure pattern of the recovered tabs from EI-AOM bore typical evidence of impact failure. This fact should be reported. Additionally, as question has been raised as to the possibility that the tab could have migrated from the impact site under the action of tides and storms in the six months between loss and discovery, BAE SYSTEMS suggest the inclusion of *'..., washed up on a beach, ...'* following *'...seven miles away.'*

Abstract No 3 – Page 22, Paragraph 5, Line 2 *'metal fatigue which in a practical flight structure...'*

BAE SYSTEMS suggest removal of the word *'practical'*, as in this context it is meaningless.

Annex B3 – Page 23, Paragraph 2 *'Unfortunately, the state of the art on the 1950's...'*

The word *'on'* above should be substituted with *'in'*.

Further, the report frequently mentions Vickers. It should be explained in the introduction to the report that Vickers were the OEM at the time of the accident.

The statement 'are not much better' is arguable and contentious. Known exercises such as Operational Load Measurements (OLM's) provide realistic loads.

Finally, Safe Life structures are still allowed in the military environment. The report should be amended to clarify that they are not now allowed in the certification of new **civil** transport category aircraft.

Annex B3 – Page 23, Paragraph 3, Line 3 *'...spectrum of the loads expected in service'*

BAE SYSTEMS suggest that the words *'...nor were required to'* be included after *'expected in service.'*

Annex B3 – Page 24, Paragraph 3, Line 2 *'with over 5000 landings (very good practice)...'*

The reason for the opinion 'very good practice' is not clearly defined. BAE SYSTEMS suggest either **clarification of the rationale supporting this opinion or, deletion.**

Annex B3 – Page 24, Paragraph 3, Line 3 *'static strength tests (not good practice)...'*

As covered above, the reason for the opinion 'not good practice' is not clearly defined. BAE SYSTEMS suggest either **clarification of the rationale supporting this opinion or, deletion.**

Annex B3 – Page 24, Paragraph 5/6

These paragraphs are repeats of paragraphs 3 and 4 on page 23 and **should be deleted.**

Annex B3 – Page 24, Paragraph 7, Line 4 *'This is very dangerous...'*

The statement that finding corrosion to the tailplane top spar boom is very dangerous is not true. The inspection, designed to find such problems, succeeded. As intended and the problem was presumably rectified. The report does not clarify whether the spar boom concerned was a new item or, had been salvaged from another aircraft. The statement that the component had been fitted only 2076 hours previously is misleading and possibly gives a false impression to the reader. BAE SYSTEMS suggest that prior to inclusion of this paragraph in the final report, further research should be carried out to determine the full facts of the situation.

Additionally, corrosion is mainly time related and not flying hour related. Reference to the flying hours of the subject aircraft **should therefore be deleted.**

Annex B3 – Page 25 *'the unconservative nature of life estimations...'*

Whilst the content of this page may be interesting to the reader with regard to the limitations of the safe-life principle, it has no relevance to the accident in question. There was no evidence from the material recovered from the wings, fuselage or fin and rudder to suggest that fatigue or other life related problems had been causal in this accident. The tail section was not recovered for analysis. BAE SYSTEMS suggest therefore that other than with the exception of the first paragraph suitably rewritten, the entire page be **deleted as irrelevant.**

Annex B3 – Page 25, Paragraph 7 *'Although designed in accordance...'*

Whilst this statement is basically correct, BAE SYSTEMS suggest the inclusion of the words *'like it's contemporaries'* to follow the word *'Although'* at the beginning of the sentence.

The comments made in this paragraph should be tempered with the data gained form the Life Extension Review conducted by BAE SYSTEMS for each series of Viscount between 1986 and 1989. A thorough Fatigue & Damage Tolerance Evaluation (FDTE) assessment was undertaken of the complete airframe using Finite Element Modelling (FEM) derived fatigue stresses across approximately 200 locations.

Annex B4 – Page 26, Paragraph 6, Line 1 *'However, full mass is to heavy...'*

Incorrect use of the word 'to', BAE suggest replacement with 'too'. In addition there is a spurious space between *'heavy'* and the comma.

Annex B4 – Page 26, Paragraph 8, Line 1 *'A wing has only one frequency...'*

BAE SYSTEMS consider this statement to be technically incorrect. A wing is similar to any other part of the aircraft and has many inherent structural frequencies of bending and twisting etc. This statement therefore requires amendment to correct the discrepancy noted above.

Annex B4 – Page 26, Paragraph 8, Line 4 *'...and elevator rotation can interact can cause...'*

BAE SYSTEMS suggest the words *'can cause'* be replaced with *'and'*.

Annex B4 – Page 26, Paragraph 9, Line 2 *'Their art is to...'*

BAE SYSTEMS suggest **deleting the *words*** *'Their art is'* in order that the paragraph reads as follows;

'During the aircraft design process, specialist flutter engineers evaluate all possible interactions over a wide range of frequencies in order to ensure that critical frequencies do not merge thereby eliminating the possibility of dangerous interactions.'

Annex B4 – Page 27, Paragraph 1 *'Once the aircraft is in service...'*

This paragraph attempts to highlight the sensitivity of the controls. No explanation or conclusions are drawn as to the history of EI-AOM in this respect i.e. had the elevators or any of the tabs been subject to change, repair or repainting during its Aer Lingus life and what action was taken to eliminate any backlash in the system. In light of the conclusions drawn by this report BAE SYSTEMS consider that this information is crucial to the causal findings.

Annex B4 – Page 27, Paragraph 2, Line 2 *'...meticulous design, maintenance of allowable free play...'*

The avoidance of flutter depends on several maintenance issues, not just minimising backlash. Of much greater importance is the issue of mass balancing controls. This is particularly important after repair or repaint. The previous paragraph does summarise all the technical issues quite accurately, but then goes on to highlight 'free play'. This indicates a pre-judging of the cause of this accident. BAE suggest that this paragraph should be amended to detail all the possibilities.

Abstract No 4 – Page 28, Paragraph 5.1 *'The formal accident report (AAP)...'*

Whilst this paragraph indicates that the original investigation was deficient in respect of the witnesses, no explanation is given as to what material was missing and in which areas the original investigation effort and report were delinquent. The conclusion is subjective and not based on factual information.

Abstract No 4 – Page 28, Paragraph 5.2 *'An exhaustive study of witness statements...'*

It is suggested by BAE SYSTEMS that the 'study' claimed is a reinterpretation of the original evidence to fit a pre judged scenario. As stated previously, any evidence gained from statements made 33 years after an accident must be viewed as extremely unreliable. Similarly, any further evidence given by the original respondents must be viewed as unreliable given the amount of media coverage that has surrounded this case since 1968.

In addition it is noted that the conclusion asserted in paragraph 5.2 has not been explored in any of the forerunner abstracts. It is suggested later in the report Abstract 5 but is in the opinion of BAE SYSTEMS based on speculative and unsafe assumption.

BAE SYSTEMS suggest therefore that this **paragraph is deleted** or, amended as follows:

'An exhaustive study and reinterpretation of the original witness statements was carried out supported by further witness interview. New witnesses were sought 33 years after the event and some new evidence was obtained. Whilst this kind of evidence is acknowledged to be potentially unreliable, a reanalysis of the collected evidence has led to a conclusion that the flight path of the aircraft was quite different from that detailed in the 1970 report.

Abstract No 4 – Page 28, Paragraph 5.4/5.5 *'Two separate scenarios...' and 'It was concluded that...'*

Both these paragraphs are restatements of paragraph 5.2 and **should therefore be deleted**. Any pertinent detail should be added to 5.2. (See 5.2 for details of BAE SYSTEMS concerns). Further, conclusion 5.4 claims that because the ATC tape is no longer available, then this evidence must be unreliable or untrue. Worryingly, conclusion 5.4 claims that 'fact' recalled from 30+ years previously must be accurate and true (despite being subject to media contamination and 'collective memory' for that period of time). Finally, no explanation is given for the conclusion drawn in paragraph 5.5 that the original investigation team made a mistake with regard to the aircraft flightpath. An explanation of the conclusion rationale is required.

Abstract No 4 – Page 28, Paragraph 5.7, Line 2 *'...contributed in any was to the accident.'*

BAE SYSTEMS suggest replacement of the word *'was'* with *'way'*.

Abstract No 4 – Page 28, Paragraph 5.8 *'Serious errors in Aer Lingus maintenance...'*

If this paragraph claims that the missing aircraft maintenance records are indicative of a less than ideal work culture, BAE SYSTEMS suggest that conclusion 5.7; *'there is no evidence to suggest that maintenance errors could have contributed in any way to the accident'* is misleading; especially when the maintenance records (which could confirm such a statement), were not made available for review at the time of the original investigation or, subsequently. In this light, BAE SYSTEMS suggest that a maintenance error or omission during the 2.04 Inspection visit may have contributed to the accident i.e. backlash at maximum limits.

Abstract No 4 – Page 28/9, Paragraph 5.9 *'With respect to the final flight...'*

As covered above, the conclusions drawn here is misleading at best and possibly totally incorrect conjecture. It has been drawn from a reinterpretation of original witness statements and new statements made 33 years after the event. BAE SYSTEMS suggest that **conclusion 5.9 be deleted in its entirety.**

Abstract No 4 – Page 29, Paragraph 5.10 *'At three stages during the flight...'*

BAE SYSTEMS consider that it is inconceivable that this type of vibration, in an aircraft of this type, with at least two engines fully functional, would create enough noise to be identified by witnesses on the ground.

The conclusion does not take into account the fact that a Irish Air Corps Dove aircraft equipped with twin Gipsy Queen 70 (Supercharged) engines was in the vicinity of Old Parish, Tory Hill and Fethard immediately following the accident, carrying out a search for the missing Viscount. It is possible that confusion exists between the Viscount and the Dove and the sound of a piston engine and a Dart turbine engine. It is the opinion of BAE SYSTEMS therefore that this conclusion is **misleading and conjectural and as such, should be deleted in its entirety.**

Abstract No 4 – Page 29, Paragraph 5.11 *'Factors considered to have influenced...'*

Discrepancies exist between conclusion a) and the impact evidence in that, this report states that the aircraft impacted left wing low, whereas this conclusion states that the aircraft suffered right wing low departure, supported in the original 1970 report by material evidence from the wing structure.

Conclusion d) claims that a progressive break-up and separation of the elevator spring tab occurred followed by the port elevator and finally the port tailplane. No proof or break-up sequence has been proposed (linked to time frames) that would assist in the understanding and acceptance of this scenario. In addition, progressive break-up is inconsistent with continuing flutter. Had the tab been responsible for flutter, separation of the originator would effectively result in cessation of the flutter condition. This scenario is addressed fully in Abstract No 2 – Page 2, Paragraph 3 above.

Finally, Whilst the event was understandably catestrophic, flutter which this report classifies as 'severe' would in the opinion of BAE SYSTEMS not allow survival of the aircraft for over 30 minutes.

Abstract No 4 – Page 30, Paragraph 5.12 *'The consequences of a 6 Hz tab free induced...'*

This conclusion draws its evidence from the investigation into Viscount PK-IVS in August 1980. Many differences exist between these 2 accidents in that:

- PK-IVS did not suffer a control upset until final separation of the tailplane
- PK-IVS remained in contact with the ground and other aircraft during the entire scenario.
- The rear pressure bulkhead was contained within the fuselage wreckage area
- The tailcone, Fin, rudder and tailplanes were all found close to the accident site.
- PK-IVS impacted inverted

In light of these major differences between the accident scenarios, BAE SYSTEMS feel that enough doubt exists in the scenario offered by this report, that an alternate scenario should be evaluated. This scenario is offered above Abstract No 2 – Page 2, Paragraph 3.

Abstract No 4 – Page 30, Paragraph 5.14 *'Report of a "mist" enveloping the aircraft...'*

The 1999/2000 review of files report addressed this very scenario and suggested, that the enveloping cloud or clouds' may have been the result of condensation forming over the wings of the aircraft following a high speed descent and recovery. Neither this conclusion nor the report preceding it whilst dismissing the original conclusion does not explain why. **BAE SYSTEMS suggest that where original conclusions, arguments are dismissed or amended, then adequate reason for the teams dismissal or amended must be presented.**

Abstract No 4 – Page 30, Paragraph 5.16 *'The accident history of the...'*

This statement is clearly untrue as the CAA permitted Viscount aircraft to continue operating under a valid type certificate, until the last aircraft was withdrawn from the UK register along with the type certificate in 2000. This withdrawal was for commercial reasons without any hint or indication of any acceptability issues in relation to the accident or safety history of the Viscount type.

This statement regarding the non-acceptability of the Viscount by comparison to today's standards is therefore not true. BAE SYSTEMS suggest that the paragraph be deleted in its entirety.

Abstract No 5 – Page 31, Paragraph 3 *'So, in addition to the witness statements...'*

The report must identify how many new witnesses were found and explain the problems with relying upon witness statements both at the time and subsequently 33 years after the event.

Abstract No 5 – Page 40, Line 4 *'...this was heard, and the separated part...'*

It is mere conjecture that something fell from the aircraft and was observed. The object in the water seen floating after the crash may have been part of the wreckage. The claim that the noise of an item separating from the aircraft was heard is unsustainable. No testing or learned opinion has been presented to justify the claim or detail the noise level to be expected during component separation.

Abstract No 5 – Page 41/42 *'So, in addition to the witness statements...'*

Whilst a great deal of interpretation has obviously been carried out with regard to the timing suggestions proposed, it can only be a hypothesis. The reliability of the statements of the new witnesses is doubtful and the original witness statements lead the investigators in the 1968/70 investigation to a different conclusion. BAE SYSTEMS suggest that where differences exist between the proposals or conclusions drawn by this report and the 1970 or 1999/2000 reports, then explanation of the rationale should be included. It is not acceptable to reinterpret the data from the original investigation without sound reasoning and explanation.

Review of the timings proposed gives confusion e.g. in paragraph C3.1 the report claims that the aircraft left Crobally at 11:55 or 11:50 and arrived at Ballytrissane about 11:45 (5 minutes earlier than it left) and the last 4 timings are all subjective.

On page 42, *'The crash is located 50 nautical miles...'* the report quotes the most probable hour for the crash as being 11:14, which the report claims is consistent with witness statements. Following a thorough review of all the original witness statements it can be stated that none time the crash at 11:14. BAE SYSTEMS suggest that this is a typographical error and the time should be amended to 12:14.

Should the information presented on Page 41 be the result of a hypothesis which suits a prejudged scenario then BAE SYSTEMS suggest that **entire page be deleted as irrelevant and unjustified.**

In paragraph C3.2 there are two references to the aircraft being disabled. There is no evidence to support **this statement and as such it should be deleted.**

Abstract No 5 – Page 43, Paragraph C4.1.1, Line 12 *'...with propeller Nr 3 looking "bent" (feathered).'*

The implication that a bent propeller blade is not consistent with a feathered blade. It is suggested therefore that the interpretation ***'(feathered)'*** **should be deleted.**

Abstract No 5 – Page 44, Paragraph 1 *'The others remain possible causes;...'*

This paragraph does not make sense grammatically and it is suggested that it be rewritten.

Abstract No 5 – Page 44, Paragraph 2 *'As a conclusion, **the probable cause is this one**...'*

This paragraph does not make sense grammatically and it is suggested that it be rewritten.

Additionally, the conclusion drawn in the second bullet point is untrue. The Dart engine in civil usage as detailed earlier in the report has no history of sensitivity to –ve G. This implication is based upon usage (unsubstantiated) in the military environment. **BAE SYSTEMS recommend that this conclusion be deleted unless substantiated fully.**

Abstract No 5 – Page 45 *'A leakage of pressurised cabin air through...'*

This scenario has been effectively eliminated earlier in the report by stating that there is no path for cabin air into the tailplane. As such this **conclusion is invalid and should be deleted.**

Abstract No 5 – Page 45 onwards – General comments

Whether this document has been translated from French to English or not for the purposes of the opportunity to comment is unknown. What is apparent however, is that much confusion is present with regard to the grammar and sense of this section of the report. It is suggested therefore that Abstract 5 be rewritten entirely to ensure that clear discourse is obtained and that the conclusions drawn have not been affected by any translation.

Much of Abstract 5 and the conclusions drawn are based on assumptions and reinterpretation (without justification) of witness statements. As such, no credence can be placed on these conclusions and they should be deleted unless justification can be provided.

The reports reliance on witness statements (acknowledged by Cranfield University during a discussion with BAE SYSTEMS to be unreliable for many reasons) and the interpretation of those statements to validate a prejudged conclusion, by assumption, discredits any conclusions this report may draw.

Abstract No 5 – Page 52, paragraph 1 *'conversation (between the Captain and the Co-pilot)...'*

No evidence of this conversation can be found from examination of the ATC tapes transcript contained in the 1970 report. What basis does the review team have for interpreting the evidence of Military Radio Interference as a conversation between the pilot and Co-Pilot?

Abstract No 5 – Page 53, paragraph 1 *'...church that its sound was enormous.'*

The word enormous should be included in quotes.

Abstract No 5 – Page 53, paragraph 5 *'...the wings and tail all red and looking funny.'*

This statement is offered to support the hypothesis that the aircraft was having control difficulties yet no explanation of the red wings and tail is offered in the conclusions to this report.

Abstract No 5 – Page 54, paragraph 1 *'my...brother...told me to look...'*

This statement is offered to support the hypothesis that the aircraft was having control difficulties yet no explanation of the red wings and tail and possible fire is offered in the conclusions to this report

Abstract No 5 – Page 57, paragraph C4.5.2 *'Explanatory Assumptions'*

Many conclusions and Explanatory Assumptions have been offered throughout Abstract 5. Many of these assumptions have no basis in fact and contradict evidence from the original investigation provided in answer to the questions posed by the review team e.g. The report claims that the 'mist' surrounding the aircraft as described by a witness, was in fact escaping fuel. This conclusion is based on the fact that the refuel/defuel valve, when recovered, showed evidence that it was partially open. BAE SYSTEMS, in answer to a question regarding the refuel/defuel valve position, provided evidence that the valve condition could have moved during impact. Even presuming that the valve had been left in the partially open position by the maintenance crew, then leakage from the system was still improbable as both the refuel and defuel pipelines upstream of the refuel/defuel valve were equipped with non return valves to cater for this possibility. Whilst this scenario may be considered, the report should detail the evidence fully in order eliminate it as a possible factor.

Abstract No 5 – Page 59, paragraph C4.6.1 *'The conclusions of the 1970 report...'*

This conclusion apparently discounts the original findings of the 1970 report regarding **material evidence** which stated that the aircraft impacted nose and right wing down. The 1970 report provided justification to explain the downward bending of the left hand wing and the upward bending of the right hand wing and disruption of the right hand fuselage side. The Rolls Royce examination of the engine cowlings and mountings also concluded that the right hand wing impacted first and the internal evidence of shaft bending also indicated some right hand bending indicative of right impact. Admittedly, there was some contradictory evidence provided by Rolls Royce and Dowty but no explanation is offered in this report as to why, if the control departures would be expected to be right wing down the aircraft should have impacted left wing down i.e. opposite to that expected if loss of the port tailplane had occurred prior to impact. This report claims that the right wing down attitude reported in 1970 is a spelling mistake. This is clearly supposition not substantiated by fact. **The conclusions offered by this section of the report is therefore unsafe and should be deleted.**

Abstract No 5 – Page 60, paragraph C4.6.1 *'However operating conditions at the time...'*

This paragraph is confusing. It claims to be making conclusions yet argues that *'it is probable...'* The logic of the paragraph is also in error and correction of witness statements should be avoided. It may be argued that the Spanish sailor could not distinguish between the right hand wing or left hand wing but it is likely that, given the distance of 2 to 3 miles form the impact site, and the length of time the aircraft was visible i.e. last 3 metres of its descent, that the witness was providing evidence that he thought the interviewer wished to hear. This is an acknowledged weakness with regard to witness statements (however well meaning) and further justification for disregarding any conclusions drawn upon such statements.

The conclusion in this paragraph again does not explain how an aircraft with a possible loss of the port tailplane or, a substantial part of this component can impact the sea in a left wing down attitude. It is to be expected that any loss of down force on the port side of the empennage would result in a right hand wing low, nose down spiral or dive. The position of the ailerons following retrieval of the wreckage provided no conclusive evidence as to the position of the roll controls (evidence found indicated aileron position anywhere from starboard aileron half up to fully starboard aileron down). Disruption of the fuselage and wings during impact may have had a significant effect upon any witness marks found.

Abstract No 5 – Page 63, paragraph C4.6.13 *'However operating conditions at the time...'*

This section is a repeat of that on page 60 and should be deleted

EXP'AIR

De : Williams, Gareth <gwilliams@dap.dowty.com>
À : <expair@nocs.fr>
Envoyé : vendredi 30 novembre 2001 10:44
Objet : Air Lingus Viscount EI-AOM Accident Report

Thank for the Electronic copy of your report and subsequently the mailed copies of it's supplements. Ray Barnfield has read the electronic copy fully and here are his suggestions for your consideration,

Page46 A note should be added above the table stating that "where 7 is the number of considered causes of the accident".

Page108 Change 1st sentence (3rd line) "oil pressure in the torque meter" change to "oil pressure supplied to the torque meter"

Page 153 Paragraph 6.17 Change 3rd statement to " It is possible that the sensitivity to high negative accelerations, of the engine fuel control unit and oil pressure supply to torque meter , were contributory factors."

Page 155 Typographical error "RECOMMENDATIONS"

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5 - DEC. 2001

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FROM THE CHIEF EXECUTIVE

15 JAN. 2002

14th January, 2002

Mr. John Lumsden
Assistant Secretary
Department of Public Enterprise
44 Kildare Street
Dublin 2

Re: Study of the Accident to Viscount, EI-AOM, near Tuskar Rock (March 24th 1968) by EXP'AIR S.A.R.L.

Dear John

I refer to your letter, dated the 13th November 2001 in connection with the above.

It is important to note that the original Accident Inquiry into the EI-AOM accident predated the formation of the Authority and its predecessor, the Air Navigation Services Office of the Department of Transport (ANSO).

The Authority has reviewed the draft study report. It is assumed that the draft report will be edited before publication to eliminate the errors of language that may have resulted from mis-translations.

The Authority has noted inconsistencies in the substance of the draft report and is, moreover, surprised to be the subject of a recommendation, arising from an accident which occurred more than 25 years before it was formed. This is most especially since:

- the (then) Air Traffic Control Units involved did not contribute in any way to the circumstances of this accident;

- there appears to be neither evidence nor motive for the entirely speculative inference on which the premise to support the recommendation is based; and

- there is reference to IAA operations, without any investigation of, or regard to, the relevance of current ATM practices and procedures in the Authority.

The Authority is aware that the final report will be published shortly and it is not proposed to comment lest such comments might be seen as seeking to restrict, in some way, the scope of the report on the study. It is incumbent on the Authority, however, to point out that there is a possibility that this retrospective informal investigation, conducted without any new evidence, may have the unfortunate effect of damaging the well-tested statutory aircraft accident procedures of the State.

Finally, the Authority must also point out that your Department should have regard to the fact that the reputations and rights of readily identified persons may be, unjustifiably, prejudiced and damaged by inferences in this study.

Yours sincerely

B.D. McDonnell

B.D. McDonnell
Director and Chief Executive

9 Beech Park Drive
Foxrock
Dublin 18
Ireland

13 December 2001

To: Yves Lemercier
Manual Pech
Colin Torkington

Subject: Study Report - Aer Lingus Viscount EI-AOM Accident

Gentlemen,

Thank you for sending me a copy of the above Study Report. In responding to your accompanying letter I wish to inform you that I do not agree with the following assessments and recommendation insofar as they apply to the investigation of the airframe wreckage.

Assessments: Paragraph 2.1.2, Page 13

> The wreckage examination and subsequent information was performed jointly by the Commission and the Manufacturers
>
> Their conclusions were exclusively based on the analysis of the recovered parts since the position of themanufacturers was not to open discussions on the non-recovered parts. As a consequence, no conclusions on what could have happened to the tail part were established.

Recommendation 4: Page 156

> The Investigation and Report showed some weak points----------:
> "the commision accepted that the manufacturers took in the invevestigation a position higher than that of technical advisor"----------
> ----------.

In support of my disagreement a brief resume of the persons involved and the method of conducting the investigation follows.

Airframe investigating team

Two persons were assigned to manage the investigation, an Aeronautical Inspectior from the Authority and the undersigned.

The Inspector was very experienced in operational maintence and quality control of aircraft structures and systems in general and the Visvcount in particular

The undersigned joined the Department of Transport in late 1964 as an Aeronautical Officer after spending13 years in aircraft design. The majority of that time was spent with the then U.K. Avro-Whiitwoth Aircraft Design & manufacturing Co.

Activity included:

Strudtural design and atress analysis
Fatigue and static testing of fail safe &safe life aircraft components
Fatigue and static testing of complete airframes
Inflight prototype testing to compare actual and theoritical stresses and structural behavior throughout the design enevelope
Preparation of documentation for certificate of airworthiness

I held the position of Assistant Chief Stressman during my latter years with the company.

The Investigation

The investigatiing team received the wreckage. Each item was examined, identified and to the extent practical the airframe was reconstructed. Strict control was placed on the wreckage.

The UK Accident Investigation Branch (AIB) as the State of Manufacture participated in the investigation and the wreckage was examined and discussed with experts from AIB, the manufacturer and rpersonnel involved in other aspects of the investigation. The investigation was greatly facilitated by the contacts.but it should be noted that the established method of communication with the manufacturer was through the UK AIB

The investigating team prepared a report identifying the wreckage recovered and the results of the investigation. This formed an appendix to the accident report.

The investigaion was conducted in an impartial manner and I cannot accept that the manufacturers role transgressed that of normal propriety in such an investigation.

Tailplane, Elevator and Tabs

During the investigation attention was directed to failure of one or more of the above components that may have precipitated the accident sequence taking into account operational experience, accidents and other Viscount ocurrences.. Following contact with UK-AIB and Manufaturer the investigating team concluded:

The field of possibilities is large and with so little hard evidence to work with theoretical anlysis is not considered practical at this time. In the event that fresh data becomes available which narrows the investigation this should be reviewed.

More recent Viscount Accidents\Occurrences considered in the Study Report may now make a theoretical study practical.

J. Mc Stay
Director of Aeronautical Operations (Retired)
Irish Aviation Authority

CC Kevin Humphreys
Chief Inspector of Accidents
Air Accident Investigation Unit
Department of Public Enterprise
Clare Street
Dublin 2

Sent: Saturday, December 08, 2001 6:38 PM

21 Dundanion Court,
Blackrock,
Cork,
Ireland
021 – 4292624 (H)

Subject: Tuskar Report

Des Heffernan

08 December 2001

To: Yves LEMERCIER, Manuel Pech, Colin TORKINGTON.

Re: Draft Tuskar Rock Report:

Dear Sirs,

I am Paul Heffernan's (First officer) eldest brother. The draft was sent to my sister Mary, who has asked me to comment.

I have comments of a general nature, requests as Paul's brother, and suggestions to make the report easier to read. (These may of course be already in hand in the final drafting)

GENERAL:

Firstly I would like to thank you for the opportunity of a preview and comment.

It is obvious that you have done an incredible amount of work in the time. Your findings are astounding, but seem very credible. It seems hard to accept that the original investigation discounted so many witnesses, even if they contradicted evidence in the ATC records. At last we have a scenario, which removes most of the worst theories which have circulated. It does seem to leave two major questions unanswered:

- What was original cause, that disabled the Viscount?
- What happened in Shannon ATC?

I presume there will now never be a conclusive answer to question 1. You have identified the most likely causes.

What happened in Shannon ATC, would not have affected the outcome of the crash but could have been a major contributor to the theories and rumours. It seems to need intensive investigation. This may be outside your terms of reference or areas of expertise, as you have stated. It would probably be a question for Irish authorities.

REQUESTS AS PAUL'S FAMILY:

- We appreciate the comments on the crew's performance. The second paragraph in section 6.19 (page 153 of the Report) is complimentary, but not fully correct English. I suggest that it be redrafted. The following seems to be the intention, with my suggested changes in italics, (obviously this may not be your intention, and you may wish to use other wording):

  "It may be considered a *major achievement* that the crew *was* able to keep flying this aircraft for more than half an hour with such poor manoeuvrability characteristics"

- We had always understood that the radio transmissions were made by our brother. It now seems, from the report that it was the captain who made the transmissions to Shannon. (Page 138). In another section, which I cannot find again, I seem to have read that the final transmission – 'spinning' was also made by the captain. This question has no general relevance but is obviously of great interest to our family. Can you clarify?

SUGGESTIONS TO MAKE REPORT EASIER TO READ:

I found it impossible to relate all the witness reports to the maps. The witnesses have different numbers on the maps and text. Could I make following suggestions:

- Number witnesses consecutively from 1 – 46. Use same numbers on maps and text. Make numbers on maps clearer. (I am somewhat colour-blind and found it hard to read red numbers when they were against a green background.)

- Number maps. Use map numbers in the headings for the different sections in scenario in the text.

- Highlight place names on maps which are referred to in text. I still cannot find some of the most important places.

- Identify on the maps the positions recorded at Shannon ATC and the scenario positions at the same time.

I hope these comments will be helpful. Once again many thanks to you all for your efforts.

Yours Sincerely,

Des Heffernan.

From: ERIC EVERS

To:M. Manuel Pech
Sent: Sunday, December 09, 2001 10:13 PM

Subject: Viscount EI-AOM Extracts from your Report

Dear Manuel,

Thank you very much for sending me extracts from your report pre-publication. It makes fascinating reading!

The witness statements from west of Waterford, rejected by the 1968 Enquiry, put a completely new picture on what probably happened. I, of course, knew nothing of these statements until I read your extract sent to me. I was also unaware of the behaviour of the Dart engine under sudden negative "g". From my own personal experience I would suggest that the root cause of the accident could well be that the metal rod controlling the port elevator trim tab snapped suddenly shortly after the Viscount passed 10000ft in the climb. I experienced this exact same failure when on the runway in a Canberra bomber and just about to get airborne. The control column suddenly shot forward, the nosewheel went back onto the runway and I had to make the quick decision do I abort take-off with very little runway left and a main road crossing it on the edge of the airfield or try to get airborne and sort out what had gone wrong once in the air. I quickly checked the elevators were still working by raising and lowering the nosewheel then got airborne. It was immediately apparent that the force required to move the elevator in flight was much greater than normal and on landing an elevator trim tab rod was confirmed as snapped.

The evidence of your first witness describes what would have happened if this rod on the Viscount had snapped. Stick forward suddenly, negative "g", engine stalls, auto feather, yaw to the right, spiral dive to the right losing height rapidly. Remember also that in the 1968 Enquiry Report, a taxi driver was interviewed who took the Viscount crew either to or from Cork Airport who said he overheard the crew discussing the previous flight from Manchester to Cork where they said the flight had been "very rough". This may have contributed to the weakening of the trim tab rod.

May I also offer my ideas as to why the Viscount followed the track it did following recovery from the first dive. As a pilot, my first thoughts on recovery from the dive would have been :-

1 Where am I?

2 Where is the nearest airfield where I can land?

The Viscount is seen to circle twice over the coast identifying their position. They work out that Waterford Airfield , SSE of Waterford town is closer than Cork. They set off for Waterford Airfield via Tramore, Tramore Bay and Brownston Head where they line up with the airfield heading North. Control difficulties quickly make it clear that landing at Waterford is not possible so they carry on North and try to put the aircraft down in a field near Tory Hill where they are seen by a young boy. Again this is not possible, so they head South back towards the coast no doubt hoping to find a friendly beach with enough length and width to allow them to put the aircraft down despite their control difficulties. The further degradation of the Viscount made even this impossible and they finally lose control at Tuskar.

A small point regarding your conclusion on Page113. Going into a turn would not have helped with the stick forces required to counter the nose-down pitch forces. On the contrary, it would have made the problem worse. In a turn, as the lift acts vertically to the wing and not the horizon,only part of the lift generated by the wings acts vertically to counter the weight. Going into a turn would require even greater effort to pull back on the stick to maintain height. What it does mean though is that the Viscount was very unstable laterally and the crew were faced with sudden involuntary sharp turns which they had to fight to bring the wings level again.

Finally how do you explain the Shannon R/T log just prior to handing over control to London? The log of the Shannon/London landline conversation at about 1143 local when they discuss the imminent handover of Flight 712 to London, shows that communication between Shannon and Flight 712 had been clear enough up to that point (which is about the time the Viscount was going into its first dive from 10000ft+). The only explanation is that Shannon made up the log on the assumption that 712 was transmitting "at FL170" as previously requested by Shannon and that the reception was very poor.

Apart from this conundrum, I think that at last your enquiry is getting close to explaining what really happened to Flight 712. If I can help any further please don't hesitate to ask.

Best Regards

Eric

21 January 2002

Mr. Kevin Humphreys
Air Accident investigation Unit
Dept. of Public Enterprise
25 Clare St.
Dublin 2.

Dear Kevin,

Please refer to the Study Report on the Aer Lingus Viscount EI-AOM accident which occurred on March 24th. 1968 near Tuskar Rock and compiled by Lemercier, Pech and Torkington, dated 27 Nov. 2001.

Thank you for the copy of this report. Be advised that I have no comment to make on its contents as I completely reject those sections of it which deal with Air Traffic Control.

Yours sincerely,

Vincent Toher & Co.

SOLICITORS

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VT.LM.

Our Ref.

Your Ref.

22nd January 2002.
FAX: 01-6041514

Kevin Humphries,
Chief Accident Investigator,
Air Accident Investigation Unit,
25, Clare St.,
Dublin 2.

Re: Aer Lingus, Viscount El-AOM, Accident – March 24th 1968 near Tuskar Rock, Ireland.

Dear Sir,

We have received instructions from the Operational Controller who was on duty from 8.30Z to 10.55Z on the above date.

Our Client has received a draft report dated the 27th November 2001 on the 4th December 2001, which report was compiled by Yves LEMERCIER, Manuel PECH and Colin TORKINGTON being the Cabinet D'Expertises Aeronautiques et Spatiales. We have been instructed to state that our client rejects the contents of the draft report in so far as it contradicts his own statement and the certified transcripts of the tapes.

Yours faithfully,

P.P Vincent Toher

VINCENT TOHER & CO.,
VINCENT TOHER.

22 JAN 2002