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**AIRCRAFT
ACCIDENT
REPORT
Pan Am Flight 103
Part IV**

Comparison between AAIB 2/90 and Smith AAR for PA 103



**Report on the accident to
Boeing 747-121, N739PA
at Lockerbie, Dumfriesshire, Scotland
on 21 December 1988
by John Barry Smith,
Independent Aircraft Accident Investigator**

Part IV: Comparison between AAIB 2/90 and Smith AAR for PA 103

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1. Observations:

Engine number three was the only engine to fall apart from the others; it was the only one to catch fire; and it contained ingested debris from within the aircraft.

There are confusing statements in the AAIB report regarding which engines had foreign object damage:

“...it is reasonable to deduce that a manoeuvre of the aircraft occurred before most of the energy of the No 2 engine fan was lost due to the effect of ingestion (seen only in this engine.”

“...No 3 engine, identified on site as containing ingested debris from within the aircraft,...”

A. Bomb explanation:

No explanation given for engine number three falling 1100 meters apart from the others. When the bomb explosion caused the 20 inch hole on the port side, the ejected debris went out and into engine number two but not serious enough to cause a fire, then went under the fuselage and into far away engine number three causing the foreign object damage and fire. The distance from bomb explosion hole to engine number two is about 27 feet aft and 30 feet outboard and the distance to engine number three is 27 feet aft and 50 feet outboard.

B. Shorted wiring/forward cargo door rupture/explosive decompression/inflight breakup explanation:

The major amount of ejected material from within the cabin or baggage hold, which had opened up in the starboard side in the explosive decompression, entered the nearby engine number three causing it to catch fire. A minor amount of ejected material from the small shotgun firing hole on port side went into engine number two. The large hole where the cargo door and skin used to be caused the forward fuselage section to bend to the starboard and impact engine number three causing it to break loose and fall apart from the other three engines. No explanation given for contradiction in AAIB report on which engines ingested foreign objects and when it occurred.

C. Conclusions:

It makes little sense that foreign objects ejected from a small hole on the port side would go around the fuselage and into engine number three serious enough to cause a fire.

It makes greater sense that foreign objects from the cabin or baggage hold ejected from the very large hole on the starboard side would go into nearby engine number three; and when the larger amount of ejected material went into engine number three a normal consequence of fire ensued. When the nose bent to the starboard because of the large hole where the door and skin used to be, the forward fuselage section hit engine number three and broke it loose to land apart from the other three engines still attached to the wing.

D. AAIB Aircraft Accident Report No 2/90 (EW/C1094) quotes:

‘By similar reasoning, the absence of such shingling damage on blades of No 3 engine was a reliable indication that it suffered no ingestion until well into the accident sequence.’

‘(ii) No 3 engine, identified on site as containing ingested debris from within the aircraft, nonetheless had no evidence of the type of shingling seen on the blades of No 2 engine. Such evidence is usually unmistakable and its absence is a clear indication that No 3 engine did not suffer a major intake airflow disturbance whilst delivering significant power.

(iii) All 3 engines had evidence of blade tip rubs on the fan cases having a combination of circumference and depth greater than hitherto seen on any investigation witnessed on Boeing 747 aircraft by the Pratt and Whitney specialists. Subsequent examination of No 4 engine confirmed that it had a similar deep, large circumference tip rub. These tip-rubs on the four engines were centred at slightly different clock positions around their respective fan cases. ‘

‘2.5 Engine evidence The shingling damage noted on the fan blades of No 2 engine can only be attributed to airflow disturbance caused by ingestion related fan blade damage occurring when substantial power was being delivered. This is readily explained by the fact that No 2 engine intake is positioned some 27 feet aft and 30 feet outboard of the site of the explosion and that the interior of the intake exhibited a number of prominent paint smears and general foreign object damage. By similar reasoning, the absence of such shingling damage on blades of No 3 engine was a reliable indication that it suffered no ingestion until well into the accident sequence.’

‘The combination of the position of the explosive device and the forward speed of the aircraft was such that significant sized debris resulting from the explosion would have been available to be ingested by No 2 engine within milliseconds of the explosion. ...The onset of this time period would have been the time at which debris from the explosion first inflicted damage to fan blades in No 3 engine and, since the fan is only approximately 40 feet from the location of the explosive device, this would have been an insignificant time interval after the explosion.’

‘Examination of engines: The No 3 engine had fallen 1,100 metres north of the other three engines, striking the ground on its rear face, penetrating a road surface and coming to rest without any further change of orientation i.e. with the front face remaining uppermost. The intake area contained a number of loose items originating from within the cabin or baggage hold. It was not possible initially to determine whether any of the general damage to any of the engine fans or the ingestion noted in No 3 engine intake occurred whilst the relevant engines were delivering power or at a later stage.’

2. Observation:

Forward fuselage section was bent to starboard and then entirely detached.

A. Bomb explanation:

No explanation given why a 20 inch bomb shatter hole on the port side caused the forward fuselage section to bend to starboard and separate.

B. Shorted wiring/forward cargo door rupture/explosive decompression/inflight breakup explanation:

A twenty foot by thirty foot hole appeared suddenly on the starboard side where the forward cargo door and skin around it used to. The large hole was too large for the fuselage to maintain structural integrity as the forward fuselage section forward of the forward cargo door bent to the starboard, hit number three engine, and the forward fuselage section separated.

C. Conclusions:

It makes little sense for a forward fuselage section to bend to the starboard and detach when the bomb exploded on the port side giving a small 20 inch hole which the aircraft is designed to withstand.

It makes greater sense that the forward fuselage section would bend into a huge hole on starboard side, lose structural integrity, and then separate.

D. AAIB Aircraft Accident Report No 2/90 (EW/C1094) Quotes:

‘1.12.3.3 General damage features not directly associated with explosive forces.

A number of features appeared to be a part of the general structural break-up which followed on from the explosive damage, rather than being a part of the explosive damage process itself. This general break-up was complex and, to a certain extent, random. However, analysis of the fractures, surface scores, paint smears and other features enabled a number of discreet elements of the break-up process to be identified. These elements are summarised below.

(v) A large, clear, imprint of semi-elliptical form was apparent on the lower right side at station 360 which had evidently been caused by the separating forward fuselage section striking the No 3 engine as it swung rearwards and to the right (confirmed by No 3 engine fan cowl damage).

(iv) The forward fuselage deflected to the right, pivoting about the starboard window belt, and then peeled away from the structure at station 800. During this process the lower nose section struck the No 3 engine intake causing the engine to detach from its pylon. This fuselage separation

was apparently complete within 3 seconds of the explosion.

(xiii) The No 3 engine detached when it was hit by the separating forward fuselage.’

3. Observations:

There are only two small fragments of plastic which are the only ‘hard’ evidence of a bomb. One is a fragment of circuit board (with serial number!) alleged to be part of a ‘timer’ of for the bomb. This fragment was discovered at an unknown time by an unknown person on a baggage container behind the container manufacturer’s data plate which contained a burnt piece of material which itself contained a fragment of circuit board. The other fragment was discovered in a buckled section of the metal container by an AAIB Inspector to contain, trapped within its folds, an item which was subsequently identified by forensic scientists at the Royal Armaments Research and Development Establishment (RARDE) as belonging to a specific type of radio-cassette player and that this had been fitted with an improvised explosive device (IED).

A. Bomb explanation:

Bomb exploded in a metal baggage container and blew the timer to pieces which lodged in baggage container. The data plate is on the outside of the container, not the inside and no explanation given for its discovery on the outside of the container. A piece of plastic from a boom box radio-cassette player was found in the folds of the container and determined to be the bomb container holding the timer and plastic explosive. No explanation given for that determination.

B. Shorted wiring/forward cargo door rupture/explosive decompression/inflight breakup explanation:

The ‘timer’ fragment did not get into a burnt piece of material and placed behind a data plate on the outside of the container by action of explosion or wind; it was placed there by a person and that person should be asked where and when he found the fragment and why he put it behind the manufacturer’s data plate on the outside of that particular container. No explanation given for matching of fragment and container which blew up at 31000 feet.

The boom box fragment may have been a piece from a boom-box loaded into the baggage compartment by a passenger who listened to music. There is no supporting evidence that a piece of plastic from a boom box was part of a bomb or that the ‘timer’ fragment was inside the plastic boom box.

C. Conclusions:

It makes little sense that a bomb containing a timer (which is neither timing or altitude actuated) explodes six miles high, scatters thousands of pieces of debris to the winds, and yet a fragment of the ‘timer’ is found in the wreckage of the baggage container, identified as such, and placed on the outside in the correct container out of many. It makes little sense that a bomb with a timer exploded inside a suitcase inside a baggage container which then sends a fragment of the timer to lodge on the outside, not the inside, of the baggage container, which is mostly intact. It makes little sense that a piece of a boom box which can reasonably be expected to be in a baggage compartment can be determined to be a makeshift bomb with no supporting evidence.

It makes greater sense that an unknown person put the plastic fragment behind the data plate for some unknown reason and that there was a boom box in a suitcase of a passenger who listened to music.

D. AAIB Aircraft Accident Report No 2/90 (EW/C1094) quotes:

Appendix F-5, item ‘c’ which states, “Container manufacturer’s data plate which contained a burnt piece of material which itself contained a fragment of circuit board.”

‘Container Reconstruction Those parts which could be positively identified as being from containers AVE 4041 PA and AVN 7511 PA were assembled onto one of three wooden frameworks; one each for the floor and superstructure of container 4041, and one for the superstructure of container 7511. Approximately 85% of container 4041 was identified, the main missing sections being the aft half of the sloping face skin and all of the curtain.’

‘While this work was in progress a buckled section of skin from container 4041 was found by an AAIB Inspector to contain, trapped within its folds, an item which was subsequently identified by forensic scientists at the Royal Armaments Research and Development Establishment (RARDE) as belonging to a specific type of radio-cassette player and that this had been fitted with an improvised explosive device.’

‘Examination of all other component parts of the remaining containers from the front and rear cargo holds did not reveal any evidence of blast damage similar to that found on containers 4041 and 7511.’

4. Observation:

The overall evidence of damage from an explosion of a powerful plastic bomb in the port side of the forward cargo hold is very limited.

A. Bomb explanation:

The powerful bomb exploded and caused a series of events which are difficult to explain but did cause the forward fuselage section to come off.

B. Shorted wiring/forward cargo door rupture/explosive decompression/inflight breakup explanation:

The firing of a rather large shotgun on the port side of the forward cargo compartment which may have given evidence which led investigators to conclude a powerful bomb had been detonated causing the destruction of Pan Am Flight 103. The limited damage to the fuselage skin and the baggage containers may have been caused by a rather large shotgun which fired after the nearby huge explosive decompression when the cargo door ruptured open. The evidence shows a relatively mild directed blast existed a corner of a baggage container, traveled 25 inches and caused a 20 inch hole in the fuselage skin. The sound of the mild directed blast was not heard on the cockpit voice recorder.

Bombs are loud, spherical, and powerful. Shotgun blasts are relatively mild and directed. The damage in the baggage container and adjacent area is from a mild directed blast as if a rather large shotgun had gone off at close range. The AAIB official opined the cause of the damage he/she personally viewed to be as if a rather large shotgun had been fired at the fuselage at close range. It may not have been exactly a shotgun but some other type of directed firearm.

This AAIB opinion may have been correct in its assessment of the cause of the mild blast, pitting, sooting, distortions, ragged, and shattered skin as if a very large shotgun had been fired at the inner surface of the fuselage at close range. It may be that pitting, sooting, distortions, ragged, and shattered skin could also have been interpreted as evidence of a bomb explosion.

Loaded guns have been inserted into baggage holds of airliners before and have been accidentally discharged, (April 26, 2000 Gun goes off in bag being loaded into jet. Associated Press - Portland “A high-powered handgun went off in the baggage compartment of an Alaska Airlines jetliner on the tarmac at Portland International Airport, sending a bullet into the passenger compartment within inches of passengers' feet. Nobody was injured.”)

Shotgun cartridges give sooty residue when fired. A shotgun fires in a directed manner and would give a relatively mild blast compared to a high explosive bomb. The sound of the weapon firing is not heard on the cockpit voice recorder because the power had been abruptly cut after the tremendous explosive decompression when the huge hole appeared on the starboard side of the hold or the gunshot was over shouted by the tremendous noise from the huge hole and the explosive decompression.

The evidence corroborates the firing of a device called a rather large shotgun in a baggage container which caused a relatively mild directed blast which resulted in a 20 inch hole in the fuselage skin on the port side. This damage was not sufficient to cause the forward fuselage section to come off Pan Am Flight 103 because the structure was designed to withstand a hole that size in the pressurized hull by the presences of stiffeners, ribs, and belts. In fact, a Boeing 747 can withstand a hole of nine feet by twenty feet in the nose just forward of the wing as shown by United Airlines Flight 811.

The firing of the shotgun was after the explosive decompression because the sound of the gunshot is not on the cockpit voice recorder which had had an abrupt power cut.

The location in the forward cargo compartment in the baggage container which had its lower quadrant blown away may have held a rather large shotgun which was stored in baggage, was loaded, and was safe unless a tremendous explosion happened nearby. A tremendous explosion did happen nearby when the opposite fuselage blew out when a huge twenty foot by forty foot hold appeared suddenly where the forward cargo door and skin above it used to be. The rather large shotgun fired, the relatively mild directed explosion left soot on a rib, burst through the corner of the baggage container, went 25 inches and made a 20 inch hole in the port side of the fuselage. A sooty rib was soon found on the ground and incorrectly declared proof a bomb had gone off instead of a shotgun cartridge.

C. Conclusions:

It makes little sense that a 20 inch hole in the fuselage was caused by a powerful plastic bomb and that small hole would cause the forward fuselage section of a Boeing 747 to bend to the starboard and detach.

It makes greater sense that a rather large shotgun inadvertently fired in a suitcase and caused the 20 inch hole in the skin and other sooty evidence and misled investigators to believe it was the result of a powerful plastic bomb explosion.

D. AAIB Aircraft Accident Report No 2/90 (EW/C1094) quotes:

Fuselage: "Where these panels formed the boundary of the shatter zone, the metal in the immediate locality was ragged, heavily distorted, and the inner surfaces were pitted and sooted - rather as if a very large shotgun had been fired at the inner surface of the fuselage at close range."

'Analysis: "With the two container reconstructions placed together it became apparent that a relatively mild blast had exited container 4041 through the rear lower face to the left of the curtain and impinged at an angle on the forward face of container 7511.'

'Throughout the general examination of the aircraft wreckage, direct evidence of blast damage was exhibited on the airframe only in the area bounded, approximately, by stations 700 and 720 and stringers 38L and 40L. Blast damage was found only on pieces of containers 4042 and 7511, the relative location and character of which left no doubt that it was directly associated with airframe damage.'

‘Blast damage to the forward face of container 7511 was as a direct result of hot gases/fragments escaping from the aft face of container 4041. No evidence was seen to suggest that more than one IED had detonated on Flight PA103. ‘

5. Observation:

The sudden loud sound on the cockpit voice recorder can be linked to the explosive decompression sound of a cargo door opening in flight on an airliner. The sudden loud sound has not been matched to any bomb explosion sound because of missing lower frequencies and a too slow rise time. The sudden loud sound is stated to be the initial event and is the best evidence because it is direct proof of the explosion.

A. Bomb explanation:

No explanation given why a bomb explosion sound is absent from the CVR when it must be present if it were the initial event.

B. Shorted wiring/forward cargo door rupture/explosive decompression/inflight breakup explanation:

The initial event of sudden loud sound is the explosive decompression sound when the rupture/structural failure occurred and the air molecules rushed out making the sudden loud sound on the CVR. Pan Am Flight 103 has been matched to Air India Flight 182 in the AAIB report. This initial event sudden sound on the CVR for Air India Flight 182 has been matched to a DC-10 explosive decompression sound when its cargo door opened in flight. All four Boeing 747 sudden loud sound events, Air India Flight 182, Pan Am Flight 103, and United Airlines Flight 811 have been matched by NTSB in Chart 12 (Cover sheet of Part II of Smith AAR) of the public docket for Trans World Airlines Flight 800. The sound of the shotgun firing was not heard because the explosive decompression noise was louder or was because there was an abrupt power cut to the recorders after the sudden loud sound of explosive decompression.

C. Conclusions:

It makes little sense to disregard the most direct evidence of the initial event which is the sudden loud sound on the cockpit voice recorder which is not matched to a bomb explosion.

It makes greater sense to determine the sudden loud sound is the sound of the explosive decompression when the hull ruptures at the forward cargo door giving a sudden loud sound have been linked to an explosive decompression in a DC-10 cargo door event.

D. AAIB Aircraft Accident Report No 2/90 (EW/C1094) quotes:

‘Cockpit voice recorder The CVR tape was listened to for its full duration and there was no indication of anything abnormal with the aircraft, or unusual crew behaviour. The tape record ended, at 19:02:50 hrs +- second, with a sudden loud sound on the CAM channel followed almost immediately by the cessation of recording whilst the crew were copying their transatlantic clearance from Shanwick ATC.” UK AAIB Report 2/90 Page 15 It is not clear if the sound at the end of the recording is the result of the explosion or is from the break-up of the aircraft structure. The short period between the beginning of the event and the loss of electrical power suggests that the latter is more likely to be the case. UK AAIB Report 2/90 Page 38’

From the Canadian Aviation Occurrence Report: ‘2.10.2 Analysis by Accidents Investigation Branch (AIB), United Kingdom An analysis of the CVR audio found no significant very low frequency content which would be expected from the sound created by the detonation of a high explosive device. Considering the different acoustic characteristics between a DC-10 and a B747, the AIB analysis indicates that there were distinct similarities between the sound of the explosive decompression on the DC-10 and the sound recorded on the AI 182 CVR.’

6. Observation:

Inflight damage to the airframe of Pan Am Flight 103 does not match airframe damage from a staged bomb explosion event in a Boeing 747 at Bruntingthorpe.

A. Bomb explanation:

No explanation given why staged Boeing 747 bombing evidence does not match the evidence of a terrorist planned bombing of another Boeing 747, Pan Am Flight 103.

B. Shorted wiring/forward cargo door rupture/explosive decompression/inflight breakup explanation:

A real bombing gives an obvious and unique signature of specific evidence. That signature was present at the Bruntingthorpe staged bombing but absent from Pan Am Flight 103 because there was no bomb explosion.

C. Conclusions:

It makes little sense to disregard a mismatch between a real bombing event and a presumed bombing event and continue to call the presumed event a bomb explosion.

It makes greater sense to determine Pan Am Flight 103 was not a bombing event because a bomb signature, such as that found at Bruntingthorpe staged bombing, was absent.

D. Quote from official at Bruntingthorpe:

"Very small amounts of explosives left very distinctive marks, unlike anything we've seen on the plane," said one investigative source, speaking of the recent tests. "Even the small amounts [of explosives] left distinctive signatures on the structures, so if a small bomb had gone off, it clearly would leave a signature."

7. Observations:

In the AAIB report there is a grammatical error in verb tense and irrelevant inclusions of phrases and conclusions for bomb explosion which are unsupported by evidence.

AAIB 2/90:

'The datum line, discussed at paragraph 1.12.1.6, was derived from a detailed analysis of the distribution of specific items of wreckage, including those exhibiting positive evidence of a detonating high performance plastic explosive.'

'The items used to define the datum line, included those exhibiting positive evidence of a detonating high performance plastic explosive, would have been the first pieces to have been released from the aircraft.'

A. Bomb explanation:

Any time an opportunity arises to declare a bomb exploded in Pan Am Flight 103 is a good time.

B. Shorted wiring/forward cargo door rupture/explosive decompression/inflight breakup explanation:

The AAIB report is generally well written, precise, grammatically correct, and punctuation is perfect; however, the only two exceptions deal with statements about the 'plastic explosive'.

The text reads clearer: 'The datum line, discussed at paragraph 1.12.1.6, was derived from a detailed analysis of the distribution of specific items of wreckage.' The inclusion of the phrase, "...including those exhibiting positive evidence of a detonating high performance plastic

explosive,” is irrelevant and incongruous in context of datum lines.

And:

‘The items used to define the datum line would have been the first pieces to have been released from the aircraft.’ The inclusion of the almost identical strange phrase, “...included those exhibiting positive evidence of a detonating high performance plastic explosive,” is appended, grammatically incorrect as written, and incongruous in context of datum lines.

C. Conclusions:

It makes little sense that AAIB investigators who have written an important document which is precise and grammatically correct in most respects would make grammar errors in two sentences concerning a detonating high performance plastic explosive.

It makes greater sense that the the phrases were inserted as changes at the last minute by a non-AAIB official to bolster a weak case and the insertions were not caught by AAIB officials.

D. AAIB Aircraft Accident Report No 2/90 (EW/C1094) quotes:

‘The datum line, discussed at paragraph 1.12.1.6, was derived from a detailed analysis of the distribution of specific items of wreckage, including those exhibiting positive evidence of a detonating high performance plastic explosive. The scatter of these items about the datum line may have been due partly to velocities imparted by the force of the detonating explosive and partly by the difficulty experienced in pinpointing the location of the wreckage accurately in relatively featureless terrain and poor visibility. However, the random nature of the scatter created by these two effects would have tended to counteract one another, and a major error in any one of the eleven grid references would have had little overall effect on the whole line. There is, therefore, good reason to have confidence in the validity of the datum line.

‘The items used to define the datum line, included those exhibiting positive evidence of a detonating high performance plastic explosive, would have been the first pieces to have been released from the aircraft.’

8. Observations:

There are two photographs in the AAIB report of the port ‘bomb’ side hole just forward of the wing in the wreckage reconstruction, B-16 and B-17, and two identical artist’s impression of the port side bomb explosion on B-19 and B-24. There are no pictures of the shattered starboard, cargo door, side just forward of the wing in the wreckage reconstruction. The forward cargo door is sketched in as undamaged in B-20 and B-21 in three drawings of explosive damage which contradicts the wreckage reconstruction evidence in the photographs of the shattered forward cargo door.

A. Bomb explanation:

The only important side to look at is the bomb explosion side which is the port side with its 20 inch hole in the fuselage skin and worthy of two photographs, two identical sketches and another of an artist’s impression of the explosion. The twenty foot by thirty foot hole in the starboard side, the cargo door side, is not relevant and thus can be omitted.

B. Shorted wiring/forward cargo door rupture/explosive decompression/inflight breakup explanation:

No explanation given for omission of photographs of the wreckage reconstruction of the other side of the cargo hold said to contain a powerful bomb. No explanation given for sketches of

an undamaged forward cargo door when the photographic evidence shows it shattered. Recent photographs of the forward cargo door area are very revealing and show much outward shattered skin and missing parts. The port side damage was exaggerated in sketches and the starboard side damage omitted or played down.

C. Conclusions:

It makes little sense to go to the expense of a total fuselage reconstruction and only show one side, a relatively smooth port side while omitting a shattered starboard side.

It makes greater sense that the investigators were making a case for a bomb explosion on the port side and deemed any other information which contradicted that conclusion as irrelevant and distracting and thus omitted.

D. AAIB Aircraft Accident Report No 2/90 (EW/C1094) quotes:

‘To facilitate this additional work, wreckage forming a 65 foot section of the fuselage (approximately 30 feet each side of the explosion) was transported to AAIB Farnborough, where it was attached to a specially designed framework to form a fully three-dimensional reconstruction [Appendix B, Figures B-16 and B-17] of the complete fuselage between stations 360 & 1000 (from the separated nose section back to the wing cut out). The support framework was designed to provide full and free access to all parts of the structure, both internally and externally.’

9. Observation:

The latch status of the forward cargo door is omitted whilst the latch status of the identical aft cargo door (frames 1800-1920) and the CRAF door is given and stated as ‘latched.’

A. Bomb explanation:

The latch status of the forward cargo door is unimportant as it was not involved in any way with the bomb explosion and thus omitted.

B. Shorted wiring/forward cargo door rupture/explosive decompression/inflight breakup explanation:

The assumption must be made that the latch status of the forward cargo door was ‘unlatched’ or ‘unknown,’ since, if it were latched, it would have been reported as same.

No explanation given for the omission in the report of the latch status of a cargo door which is known to have failed before, is a complex device prone to airworthiness directives, and was very near the site of the ‘bomb’ explosion.

C. Conclusions:

It makes little sense to omit such vital information about a complex device that has failed before which could cause a hull rupture inflight if it had failed again.

It makes greater sense that the information was omitted because it conflicted with the official conclusions of a bomb explosion and thus deemed unimportant.

D. AAIB Aircraft Accident Report No 2/90 (EW/C1094) quotes:

‘The CRAF door itself (latched) apart from the top area containing the hinge;’

‘Other items found in the wreckage included both body landing gears, the right wing landing gear, the left and right landing gear support beams and the cargo door (frames 1800-1920) which was latched.’

10. Observation:

There is much more airframe damage on the starboard side of the airframe away from the

'bomb' explosion in areas such as the leading edge of the right wing and the right horizontal stabilizer.

A. Bomb explanation:

The ejected material and skin from the post side bomb explosion went out, aft, and over the fuselage then impacted the starboard side wing and tailplane. The bomb energy spread out and through the aircraft gaining power and blew out the faraway sections of skin although it was not possible to find a specific mechanism for the damage.

B. Shorted wiring/forward cargo door rupture/explosive decompression/inflight breakup explanation:

The more severe starboard side fuselage, tail, and wing damage was caused by the tremendous explosive decompression on the starboard side of the fuselage just forward of the wing in the forward cargo door area. The evidence of localised skin separation and peel-back is from the explosive decompression forces, not the relatively mild blast from the 'bomb explosion.'

C. Conclusions:

It makes little sense that a small 20 inch hole on the port side could cause the severe damage on the starboard side of the airframe or that material from the port side of the aircraft travels out, over, and aft of the fuselage and impacts on the starboard side of the tailplane.

It makes greater sense that the more severe airframe localised skin separation and peel-back inflight damage on the starboard side is because of the massive ejected material and torn away skin from the forward cargo door area on the starboard side of the airframe from the explosive decompression that ejected material out and directly aft into the right wing leading edge, engine number three and right horizontal stabilizer.

D. AAIB Aircraft Accident Report No 2/90 (EW/C1094) quotes:

'Whilst it has not been possible to find a specific mechanism to explain the regions of localised skin separation and peel-back (i.e. the 'pressure blow' regions referred to in para 2.12.2), they were almost certainly the result of high intensity shock overpressures produced locally in those regions as a result of the additive recombination of shock waves transmitted through the lower hull cavities. It is considered that the relatively close proximity of the left side region of damage just below floor level at station 500, [Appendix B, Figure B-19, region D] to the forward end of the cargo hold may be significant insofar as the reflections back from the forward end of the hold would have produced a local enhancement of the shock overpressure. Similarly, 'end blockage effects' produced by the cargo door frame might have been responsible for local enhancements in the area of the belly skin separation and curl-back at station 560.'

'(iv) The fuselage left side lower lobe from station 740 back to the wing box cut-out, and from the window level down to the cargo deck floor (the fracture line along stringer 38L), had peeled outwards, upwards and rearwards - separating from the rest of the fuselage at the window belt. The whole of this separated section had then continued to slide upwards and rearwards, over the fuselage, before being carried back in the slipstream and colliding with the outer leading edge of the right horizontal stabiliser, completely disrupting the outer half.'

'The right tailplane exhibited massive leading edge impact damage on the outboard portion which also appeared to have progressed to disruption of the aft torsion box. A fragment of right tailplane spar cap was found embedded in the fuselage structure adjacent to the two vent valves, just below, and forward of, the L2 door and it is clear that this area of forward left fuselage had travelled over the top of the aircraft and contributed to the destruction of the outboard right tailplane.'

11. Observation:

There was a single primary return received by both Great Dun Fell and Claxby radars approximately 16 seconds before SSR returns were lost. The return was only present for one paint and no explanation can be offered for its presence. It is displayed as a green diamond in Figures C-15 through C-23 in the AAIB Report 2/90.

A. Bomb explanation:

No explanation given for radar returns shown as green diamond. Information was disregarded.

B. Shorted wiring/forward cargo door rupture/explosive decompression/inflight breakup explanation:

One primary target on one radar may be an artifact. Two targets on two radars may be a coincidence. Two targets on two radars at the same time and at the same place is a real target which means a large piece of metal reflected radar energy to two radars.

The explanation offered for its presence is of the lower half of the forward cargo door rupturing outward and spinning away in the night. The angles of the spinning metal skin were such to only return energy to two radars on only one sweep. A precedent was set of surveillance radars picking up pieces of cargo door spinning away in flight has been set by United Airlines Flight 811.

C. Conclusions:

It makes little sense for a genuine primary radar target to appear just before the destruction of a large airliner and for that target information to be disregarded.

It makes greater sense that when the lower half of the forward cargo door ruptured open in flight and ejected the door pieces and fuselage skin into the air that two radars picked up the reflections from the spinning metal skin and the target appeared on the radar scopes at the same time at the same location.

D. AAIB Aircraft Accident Report No 2/90 (EW/C1094) quotes:

'Recorded radar information: Recorded radar information on the aircraft was available from from 4 radar sites. Initial analysis consisted of viewing the recorded information as it was shown to the controller on the radar screen, from this it was clear that the flight had progressed in a normal manner until Secondary Surveillance Radar (SSR) was lost. There was a single primary return received by both Great Dun Fell and Claxby radars approximately 16 seconds before SSR returns were lost. The Lowther Hill and St. Annes radars did not see this return. The Great Dun Fell radar recording was watched for 1 hour both before and after this single return for any signs of other spurious returns, but none was seen. The return was only present for one paint and no explanation can be offered for its presence.'

12. Observation:

The aircraft, Flight PA103 from London Heathrow to New York, had been in level cruising flight at flight level 310 (31,000 feet) for approximately seven minutes when the last secondary radar return was received just before 19.03 hrs. The radar then showed multiple primary returns fanning out downwind.

A. Bomb explanation:

A bomb was placed in a Boeing 727 which took off from Malta and flew to Frankfurt Germany without the bomb going off. The plane then flew to London without the bomb going off. The bomb was transferred to a Boeing 747 which took off and then the bomb went off. The timer was thus not an altitude timer nor a timing timer but a timer of unknown type.

B. Shorted wiring/forward cargo door rupture/explosive decompression/inflight breakup explanation:

The explosion occurred soon after the highest pressure differential was reached, 8.9 PSI at 31000 feet MSL, when the midspan latches ruptured open the forward cargo door. There was no bomb and there was no timer and there was no bomb explosion but there was something that looked, smelled, and sounded like a bomb explosion, but wasn't. It was a tremendous explosion of an explosive decompression from a hull rupture at a door. There was something that looked like a rather large shotgun had gone off in a baggage container and it probably was and it probably did which led investigators to assume a bomb explosion had occurred.

C. Conclusions:

It makes little sense for a bomb to be placed aboard an aircraft which flies and flies without detonating and then the bomb is transferred to another plane which explodes later by some unknown type of timer.

It makes greater sense that an explosive decompression occurred, which mimics a bomb explosion, at the highest pressure differential in the hull soon after takeoff and cruise established.

D. AAIB Aircraft Accident Report No 2/90 (EW/C1094) quotes:

None regarding the several flights of the bomb in two aircraft in three airports in three countries before it detonated.

13.Observation:

Pan Am Flight 103 was proceeding normally until a sudden, loud, audible sound was immediately followed by an abrupt power cut to the data recorders.

A. Bomb explanation:

The bomb explosion cut the power to the recorders.

B. Shorted wiring/forward cargo door rupture/explosive decompression/inflight breakup explanation:

The tremendous explosive decompression explosion cut the power to the recorders in the adjacent main equipment compartment abruptly after the sudden loud sound of the air rushing out of the forward cargo compartment was picked up on the cockpit voice recorders.

C. Conclusions:

It makes little sense that a relatively mild explosion which caused a 20 inch hole in the fuselage skin would cause an abrupt power cut to the recorders when the aircraft is designed to easily withstand such an event.

It makes greater sense that a tremendous explosive decompression would cause an abrupt power cut to the recorders in the adjacent compartment.

D. AAIB Aircraft Accident Report No 2/90 (EW/C1094) quotes:

'Digital flight data recordings The analysis of the recording from the DFDR fitted to N739PA, showed that the recorded data simply stopped. Following careful examination and correlation of the various sources of recorded information, it was concluded that this occurred because the electrical power supply to the recorder had been interrupted at 19:02:50 +- second. UK AAIB Report 2/90 Page 37 The analysis of the cockpit voice recording, which is detailed in Appendix C, concluded that there were valid signals available to the DVR when it stopped at 19:02.50 +- second because the power supply to the recorder was interrupted. It is not clear if the sound at the end of the recording is the result of the explosion or is from the break-up of the aircraft structure. The short period between the beginning of the event and the loss of electrical

power suggests that the latter is more likely to be the case. UK AAIB Report 2/90 Page 38

14. Observation:

The evidence of Pan Am Flight 103 was matched to Air India Flight 182 in AAIB 2/90 but not to United Airlines Flight 811.

A. Bomb explanation:

Air India Flight 182 was deemed a bomb explosion by the Indian judicial authorities. Since Pan Am Flight 103 was determined early on to be a bomb explosion, only that flight information was relevant and thus compared and included in AAIB 2/90.

B. Shorted wiring/forward cargo door rupture/explosive decompression/inflight breakup explanation:

No explanation given why the evidence of United Airlines Flight 811 with much similar evidence to Pan Am Flight 103 was not matched to Pan Am Flight 103 as well as Air India Flight 182 in AAIB 2/90.

Both United Airlines Flight 811 and Pan Am Flight 103 were:

Aged.

High flight time.

Early model-100.

Poly x wired.

Boeing 747.

Experienced hull rupture forward of the wing on right side in cargo door area.

Shape of hull rupture forward of the wing on the right side is rectangle with specific rectangular shape.

Fodded number three engine.

On fire number three engine.

Sudden sound on CVR

Loud sound on the CVR.

Short duration sound on the CVR.

Abrupt power cut to FDR.

Outwardly peeled and down skin in cargo door area from aft midspan latch.

Longitudinal break at midline of the forward cargo door at midspan latch.

More severe inflight damage on starboard side.

At least nine never recovered bodies.

Vertical fuselage tear lines forward of the wing and aft of cargo door.

Torn off and missing skin in forward cargo door area on starboard side.

Outward peeled skin on upper forward fuselage.

Destruction initially thought to be have been caused by a bomb.

C. Conclusions:

It makes little sense to ignore closely matching evidence of Pan Am Flight 103 to another similar event of United Airlines Flight 811 while including an accident with inconclusive findings, Air India Flight 182.

It makes greater sense to compare Pan Am Flight 103 to United Airlines Flight 811 as well as Air India Flight 182. (Trans World Airlines Flight 800 had not yet occurred.)

D. AAIB Aircraft Accident Report No 2/90 (EW/C1094) quotes:

'Detection of explosive occurrences: In the aftermath of the Air India Boeing 747 accident (AI 182) in the North Atlantic on 23 June 1985, RARDE were asked informally by AAIB to

examine means of differentiating, by recording violent cabin pressure pulses, between the detonation of an explosive device within the cabin (positive pulse) and a catastrophic structural failure (negative pulse).’

15. Conclusions:

Pan Am Flight 103 occurred before United Airlines Flight 811 and Trans World Airlines Flight 800 and after Air India Flight 182.

The AAIB Aircraft Accident Report No 2/90 (EW/C1094) report reflects the sentiment of the times in the late 1980s that terrorists were everywhere and were blowing up airplanes at will. The determination was made within days of the inflight breakup that the cause was probably a bomb explosion and efforts were directed toward catching the culprits. A precedent has been set by the Indian government who declared that the similar accident, Air India Flight 182, was caused by a bomb explosion in the forward cargo hold, although the Canadians refused to state the cause of that explosion. A mechanical explanation for Pan Am Flight 103, such as that of United Airlines Flight 811, was given very little consideration.

The AAIB investigators did not have the luxury of hindsight to learn the lessons of Trans World Airlines Flight 800 nor did they take advantage of the lessons of United Airlines Flight 811 which occurred a short two months later after Pan Am Flight 103.

The writers of the AAIB report struggled to explain how a relatively mild directed blast on the port side of the forward cargo compartment caused outward ruptures faraway from the shatter zone, caused foreign object damage in an engine far away, caused inflight damage to an opposite side horizontal stabilizer, and caused much more damage throughout the starboard side of the airframe. They stretched with explanations such as the ejected material did strange things by going over, around, and under the fuselage to get to the affected areas. They brought in a theory of Mach Stem which presents the novel idea that a mild blast which disseminates through ducts and baggage containers actually manages to gain enough energy to do more damage faraway even as the energy is being absorbed by suitcases, baggage containers, and floor panels.

The writers ignored the logical questions of how a mild blast on the port side could have caused such a large hole opposite on the starboard side at initial event time; why the forward section buckled to the starboard instead of the port side; why was the sound of a powerful bomb not heard on the cockpit voice recorder; how a mild blast abruptly shut off the entire power supply to the aircraft, and how a piece of timer of a bomb which exploded high up shows up inexplicably tucked in behind a plate on the outside of a baggage container.

Only photographs of the port side are revealed, no text explanations are given to the starboard side opposite, sketches of the cargo door are inaccurate while the port side sketches are exaggerated. The writers generally ignored the starboard side of the wreckage reconstruction although it showed more damage than the port and all of the inflight damage to engine number three, right wing, and right horizontal stabilizer would be easily explained if the explosion had occurred on the starboard side.

The AAIB report reads more like a prosecution case for a crime of a terrorist bombing than an objective investigative aircraft accident report. In fact, one could say the report doth protest too much that it was a bomb explosion. (As one might say the Smith AAR doth protest too much it was a wiring/cargo door event.)

The precision of the English language was put to good use by the conclusions reached of an

“Improvised Explosive Device’ instead of a “Bomb’ since the evidence did show an improvised explosive device and not a bomb explosion, although the intent was for the reader to believe it was a bomb explosion. To this day, officials continue to call the object which started the destruction a ‘device’ and not a ‘bomb’.

Mechanical alternatives were not given due consideration after the first few days when a sooty and pitted rib was found in the wreckage. There is very little information in the AAIB report about possible alternatives such as a center fuel tank explosion, hull rupture by structural failure, or explosive decompression by a mechanical source such as inadvertently opened cargo door or cargo shift.

Since major aircraft accidents now have international repercussions, politics which reflects the popular will of the moment takes precedence over objective investigations conducted in a calm and thoughtful manner. Extreme pressure was put on all investigative authorities from law enforcement to aviation accident investigators for a quick answer to the cause of Pan Am Flight 103. A popular answer was that the cause was not the fault of the manufacturer, the airline, or the government oversight agencies but was the fault of evil terrorists who had managed to slip by inadequate security. The direction of the investigation was set; a crime of a bombing and find the perpetrators.

The result is AAIB Aircraft Accident Report No 2/90, written fifteen months after Pan Am Flight 103 suffered the inflight breakup which appeared to be caused by a bomb, was assumed to be a bomb explosion, and almost all of the report describes what happened after the bomb went off on the port side of the forward cargo compartment. To this day, it is assumed a bomb exploded in Pan Am Flight 103 and the only disagreements are who put it there, when, and why.

The conclusion reached by this investigator in this AAR is that there was no bomb in Pan Am Flight 103. There was no bomb explosion. There was something that looked like a bomb explosion but wasn't. The evidence revealed by subsequent similar accidents indicates that there was a tremendous explosion of an explosive decompression when the forward cargo door ruptured open inflight, probably at the midspan latches and probably caused by faulty wiring or switch.

Respectfully submitted;

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1 May 2002,
Carmel Valley, California