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**NATIONAL TRANSPORTATION SAFETY BOARD**  
**WASHINGTON, D.C.**

**STRUCTURES GROUP CHAIRMAN'S FACTUAL REPORT**

By: Alexander Lemishko  
(17 Pages)

**NATIONAL TRANSPORTATION SAFETY BOARD**

Office of Aviation Safety

Washington, D.C. 20594

February 20, 1998

**STRUCTURES GROUP CHAIRMAN'S FACTUAL REPORT**

**A. ACCIDENT DCA-97-MA-058**

Location: Agana, Guam  
Date: August 6, 1997  
Time: 0142 Guam Local Time  
Aircraft: Boeing 747-300, HL-7468, Korean Air, Flight No. 801

**B. STRUCTURES GROUP**

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### **C. SUMMARY**

On August 6, 1997, approximately 0142 Guam Local Time, a Boeing 747-300 (3B5B), operated by Korean Air as Flight 801, en route from Seoul Korea (RKSS) to Agana, Guam, crashed on approach to runway 6 Left (L) at the Guam International Airport (PGUM).

At the time of the accident, the glide slope associated with the instrument landing system (ILS) to runway 6L was out of service and the crew was conducting a "localizer only" approach to the runway when the airplane contacted high terrain approximately 3 miles southwest of the airport.

The 0132 reported weather at Guam International indicated that the wind was from 090 degrees at 6 knots; visibility was 7 statute miles with showers and there was a scattered layer of clouds at 1,600 feet, a broken layer at 2,500 feet and an overcast layer at 5,000 feet.

The flight was operated as a scheduled 14 Code of Federal Regulations (CFR) Part 129 passenger flight. There were two pilots, one flight engineer, one purser, thirteen flight attendants and 231 passengers (including six deadheading flight attendants) on board the airplane at the time of the accident. The airplane was destroyed by impact forces and a post accident fire. Of the 254 occupants on board, 223 were killed; and 25 passengers and 4 flight attendants survived the accident with minor to serious injuries. However, during the 30 days following the accident, two passengers and one deadheading flight attendant succumbed to their injuries.

### **D. DETAILS OF THE ON SCENE INVESTIGATION**

The Structures Group was formed during the initial organizational meeting conducted on Thursday, August 7, 1997. On site examination of the wreckage commenced on August 8, and was completed on August 13.

The main wreckage of the airplane was found resting on a hillside along the approach path to runway 6L, approximately 3.3 statute miles short of the runway threshold (coordinates 13 degrees 27.35 minutes north 144 degrees 43.92 minutes east). The total wreckage distribution, including aircraft debris, tree strikes and ground impressions, encompassed an area

approximately 2,100 feet long and 400 feet wide. The general bearing of the down slope debris path and ground impressions was approximately 060 degrees magnetic. The terrain was hilly and densely vegetated with chest high brush and small trees ranging from 5 to 20 feet tall. The elevation (elevations were measured from established survey benchmarks) within the debris path ranged from approximately 680 feet MSL at the beginning of the tree strikes to about 620 feet MSL where the main wreckage rested.

All of the major structural components of the aircraft and control surfaces that were not consumed by the post impact fire were identified along the wreckage path. No evidence of an in-flight fire, or structural component failure prior to impact was found. A survey was conducted of the entire wreckage area to produce a plot of the major structural components along the debris path. The plot data included, and was combined with the locations of the initial tree strikes and ground impressions. See wreckage plots and data table [Attachment 1] for detailed information.

The first signs of the aircraft contacting terrain were several topped trees extending from the first observed cut tree top (elevation about 675 feet MSL) forward about 200 feet along the path. Approximately 400 feet along the path were ground impressions corresponding to landing gear and a broken pipe line running parallel and to the right of the debris path centerline. A ground impression measuring about 89 feet long, 6 feet wide, and 2 feet deep, was found about 430 feet along the path. This ground impression had several small pieces of the #1 engine cowl embedded within it. The first wreckage items found along the flight path of KAL 801 were components from the #1 engine (mounted on the outboard left wing) and portions of leading and trailing edge flap structure from the left hand side (LHS) wing. The #1 engine components, found early in the debris path included cascade guide vanes, cowl structure, and fan exit guide vanes.

The first major aircraft component located along the debris path (approximately 970 feet along the path) was the #1 engine. The next major component found along the path was the LHS wing landing gear. Further along the path (about 1,430 feet), a portion of the left main body gear with two wheels and tires was found embedded into a small berm. Just beyond the berm, portions of lower body skin, followed by pieces of cargo floor were found. Beyond the cargo floor pieces, many internal cargo articles littered the path toward the main wreckage. A large portion of the station (STA) 1450 bulkhead and lower section 46 skin were found just before the main wreckage area.

## **1.0 FUSELAGE STRUCTURE**

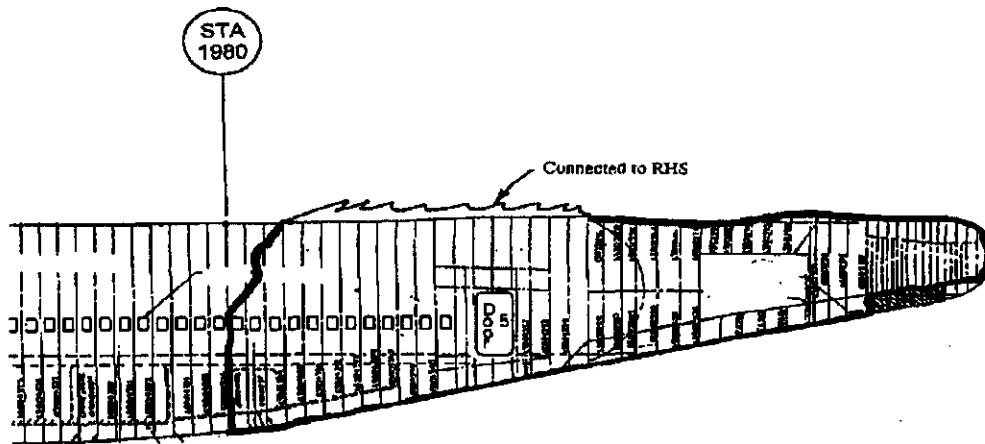
The majority of the fuselage structure was located in the main wreckage area. For the purposes of this report, five main sections will be described: Aft Body and Empennage Section, Section 46 Skin, Center Section, Forward Fuselage Section (except cockpit), and Cockpit Section (structure forward of STA 400). Aircraft doors are also discussed in this report.

## 1.1 Doors

The doors were examined to determine general condition and whether they were open or closed. Doors 1L, 1R, 2L, and 2R could not be examined. The structure in the vicinity of these doors was heavily burned, and only portions of the doors were located in the main wreckage site. Door 3L was found closed and locked, and door 3R was found not attached to the fuselage. More than 1/2 of the 3R door cutout area was missing as the fuselage section was broken at this location. KAL records indicate that both Door 3L and 3R were deactivated on this airplane prior to delivery. Both door 4L and 4R were found detached, and approximately 1/3 of the 4R cutout was missing. Door 5L was found closed and latched, and this area of the fuselage was in contact with the ground in the main wreckage area. Door 5R was found in the open position, however the door handle was not in the full open position. The upper deck doors were not located (these were in the vicinity of heavily burned fuselage).

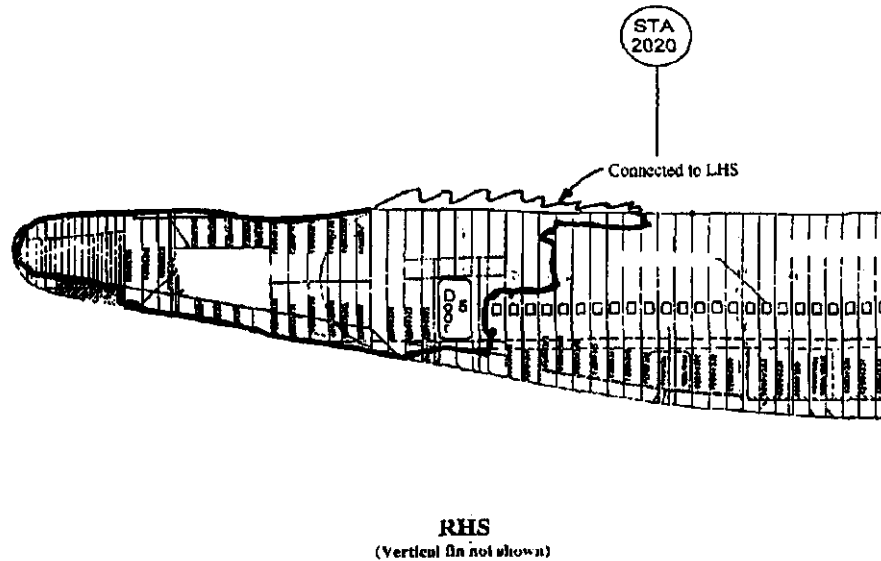
## 1.2 Aft Body and Empennage Section

The empennage structure and the aft portion of the section 46 fuselage structure remained attached and essentially intact forward to approximately STA 1980. The RHS and LHS horizontal stabilizer components (including elevators) and the vertical fin were still intact and attached. This entire section was in an upright position and tilted slightly to the LHS. See [Figure 1] and [Figure 2] for a definition of this section.



**LHS**  
(Vertical fin not shown)

**Figure 1**

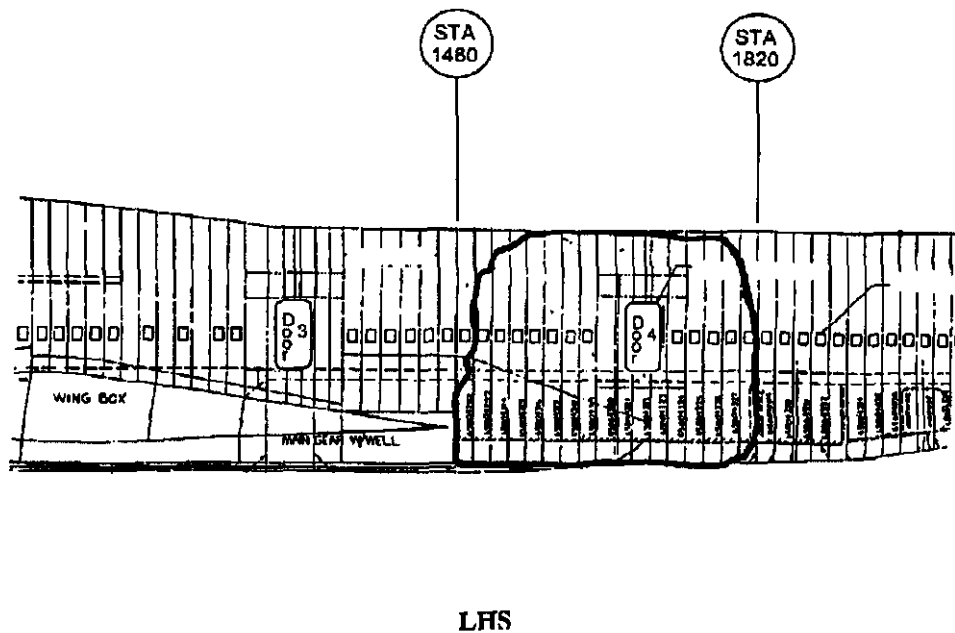


**Figure 2**

The exterior surface was lightly sooted on the LHS with heavy fire damage on the forward portion which rested on the RHS wing. The exterior of the RHS had almost no sooting but was burned around the periphery of door 5R and within 3 frame bays of the break line. The interior was fire damaged from the main deck floor level to the belly. The upper portions of the internal structure were not burned significantly. The aft pressure bulkhead was intact and the lower portion was deformed due to impact forces. There was no fire damage to the bulkhead.

### **1.3 Section 46 Skin**

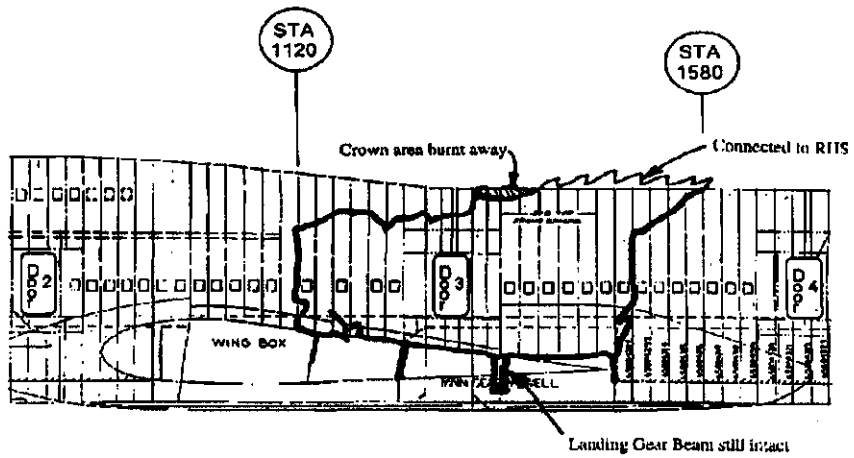
A large panel of the section 46 skin rested with the outside surface down and was partially covered by the center section structure. The panel was from the LHS of the fuselage and extended from approximately the crown centerline to the belly centerline, from STA 1480 to STA 1820. The majority of the frame and stringer segments remained attached to the panel. The interior structure was not burned, however, the exterior was heavily sooted. See [Figure 3] for a definition of this segment.



**Figure 3**

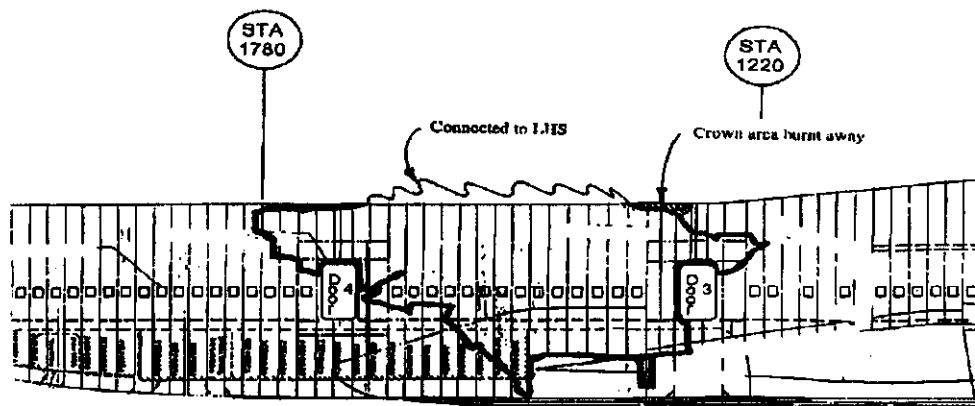
#### **1.4 Center Section**

The center portion fuselage structure extended from STA 1120 (LHS) and STA 1240 (RHS) aft to STA 1780. The LHS and RHS skin were still attached across the crown and the section was still attached to the RHS wing by the landing gear beam. The STA 1350 landing gear beam was still attached to the section on both the LHS and RHS. The majority of the rear spar and spanwise beam #1 were still in place, as well as portions of the midspar. The remaining spanwise beams and the front spar were found fragmented. The entire center section was found rotated 180 degrees to the debris path, with the forward end of the section facing the aft body and empennage structure described previously. The interior was extensively fire damaged throughout the section with the crown area forward of STA 1350 burned through. The exterior skin had fire damage primarily adjacent to the break and the exterior of the RHS skin was heavily burned between door 3R and door 4R. See [Figure 4] and [Figure 5] for a definition of this section.



LHS

Figure 4



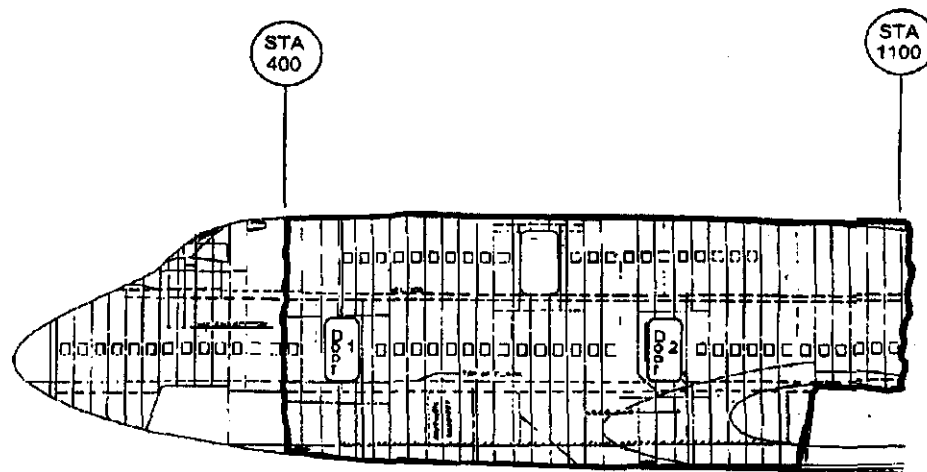
RHS

Figure 5



### 1.5 Forward Fuselage (except cockpit) Section

The forward fuselage section from approximately STA 1120 to STA 400 was located on a hillside just beyond the center section (toward the runway). The structure was split just above the main deck floor on the RHS and most of the internal structure (frames, stringers, and fractured floor beams) remained attached. There was extensive fire damage to the structure that was on the lower portion of the hillside (LHS structure and crown area). Much of the structure in this lower area was burned through. There was minimal fire damage to the structure at the top of the hillside (LHS main deck structure). See [Figure 6] for a definition of this section.

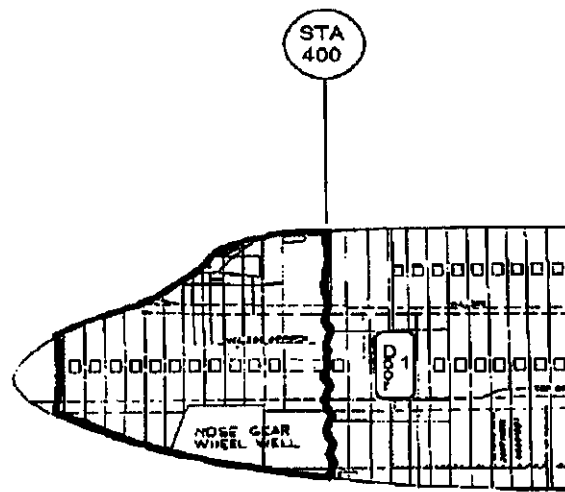


**FWD Fuselage Structure**  
(except cockpit)

**Figure 6**

### 1.6 Cockpit Section

The forward portion of section 41 was located down an embankment beyond the large portion of the forward fuselage. The section was found separated primarily at the STA 400 skin splice and included the cockpit and nose wheel well. The majority of the aft nose wheel well doghouse structure (where the nose gear attaches) was essentially intact with the trunnion support fittings, drag brace fittings, and transverse beam still attached. The gear trunnion barrel and linkage above the trunnion barrel was intact and in the extended position. There was no evidence of fire damage. See [Figure 7] for a definition of this section.



**Cockpit**  
(Structure FWD of STA 400)

**Figure 7**

## 2.0 WING STRUCTURE

The majority of the wing structure was also located in the main wreckage area. Both wings were located on the same side of the fuselage in the main wreckage area. The right hand side (RHS) wing was found still attached to the fuselage center section. The left hand side (LHS) wing was partially covered by the RHS wing and fuselage.

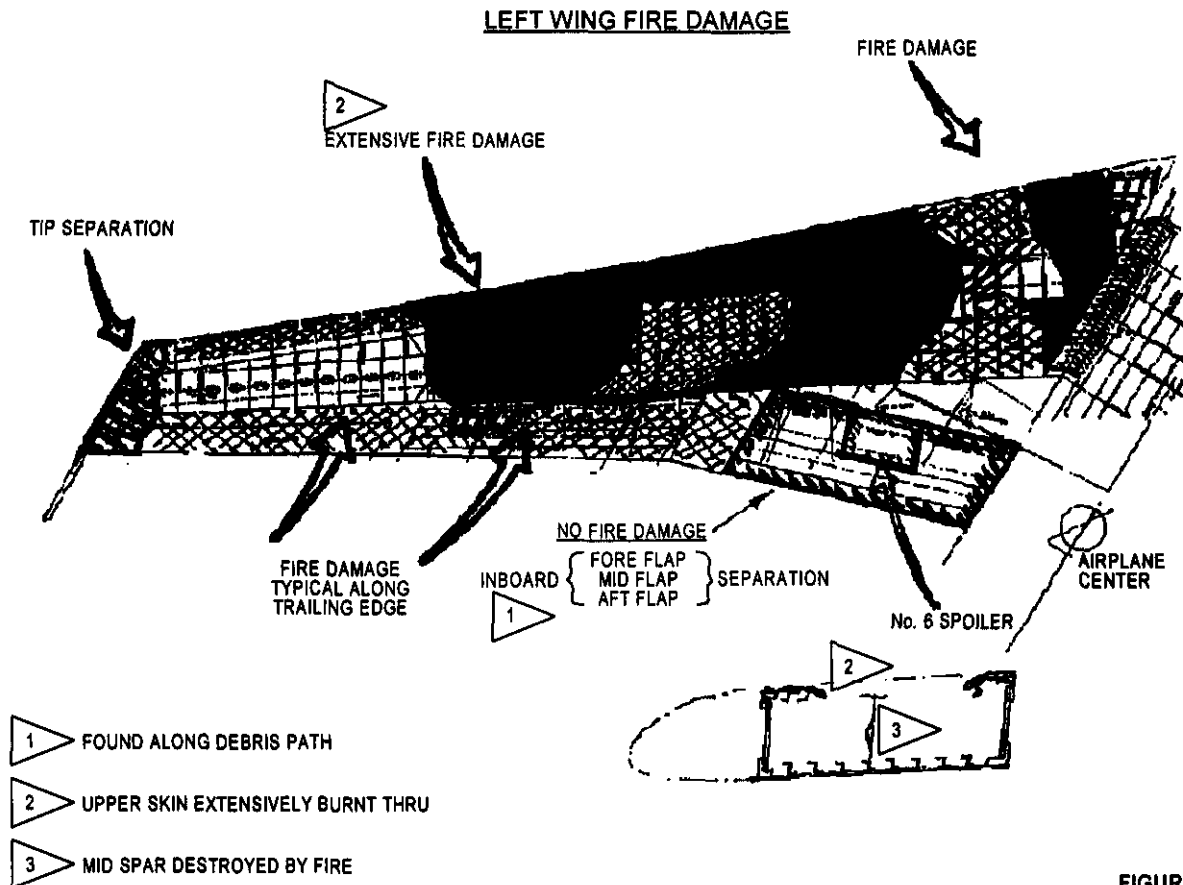
### 2.1 LHS Wing Section

The LHS wing outboard section was located approximately parallel to the RHS wing section within the main wreckage area. This wing structure was approximately 80% complete. Extensive post impact fire resulted in heavy damage to the wing upper skin and mid spar between wing station (WS) 470 and WS 1200, including the mid-spar web and chord structure. The corresponding lower skin and stringers also had considerable fire damage. Exposure to the post impact fire resulted in various degrees of damage to the remaining wing structure, including the leading edge and trailing edge flap structure. The outboard wing tip, which was comprised of

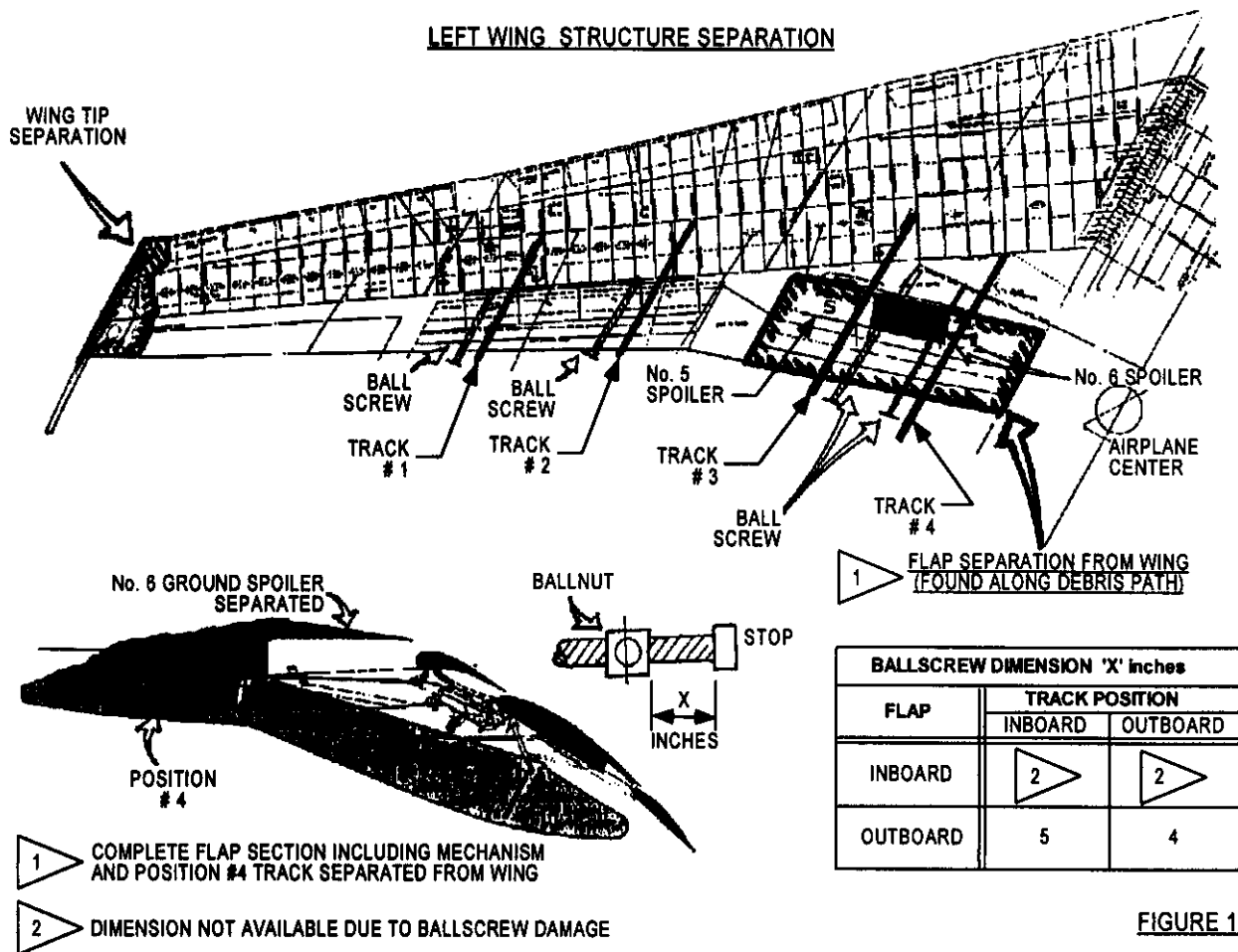
composite aluminum and fiberglass structure, was found separated from the wing box at the surge tank end rib at WS 1548 and had no related fire damage.

Due to impact forces and extensive fire damage, all the leading edge variable camber flap and inboard Krueger flap structure was destroyed.

The trailing edge flaps and control surfaces were found mostly intact with some local fire damage, with the exception of the inboard flap system, #4 flap track, and #6 spoiler, which separated from the wing box during initial impact (The #4 flap track was located in the debris path prior to the main wreckage area. See wreckage plots and data table [Attachment 1] for location of these components). Examination of these components showed that the fractures typical of overload, resulting from impact. Details of the LHS wing damage are shown in [Figure 9] and [Figure 11].



**FIGURE 9**



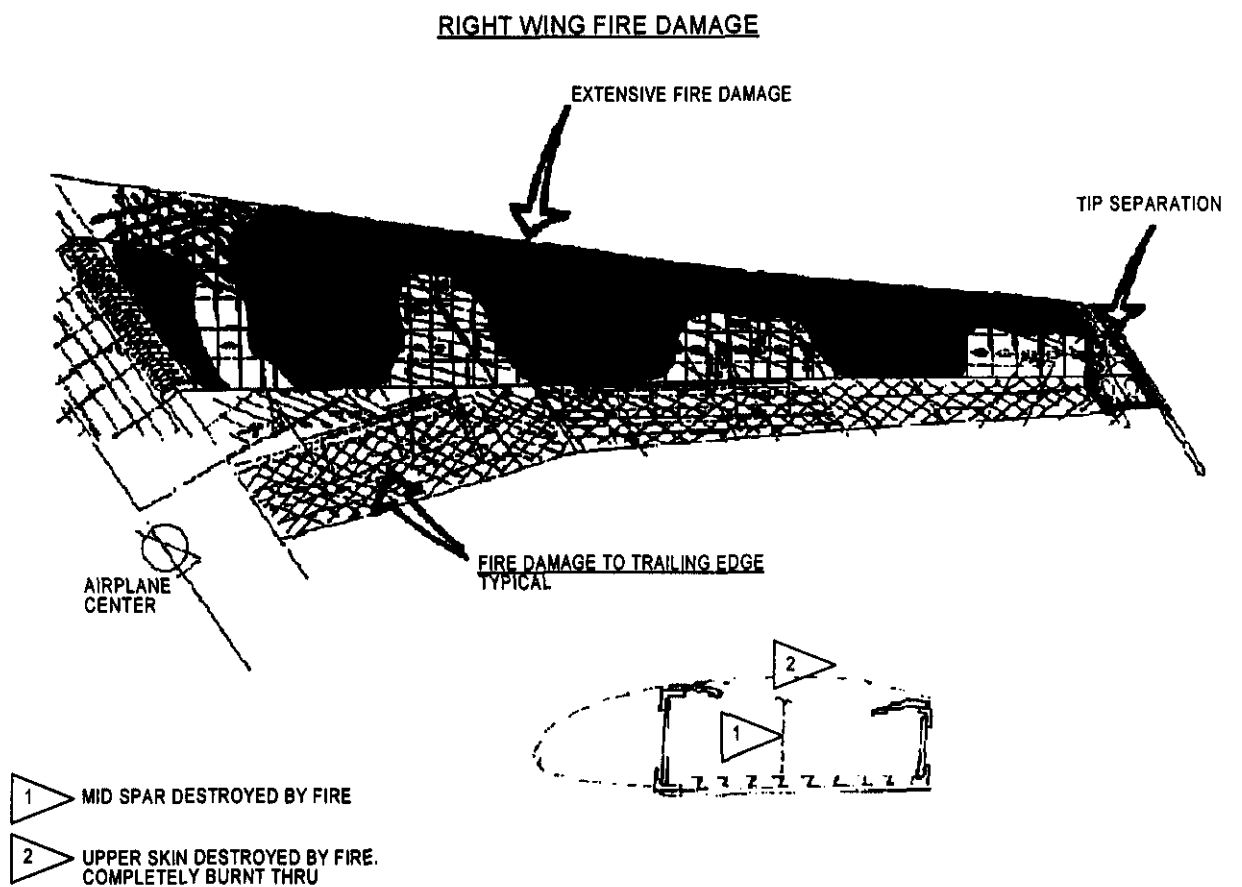
**FIGURE 11**

## 2.2 RHS Wing Section

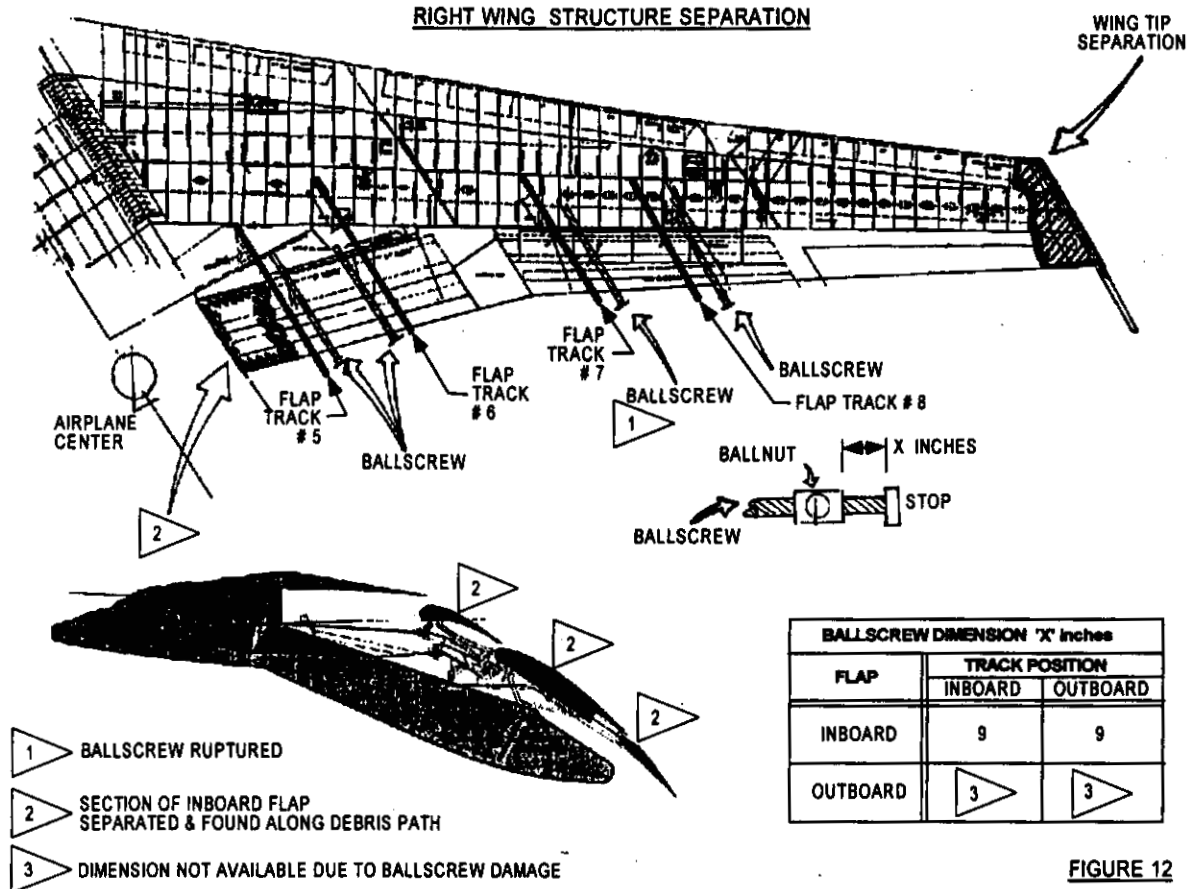
The RHS outboard wing section was located alongside the LHS wing within the main wreckage area, with similar damage to the wing box structure as a result of impact forces and post impact fire damage. The wing structure was approximately 75% complete with extensive fire damage between of the upper skin and related mid-spar web structure between WS 500 and WS 1400. The outboard wing tip was separated at the surge tank end rib in a similar manner to the LHS wing structure and was free of fire damage.

The complete leading edge structure was destroyed by impact forces and post impact fire.

The full compliment of flight control surfaces and trailing edge flaps remained with the wing box, with the exception of approximately six feet of the inboard end of the fore, mid, and aft flap structure (These components were found in the vicinity of the initial impact. See wreckage plots and data table [Attachment 1] for location of these components). The fractures are typical of overload, resultant from impact forces. This section was free of fire damage. Details of the RHS wing damage are shown in [Figure 10] and [Figure 12].



**FIGURE 10**



**FIGURE 12**

### 3.0 WING FLIGHT CONTROL SURFACES

#### 3.1 Spoilers LHS

All flight spoilers, #1 through #5, were accounted for and found in place in a neutral position at the in-spar box structure. Each spoiler had heavy fire damage, with the #1 spoiler outboard end heavily damaged due to the extensive post impact fire.

The #6 ground spoiler was separated from the wing, and was not found, but believed to be in the debris field. Separation point of the spoiler from the spoiler support beam is consistent with overload resultant from impact forces.

#### 3.2 Spoilers RHS

The #7 ground spoiler and flight spoilers #8 through #12 were found in place in the neutral position and attached to the wing. Each spoiler had heavy fire damage.

### **3.3 Ailerons LHS**

Both inboard and outboard ailerons were found attached to the wing box structure. Both flight control surfaces were in the neutral position, with heavy fire and impact damage.

### **3.4 Ailerons RHS**

Both inboard and outboard flight control surfaces were in the neutral position with heavy fire damage.

### **3.5 Flaps LHS**

The full combination of outboard flap and support structure was found in place on the wing box with a detent extension representative of approximately 25 degrees, as indicated by the measured ball screw position (see Figure 11). The flap structure had heavy fire damage.

One hundred percent of the inboard flap and the majority of the support structure was found separated from the wing box and was located in the debris path, with the majority of the structure found close to the initial impact area. The flap structure was found separated into multiple pieces, and was typical of overload, resultant from impact forces. The flap structure remaining with the wing box included the #3 flap track and ball screw transmission unit, from which the aforementioned ball screw measurement was derived from.

### **3.6 Flaps RHS**

The majority of the inboard and outboard trailing edge flaps and support structure were found intact and attached to the wing box, with the exception of approximately 6 feet of the inboard fore, mid, and aft flap structure of the most inboard section of the flap. This section had separated and was found in the debris path in the vicinity of the initial impact area. Separation of this section was typical of overload, resultant from impact forces.

The flap structure attached to the wing box had heavy fire damage.

Examination of the ball screw indicated the flap detent to be approximately 25 degrees. Examination of the #7 flap ball screw revealed a complete fracture of the screw between the universal and the ball nut.

## **4.0 ENGINE ATTACHMENT STRUCTURE**

### **4.1 Engine to Strut**

All four P&W JT9D-7R4G2 engines were found detached from the aircraft. Engines #2, #3, and #4 were located in the main wreckage area. The #1 engine was located close to the initial impact area as shown in [Attachment 1]. Typical engine mount separation is shown in [Figure 13].

Each forward and aft engine mount assembly was located and included the strut forward bulkhead, the cone bolt assembly, and the strut rear engine mount and tangential link assembly. Each of these components were found intact and connected to a section of the fan case and "S" frame segments respectively.

Although the strut and engine frame had extensive impact damage, the primary interface assemblies for both the cone bolt and tangential link assembly of each engine remained intact.

#### **4.2 Strut to Wing**

Each strut to wing attachment common to the upper link, and the strut mid spar under wing fitting of each strut were located and examined (with the exception of the inboard mid spar fitting assembly of the #2 strut installation). This position was inaccessible due to the portion of the wing spar area being completely covered by debris.

Each mid-spar fitting fuse pin was intact as was each mid spar and under wing fitting clevis. All upper links and their respective fuse pins were in place at the wing interface and all the fuse pins appeared to be free of damage. Only the fuse pin and fitting assembly at the forward position of the #4 strut was examined and determined to be free of damage. Similar forward upper spar structure of the remaining struts were inaccessible for examination, as were the diagonal brace to under wing fitting and fuse pin assemblies.

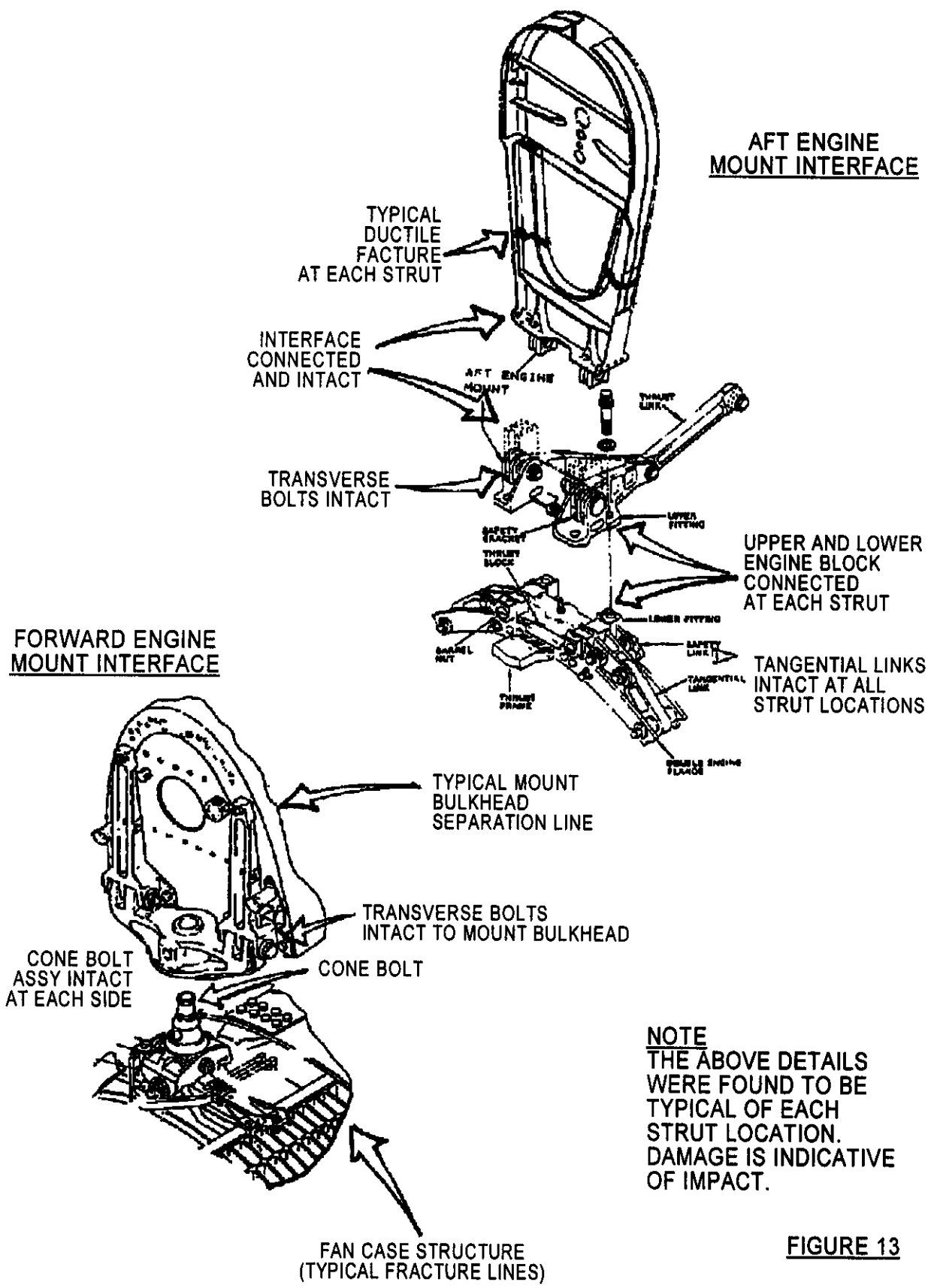
Only three diagonal brace assemblies were located, two in the debris field and one in position under the wing and strut position #3.

#### **5.0 LANDING GEAR**

Examination of the landing gear components revealed that all gears were in the extended position at the time of impact.

End of Page





**FIGURE 13**

A handwritten signature in black ink, which has been partially obscured by a thick black horizontal bar.

Alexander Lemishko  
Structures Group Chairman, Korean Air Flight 801  
National Transportation Safety Board