TWA

April 28, 2000

National Transportation Safety Board
490 L'Enfant Plaza, S. W.
Washington, DC 20594-2000

Attn: Al Dickinson
Investigator In Charge

Dear Mr. Dickinson,

Since the occurrence of this accident TWA has provided the services and expertise of its engineers, flight managers, mechanics, and other safety, maintenance and aviation professionals to assist the NTSB in uncovering the cause of this accident. During the course of the NTSB investigation, TWA personnel spent thousands of hours working at the recovery and reconstruction sites, and some employees remained at the Calverton New York reconstruction site in excess of nine continuous months. Countless others assisted the FBI in obtaining information necessary to their criminal investigation.

As you know, of the 230 persons aboard the accident aircraft, 51 victims were TWA employees and family members Many of those who participated in this NTSB investigation were acquaintances, colleagues or friends of those who perished. While this may have made their participation painful, it also served to create a sense of personal resolve to find the cause of this horrific accident.

What follows is the written submission of Trans World Airlines, Inc. to the NTSB accident investigation of Flight 800. The particular scenario presented to the investigators--the fall of the aircraft more than 13,000 feet, the impact with the water and the efforts necessary to recover aircraft debris and victims from beneath at least 120 feet of water--coupled with the magnitude and scope of the ongoing criminal investigation and intense media coverage, presented the NTSB and the party participants with challenges that were almost unprecedented in prior aviation investigations. We hope to take the lessons learned here and apply them in future investigations.

The perseverance and dedication of all those who worked on this investigation, both our fellow party participants and government employees is to be commended. In particular, we appreciate your efforts and all the work you and your staff have expended on this investigation.

Very truly yours,

Margaret Giugliano

Margaret Giugliano
Assistant General Counsel

April 30, 2000

1. History of the Flight

On July 17, 1996 at 2019 hours a Boeing 747-131, FAA registration number N93119, operating as Trans World Airlines Flight 800 departed John F. Kennedy International Airport, New York en route to Charles De Gaulle Airport, Paris, France. Approximately 12 minutes into flight, the aircraft exploded and fell into the Atlantic Ocean off the coast of Long Island, New York. The last transponder return was recorded at approximately 2031:08; the last altitude reported by air traffic control radar was 13,700 feet. The Captain's altimeter was found fixed at slightly more than 13,820 feet.

1.2 Injuries to Passengers

The active crew of 18 and all 212 passengers sustained fatal injuries and perished in the accident.

1.3 Damage

The aircraft was totally destroyed by the mid-air explosion and subsequent impact with the water.

1.4 Other Damage

None.

1.5 Personnel Information

The crew was fully qualified and current in accordance with FAA and TWA requirements. Captain Steven E. Snyder had approximately 17,268 total flying hours with TWA, of which 4,749 were in the Boeing 747. Captain Snyder was serving as a check airman and was the pilot in command. Captain Ralph G. Kevorkian had approximately 18,800 total flying hours with TWA, of which 5,490 were in the Boeing 747. Captain Kevorkian was occupying the left seat. Flight Engineer Richard Campbell had approximately 18,526 total flying hours with TWA, of which 3,873 were in the Boeing 747 and 2,397 were as a Boeing 747 Flight Engineer. Mr. Campbell was a check airman conducting training of the Flight Engineer. Flight Engineer Oliver Krick had approximately 2,520 total flight hours and approximately 30 hours flight engineer experience flying with TWA, all on the Boeing 747; Mr Krick was receiving "initial operating experience" on this flight.

1.6 Aircraft Information

The aircraft was a Boeing 747-131, manufacturer's serial number 20183, equipped with four Pratt and Whitney JT9D-7AH engines. The aircraft was purchased new from The Boeing Company by TWA in July 1971. Title to the aircraft was conveyed to Iran in 1975, but actual possession was never transferred

to the Iranian government and the aircraft remained in the United States. The aircraft was transferred back to TWA in 1976, where it remained in commercial operation until the accident.

As part of its review of the maintenance records, all maintenance records dating back to the aircraft's date of manufacture through the date of the accident were reviewed by the Maintenance Records Group. According to the NTSB "The records indicated that TWA had accomplished mandatory directives, maintained scheduled maintenance and maintained a continuous airworthiness maintenance program on the accident aircraft. All applicable directives had been complied with, and no maintenance items were deferred."[1]

The aircraft had 93,303 hours and had completed 16,869 cycles at the time of the accident.

1.7 Meteorological Information

Visual meteorological conditions prevailed. The following surface observations were taken at JFK at 1951 hours (Eastern Daylight Time): Winds 220 degrees at 8 knots; clear skies with 25 miles visibility, temperature 71° Fahrenheit, dew point 68° Fahrenheit and an altimeter setting of 30.09 inches of mercury.

[1] Transcript of the Investigator-in-Charge, Hearing Before the National Transportation Safety Board, December 8, 1997 page 34.

1.8 Aids to Navigation

Aids to navigation were not a factor in the cause of this accident.

1.9 Communications

Air Traffic Control communications with Flight 800 were routine. No communications indicative of any problems were sent by the crew prior to the explosion. The last transmission from the flight crew was recorded at nineteen seconds past 8:30pm when they acknowledged clearance to 15,000 feet. All communications were lost at the time of the breakup of the aircraft.

1.10 Aerodrome Information

Facilities were not a factor in the cause of this accident.

1.11 Flight Recorders

Both the cockpit voice recorder (CVR) and the flight data recorder (FDR) were recovered from the submerged wreckage. While the recorders showed signs of extensive impact damage, there was no evidence of fire damage.

The aircraft was equipped with a Sundstrand Model UFDR, serial number 10291 which recorded 18 parameters. The FDR signal amplitude was degraded due to hydrolysis; the CVR tapes were not examined for hydrolysis and attendant loss of high frequency.

The last FDR reading was taken at 20:31:12 and is consistent with the loss of power to the recorder. At the time the recording stopped, the data indicated a wings-level climb, with the parameters of vertical and longitudinal acceleration indicating normal aircraft loads. Some FDR parameters remain unexplained.

The airplane was also equipped with a Fairchild model A-100 cockpit voice recorder (CVR). The CVR indicated a routine flight and included all appropriate checklist requirements. The CVR recording ended at 20:31:12.5 and correlates to within a quarter of a second with the loss of power to the FDR. Termination of the CVR recording was preceded by an abnormal change in the background 400H_z electrical system "hum" and then, approximately 0.73 seconds later the recording stopped abruptly with a loud noise. No further testing of this electrical system "hum" was conducted.

No radar transponder return was recorded after the last FDR and CVR data. The very next sweep of the radar generated only skin paints (non-transponder returns) of the airplane and parts that were separating in the breakup. Consequently there is no radar data that showed altitude information after the explosion of the airplane in flight.

No analysis of the non-speech data on the CVR tape was conducted. Further, no simulation of FDR shutdown due to power loss was conducted to validate that the

terminal data and terminal wave shapes were consistent with Flight 800 data.

1.12 Wreckage Recovery and Impact Information

Wreckage from the airplane was recovered from more than nine square miles of ocean. Recovery efforts were directed by the U.S. Navy and included diving and rescue teams from the FBI, Suffolk County, New York State Police, and New York City Police and Fire Departments. Wreckage was targeted with the use of side scan sonar and laser line scan systems. Wreckage was collected by divers, remote operated vehicles (ROV), ship mounted cranes and winches, and trawling operations. The largest piece of wreckage brought up from the sea was a part of the right wing which measured 80 feet by 15 feet by 30 feet. This piece had to be cut into three smaller pieces to be brought to the beach and then transported over land to the reconstruction site. Floating wreckage was brought in by search and rescue vessels; debris that washed ashore was discovered and turned over by police and private citizens.

The massive recovery efforts resulted in the recovery of approximately 95% of the aircraft. With the aid of an independent rigging contractor, 94 feet of the aircraft fuselage, including the center wing tank, was reconstructed in a three dimensional mock-up. The cabin interior, seats, galleys and lavatories were also reconstructed. All recovered pieces were carefully examined for evidence of an explosive device and none was found.

Debris wreckage recovery fields were designated as red (closest to JFK), yellow (intermediate), green (furthest from JFK), blue (floating) and white (unknown). The red debris field contained pieces of wreckage that separated and fell from the aircraft first; the green debris field contained pieces that fell last. The aircraft nose section was recovered in the portion of the yellow field which overlapped the red zone. The green debris was approximately 1.5 miles east of the red field. The wings, all four engines and the aft section of the aircraft were recovered in the green field.

Because of the complexity and difficulty of recovering tens of thousands of pieces of wreckage from and below the sea, the NTSB admitted errors were made in cataloging and positioning of some of the recovered wreckage .

The accuracy and integrity of the wreckage recovery database were "less than central" and did not form a "foundation" for the Board's determinations and findings, including its reports pertaining to the structural sequence of the breakup of the aircraft and aircraft trajectory.[2]

1.13 Medical and Pathological Information

Autopsies were performed on many of the victims. Every individual had very serious traumatic injuries which evidenced sudden death or onset of unconsciousness. No passengers showed evidence of smoke inhalation and those

[2] Letter dated November 30, 1997 from D. Campbell, General Counsel, NTSB

with thermal injuries had only very superficial burns. However, the complete medical and pathological data base was not made available to the parties for review or analysis.

1.14 Fire

Extensive fire damage is limited to a few very specific areas of the airplane. Fire damage was found on components in the center wing tank; some of the seats above and just aft of the center wing tank; part of the fuselage over the right wing; parts of the right wing including the wing front spar; and parts of the left wing just outboard of the number one engine.

Main cabin floor beams and flooring material (composite fiberglass) were free of fire and/or soot damage. More than one half of the floor panel structure was recovered. Floor panels were reconstructed as to their position in the aircraft and it was noted that very few pieces of the floor panels over the center wing tank showed any evidence of fire or sooting.

Sooting of the fuselage aft of the front spar was limited to the external skin of the aircraft. There was heavy sooting on the aft section of the keel beam. However, the forward section of the keel beam shows little sooting.

The two primary Halon fire suppression bottles in the forward cargo compartment were recovered and had not been fired. Three of the four bottles of

the surge tank fire suppression system for the left wing were recovered; all four bottles for the right wing were recovered. None of the recovered bottles had been discharged.

Vent stringers in the right wing, used to vent the fuel tanks, showed soot deposits. While fire damage was noted on the right outboard wing (where the wing tip broke off outboard of engine number four), no fire damage was noted on the matching wing tip piece except for sooting in the surge tank and in the vent stringer sections.

Passenger seats and certain areas of the center wing tank were examined visually for evidence of high explosive damage such as hot particle penetration, metal erosion, and degree of fragmentation. No evidence of a bomb, missile, or high order explosive damage was found on any pieces of wreckage which were examined.

A large piece of the rear spar (the aft portion of the center wing tank) is heat damaged and sooted on both the inside and outside surfaces. The center of the rear spar is heavily sooted on the inside wall of the center wing tank. However adjoining sections of the rear spar are only lightly sooted. No evidence of electrical wiring or other mechanical failure has been noted on the hardware in the center wing tank.

1.15 Survival Aspects

Every individual had very serious traumatic injuries which evidenced sudden death or onset of unconsciousness. This was not a survivable accident.

1.16 Tests and Research

Metallurgical and forensic examinations conducted found no evidence of a missile impact or detonation of a bomb within the aircraft.

Not all reports were shared with the parties and the results of certain explosive residue tests conducted by the FBI were excluded from evidence presented at the Board's initial hearing in December, 1997.

Despite the extensive testing and research undertaken by the Board, no defective components were identified on the accident aircraft. TWA was not a party participant in testing conducted by outside organizations on ignition energy and Jet-A fuel characteristics and cannot comment on these test protocols or results. However, fuel flammability tests which were conducted do not appear to address the issue of minimum energy required or available within the aircraft for fuel vapor ignition.

1.17 Organization and Management Information

Initially the NTSB did not act as the lead agency in the accident investigation and the lack of coordination between the NTSB and Federal Bureau of Investigation

contributed to the loss of relevant information. Until the NTSB assumed control of the investigation after November 1997, parts of the wreckage were freely removed by the FBI from the reconstruction site for testing at the FBI crime lab. In many instances the FBI did not document removal of such wreckage and/or did not document its return, in accordance with the procedures set up by the NTSB.

1.18 Additional Information

1.18.1 Air-conditioning Packs

The three air conditioning packs which provide conditioned air (pressurization, ventilation and temperature) to the passengers and crew areas are located below the center wing tank. In accordance with standard TWA procedures, only two of the three air conditioning packs are operated while the aircraft is on the ground and this operation was confirmed for Flight 800. Further during such ground operation, the packs are powered by the APU.

At the time of the accident, all three packs were in operation. Visual inspection of electrical wiring for the heat exchanger section showed no evidence of arcing or melting of any wiring.

1.18.2 Systems

(a) Center Wing Tank Pumps

Electrical power to the fuel pumps in the center wing tank are controlled

by a switch on the flight engineer's panel. After exhaustive testing, no mechanism that could provide power to the center wing tank pump was identified. In accordance with TWA standard flight manual procedures, none of the pumps in the center wing tank would have been in operation at the time of the explosion. No physical evidence was found to suggest this was not the case.

(b) Analysis of Aging Aircraft Wiring

Most of the deficiencies in electrical system wiring cited in NTSB reports were observed in retired, out-of-service aircraft and no relevant deficiencies were observed in the wiring recovered from the accident aircraft.

(c) Fuel Flow Indicator

Approximately 10 minutes after take-off the flight crew observed an erratic fuel flow indicator for engine number 4. According to the NTSB this is "a common occurrence in the 747".[3]

(d) Maintenance Repairs

In its recommendations (NTSB letter dated April 7, 1998 to Federal Aviation Administration), the NTSB alleged two "inappropriate repairs" on the accident aircraft. The shielding of the wing tip FQIS probe wire

[3] Transcript, p 35.

had been broken and repaired by splicing a crimped connector and covering it with adhesive tape. This repair was made in accordance with TWA's FAA approved maintenance program, using manufacturer-approved repair materials.

The second repair involved an oversized terminal block strain relief "P" clamp. However, after a thorough search of tens of thousands of pages of maintenance records on the accident aircraft, no record of this clamp being repaired or replaced was found.

In any event, there is no alleged nexus between either of the above two repairs and the probable cause of this accident.

1.18.3 **Eyewitness Statements**

Early attempts by the Board's Witness Group to assemble, review and analyze eyewitness accounts of the accident were entirely pre-empted by the FBI's criminal investigation. The Board's initial Witness Group disbanded after it became apparent that the FBI would not cede authority to the NTSB to conduct interviews of eyewitnesses to the accident. Further, the Group's preliminary, draft report, as well as all other eyewitness data, were purposefully omitted from the Board's discussion and presentation at the December 1997 public hearing, at the insistence of the FBI.

After the FBI announced it was suspending its criminal investigation into the accident during a November 1997 press conference, the NTSB reconvened the work of the Witness Group. Subject to few exceptions (noted below) the NTSB investigation and analysis of eyewitness accounts of the explosion and breakup of the Flight 800 aircraft was based entirely on accounts of such witness as were recorded by hundreds of FBI agents who conducted such witness interviews.

Between February and April 1998 a total of 755 witness statements had been turned over to the NTSB Witness Group by the FBI; the Group determined that these accounts represented the statements of 736 different witnesses, of whom 105 were interviewed more than once. The quality of the reports of witness observations was so poor that the Group could not determine the credibility of the witness's account nor the context of the statement, i.e., if a witness saw the complete sequence of events. Names, addresses and other identifying information had been redacted from the statements by the FBI. The statements varied greatly in the level of detail and were generally geared towards the FBI's investigation of evidence of a bomb or missile. The severe limitations in the methodology evident in this body of data is more fully documented in the Witness Group Chairman's Factual Report (dated February 9, 2000).

The Group identified 258 witnesses who saw a streak of light, frequently described as a flare or fireworks, traveling in various directions. Of these witness accounts, 210 contain descriptions of a ball of fire. While most of the streak of light accounts are consistent with the calculated flight path of the aircraft, the Group identified 38 accounts from eyewitnesses positioned in diverse locations along the south shore of Long Island that described a streak of light that rose vertically or near vertically. These 38 accounts of a streak of light are inconsistent with the flight path of the accident aircraft, its break-up, and fall into the ocean.

The significant findings of the Group Report do not refute nor support any explanation or theory of events with respect to the probable cause of the explosion.

The notable exception to FBI generated accounts of eyewitness reports consists of statements of certain airborne witnesses taken by NTSB and by the Witness Group, as a whole. Most airborne witnesses were pilots and hence experienced observers of aircraft whose statements were particularly reliable. The captain of Eastwind flight 507 was in a good position to view the accident aircraft prior to the explosion. He related observing the accident aircraft for several minutes in normal flight, with what appeared to be its landing lights on, whereafter the aircraft exploded in a huge orange ball and evidenced no climb above its pre-explosion altitude.

These observations did not comport with the trajectory of the aircraft in its final stages of flight and structural breakup, as depicted in the CIA videotape entitled “TWA Flight 800; What Did the Witnesses See”.

1.18.4 **Database**

Aircraft wreckage was scattered over a large area and was submerged under approximately 120 feet of water. At various times in the recovery process, each piece of wreckage passed through the hands of the several government agencies involved in the recovery process. Each such agency assigned an identifying number to each piece and kept a log of its recovery efforts.

While most Navy recovery vessels remained in a fixed mooring, pieces of wreckage were identified by laser line scan, side scan sonar and remote operated vehicles and the locations were entered into a target data base by latitude and longitude. Navy divers, using such target data, would recover wreckage (or direct surface vessels in the underwater recovery of heavy pieces of wreckage); divers maintained logs of their finds and in some instances divers also prepared sketches of wreckage they observed. Once on board the recovery vessel, the location of the recovery was also entered into the ship’s log. Wreckage was then tagged and also given an FBI identifying lot number. Wreckage was transferred to land by Navy landing craft, and sometimes, depending on the type or size of the wreckage, by

other ships or helicopter. On land the wreckage was loaded onto trucks and transported to the reconstruction site.

The very dynamics of this process along with time pressures brought to bear by the high level of media attention and family concern for the prompt recovery of victims, led to incorrect data entries and tagging. The NTSB, recognizing the initial deficiencies in the process attempted to conduct a database validation study[4] but, due to the enormity of the task, only succeeded in validating ad hoc pieces of the recovered aircraft.

In this study, the NTSB reported instances of missing, incomplete, unavailable or duplicate data. For instance, pieces of wreckage arrived at the hangar that had been purposely cut or that had broken in transit and which had no tags. Other pieces arrived with wet and illegible or patently inaccurate or invalid tag numbers. Further, the ships logs were not available to the parties and were not used by the NTSB in their tags validation documentation. For certain wreckage, the study relied on the FBI's identifying lot numbers, which were "never intended to provide a mechanism for tracking recovery locations."[5] In short while the report provides a comprehensive overview as to the complexity of the process of identifying the location of all wreckage recovered, it also serves as an excellent source for identifying the unreliability in that process.

[4] NTSB "Data Management Study Report" dated October 20, 1997

Accordingly, some pieces of wreckage have a higher degree of certainty as to the location of their recovery and this level of certainty varies greatly among the wreckage overall.

Finally, it should be also noted that Database Management was not initially a party activity, and by the time all parties were engaged in database activity, they were confronted with a whole set of data and recovered wreckage which had been tagged with inherent flaws in the process.

2.0 Analysis

2.1 **Investigative Techniques** While publicly the NTSB and FBI claimed to work closely together in an effort to find the cause of the accident, it became readily apparent that the lack of coordination between the two agencies had serious implications in the quality of the investigative product.

2.1.1 The taking of eyewitness statements by a disjointed corps of FBI agents who were untrained and uninformed in aviation matters, resulted in a body of witness statements unsuited to an aircraft accident investigation. Further, many witness accounts gathered by the FBI were tainted by newspaper accounts of the accident and/or by suggestive questioning of

[5] Data Management Study Report p 29

the FBI interviewer. Finally, the failure of the NTSB to obtain and review the witness statements promptly after the accident and again after the FBI suspended its criminal investigation in November 1997, resulted in the irretrievable loss of valuable information.

2.1.2 The premature release of incomplete investigative information, the clear break with established protocol, the intense media attention this accident received, and the parallel criminal investigation obscured the focus and direction of the search for the probable cause of the accident.

2.2 Testing

The NTSB conducted many tests (such as the quarter-scale testing, fuel flammability and others) outside the party system. Consequently party members were unable to participate in any meaningful way, such as commenting on the testing protocol or making suggestions as to the methodology, or analyzing the results with respect to other evidence uncovered in the investigation.

3.0 Conclusion

3.1 Findings

3.1.1 The aircraft was operated and maintained in accordance with all FAA, Boeing and TWA requirements. No change in the airline's operating procedure was mandated by information developed during the course of the accident investigation.

3.1.2 There were no pre-explosion failures of any component on the accident aircraft or any of its systems.

3.1.3 TWA no longer operates the Boeing 747 aircraft.

3.2 **Probable Cause**

3.2.1 The aircraft exploded in flight. The source of ignition of the Jet-A fuel vapor remains unidentified.

4.0 Recommendations

4.1 Where a criminal investigation parallels the NTSB accident investigation, the NTSB must take all necessary steps to ensure preservation of all evidence pertinent to finding the probable cause of the accident.

4.2 Where aircraft wreckage is to be recovered from under sea or from difficult or remote terrain the NTSB should ensure that an accurate mapping of such wreckage is complete before recovery efforts proceed.

4.3 Regardless of any parallel or on-going criminal investigation, the NTSB must have prompt access to all eyewitnesses to an accident.