DOCKET NO. **SA- 516**

EXHIBIT NO. **23B**

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C

FLIGHT TEST PLAN

(50 Pages)

NATIONAL TRANSPORTATION SAFETY BOARD
Office of Aviation Safety
Washington, D.C. 20594

July 10, 1997

FLIGHT TEST PLAN

A. ACCIDENT : DCA96MA070

Location : East Moriches, New York

Date : July 17, 1996

Time : 2031 Eastern Daylight Time

Airplane : Boeing 747-131, N93119
Operated as Trans World Airlines (TWA) Flight 800

B. FLIGHT TEST GROUP

		Initials for agreement with: Safety	Test Plan
NTSB Test Director:	Robert Benzon	______	______
Boeing Test Director:	Roland Johnson	______	______
FBI/DoD Coordinator:	Steven A. Bongardt	______	______
Evergreen Airlines (EVG):	Kevin Rickard	______	______
FAA Coordinator	Michael Collins	______	______
ALPA:	Steven D. Green	______	______
TWA:	Terry Stacey	______	______

C. SUMMARY

On July 17, 1996, at 2031 EDT, a Boeing 747-131, N93119, crashed into the Atlantic Ocean, about 8 miles south of East Moriches, New York, after taking off from John F. Kennedy International Airport (JFK). All 230 people aboard were killed. The airplane was being operated as a Code of Federal Regulations (CFR) Part 121 flight to Charles De Gaulle International Airport (CDG) at Paris, France, as Trans World Airlines (TWA) Flight 800.

This document contains the details of a flight test plan to obtain time/temperature histories for a 747-100 series airplane fuel system during specific flight configurations that follow specified preflight, taxi, takeoff, and climb flight profiles. The data is to be collected from center wing tank (CWT) surface temperatures, CWT air temperatures, and pressure within the several bays of the CWT and the wing tip surge tanks. Additional goals will be to obtain a time temperature history of the inside of the air conditioning pack bay beneath the CWT. Vibration instrumentation and vapor sampling equipment will also be installed on the aircraft. An airframe identification exercise will be conducted with FBI/DoD ground-based personnel and equipment.

DETAILS OF THE TEST FLIGHT SERIES

1. Dates

The airplane is to be in position for the accomplishment of Boeing Service Bulletin 747-28-2205 on the morning of July 7, 1997. Evergreen Airlines (EVG) is responsible for getting the airplane in position and for ventilating the CWT sufficiently to allow instrumentation work to begin.

Boeing is to have test instrumentation ready for installation and at the airplane on the morning of Tuesday, July 8, 1997. The installation is planned to take no longer than 4 days.

Flight testing is scheduled to begin on July 12-14, 1997, unless the instrumentation installation is completed earlier.

Boeing will be notified 48 hours prior to when the instrumentation needs to be removed. Removal of instrumentation is tentatively scheduled for July 16-17, 1997, following the completion of the modified air conditioning pack inlet flight of the series, and after EVG purges the CWT of fuel fumes.

2. Location of Project and Prior Required Coordination

The location for the test will be John F. Kennedy International Airport, New York.

Coordinating for aircraft certification for the test flights will be the performed by the NTSB, with the cooperation of Evergreen to make application, Boeing for instrumentation and engineering, and the FAA Farmingdale, NY, MIDO.

The Boeing flight crew and Evergreen will coordinate to perform dispatch and flight planning, with NTSB and FAA approval. The FBI/DoD will provide approval for FBI/DoD flights.

The NTSB will coordinate with the FAA and aircraft captain to arrange air traffic considerations and will request non-routine operations in writing prior to commencing flight tests.

2.1 Required Meetings

All members of the flight test group, the flightcrew, and required technicians will attend one flight readiness review meeting on the Friday, July 11, at 10 am, to discuss procedures and the overall safety of the test flight series. The meeting place is EVG Hangar 16, CREW ROOM (located behind the Tower Air blast fence).

Individuals involved with each test will meet prior to each test to discuss the conduct of that test. Following each test, the individuals involved will meet to debrief and exchange notes taken during the test flight.

3. Test Aircraft

This test will be conducted on a Boeing 747-121 series airplane. The airplane to be flown is an Evergreen freighter and was built as Boeing line number 106 (S/N 20348), registered as N480EV. The aircraft will be IFR certified.

EVG will provide internal space in the cabin for instrument installation by removing any passenger seats and interior trim panels and installing seating, floor rails, or other aircraft mounting points for test equipment.

EVG will provide weights to simulate the weight and center of gravity loading of the accident airplane. These weights may be necessary to replicate the climb performance, fuel flow, and thermal signature of the airplane.

Weights shown in the Operations Group Notes include: take-off weight of 590,441 lbs., dispatch fuel of 181,100 lbs., takeoff fuel of 176,600 lbs., and fuel at time of accident as 165,000 lbs. [estimated]. An attached page shows an operating weight of 359,440 lbs. and zero fuel weight of 413,841 lbs. Copies of the Weight and balance papers from the accident flight have been distributed to the parties to this activity.

EVG will reinstall any previously removed passenger seats and interior trim panels following the completion of the flight test, if required, and return the airplane to operational status.

3.1 Minimum Aircraft Requirements

The standard for aircraft conformity includes floorboards over the CWT, operating APU, and three fully operational air conditioning packs.

3.2 Deviations

An inspection will be performed by EVG to confirm that no fuel is leaking into the CWT. Other sources to inspect for will include a pressurized cross-feed manifold, APU line, and jettison tubing. Sources of leakage found will be documented and corrected prior to the beginning of testing.

3.3 Instrumentation/Modifications

3.3.1 General

Flight test instrumentation will minimize changes to the airplane. The airplane will be returned without change, other than potential minor cosmetic marks in concealed areas. An example of potential cosmetic marking would be the location of thermocouple attachment in the air conditioning bays, on wing spars, or in fuel tanks that are not visible when the airplane is operational.

Power for any instrumentation will be independent or will come from non-flight critical electrical sources, such as a cabin or galley service electrical bus.

All instrumentation parameters will be automatically recorded on data recording equipment at a rate of one sample per second, minimum. Specialized requirements may require higher sampling rates, such as for vibration.

Recording equipment shall be activated before the air-conditioning packs begin operation on the ground.

In addition to specialized instrumentation that is added for the flight test, altitude, mach, pitch attitude, airspeed, roll attitude, and any available source of aircraft data for CWT fuel quantity, bleed air, and pack data shall also be recorded from existing aircraft sensors or sensor locations. TAT shall be automatically recorded data.

Flight deck video recording will be accomplished continuously through the test sequences by video record(s), to be provided by Boeing. The recorder is to be focused continuously upon the flight engineer's panel in the area of the fuel, bleed, and pressurization panels.

The data shall include individual parameter recordings from each of the source sensors that normally lead to the following flight engineer panel information <u>or</u> video recording that includes:

1. Left and right duct pressures (2 sensors),
2. Manual bypass valve position (1 sensor),
3. Inlet Door position (1 sensor),
4. Exit Door position (1 sensor),
5. ACM outlet temperatures (3 sensors),

6. Compressor discharge temperatures (3 sensors),
7. L/P Duct pressures (3 sensors)
8. Trim valve positions (4 sensors)
9. Compartment and duct temperatures (8 sensors)

The CWT Fuel Quantity Instrumentation System LO Z wiring shall be instrumented with shielded wiring to record voltage and current.

No on-line data will be available, but there will be a limited real time data monitoring capability.

Provisions will be made to secure the flight recorder data for readout by the NTSB laboratory following the flight test series. The circuit breaker is to be pulled following each flight and reset prior to beginning each test sequence.

3.3.2 <u>Temperature instrumentation:</u>

3.3.2.1 <u>Pre-flight</u>

The following data will be recorded at intervals during the ground portions of the test:

Outside air temperature(15 minute intervals)

Fuel tank temperature (production probe indication). Record during refueling operation at start, near midpoint and after main tank is fueled. Thereafter, record at least every 15 minutes on the ground and by video recording during flight (manual notes may be taken if data is not captured by video).

A checklist form, such as a Boeing Test Item Planning Sheet, will be used in flight for recording data and ensuring that test items or results are not omitted shall be developed by Boeing (and approved by NTSB) prior to the flight test.

3.3.2.2 <u>Surface measurements</u>

1. 10 thermocouples on external CWT bottom right side located midway between tank centerline (keel beam) and right CWT side of body structure at right butt-line 58. Thermocouples should be spaced approximately equidistant from front to rear of the tank (approximately every 2 feet, beginning 1 foot aft of front spar). Due to interference of air conditioning packs, these locations may need to be altered slightly. [10 total]

2. Same as #1, on left side of tank. [10 total]

3. 5 thermocouples on external CWT bottom approximately at right butt-line 22. Thermocouples should be centered under each CWT fuel bay. [5 total] Due to interference of air conditioning packs, these locations may need to be altered slightly.

4. Same as #3, on left side of keel beam. [5 total]

5. 4 thermocouples on interior of the right side of body rib, within the fuel tank. Each thermocouple should be equidistant from top and bottom, centered longitudinally in each bay. [4 total]

6. Same as #5, on left side of body rib. [4 total]

7. Surface thermocouple on tank bottom above the right side pneumatic bleed duct at the front and rear of the lower tank surface. . [2 total]

8. Same as #7, on left side. [2 total]

9. On interior roof of CWT, one thermocouple located in the center of the aft bay (left side), one between mid-spar and spanwise beam 2, one between spanwise beams 2 and 3. [3 total]

10. 1 on fuel cross feed tube near the butt-line zero rib. [1 total]

11. 1 each (left and right rear bay) centered on interior rear spar. [2 total]

12. 1 near each flow control valve [3 total]

13. 1 between the ACM compressor outlet and the check valve [3 total].

14. 1 on the back/top of an exhaust louver for each heat exchanger, near the center of the exchanger. [3 total] NOTE: May be changed to a measurement of air temperature at same location upon review of louvers for instrumentation.

15. 1 at the outlet from each water separator [3 total]

3.3.2.3 Air temperature measurements

1. In the two forward bays (between spanwise beams 2 and 3, between spanwise beam 2 and mid spar) one thermocouple tree located in center of bay (above keel beam). Each tree consists of 11 thermocouples arranged vertically, one in the center and five thermocouples at each end spaced vertically at 1 inch intervals starting one inch from the top and bottom tank surfaces. [22 total]

2. In the forward two bays (between spanwise beams 2 and 3, between spanwise beam 2 and mid-spar) approximately four inches from the side of body rib on the left and right sides, centered longitudinally between the respective spanwise beams and/or the midspar. Each tree consists of three thermocouples arranged vertically, one each located 3 inches from the top and bottom surfaces, one in the center. [12 total]

3. 5 thermocouples located 4 inches below every other surface thermocouple installed in Section 3.3.2.2, items 1 and 2. Five additional thermocouples located beneath each of the thermocouples installed by Section 3.3.2.2, items 3 and. Location may be adjusted slightly depending upon convenience of installation. [10 total]

4. 1 thermocouple tree centered in each the left and right bays (between mid spar and spanwise beam 1, and in each of the aft-most bays between spanwise beam 1 and rear spar. [12 total]

5. One thermocouple located in center of each CWT vent inlet, as far into the vent as practical. [4 total]

6. Thermocouple located in main gear well near scavenge pump, approximately 1 foot above keel beam. [1 total]

7. One thermocouple centered in the flow of the vent stringer coming into the right wing vent surge tank and one in the collector can, as far into each stringer as installation permits, where the venting from all tanks is combined to pass overboard. [2 total]

8. Same as #7, in left wing surge tank. [2 total]

9. One fuel temperature thermocouple centered laterally in right rear bay, ½ inch from the floor at the rear spar. [1 total]

10. Same as # 10, in left rear bay [1 total]

11. One fuel temperature thermocouple on right side of tank, ½ inch from floor at lowest point in CWT as airplane is sitting on runway [1 total]

12. Same as # 12, on left side of tank [1 total]

13. Check operation and accuracy of temperature sensors used for flight engineer panel information relating to pressurization and air conditioning. Note: This does not have to be finished prior to flight, but will be needed to interpret video recorder data. Boeing is to accomplish this check with hand-held instrumentation.

14. Additional thermocouples as requested by the Federal Aviation Administration (FAA) in tank 3 and the vent system. This will include a surface thermocouple located as far into a vent stringer as is practical from the wing tip surge tank.

3.3.3 **Pressure Instrumentation:**

1. One (absolute) pressure sensor installed on one thermocouple tree located in forward bay (swb 2- 3), rear bay, and between spanwise beam 2 and mid spar. [3 total]

2. One (absolute) pressure sensor located in each left and right wing surge tank. [2 total]

3. Check operation and accuracy of pressure sensors used for flight engineer panel info relating to pressurization and air conditioning. Note: This does not have to be finished prior to flight, but will be needed to interpret video recorder data. [*Bob Lonneman is checking into this item*]

3.3.4 **Vibration Instrumentation:**

1. Measurements for vibrations in all three axis are to be taken from instrumentation mounted on the exterior of the lower CWT skin. The transducers will be mounted as close as practical to the center of the right aft-most bay of the CWT.

2. Vibration frequency of interest is believed to be below 400 hertz, which will be within the capability of the accelerometers provided by Boeing. Data sampling will be at a rate of 800 samples per second.

3.3.5 **Vapor Sampling**

3.3.5.1 To be installed to sample CWT vapors at specified points in the test program. Copper or stainless tubing will carry the samples to six pre-evacuated one liter flasks that are contained within a metal box that has control valves on the outside. The samples will be taken from between spanwise beams 2 and 3, about one-third from the top of the CWT.

3.3.5.2 When samples are taken, time and altitude will be written down. Fuel samples will be taken before and after each vapor sampling flight. The temperature of the closest thermocouple will be used for a temperature reference. Target points for each sample are after two hours of pack operation and during each flight test are:

Sample 1. Prior to flight.

Sample 2. At approximately 10,000 feet in climb.

Sample 3. At approximately 14,000 feet in climb.

4.0 **Personnel**

4.1 **Airplane Occupants During the Test Flights:**

The personnel aboard the airplane will be limited in flight to those required for operating the airplane and conducting tests. No other personnel will be authorized to occupy the airplane during the flight test without the expressed permission of the NTSB test director. The following are the currently anticipated personnel to be aboard the airplane for the tests:

1.	Captain	Dale Ranz
2.	First Officer	Jamie Loesch
3.	Flight Engineer	George Kegebein
4.	NTSB Program Test Director	Robert Benzon
5.	NTSB Data Analysis Engineer	Dan Bower
6.	Boeing Test Director	Roland Johnson
7.	Flight Instrument Engineer	Rob Pugh
8.	Vapor Sampling Ops. (Vapor only)	Bob Lonneman
9.	Flight Analysis Engineer	Dan Peters
10.	Analysis Engineer (Boeing flights only)	Dave Talbot
11.	Design Engineer (Boeing flights only)	Casey Ng

4.2 **Maintenance crew**

Maintenance personnel and tooling to support the flight operation will be the responsibility of EVG.

5.0 **Test Procedure**

5.1 **Dispatch and data recording**

EVG will be responsible for the mechanical dispatch of the airplane.

Boeing, NTSB, and FBI/DoD will be responsible for flight planning (See Section 2).

Boeing will be responsible for data recording, with NTSB monitoring.

The target outside air temperature for at least one dispatch is 80-85°F, or the closest local temperature for the days of test flights, although the final go/no go decision is the responsibility of the Safety Board Test Director.

Data recording will begin with CWT and air conditioning packs near ambient temperature, prior to beginning of pack operation on the ground. Supplemental fans may be used to speed cooling of the pack bays. Evergreen is to collect one liter fuel samples before and after each test flight from the center wing tank sump.

See Section 2 for air traffic and any other FAA coordination.

Perform normal TWA fuel tank management procedures during the test sequences unless otherwise noted.

5.2 Airplane Fuel Load

EVG will fuel the CWT after filling all other tanks and as a separate operation from other tank fueling. The type of fuel to be used will be Jet A.

Total fuel tank loads at take-off will be:

M1 & M4 = 24,600 lbs. each
M2 & M3 = 62,900 lbs. each
CWT = 50 gallons (may use truck or hydrant meter)
R1 & R4 = 3400 lbs. each

5.2.1 Measure the 50 gal addition to the CWT by using the fuel truck meter at low fueling flow rate for best accuracy of loading. Do not transfer fuel into or out of the CWT after this loading. Provisions will be made to secure fuel from Athens for the 50 gal addition before the execution of the NTSB flights.

While adding fuel to the CWT, the flight engineer will monitor the flight engineer fuel panel and record the point at which the CWT quantity begins to register, if it does.

5.2.2. The truck or hydrant temperature of the fuel loaded into the airplane is to be recorded. Temperature acceptance is the responsibility of the NTSB.

5.2.3 Record fuel quantities shown on flight engineer's panel.

5.2.4 If not already in operation, start the APU.

5.2.5 Verify dispatch fuel load if the APU has been used.

Test Flights Description - The order and dates on which the test flights are performed are subject to change due to operational considerations. The final test flight calendar will be detailed as a separate attachment. The flights are detailed here, and do not reflect the order in which they will be flown, with the exception of the cruise flight and TWA800 emulation flight, which much be performed sequentially, and the last two Boeing pack inlet modification flights, which must be done sequentially and at the end of the test flight series. Additionally, the FAA has requested the cross-feed flight to be a second flight on any flight day.

5.3 **Packs 2 & 3 Continuous**

Note: Record all start/stop fuel quantities and fuel panel actions during the test sequence.

5.3.1 Start the data recording equipment

5.3.1.1 Once data recording begins, the number 2 & 3 air-conditioning packs will be manually selected to high flow for three hours. Ensure that the flight engineer panel controls are set to the fully COLD position and that the engine bleed valve knobs are in the closed positions. Temperature data will be monitored by the NTSB. NTSB will determine the feasibility of reducing the air-conditioning run time to 2 hours.

5.3.1.2 Check to ensure that the FDR circuit breaker is set.

5.3.2 Following the three hour period, takeoff and climb according to the following flight profile with the number 2 & 3 air-conditioning packs selected. Start engines by the TWA Start, Taxi, and Takeoff Fuel Management Procedures identified in TWA Flight Handbook, with the following requirements:

Maintain air conditioning pack operation through start, takeoff, and climb.

Engine start order is 1, then 2, then 4. Start engine 3 when 5 minutes from takeoff.

Note: Chart a sample of CWT temperatures while in flight.

5.3.3 Brake release to 1500 feet AGL: Takeoff and climb through flap retraction and accelerate to 220 KCAS (Takeoff EPR of approximately 1.35). Record CWT fuel quantity.

5.3.4 1500 ft AGL to 5,800 ft AGL: Climb at 1900 fpm and accelerate to 250 KCAS. (Reduce EPR to 1.25 at 2400 ft AGL). Remain at 5800 ft AGL for 20 seconds.

5.3.5 5800 ft AGL to 12000 ft: Climb at 2000 fpm and remain at 250 KCAS. (Increase EPR to 1.32) Record CWT fuel quantity.

When the fuel quantity in main tanks 1 and 4 is 23,000 pounds each, perform cross-feed according to the TWA Flight Handbook procedure.

5.3.6 12000 to 13000 ft: Reduce climb rate to 1000 fpm and increase to 295 KCAS. (Reduce EPR to 1.2 at 12,500; reduce to 1.0 at 13000)

5.3.7 13000 ft.: Reduce altitude to 12800 ft over the next minute; reduce speed to 280 KCAS. Once 12800 ft is obtained, increase EPR to 1.10

5.3.8 13000 to 13700 ft: Slowly start to increase altitude to 13200; Increase EPR to 1.3, one minute after previous EPR increase, and climb through 13700 at 1200 fpm to 17,500 feet AGL. Monitor CWT temperatures and begin descent after constant CWT temperatures (NTSB decision) have been maintained for 20 minutes. Record CWT fuel quantity.

5.3.9 Record CWT fuel quantity in descent. Return to JFK and prepare airplane for the next flight.

5.3.10 Following parking and engine shut-down, ensure that FDR circuit breaker is pulled.

5.4 **<u>Packs 1 &2 and cross-feed from tank 3</u>** <u>(Must follow a flight at altitude to cold soak)</u>

5.4.1 Once the CWT temperature has stabilized after the flight, start the data recording equipment.

5.4.1.1 Take a one liter fuel sample.

Note: Record all start/stop fuel quantities and fuel panel actions during the test sequence.

5.4.1.2 Once data recording begins, the number 1 & 2 air-conditioning packs will be manually selected to high flow for three hours. Ensure that the flight engineer panel controls are set to the fully COLD position and that the engine bleed valve knobs are in the closed positions.

5.4.1.3 Check to ensure that the FDR circuit breaker is set.

5.4.2 Following the three hour period, start engines by the TWA Start, Taxi, and Takeoff Fuel Management Procedures identified in TWA Flight Handbook, with the following requirements:

5.4.2.1 Shut the air conditioning packs to start engines 1, then 2, then 4.

5.4.2.2 Use packs 1 and 2 for taxi.

5.4.2.3 Start engine 3 when 5 minutes from takeoff.

5.4.2.3 Take a vapor sample while on the ground.

5.4.2.3 Shut the packs for takeoff, then turn one pack on at 400, 600, and 800 feet AGL.

Note: Chart a sample of CWT temperatures while in flight.

5.4.2.4 Take vapor samples at 10,000 and 14,000 feet AGL.

5.4.2.5 Climb according to the schedule prescribed in steps 5.3.3 to 5.3.10, but at 6:20 minutes into the climb, use the cross-feed configuration of main tank 3 feeding engines 1,2, and 3 (both No. 3 boost pumps operating) and tank 4 feeding engine 4 (both boost pumps operating).

5.4.2.6 Stop the cross-feed after 5 minutes and return to TWA Flight Handbook fuel management procedures and resume the schedule prescribed in 5.3.X (as appropriate to the altitude), climbing to 17,500 feet AGL.

5.4.2.7 The flight is to last until CWT temperatures stabilize (NTSB decision). Record CWT fuel quantity.

5.4.2.8 Record CWT fuel quantity in descent. Return to JFK and prepare airplane for the next flight.

5.4.2.9 Following parking and engine shut-down, ensure that FDR circuit breaker is pulled.

5.4.2.10 Take a one liter fuel sample.

5.5 Support of FBI/DoD aircraft identification activity

The Federal Bureau of Investigation (FBI) and the Department of Defense (DoD) will conduct passive aircraft identification activity during a flight in this series. The flight will originate out of JFK, utilize airspace over and near the FAA Technical Center runways (ACY) in Atlantic City, New Jersey, and return to JFK. No extra onboard equipment is required. All data will be collected by mobile vans on the ground. Phase 1, phase 2, and phase 3 flight activity (described below) in support of the FBI/DoD must be done in VFR conditions. A communications capability between the Boeing flightcrew and the FBI/DoD data collection van will be established via VHF radio. Available VFR days near Atlantic City, New Jersey, during the test week will be used for the flight. The earliest day that the flight could take place, for logistical reasons, would be Sunday, July 12. Because of sun angle considerations, this flight should begin on or about 1300 hours and will last 7-8 hours.

Details of the flight activity will be coordinated between the FBI/DoD contractor (Dr. H.C. Schau, Hughes Aircraft) and the Boeing flight crew during a meeting at JFK on or about Friday, July 11, 1997. A general description this activity is attached:

5.6 **<u>Cruise Condition (All packs to FL 350)</u>** (Must precede TWA800 emulation)

5.6.1 On the ground, prior to this flight, with electrical power provided by the APU, record the voltage and current on the CWT FQIS LO Z wiring during:

Note: Record each event as it is being tested for later correlation with the electrical recording.

1. Cycle on/off interior and exterior lights,
2. Transmit on each radio,
3. Verify transponder and radar altimeter operation,
4. Operate each switch (possible) at the flight engineer's panel. Operate the CWT Jettison pumps and then scavenge pump (last), only turning the pumps on momentarily on and off.
5. Operate a cellular telephone or other transmitter long enough to walk aft from the flight deck along the left upper deck wall near the CWT FQIS wiring, holding the cellular telephone beneath the window line, then along the left side of the main deck to aft of the mid-cabin area.
6. Operate a lap-top computer and perform a "file save" operation (to run the hard drive) operate the CD drive, every 5-10 ft along the same route.
7. Test any other personal electronic devices that may become available.

5.6.1.1 Perform ground test and this flight with test instrumentation recording background voltage and current on the CWT FQIS system.

5.6.1.2 Take a one liter fuel sample.

5.6.2 Begin the pack heating and flight portions of this test after the CWT temperatures have reached equilibrium.

Note: Record all start/stop fuel quantities and fuel panel actions during the test sequence.

5.6.2.1 Start the data recording equipment

5.6.2.2 Once data recording begins, all three air-conditioning packs will be manually selected to high flow for three hours. Ensure that the flight engineer panel controls are set to the fully COLD position and that the engine bleed valve knobs are in the closed positions. Temperature data will be monitored by the NTSB. NTSB will determine the feasibility of reducing the air-conditioning run time to 2 hours

5.6.2.3 Check to ensure that the FDR circuit breaker is set.

5.6.2.3.1 Take a vapor sample prior to takeoff.

5.6.2.4 Following the three hour period, takeoff and climb according to the following flight profile with all three air-conditioning packs selected. Start engines by the TWA Start, Taxi, and Takeoff Fuel Management Procedures identified in TWA Flight Handbook, with the following requirements:

Maintain air conditioning pack operation through start, takeoff, and climb.

Engine start order is 1, then 2, then 4. Start engine 3 when 5 minutes from takeoff.

Note: Chart a sample of CWT temperatures while in flight.

5.6.2.5 Brake release to 1500 feet AGL: Takeoff and climb through flap retraction and accelerate to 220 KCAS (Takeoff EPR of approximately 1.35). Record CWT fuel quantity.

5.6.2.6 1500 ft AGL to 5,800 ft AGL: Climb at 1900 fpm and accelerate to 250 KCAS. (Reduce EPR to 1.25 at 2400 ft AGL). Remain at 5800 ft AGL for 20 seconds.

5.6.2.7 5800 ft AGL to 12000 ft: Climb at 2000 fpm and remain at 250 KCAS. (Increase EPR to 1.32) Record CWT fuel quantity.

5.6.2.7.1 Take a vapor sample at 10,000 feet AGL.

5.6.2.7.2 When the fuel quantity in main tanks 1 and 4 is 23,000 pounds each, perform cross-feed according to the TWA Flight Handbook procedure.

5.6.2.8 12000 to 13000 ft: Reduce climb rate to 1000 fpm and increase to 295 KCAS. (Reduce EPR to 1.2 at 12,500; reduce to 1.0 at 13000)

5.6.2.9 13000 ft.: Reduce altitude to 12800 ft over the next minute; reduce speed to 280 KCAS. Once 12800 ft is obtained, increase EPR to 1.10

5.6.2.9.1 Take a vapor sample at 14,000 feet AGL.

5.6.2.10 13000 to 13700 ft: Slowly start to increase altitude to 13200; Increase EPR to 1.3, one minute after previous EPR increase, and climb through 13700 at 1200 fpm to 17,500 feet AGL. At 17,500 feet, adjust pack outlets to maintain a comfortable cabin temperature. After stabilized CWT temperatures have been maintained for 20 minutes (NTSB decision), continue climb from 17,500 feet to an altitude of 35,000 feet. Monitor CWT temperatures and begin descent after constant CWT temperatures (NTSB decision) have been maintained for 20 minutes. Record CWT fuel quantity.

5.6.2.11 Record CWT fuel quantity in idle power and .84 mach descent, returning to JFK and prepare airplane for the next flight.

5.6.2.12 Following parking and engine shut-down, ensure that FDR circuit breaker is pulled.

5.6.2.13 Keep air conditioning packs one and three running for the following test.

5.6.2.14 Take a one liter fuel sample.

5.6.2.15 Defuel to TWA Flight 800 weights, ASAP.

5.7 **Emulation of TWA flight 800** (Must follow Cruise condition flight)

5.7.1 Time between flights to be about 3 1/2 hours [*Per Dan Bower*].

5.7.1.1 Take a one liter fuel sample.

5.7.2 Start the data recording equipment.

Note: Record all start/stop fuel quantities and fuel panel actions during the test sequence.

5.7.2.1 Once data recording begins, the number 1 & 3 air-conditioning packs will be manually selected to high flow for three hours. Ensure that the flight engineer panel controls are set to the fully COLD position and that the engine bleed valve knobs are in the closed positions.

5.7.2.2 Check to ensure that the FDR circuit breaker is set.

5.7.2.3 Following the three hour period, start engines by the TWA Start, Taxi, and Takeoff Fuel Management Procedures identified in TWA Flight Handbook, with the following requirements:

5.7.2.4 Shut the air conditioning packs to start engines 1, then 2, then 4.

5.7.2.5 Use packs 1 and 3 for taxi.

5.7.2.6 Start engine 3 when 5 minutes from takeoff.

5.7.2.7 Take a vapor sample while on the ground.

5.7.2.8 Shut the packs for takeoff, then turn one pack on at 400, 600, and 800 feet AGL, as stated in the TWA Climb Procedures identified in the TWA Flight Handbook.

Note: Chart a sample of CWT temperatures while in flight.

5.7.2.9 Take vapor samples at 10,000 and 14,000 feet AGL.

5.7.2.10 Climb according to the schedule prescribed in steps 5.3.3 to 5.3.10, climbing to 17,500 feet AGL.

5.7.2.12 The flight is to last until CWT temperatures stabilize (NTSB decision). Record CWT fuel quantity.

5.7.2.13 Record CWT fuel quantity in descent. Return to JFK and prepare airplane for the next flight.

5.7.2.14 Following parking and engine shut-down, ensure that FDR circuit breaker is pulled.

5.7.2.15 Take a one liter fuel sample.

5.8 **Tankered Fuel (uses Cruise condition as a baseline)**

Once the CWT has cooled sufficiently to an approximate constant temperature (target ambient temperature), repeat cruise condition flight (steps 5.6), using all A/C packs on the ground, takeoff, and climb; with 6,000 pounds of CWT fuel. Use of locally purchased fuel is acceptable in the CWT. After stabilized CWT temperatures have been obtained (NTSB decision) for 20 minutes at 17,500 feet, adjust temperatures to comfortable temperatures and resume climb to 35,000 feet AGL.

5.9 **Packs 1 & 3 continuous, replication of 2 & 3 continuous** (Boeing Baseline Flight)

Once the CWT has cooled sufficiently to an approximate constant temperature (target ambient temperature), repeat flight with packs 1 & 3 continuous (steps 5.3), using packs 1 and 3 on the ground, takeoff, and climb; with 50 gallons of CWT fuel. Locally purchased fuel is acceptable in the CWT. Climb to 35,000 feet AGL.

5.10 **Modified Air Conditioning Pack Inlet**

The test will disable pack two and use an inlet diffuser to test the effects of cooling the pack bay in the area of pack 1. The conditions for this test are to be as similar as possible to flight with packs 1 & 3 continuous (steps 5.3). Test data is to be considered proprietary and shared between Boeing and the NTSB. Further details about how this test will be conducted are to be identified as the installation is finalized.

5.11 **Modified Air Conditioning Pack Inlet With New Pack Components**

The test is to be similar to previous flight with modified air conditioning pack inlet, following replacement of air conditioning pack seals with new hardware.

6.0 **Support Hardware**

6.1 Individuals on the flight must supply their own cold weather clothing. (The packs will be running at full cold for much of the testing.)

6.2 **EVG will provide:**

Tank entry air masks and other equipment (such as lights) have been contracted from International Aircraft Tank Services (IATS).

Ballast to replicate center of gravity and weight of TW800 flight.

Refuel/Defuel cart, contracted from Ogden/Allied Aviation Services.

Sump drain tools and hoses.

Specialized tooling, beyond those hand and other tools that are provided by the maintenance personnel. This includes any specialized items or tooling required to operate and repair the B-747.

Air stairs, if possible.

Air cart(s) to power hand tools (EVG).

Air cart(s) to ventilate fuel tanks (IATS).

Electric cart (EVG).

Shop-type or other air fans to cool the pack bays, as required, to be rented for NTSB by EVG.

Ladders or other lifts to install instrumentation.

6.3 **Boeing will provide:**

Safety equipment related to entry into the CWT by instrumentation personnel.

Tooling, software, and any support activities to support the installation, repair, and operation of the test instrumentation.

6.4 **NTSB will provide:**

Cellular telephone or other transmitter for test point 5.5.1.

Laptop computer for test point 5.5.1.

7.0 Completion Criteria

The test will be completed when usable flight test data has been collected through step 7 by the NTSB, Boeing, FAA, and the FBI/DoD.

8.0 Data Collection Methodology and Test Reports

8.1 Custody of the data will remain with the NTSB and the NTSB will be present for data reduction. Data will be shared with the parties to the investigation of the TWA flight 800 accident, other than from flights 6, 7, and 8.

8.2 Boeing is responsible for data reduction of NTSB/Boeing data by [*DATE*].

8.1.1 Reduced data for each parameter recorded is to be provided in electronic ASCII form (tab, comma, or space delimited). Raw data will also be provided in an electronic format.

8.1.2 For the instrumentation of temperature, pressure, and acceleration, Boeing will provide:

Calibration information for all gages used.

Data reduction conversion algorithms used in converting raw data to engineering data.

Details of any signal processing in the data acquisition system (e.g. amplifier gains, analog to digital conversion, etc.).

8.2 Data collected by FBI/DoD will not be made available to any non-FBI/DoD agency without the expressed permission of the FBI/DoD.

8.3 The Desert Research Institute at University of Nevada will analyze vapor samples and provide results to the NTSB for dissemination to the parties.

8.4 Fuel samples are not currently planned to be tested and are being retained for potential future questions or concerns.

9.0 Responsibilities

The NTSB Test Director shall be responsible for coordination of the test.

Boeing shall be responsible for installation and operation of the instrumentation system.

The NTSB Test Director shall be responsible for ensuring that all test conditions are completed, that data is usable, and that all required data has been collected.

10.0 Financial Arrangements

10.1 The NTSB will lease the airplane from Evergreen for all test flights, and will be billed for any services provided by Evergreen in support of the test flight series, in accordance with a formal lease agreement between the NTSB and Evergreen.

End

Attachment List

1. People attending introductory meeting of July 8, 1997.
2. Map of John F. Kennedy International Airport
3. Nonconformance found prior to flight test.
4. TWA Flight Handbook Fuel Management Procedures, pages 2.11.1-2.11.3
5. TWA Flight Handbook Engine Start Procedures, page 2.19.3
6. TWA Flight Handbook Taxi-Before Takeoff Procedures, pages 2.21.1-2.21.4
7. TWA Flight Handbook Climb Normal Procedures, page 2.30.1
7. TWA Flight Handbook Ramp Procedures, pages 2.45.1-2.45.2
8. TWA Flight Handbook Non-Normal Procedures, pages 3.20.3-3.20.4
9. TWA Flight 800 Fueling, Weight, and Balance Data From Operations Group Notes
10. FBI/DoD Test Planning Material
11. Flight Test Matrix

People attending introductory meeting of July 8, 1997:

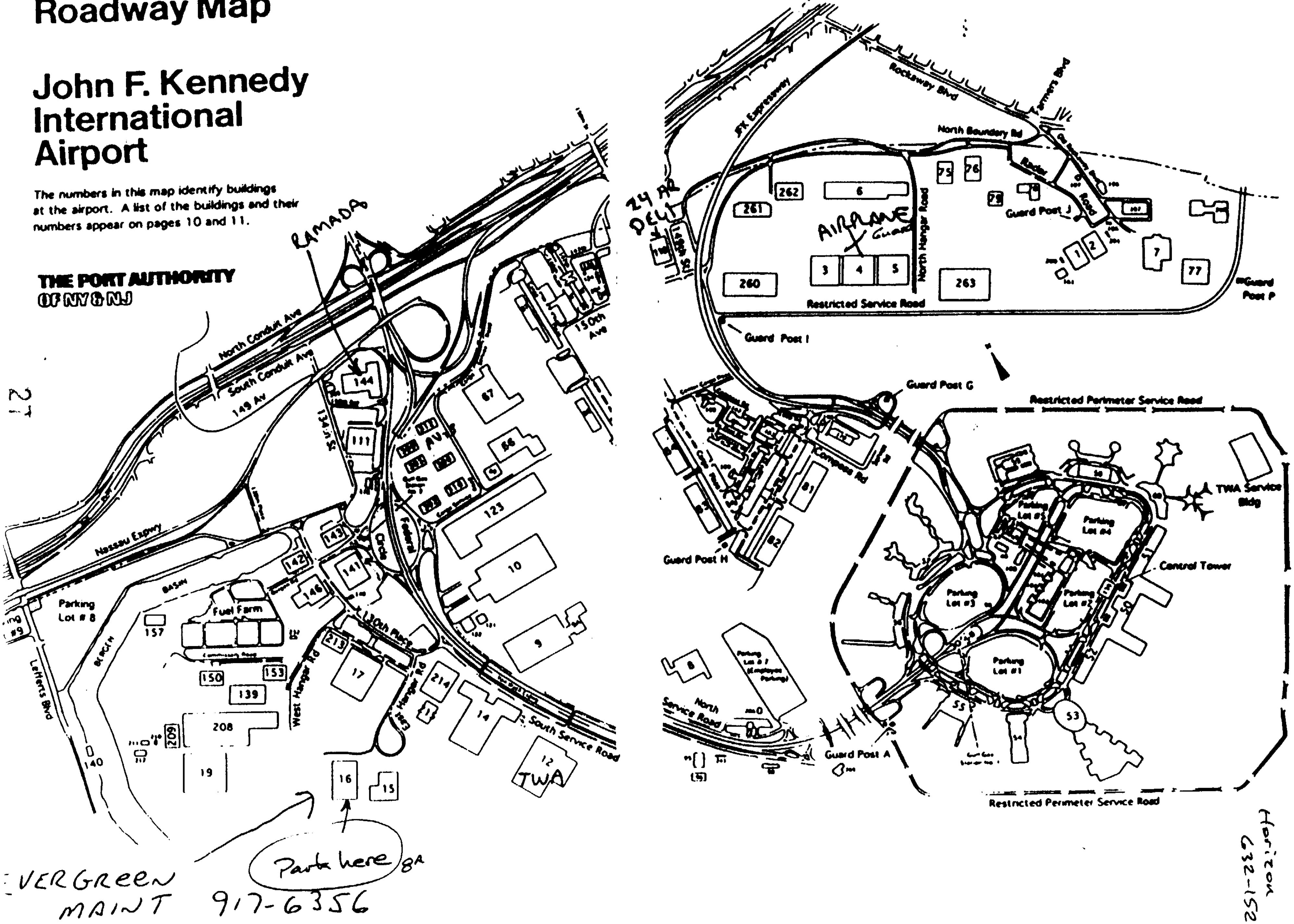
NTSB Test Director:	Robert Benzon	202-314-6313 Fax: 314-6319 1-800-SKY-8888, PIN 255-3505 benzonr@ntsb.gov
NTSB Aircraft Acquisition	Frank McGill	202-614-6391
NTSB Fire/Explosion:	Dr. Merritt Birky	202-314-6503 Fax: 314- 1-800-SKY-8888, PIN birkym@ntsb.gov
NTSB Systems & Test Plan:	Robert L. Swaim	202-314-6394 Fax 314-6349 1-800-SKY-8888, PIN 550-3143 swaimbo@ntsb.gov
NTSB Thermal & Data:	Dr. Daniel Bower	202-314-6562 Fax 314- 1-800-Skypage, PIN 550-3160 bowerd@ntsb.gov
Boeing Test Director:	Roland Johnson	425-342-0991 Fax roland.johnson2@pss.boeing.com
Evergreen Airlines (EVG):	Kevin Rickard	718-917-6356 Fax: 995-0966
FAA Coordinator	Michael Collins	206-227-2689 Fax: 227-1181 michaelcollins@dot.faa.gov
ALPA:	Steven D. Green	
TWA:	Terry Stacey	908-439-2048

Building and Roadway Map

John F. Kennedy International Airport

The numbers in this map identify buildings at the airport. A list of the buildings and their numbers appear on pages 10 and 11.

THE PORT AUTHORITY OF NY & NJ



EVERGREEN MAINT 917-6356

Bob Swain's Horizon 632-1527

Nonconformance found prior to flight test

GENERAL

Boost pump pressure is required during flight to preclude the possibility of engine surge and/or flameout.

EXTENDED TAXI

When expecting an extended taxi that will burn more than 3,000 pounds of fuel, use the following appropriate procedure.

With Center Tank Fuel:

Use center tank to feed all engines during taxi.

With No Center Tank Fuel:

Use main tanks 2 and 3 to feed all engines until quantity in main tanks 2 and 3 equals quantity in main tanks 1 and 4 plus their adjacent reserves, then return to tank to engine feed.

Establish appropriate fuel panel configuration prior to takeoff.

LATERAL FUEL BALANCE

Fuel balance should be maintained during normal operations. Fuel balance procedures should normally be delayed until the total unbalance reaches 1,000 pounds. Ensure unbalanced fuel limits in section 3.14 are not exceeded.

Normally lateral fuel balance is maintained by use of boost pump control. Crossfeed valves 1 or 4 should not be closed to balance fuel until terminating crossfeed. If lateral balance cannot be maintained by boost pump control during crossfeed operation, operate crossfeed valves 2 or 3 as required to maintain normal lateral balance. Do not use less than three pumps to feed all engines.

RESERVE TANK FUEL

TAKEOFF WITH RESERVE TANKS EMPTY

If takeoff is planned with the reserve tanks empty and additional fuel is required, it may be added to the four main tanks provided the following limitations are observed:

Center wing tank must be empty.

100 – Fuel in any main tank must not exceed 23,000 pounds and takeoff weight must not exceed 600,000 pounds.

200 – Fuel in any main tank must not exceed 27,800 pounds and takeoff weight must not exceed 638,000 pounds.

LANDING WITH RESERVE TANKS FULL

There are no limitations on fuel remaining in any tank for landing. Therefore, if the next takeoff requires fuel in the reserve tanks, landing is permissible with reserve tanks full.

The aircraft may depart with landing fuel distribution provided no fuel is added.

Use normal fuel management procedures.

START, TAXI, AND TAKEOFF – 100

Prior to engine start, turn on all main tank boost pumps, open crossfeed valves 1 and 4, and close crossfeed valves 2 and 3.

Start engines, taxi, and takeoff using main tank to engine fuel feed.

If more than 3,000 pounds of fuel is expected to be used during taxi use the Extended Taxi procedure this section.

CROSSFEED – 100

Prior to initiating and terminating crossfeed procedure advise the captain and enter the fuel quantity and time on the fuel log.

When the quantity in main tanks 1 and 4 is between 23,000 and 20,000 pounds each, begin crossfeed using one of the following procedures.

With Center Tank Fuel:

Turn on center tank override/jettison pumps, open all crossfeed valves, turn off boost pumps in main tanks 1 and 4 and feed all engines from the center tank. When override/jettison pump low pressure lights come on steady or inboard tank quantity begins to decrease, turn off the override/jettison pumps.

(Contd)

CROSSFEED – 100 (Contd)

Turn on the scavenge pump. When its low pressure light comes on steady, turn it off. Continue flight using main tanks 2 and 3 to feed all engines.

With No Center Tank Fuel:

Open all crossfeed valves, turn off boost pumps in main tanks 1 and 4 and feed all engines from main tanks 2 and 3.

RETURNING TO TANK–TO–ENGINE FEED

Prior to returning to tank–to–engine feed, apply fuel heat as required. See Fuel Heat this section.

When the quantity in main tanks 2 and 3 equals the quantity in main tanks 1 and 4 plus their adjacent reserves, turn on boost pumps in main tanks 1 and 4 and close crossfeed valves 2, 3, and 4. Leave No. 1 crossfeed valve open for remainder of flight.

RESERVE TANK 1 AND 4 FUEL TRANSFER

Transfer reserve tank fuel when the quantity in main tank 1 or 4 is 5,000 pounds or at start of descent, whichever occurs first. Leave reserve tank transfer valves open for remainder of flight. Wing life will be improved by keeping reserve tanks full as long as possible. However, if conditions require, reserve tank fuel may be transferred when aircraft weight is 600,000 pounds or less and quantity in main tanks 1 and 4 is less than 19,500 pounds each.

START, TAXI, AND TAKEOFF – 200

Center Tank Fuel Less Than 10,000 Pounds:

Prior to engine start, turn on all main tank boost pumps, open crossfeed valves 1 and 4 and close crossfeed valves 2 and 3.

Start engines, taxi, and takeoff using main tank to engine fuel feed.

If more than 3,000 pounds of fuel is expected to be used during taxi, use the Extended Taxi procedure this section.

Center Tank Fuel 10,000 Pounds or More:

Center tank fuel must be used to feed engines 1 and 4 for takeoff when center tank contains 10,000 pounds or more prior to taxi.

Prior to engine start, turn on all main tank boost pumps and center tank override/jettison pumps, open crossfeed valves 1 and 4 and close crossfeed valves 2 and 3.

Start engines, taxi, and takeoff using main tanks 2 and 3 to feed engines 2 and 3, use center tank to feed engines 1 and 4.

If center tank fuel is to be used for takeoff, it must be sampled for a minimum of four minutes anytime prior to takeoff.

If more than 3,000 pounds of fuel is expected to be used during taxi, use the Extended Taxi procedure this section, with the following restriction.

Do not reduce center tank fuel to less than 8,500 pounds prior to takeoff. If the center tank approaches 8,500 pounds, open all crossfeed valves, turn off center tank override/jettison pumps and boost pumps in tanks 1 and 4. Use main tanks 2 and 3 to feed all engines.

Prior to takeoff ensure all main tank boost pumps and center tank override/jettison pumps are on, and crossfeed valves 2 and 3 are closed.

CROSSFEED – 200

Prior to initiating and terminating crossfeed procedure, advise the captain and enter the fuel quantity and time on the fuel log.

After climb power is set, and prior to using a total of 16,000 pounds of fuel, begin crossfeed using one of the following procedures.

With Center Tank Fuel:

Turn on center tank override/jettison pumps, open all crossfeed valves, turn off boost pumps in main tanks 1 and 4 and feed all engines from the center tank. When override/jettison pump low pressure lights come on steady or inboard tank quantity begins to decrease, turn off the override/jettison pumps. Turn on the scavenge pump. When its low pressure light comes on steady, turn it off. Continue flight using main tanks 2 and 3 to feed all engines.

(Contd)

CROSSFEED - 200 (Cont'd)

With No Center Tank Fuel:

Open all crossfeed valves, turn off boost pumps in main tanks 1 and 4 and feed all engines from main tanks 2 and 3.

RETURNING TO TANK TO ENGINE FEED

Prior to returning to tank to engine feed apply fuel heat as required. See Fuel Heat this section.

When quantity in main tanks 2 and 3 equals quantity in main tanks 1 and 4 plus their adjacent reserves, turn on boost pumps in main tanks 1 and 4 and close crossfeed valves 2,3, and 4. Leave No. 1 crossfeed valve open for remainder of flight.

RESERVE TANK 1 AND 4 FUEL TRANSFER

Transfer reserve tank fuel when the quantity in main tank 1 or 4 is 5,000 pounds or at start of descent whichever occurs first. Leave reserve tank transfer valves open for remainder of flight. Wing life is improved by keeping reserve tanks full as long as possible. However, if conditions require, reserve tank 1 and 4 fuel may be transferred when aircraft weight is 638,000 pounds or less and fuel quantity in main tanks 1 and 4 is less than 23,500 pounds each.

FUEL HEAT

GENERAL

Apply fuel heat for one minute when engine fuel temperature is +5 to -15C or two minutes when temperature is colder than -15C during the following phases of flight:

Before takeoff.

Every thirty minutes in flight.

During descent for landing.

When applying fuel heat in flight, open fuel heat valves one at a time at fifteen second intervals.

Verify fuel heat operation by observing an increase in fuel temperature and an initial decrease in EPR. When operating at maximum climb or cruise thrust, maintain EPR within limits.

As each fuel heat valve closes, check for a decrease in fuel temperature and an initial increase in EPR.

Fuel heat valves must be closed for takeoff and on final approach.

ICING LIGHT ON

Whenever an engine icing light comes on use fuel heat on the affected engine for one minute.

RETURNING TO TANK TO ENGINE FEED

When No. 1 tank temperature is 0C or colder, or engine fuel temperature is +5C or colder, use fuel heat for three minutes as follows:

Open the number 1 and 4 fuel heat valves. After one minute, turn on boost pumps in main tanks 1 and 4 and close crossfeed valves 2,3, and 4. After a total of three minutes close 1 and 4 fuel heat valves.

OUTBOARD ENGINE FUEL HEAT

When outboard engine fuel temperature is -5C or colder, apply fuel heat to outboard engines for 1 minute every 10 minutes.

* • •

AFTER START CHECKLIST AMPLIFICATION

PILOTS

1. FLIGHT RECORDER .... ON

   Check OFF light out.

   Engineer's duty when installed on his panel.

2. START SWITCHES .... OFF

   Check ground start switch ON lights out.

3. BEACON LIGHTS .... ON

4. BRAKE PRESSURE .... CK

   Check normal brake pressure approximately 3,000 psi and brake source low pressure light out.

5. START LEVERS .... IDLE DETENT

6. ENGINE ANTI–ICE .... _____

   Respond "On" or "Off," as appropriate. If engine anti–ice is on, check NACELLE VALVE OPEN lights on.

ENGINEER

1. ELECTRICAL PANEL .... CK

   Check essential power selector in NORMAL.

   Check galley power switches ON and TRIP OFF lights out.

   Check GFR, MGR, BTR, and SSB lights out and power meters indicate approximately equal KW loads.

2. PACK VALVES .... OPEN

   Press each pack indicator selector switch as its pack valve is opened. If the low pressure duct indicator is installed, note pressure indication as pack valve opens.

3. DOOR WARNING LIGHTS .... OUT

   Check door warning annunciator panel.

4. HYDRAULIC PANEL .... CK & SET

   Check electric hydraulic pump switch off, and place air driven pump switches to AUTO.

   Check overheat, low pressure, and low quantity lights out, system pressure indicates normal pressure and hydraulic quantity in the green band.

PRIOR TO TAXI

When the After Start checklist is completed, the captain challenges the first officer with "clear on the right," and the first officer responds. The first officer obtains taxi clearance at the captain's request.

After acknowledging the clearance salute and receiving the response to the challenge "clear on the right," the captain releases brakes.

* * *

LEAVING RAMP

If possible, keep nosewheel centered until aircraft starts rolling. Normally, gate departure can be accomplished by initially rolling straight forward and then initiating turn out.

Use equal thrust on all engines to start aircraft rolling. Keep engine thrust as low as possible in the ramp area.

Use INS ground speed information as a speed reference while taxiing.

Make large radius turns whenever possible. For sharp turns use a maximum of 10 knots at start of turn to avoid nose tire scrubbing. Allow a few feet extra wing tip clearance during turns and watch wing tips closely when near other aircraft or ramp equipment.

Do not make rapid abrupt movements of steering tiller. If steering tiller is released while in a turn, the nosewheel will rapidly return to the rudder pedal steering position.

If ramps or taxiways are covered with ice, compacted snow or standing water which reduces traction, place body gear steering to DISARM. Use a maximum of 5 knots taxi speed. For sharp turns, rearm body gear as necessary until turn is completed.

Do not use reverse thrust for backing or taxiing the aircraft.

180–degree turns on runways less than 164 feet (50 meters) wide should not normally be attempted without ground signaling assistance.

ENGINE OUT TAXI

An engine that has been shutdown for more than 2 hours should be warmed up for 5 minutes at thrust settings used for normal taxi operations.

Taxi may be accomplished with the No. 3, or the No. 3 and 2 engines shutdown SCD, provided:

Not prohibited by the Jeppesen manual blue/green pages.

Taxiways not slippery with no difficulty anticipated in maneuvering to the runway.

De–icing program not in effect.

Hydraulic systems 1, 2 and 4 must remain pressurized.

Two operating generators must be on line with all busses powered.

Body gear steering is operating normally.

There is no requirement to turn off boost pumps or close the bleed valve since a restart is anticipated.

Use the normal crossfeed procedures to maintain lateral fuel balance.

When ready to start engine(s), the engineer verifies that the boost pumps are on and reduces air demands as necessary. Use the Cross Starting procedure in section 3.20.

Complete the Delayed Engine Start check list.

FLAPS

After taxi from the gate, the captain will command the first officer to place the flap handle to flaps 10.

NACELLE ANTI–ICING

Nacelle anti–ice must be on for taxi and takeoff when icing conditions exist. Turn on nacelle anti–ice immediately after engine start. Flight start ignition is not required during taxi operations.

Icing conditions exist when the OAT on the ground or TAT inflight is 10C (50F) or below and visible moisture in any form is present (such as clouds, fog with visibility of one mile or less, rain, snow, sleet, ice crystals), or standing water, slush, ice, or snow is present on the ramps, taxiways, or runways.

FUEL HEAT

When engine fuel temperature is +5C or colder, use fuel heaters during taxi for one or two minutes (as required). Place fuel heat switches to OPEN. Check for a fuel temperature increase on all engines. After one or two minutes (as required), place fuel heat switches to CLOSE. Observe fuel temperature decrease before applying takeoff thrust.

TAKEOFF PERFORMANCE

CLOSEOUT WEIGHT SLIP

The engineer will contact load control for closeout data. Place the final passenger count, takeoff fuel, gross takeoff weight, and trim information in the appropriate spaces on the computer weight slip. Record gross takeoff weight and trim information on the takeoff performance data worksheet.

STABILIZER TRIM SETTING

Normally, the engineer obtains the stabilizer trim setting from the closeout weight slip. If not available, see Stabilizer Trim Computer Instructions in section 4.05.

WORKSHEET

The first officer and engineer will complete the takeoff performance data worksheet. See Takeoff Data Worksheet Instructions in section 4.50.

AIR CONDITIONING CONTROLS

Operate packs, recirc fans and gasper fan as needed. Check pack ACM outlet and compressor discharge temperatures.

WEATHER RADAR

When the radar is to be used for takeoff complete the initial tuning as follows.

INITIAL TUNING

Mode – NORM. Radar will be operational after 30 seconds.

Indicator – AHEAD. If IND was off, a 60–second warm up is required. LEFT or RIGHT may be selected after initial tuning.

Range – Use 30–mile range selection for takeoff for a detailed display of weather requiring immediate evasion.

Tilt – If significant weather exists along the intended takeoff flight path, leave the radar on for takeoff. When in position for takeoff, raise the antenna up as needed to scan the takeoff corridor and initial climb area.

Before takeoff, return the tilt control to 4 degrees up when operating in areas of level terrain, or 5 degrees up in areas of mountainous terrain.

Polarizing Filter – Full left until radar is tuned; then adjust as desired.

Range Marks – Adjust until visible. Avoid setting too bright so as not to obscure returns.

Intensity – Adjust until sweep line is visible, but trailing no luminescence.

TAXI CHECKLIST AMPLIFICATION

PILOTS

1. **FLAPS & RWY . . 10 & GREEN LIGHT ____**

   Check both trailing edge flap indicators display flaps 10 and the green LE FLAP light on.

   The captain responds with flap position, leading edge light status, and takeoff runway, e.g., "10 and green light for runway 31L."

   The engineer confirms the takeoff runway and responds by calling out the indicated flap position, the number of green leading edge lights on the engineer's panel, and takeoff runway, e.g., "10 and 8 green for runway 31L."

2. T/O DATA, EPR & A/S BUGS .... ____SET & CROSS CK

   The captain verifies the weight, cross checks the V_2 placard, and confirms that the correct V_1, V_R, and V_2 for the takeoff runway are entered on the takeoff data card. Set the bug on each airspeed indicator to V_2 and cross check the settings.

   Set takeoff EPR in the command window, check that all bugs are aligned and agree with CMD window setting. Set standard thrust EPR when making a standard thrust takeoff.

   Respond by calling out the airspeed bug setting on both pilots' airspeed indicators.

   If any standing water or slush is on the runway, observe appropriate restrictions.

TAXI CHECKLIST AMPLIFICATION (Contd)

3. STABILIZER TRIM .... _____SET

   Set trim to the value indicated on the takeoff performance data worksheet and cross check both stabilizer position indicators.

   Respond by calling out the setting on the stabilizer position indicator.

4. PROBE HEAT .... ON

   Check amber fail lights out.

5. FLIGHT CONTROLS .... CK

   Ensure all hydraulic systems are pressurized.

   Check freedom of movement and observe the surface position indicator for proper indication.

   The first officer performs the following:

   Move the control column full travel fore and aft.

   After flaps are extended to takeoff, rotate control wheel full travel in both directions to check the ailerons and spoilers.

   The captain maintains directional control with the nose steering tiller and moves rudder pedals smoothly and slowly. Minimum time for a complete cycle should be 8 seconds. Rapid movement may damage the rudder control unit.

6. AUTO BRAKES .... ARM

   Check auto brake light out.

7. YAW DAMPERS .... CK

   While turning the aircraft with the nose steering tiller, note that both upper and lower rudder position indicators show rudder movement opposite to the direction of turn.

8. SEAT BELT & SHOULDER HARNESS .... CK

ENGINEER

1. APU .... OFF

   Check all APU annunciator lights out.

2. FUEL HEAT .... OFF

   Check engine fuel temperatures are normal.

3. TOTALIZER & AIDS/ACARS GROSS WEIGHT .... SET

   Upon receipt of radio closeout data, enter gross takeoff weight into ACARS.

   Set totalizer to closeout gross weight plus any fuel on board in excess of fuel stated in closeout. Record this weight on the fuel log.

4. F/E & PILOT PANELS .... CK

   Scan pilots' instrument panels, overhead switch panel, and engineer's panel for annunciator and indicator lights. If any abnormal indications are observed, notify the captain immediately. The absence of lights that should be on is an abnormal indication.

5. AFT CARGO HEAT .... NORMAL

   If compartment temperature is cool, the ON light will be on.

6. SEAT BELT & SHOULDER HARNESS .... CK

DELAYED ENGINE START CHECKLIST AMPLIFICATION

PILOTS

1. START SWITCHES .... OFF

   Check ground start switch ON lights out.

2. START LEVERS .... IDLE DETENT

3. ENGINE ANTI–ICE .... _____

   Respond "On" or "Off" as appropriate. If engine anti–ice is on, check valve open lights are on.

ENGINEER

1. ELECTRICAL PANEL .... CK

   Check essential power selector NORMAL.

   Check galley power switches on and trip off lights out.

(Contd)

DELAYED ENGINE START CHECKLIST AMPLIFICATION (Contd)

Check GFR, MGR, BTR, and SSB lights out and power meters indicate approximately equal KW load division.

2. PACK VALVES .... OPEN

   Press each pack indicator selector switch as its pack valve is opened. If the low pressure duct indicator is installed, note pressure indication as pack valve opens.

3. HYDRAULIC PANEL .... CK & SET

   Check electric hydraulic pump switch off and place air driven pump switches to AUTO.

   Check overheat, low pressure, and low quantity lights out, system pressure indicates normal pressure and hydraulic quantity in the green band.

BEFORE TAKEOFF CHECKLIST AMPLIFICATION

PILOTS

1. ICING CONSIDERATIONS .... CK

   Within five minutes of takeoff, evaluate anti–ice requirements. Conduct a Pretakeoff Check or Pretakeoff Contamination Check as needed.

   Conduct engine runups as required for use of engine anti–ice prior to takeoff.

2. CABIN ALERT .... CK

   Make a brief PA announcement, "All flight attendants please be seated."

3. TRANSPONDER .... CK

   Select transponder 1.

   Select TA/RA on the transponder mode selector just prior to takeoff. TA may be selected to preclude nuisance RAs if flying in close proximity to known traffic or when operating on parallel runways. All RAs are inhibited when TA is selected.

   If TA is selected, reselect TA/RA as soon as practicable.

4. IGNITION .... FLT START

5. BODY GEAR STEERING .... DISARM

   When aligned with runway and prior to advancing throttles for takeoff, check that GEAR NOT CENTERED light is out, then place body gear steering switch to DISARM.

ENGINEER

1. PACK VALVES .... CLOSED

   Turn on appropriate fans to maintain cockpit and cabin ventilation.

2. PRESSURIZATION MODE SELECTOR .... AUTO

3. FUEL BOOST PUMPS .... ON

   Check low press lights out. If center tank is used for takeoff check override/jett pumps on.

4. CROSSFEED VALVES .... CK

   Check 1 and 4 crossfeed valves open, and 2 and 3 crossfeed valves closed.

CLIMB THRUST

The engineer selects the appropriate EPRL mode and sets climb thrust using the indicated EPR. EPRL computer modes are as follows:

CON – Maximum Continuous Thrust.

CRZ – Maximum Cruise Thrust.

Use the climb thrust setting charts or the mechanical EPR computer to confirm the accuracy of the EPRL computer.

Select CRZ mode and utilize Maximum Cruise Thrust until the rate of climb decreases to 500 FPM or until reaching FL 250. At this point select CON mode, reset thrust and continue climb to cruise altitude.

If the EPRL computer is not available, determine climb thrust from the appropriate thrust setting chart or use the mechanical EPR computer.

An EPR comparison check should be made periodically during climb and EPR reset as necessary to maintain climb limit EPR. Check climb EPR setting just prior to level–off at cruise altitude to ensure proper thrust is available to accelerate to cruise speed.

In the event of an engine failure select CON mode and set EPR as indicated. A cross check should be made with Maximum Continuous or Engine Out thrust setting chart.

When an EPR indicator is inoperative, set thrust by aligning N_1 indicator to the average of the other N_1 indicators.

AFTER TAKEOFF CHECKLIST AMPLIFICATION

PILOTS

1. GEAR LEVER .... OFF

   After the landing gear and door lights go out, return the gear lever to the off detent. The engineer should monitor fluid quantity in hydraulic systems 1 & 4 during gear retraction.

2. LANDING & LOGO LIGHTS .... OFF
3. IGNITION .... CK

   If not required for icing or turbulence, press all ignition off switches and check that flight start switches trip off.

   Engineer should check that IGN ON light goes out.

4. SEAT BELT – NO SMOKING .... CK

   For flights where smoking is permitted, the no smoking sign may be turned off after the flaps are retracted.

   The seat belt sign may be turned off above 10,000 feet. The seat belt sign is the signal to the flight attendants not to enter or call the cockpit except in an emergency.

ENGINEER

1. PACK VALVES .... OPEN

   Turn on first pack when 400 feet AGL. Turn on the second pack at approximately 600 feet and the third pack at approximately 800 feet.

   Two packs should normally be used after reaching initial cruise altitude and setting cruise thrust.

   When operating with a pack off, manually close the pack inlet door to reduce air drag. See Cruise Pack Operation procedure in section 2.35.

2. *FUEL HEAT* .... *AUTO*

PARKING

Before entering congested area, check brake pressure. Use gradual pressure on steering tiller to start turn. Hold tiller firmly during turn. If tiller is released, the nose wheel rapidly returns to rudder pedal steering position.

GATE ARRIVAL SIGNAL

Place the seat belt sign off as the signal to the cabin that the aircraft is parked at the gate.

GATE TOW-IN PROCEDURE

When the airplane must be towed into the gate, use one of the following procedures to provide hydraulic pressure for brakes and body gear steering.

APU OPERATIVE

After engine shutdown, and with the APU running, turn on the electric pump to provide brake pressure, and operate the No. 1 ADP for body gear steering.

APU INOPERATIVE

When the APU is inoperative, the electric pump is not available for brakes and APU air is not available for ADP operation. Therefore, it is necessary to leave an engine running during the tow-in process. With the No. 1 engine running, hydraulic system 1 can be used for both body gear steering and brakes.

ENGINE SHUTDOWN

Ensure engines have operated below 80% N_2 for one minute before shutdown.

When placing start levers to CUTOFF, observe engine fuel valve in-transit light, N_2, fuel flow, and EGT for an immediate indication of shutdown.

After all engines have been shut down, the captain advances throttles to the full forward position. Check for freedom of movement and return throttles to the idle position.

WHEN PARKED AT THE RAMP

After the seat belt sign is off, complete these items in the following sequence:

- Turn off all fuel boost pumps.
- Turn off ADPs one, two, and three.
- Close engine bleed valves two, three, and four. Check HIGH STAGE lights out.
- Reduce to one pack.
- Shut down engines two, three, and four.

CHANGEOVER TO EXTERNAL POWER

- Check external power voltage and frequency.
- Close external power relay(s).
- Check that PWR ON BUS light(s) and engine GEN OPEN light(s) come on.
- Turn off No. 4 ADP.
- Close No. 1 engine bleed valve. Check HIGH STAGE light out.
- Close the remaining pack valve.
- Advise captain "Electrical power changed over."

Shut down No. 1 engine.

Turn on zone 1 recirc fan to provide airflow to cockpit until an air conditioning pack is available, then the fan may be operated as desired.

CHANGEOVER TO APU ELECTRICAL POWER

- Check APU generator voltage and frequency.
- Close APU generator relay.
- Check that APU GEN OPEN lights go out and engine GEN OPEN lights come on.
- Turn off No. 4 ADP.
- Close No. 1 engine bleed valve.

(Contd)

ENGINE SHUTDOWN (Contd)

Advise captain "Electrical power changed over."

Shutdown No. 1 engine.

Open APU bleed air valve to restore cockpit and cabin air conditioning.

INS

Erase all triple mix positions and inflight updates by selecting DSRTK/STS and pressing 1 and the insert switch. Select POS on each CDU to display aircraft latitude and longitude for logbook entry.

If an INS comparator light came on during flight, refer to INS Comparator Light On procedure in section 3.18.

SECURE COCKPIT CHECKLIST AMPLIFICATION

PILOTS

1. BRAKES .... PARKED

   Engage parking brakes, check PARK BRAKE and ANTI–SKID HYD lights on.

   Normally, brakes remain parked. However, if excessive heat requires brakes to be released, release brakes only after ground personnel advise that wheels are chocked and brakes may be released. Advise ground personnel, "Brakes released" after releasing brakes.

2. BEACON LIGHTS .... OFF
3. INS .... ALIGN
4. FLIGHT RECORDER .... OFF

   Engineer's duty when installed on his panel.

5. PROBE & WINDOW HEAT .... OFF

FLIGHT TERMINATION

6. EMERGENCY LIGHTS .... OFF
7. RADAR .... OFF

ENGINEER

1. UPPER DECK HEAT .... OFF
2. PACK VALVES .... CK

   Leave packs 1 and 3 or packs 2 and 3 on if required for passenger comfort. If APU is not operating and ground air is not available, close all pack valves and turn on No. 1 recirculating fan.

3. FUEL BOOST PUMPS .... OFF

   If the APU is operating, the No. 2 aft boost pump LOW PRESS light will be out.

4. RESERVE TANK VALVES .... CLOSED
5. HYDRAULIC PANEL .... CK

   Leave EDPs in NORMAL and ADPs in OFF.

6. OXYGEN .... CK

   Check crew and passenger oxygen pressures. If below minimum dispatch, make logbook entry.

   At flight termination, turn off crew oxygen.

FLIGHT TERMINATION

7. INS .... OFF

   After position information and OFF time have been recorded in logbook, place mode selectors to OFF.

8. RADIO SWITCHES .... OFF

FLIGHT TERMINATION

Leave electrical power on all busses and the battery switch on. If necessary to shut down electrical power, close APU bleed air valve, place APU master switch to STOP and, when APU inlet door closes, place battery switch OFF.

Turn off all unnecessary cockpit lights.

• • •

TWO ENGINE APPROACH (Contd)

12. COMPLETE LANDING CHECKLIST.

13. 500 – 800 FEET EXTEND FLAPS TO 20.

    Leave flaps at 20 for landing.

14. USE NORMAL APPROACH SLOT, REDUCING TOWARD BUG +5 ON FINAL.

15. PRIOR TO TOUCHDOWN – ZERO RUDDER TRIM.

ENGINE FLIGHT START

If an engine must be started to sustain safe flight following a shutdown resulting from an engine overtemperature, consider the following:

Operate the engine at the minimum thrust required to maintain safe flight and land as soon as possible. If feasible, remove all accessory and bleed loads from the affected engine. Avoid rapid throttle movements, and hold throttle adjustments to a minimum.

1. START LEVER CUTOFF.

2. THROTTLE CLOSED.

   Keep throttle closed to limit engine RPM to idle after lightoff.

3. CHECK N_1 & N_2 ARE ROTATING.

   If no rotation of either rotor, do not attempt to restart engine.

4. FIRE CONTROL HANDLE IN.

5. FUEL BOOST PUMPS ON.

   Turn on main tank boost pumps for associated engine.

6. ENGINE BLEED VALVE SWITCH OPEN.

7. ENGINE IGNITION:

   a. AIRSPEED BELOW 250 KTS – GROUND START

      When N_2 windmilling RPM is significantly below normal ground start RPM, the starter must be used to crank the engine.

      If necessary, ground start may be re-engaged below 30% N_2.

   b. AIRSPEED ABOVE 250 KTS – FLIGHT START.

      At airspeeds above 250 knots, engine windmill speed should be sufficient to initiate lightoff.

      It may be necessary to use ground start if speed is slightly above 250, but low RPM is encountered.

8. START LEVER:

   Follow normal N_2 RPM ground start procedures before raising the start lever.

   TAT BELOW –9C: RICH.

   Place start lever to idle after engine stabilizes.

   TAT –9C & ABOVE: IDLE.

9. ENGINE AT IDLE – IGNITION OFF.

10. ELECTRICAL, HYDRAULIC & PNEUMATIC SYSTEMS – CHECK.

    When engine is operating normally, close the generator relay. Check hydraulic and bleed air systems for normal indications.

INFLIGHT REVERSE THRUST

1. REVERSE LIGHT ON BUT NO YAW – OPERATE NORMALLY.

   If REVERSER OPERATING light is on but no yaw has occurred, reverser is in forward thrust.

2. REVERSE LIGHT ON WITH YAW:

   With aircraft yaw, reverser is in reverse thrust position. Complete the following:

   a. SHUT DOWN AFFECTED ENGINE.

      Complete Engine Failure checklist.

   b. SET BUG TO V_{REF} +15 KTS.

   c. USE NORMAL LANDING CONFIGURATION.

POWERPLANT ADDITIONAL PROCEDURES

AVM SUSTAINED INCREASE

When any AVM reading increases more than 1.0 unit above previous logbook recording:

1. Scan all basic engine instruments for any obvious problem.
2. Note any unusual aircraft vibration.
3. Vary engine RPM, and operate at minimum vibration point.
4. Check the following individually:

    Generator (CSD RPM).

    Hydraulic pump (momentarily select EDP to DEPR).

If able to determine that one of the above is causing the vibration, operate without the faulty unit, if practical.

CROSS START

If cross start is necessary, use the following procedure to start remaining engine(s):

1. In ramp area, obtain ground clearance to accelerate the operating engine(s).
2. Reduce bleed air loads as much as practical.
3. Advance throttle on the operating engine(s) until manifold pressure is at least 35 psi. Ensure that the high stage valve remains open.
4. Use normal start procedures for the remaining engine(s).

ENGINE START – ABNORMAL INDICATIONS

During engine start, immediately report any abnormal indications to the captain.

FUEL FOGGING BEFORE RAISING START LEVER

If fuel fogging (white or gray fuel vapor mist) is reported while N_2 is accelerating, immediately press engine start OFF switch. A maintenance check is required.

HOT START OBSERVED OR ANTICIPATED

Anticipate a hot start if:

Instant light off occurs at start lever movement.

Initial stabilized fuel flow exceeds 1,200 pounds per hour.

EGT rapidly approaches the 650C start limit.

For any of the above conditions, move start lever to CUTOFF, and continue to motor the engine with the starter for 30 seconds, or until the EGT is 100C, whichever takes longer. If start is aborted after starter cutout, reengage starter when N_2 is below 20%.

If EGT did not exceed takeoff limit, a restart may be attempted. Record the overtemp in the maintenance log. If EGT exceeded takeoff limit, do not attempt a restart until appropriate maintenance action has been accomplished.

NO INDICATION OF LIGHTOFF WITHIN 20 SECONDS

Move start lever to CUTOFF. Continue to motor the engine for 30 seconds. Check ignition circuit breakers on P6.

NO INDICATION OF OIL PRESSURE WITHIN 30 SECONDS OF ENGINE ROTATION

Move start lever to CUTOFF. Continue to motor the engine for 30 seconds. A maintenance check is required.

ENGINE OIL PRESSURE ABOVE 60 PSI

During cold weather starts, oil pressure above 60 psi may be indicated until oil viscosity is reduced by an increase in oil temperature. Do not exceed idle power when oil pressure is above 60 psi.

ENGINE BLEED VALVE CLOSED LIGHT FAILS TO COME ON AT STARTER CUTOUT

If, after the engine start switch returns to off, the engine bleed valve closed light does not come on, the N_2 compressor will be back pressured through the open high stage valve. This will severely retard normal engine acceleration and may result in a hot start.

(Contd)

Bob Swain's

NATIONAL TRANSPORTATION SAFETY BOARD
OPERATIONAL FACTORS GROUP
DCA 96-F-A070

FIELD NOTES

On July 17, 1996, at 2031 eastern daylight time (all times are eastern daylight time unless otherwise specified), a Boeing 747-131, N93119, operating as Trans World Airlines flight 800 from John F. Kennedy Airport, New York, to Charles DeGaulle Airport, Paris, France, impacted into the Atlantic Ocean at 72:37.46N, 40:39.52W off the coast of Long Island, New York. The active crew of 18, dead heading crew of 17, and the 195 passengers received fatal injuries and the aircraft was destroyed. Push back for the flight occurred at 2002, and takeoff occurred at 2019 for this scheduled air carrier flight operating under Title 14, CFR Part 121. Visual meteorological conditions prevailed and an IFR flight plan was filed.

Scheduled departure time for the flight was 1900. The one hour and two minute delay was due to a passenger/luggage mismatch and a piece of disabled ground equipment.

The flight was normally scheduled to terminate in Paris but was extended to Rome due to cancellation of a company Kennedy/Rome flight earlier in the day. A crew change was planned in Paris.

AIRCRAFT

Boeing 747-131, N93119. Year of manufacture 1971.
Maximum gross weight 734,000 lbs.
→ Take off weight 590,441 lbs.
Number persons on board - 230, 18 active crew, 17 dead heading crew, and 195 passengers.
Dispatch fuel - 181,100 lbs, take off fuel 176,600 lbs, and fuel at the time of the accident was calculated to be 165,000 pounds. There was residual fuel only in the center tank which has a capacity of 86,360 pounds of useable fuel. The tank has an approximate volume of 1,625 cubic feet. Aircraft weight at the time of the accident was calculated to be approximately 574,000 pounds.

According to the dispatch release, three items were listed on the minimum equipment list. (1) Number two left canoe flap track faring was missing. (2) The number three engine thrust reverser was inoperative. (3) One of the two weather radar transmitter/receiver units was inoperative. The maintenance records group confirmed these items.

Take off data.
V1-113kts, Vr-146kts, V2-153kts, Stab trim - +6.1 (MAC 18.4)
Maximum EPR - 1.455, Standard EPR - 1.330

```
JFKW[illegible]
.HDQ[illegible] TW 172334/DMCD1316
FLIGHT  ORIG DATE  PLANE   CONFIGURATION   DEP   HUB  DM
800     17 JUL  -  17119   A29-404         JFK   JK2
OPERATING WEIGHT            C3-14          357440
CLASS 1 SECT 1 PSGRS  21                     3465
CLASS 1 SECT 2 PSGRS   8         ( 29)       1320
CLASS 2 SECT 1 PSGRS 115                    18975
CLASS 2 SECT 2 PSGRS  66         (181)      10890
FORWARD COMPARTMENT CARGO                    6062
REAR COMPARTMENT CARGO                      12428
AFT COMPARTMENT CARGO                        1261
ZERO FUEL WEIGHT          (MZFW  526500)   413841
TAKE-OFF FUEL                              176600
GROSS TAKE-OFF WEIGHT     (ATOW  708300)   590441
TAXI FUEL                                    4500
TAXI WEIGHT               (MTXW  738000)   594941
                                   MAC      18.4   TRIM   6.1
MAXIMUM ADJUSTMENT WITHOUT CONTACTING LOAD CONTROL
OPTION 1 - PSGRS F/C 0 COACH 20 OR CARGO 2390 POUNDS
OPTION 2 - MAXIMUM PSGR AND CARGO 2128 POUNDS
ADVISE LOAD CONTROL IMMEDIATELY AFTER DEPARTURE
NO REPORTED GROUND SECURITY IRREGULARITIES
AGENT DM   JK2        TIME 23134Z

NH6 00189 07/172334
```

```
JFKWITW
.HDQRMTW 172334/DMCD1316
800/17JUL JFK INTO CDG 17119
----------------INBOUND LOADMAP----------------
                    FORWARD
          FD9  FD7  FD8 [illegible]
          FC15 [illegible]
          FC16 [illegible]
[illegible]
FD5.   -
FD6.   -
FD7.   -
FD8.   -
RI1.   CDG AF25-1885 \AAP7308
RI2.   CDG AF15-1920 \AAP7309
RD4.   CDG AF27-1245 \AUB0458
RC9.   CDG AF1-1700 \AKN7488
```

JFKWI TW JFK87TW
.HDQRRTW 172136/DMCD1316

FLIGHT	ORIG DATE	PLANE	CONFIGURATION	DEP	HUB	OM
800	17 JUL	17119	A29-404	JFK	JKZ	NM

OPERATING WEIGHT	C3-14		359440
CLASS 1 SECT 1 PSGRS 21			3465
CLASS 1 SECT 2 PSGRS 8		(29)	1320*
CLASS 2 SECT 1 PSGRS 100			16500
CLASS 2 SECT 2 PSGRS 110		(210)	18150*
FORWARD COMPARTMENT CARGO			13131
REAR COMPARTMENT CARGO			7632
AFT COMPARTMENT CARGO			2832
TOTAL PAYLOAD			63030
ZERO FUEL WEIGHT	(MZFW	326500)	422470
TAKE-OFF FUEL			185000*
GROSS TAKE-OFF WEIGHT	(ATOW	711900)	607470*
TAXI FUEL			4500
TAXI WEIGHT	(MTXW	739000)	611970

MAC 18.3 TRIM 6.8*

NO REPORTED GROUND SECURITY IRREGULARITIES *

AGENT OM JKZ TIME 21:36Z

PLEASE REPORT OUT TIMES AND EXPECTED OFF TIMES TO LOAD
CONTROL AGENT WHEN RECEIVING FINAL WEIGHT DATA.
RADIO FREQUENCY 130.72

NM6 00087 07/172136

PRELIMINARY WT SLIP

CC 9855 2500

Akin 7639 HEGRX
40445

800

800
29/181

Marie
1934

QU JFKKATW
.MKCVDTW 172117

--------DISPATCH RELEASE-------

RF 00800/17JUL A P17119 TO LFPG
KJFK 185000 LFPG 711900
DUE CDL 27-51-2 FLIGHT PLAN FUEL BURN INCREASED BY 2 PER CENT
STRAIGHT RLSE DUE TO EINN/EIDW BELOW MINS
MEL 27-51-2 2L CANOE FLAPTRACK FAIRING
MEL 78-1 3 THRUST REVERSER
MEL 34-23 WEATHER RADAR
ANDRE BAUMGARDT DEPARTING DISP SCTR 79 718-244-2935
RLS TM 172115 RECEIVING DISP SCTR 32
FUEL SUMMARY:

ORIG/DEST	KJFK/LFPG
RLSE FUEL	185000
TAXI FUEL	4500
TOTAL	189500

CAPT ADD --------

TOTAL FUEL --------

CAPTAIN --

FUEL BURN COST FIGURE REFLECTS CURRENT PRICE AT DEPARTURE STATION
RELEASE 00800/17JUL/KJFK-LFPG PAGE 01 OF 01

NI1 00044 07/172117

QU JFKKATW
.MKCVDTW 172158

--------DISPATCH RELEASE-------

RF 00800/17JUL A P17119 TO LFPG
KJFK 176600 LFPG 708200
DUE CDL 27-51-2 FLIGHT PLAN FUEL BURN INCREASED BY 2 PER CENT
NEW RELEASE DUE TO PAYLOAD CHANGE.
MEL 27-51-2 2L CANOE FLAPTRACK FAIRING
MEL 78-1 3 THRUST REVERSER
MEL 34-23 WEATHER RADAR
STRIAGHT RELEASE DUE TO SNN DUB WX BELOW MIN.
* BUST PREVIOUS RELEASE *
ANDRE BAUMGARDT DEPARTING DISP SCTR 79 718-244-2935
RLS TM 172149 RECEIVING DISP SCTR 32
FUEL SUMMARY:

ORIG/DEST	KJFK/LFPG
RLSE FUEL	176600
TAXI FUEL	4500
TOTAL	181100

CAPT ADD --------

TOTAL FUEL --------

CAPTAIN --

FUEL BURN COST FIGURE REFLECTS CURRENT PRICE AT DEPARTURE STATION
RELEASE 00800/17JUL/KJFK-LFPG PAGE 01 OF 01

NI1 00110 07/172159

07/20/96 12:53 NO.079 001

QU ZTW
.M.... W 000000

TWA FUEL LOAD SERVICE RECORD M-180C 17JUL/1805

STA JFK PLANE 17119 FLT 800 AGENT JC FUEL TYPE .A...

TOTAL FUEL 181100 LBS WITH TAXI TYPE LOAD STANDARD/STD

TANK	BEFORE FUELING (From airplane)	PLANNED POUNDS	AFTER FUELING (From Airplane)	INOPERATIVE FUEL GAUGE NR	INCHES/LBS	TRUCK-METER	GAL
1R	....	3350	3400...	...	....	....	500
1	.5400.	24596	24600.	...	....	....	3671
2	.5300..	62605	62900.	...	....	....	9344
CTR	..300..	0	..300.	...	....	....	0
3	.6900...	62605	62700.	...	....	....	9344
4	6300...	24596	24600	...	....	....	3671
4R	....	3350	.3300.	...	....	....	500
TOT	24200...	181100	181800.				

READINGS BY .... VERIFIED BY ....

AFTER FUELING .181100. (LBS)

(SUBTRACT) (-)
BEFORE FUELING .24200. (LBS)

(EQUAL)
CALCULATED ADD 157600 (LBS) (/) DIVIDED BY 6.70 FUEL DENSITY

EQUAL CALCULATED ADD 23522 (GAL)

TRUCK METER READINGS COMPARE
LEFT RIGHT

......AND......EQUAL TOTAL 23871 (GAL) (COMPARE TO CALCULATED ADD)

TRUCK READING 7349

ADD TOLERANCE PLUS/MINUS 650 (GAL) CALCULATED BY ....

COMPARE CALCULATED ADD GALLONS TO TRUCK METER ADD GALLONS. IF DIFFERENCE IS GREATER THAN ADD TOLERANCE CONTACT OPERATIONS PRIOR TO DEPARTURE.

ENGINE OIL (QUARTS)

. 1 . 2 . 3 . 4 . OIL SERVICED BY

FUEL SERVICED BY (EMPLOYEE ID)
~~LEFT~~ RIGHT
....

DATE/TIME ..17 July......

PLACE COMPLETED COPY BETWEEN COCKPIT THROTTLES AND RETURN ORIGINAL TO TWA OPERATIONS FOR FILING.

FLIGHT CREW ....
SIGNATURE NOT REQUIRED ON FUELERS COPY.

NOTE- FUEL WITH 4500 TAXI...BUST PREVIOUS FUEL PER DISPATCH

KA4 00091 07/172206

STLFCTW
.HDQRMTW 181355/P8FE0A23
800/17JUL JFK
17119 747-100/NM/A29-404/50/A
MTOW 708300 F176600 C3-14 KO
MTXW 738000 TF4500
ZFW 414171 CG 21.5 LIMITS 14.9 - 31.4
GTW 590771 CG 18.3 LIMITS 12.2 - 31.7

CALCULATIONS: 6
MANIFESTS: 5 M CLOSING AGENT DM JK2 TIME 2313GZ
STATUS: CLOSED

FC1/2 2 SIDE BY SIDE
3 4 " " "

PRESENT LOADING
C1S1 21 F/C
C1S2 8 40
C2S1 117 } COACH
C2S2 66

. ANN LO3

LO3 L FC1. CDG B43 \AKN7415 NORDISK
LO3 R FC2. CDG B45 \AKN7866 NORDISK
LO3 L FC3. CDG B40 \AKN9737 NORDISK
LO3 R FC4. CDG B31
CDG/TW1 B17 \AKN7430 NORDISK

} LO3's

FD3. -
FD4. -
FD5. -
FD6. -
FD7. -
FD8. -
LO9 RI1. CDG AF23-1885 \AAP7308 NORDISK 1989
LO9 RI2. CDG AF15-1920 \AAP7309 NORDISK 1980 → went out of business sold many years ago to Air Cargo Equipment Corp.
LO5 RD4. CDG AF27-1245 \AWB0683 TR 1981 → TRANSEQUIP
LO3 RC9. CDG AF1-1780 \AKN7488 NORDISK
LO3 RC10. CDG AF17-667 \AKN7746 NORDISK
LO3 RC11. CDG AM1000 \AKN7639 NORDISK
LO3 RC12. CDG B9-P583 \AKN7501 NORDISK

APP LO9's

RD7. -
ABA. CDG AF14-294 14 PIECES 294 LBS
ABB. CDG AG1-2 AOG
ABC. CDG X1-38 AIR EXPRESS 1 PIECE 38 LBS
ABD. CDG/CDG/MXP B35 35 BAGS MXP

VMP 00130 07/181355

Test Plan in Support of the Simulation For Basic Stinger Against High Flying Target-Revision B -7/3/97

Introduction

This test plan identifies the measurement of a high flying target and subsequent deliverables in support of simulation activities designed to identify the capability of the Stinger family of missiles to intercept an aircraft traveling at 300 knots at an altitude of 13,000 feet. This revised test plan has been modified following the meeting held 7/2/97 at the FAA Atlantic City facility. It is assumed that some estimate of range will be available either through installation of the Hughes mini-ranger or from GPS or other means, that aircraft-to-Hughes communications will be possible through VHF (122.8 or 122.5), and that pilots will call out EGT as required by Hughes.

Phase 1: Take Off

The aircraft will be measured in a climb-out scenario at zero azimuth, from 40 to 80 degrees elevation (90 degrees elevation is directly overhead). Aircraft will climb at a 5 to 10 degree angle such that the climb is initiated from level flight at 2000, 6000, and 13500 feet altitude AGL approximately 2500 feet ahead of the test site. Three passes at each altitude will be flown, the first and third with landing lights off, the second with landing lights on in all cases. Aircraft heading will be approximately 291 degrees true.

Phase 2: Constant Altitude Offsets

In the event range is available, constant altitude flights at 13000 feet will be flown . Five flights with minimum distance increasing by 2000 feet per flight will be flown with in initial flight directly over the test site. Altitude will be 13500 feet AGL, speed will be 300 knots. Heading will be approximately 291 true. GPS coordinates will be provided if needed prior to the flight.

Phase 3: Rosettes

Two rosette patterns will be flown at elevation angles of 40 and 60 degrees Airspeed will be 250 knots. The table below provides the ground range and altitude for crossover point from the measurement site for each angle.

Angle	Ground range in feet	Altitude AGL in feet
40 degrees	1915	3149
60 degrees	1915	4282

The ground range is constant for both rosettes which will allow placement of a horizontal camera for aircraft range and bearing estimation. The aircraft will be required to fly directly over the field of view of the camera. Again GPS coordinates will be provided as needed prior to the test.The following table shows the rosette pattern that will be flown. Although all turns are shown as left turns the direction of turnout will be at the pilots discretion to avoid restricted airspace. Both the aspect angle to the measurement site at crossover, heading, and, the arc flown to get from the current angle to the next angle is shown. Since 7 angles are required for each elevation, assuming 50% of the data points must be done twice, and a turn around time of 10 minutes per angle, a total of 210 minutes of flight time will be required for the rosette portion.

Aspect at crossover - heading (true)	Arc to be flown to next crossover

0 degrees - 291 degrees	60 degrees
240 degrees - 51 degrees	90 degrees
150 degrees - 141 degrees	60 degrees
30 degrees - 261 degrees	90 degrees
300 degrees - 351 degrees	60 degrees
180 degrees - 111 degrees	90 degrees
90 degrees - 201 degrees	RTB or begin next rosette

Instrumentation

Phase 1 - Data will be collected with the RedSting radiometer seeker and documentation imagers. Radiometric data of the track point and trackpoint location will be collected. The trackpoint data will serve to validate the simulation model for similar aircraft presentations. Minimum of 10 minutes required prior to initiating phase 2.

Phase 2 - Same as phase 3. Minimum of 10 minutes required prior to initiating phase 3.

Phase 3 - Data will be collected with calibrated imagers in the long and mid wave infrared bands as well as the normal UV band. In addition, the PFS201, a Fourier Transform spectrometer will collect spectral data of the aircraft. Spectral data will be collected of the aircraft as a whole from 2 to 5 microns. Following background subtraction, spectral contrast functions will be produced for use in modeling. The spectral data will show plume characteristics and act as an aid in setting engine operating conditions for accurate plume prediction. The data collected in phase 3 will be employed to validate the wireframe model.

Outputs

A 3-D target model will be validated with the data collected in the field portion of the test. From this model, input to the ARL Basic Stinger model will be gleaned and delivered to ARL in the form of an ASCII file of source, location, and size of track points on the aircraft up to a total of six sources for a variety of azimuth and elevation angles. In addition a brief report will be generated describing the measurements and a review of the data collected.

Monday 7/14	**Tuesday, 7/15**	**Wednesday, 7/16**	**Thursday, 7/17**	**Friday, 7/18**	**Saturday, 7/19**	**Sunday, 7/20**
AM: Packs 2 & 3 Continuous (5.3)	**AM:** Cruise Condition (All packs to FL 350) (5.6)	**AM:** Packs 1 & 3 continuous, flight plan in replication of 2 & 3 continuous (Boeing Baseline) (5.9)	**AM:** Tankered Fuel (6000 lbs) (used Cruise condition as a baseline (5.8)	**AM:** Fuel added before taxi, (12000 lbs) Packs 2 & 3 AM: Finish pack bay modification	**AM:** Replace air conditioning pack seals.	**AM:** Refurbish
PM: FBI/DoD flight tests (5.5)	**PM:** Emulation of TWA Flight 800 (Packs 1&3) (5.7)	**PM:** Packs 1 & 2 and cross-feed from tank 3 (FAA crossfeed procedure)(5.4)	**PM:** Begin to modify for Boeing pack cooling test	**PM:** Modified Air Conditioning Pack Inlet (5.10) (Boeing Flight)	**PM:** : Modified Air Conditioning Pack Inlet with New Pack Components (Boeing Flight)(5.11) Begin Refurbish	**PM:** Refurbish
Monday, 7/21	**Tuesday, 7/22**	**Wednesday, 7/23**	**Thursday, 7/24**	**Friday, 7/25**	**Saturday, 7/26**	**Sunday, 7/27**
AM: Refurbish	**AM:**	**AM:**	**AM:**	**AM:**	**AM:**	**AM:**
PM: Return to Standard A/W Certificate	**PM:**	**PM:**	**PM:**	**PM:**	**PM:**	**PM:**