NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

Attachment 10 - B707 Simulator Work

OPERATIONAL FACTORS

DCA11MA075

CONTENTS

A. ACCIDENT

Operator:	Omega Aerial Refueling Services, Inc.
Location:	Point Mugu Naval Air Station, California
Date:	May 18, 2011
Airplane:	Boeing 707-321B, Registration Number: N707AR

B. NATIONAL TRANSPORTATION SAFETY BOARD (NTSB) OPERATIONS GROUP

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C. SUMMARY

On May 18, 2011, at approximately 1727 pm local time (0027 UTC), Omega Air flight 70, a Boeing 707-321B (N707AR), crashed on takeoff at the Point Mugu Naval Air Station[1], Point Mugu, California. The airplane impacted beyond the departure end of runway 21 and was destroyed by post-impact fire. All three flight crewmembers aboard escaped with minor injuries.

D. B707 SIMULATOR WORK

1.0 Background:

On June 16, 2010, from 0835 to 1045 EDT, in support of the Omega Air 70 accident investigation, the NTSB Ops Team conducted documentation of the B707 Level A simulator used for recurrent training by the accident crew located at Pan Am International Flight Academy in Miami, Florida. Following documentation of the cockpit and instructor panels in the simulator, Ops Team members conducted a series of flight profiles to demonstrate the B707 simulator capabilities.

[1] Naval Base Ventura County.

Photo 1: Pan Am B707 Full Flight Simulator (FFS)

Photo 2: Pan Am B707 FSS Cockpit

Photo 3: Pan Am B707 FFS Throttle Quadrant

2.0 Profile Number 1: Normal taxi out, normal takeoff.

2.1 Pilot Positions

Captain Seat: Mike Coker (Boeing)
First Officer (FO) Seat: Tony James (FAA)
Flight Engineer Seat (FE): Liz McGrath (NTSB)
Test Director: David Lawrence (NTSB)
Simulator Operator: Juan R. Serrano (Pan Am)

2.2 Simulator Set up

Weather: Calm winds, clear skies, standard temperature (15 degrees Celsius)
Weight: max landing weight
Configuration: Flaps 14 degrees
Takeoff thrust: 1.85 EPR[2] - outboard engines, 1.82 - inboard engines (reduced inboard thrust due to activation of turbo compressors on inboard engines, resulting in a 0.03 EPR performance penalty. Thrust settings were determined by referencing the B707 Takeoff Performance Chart).

2.3 Notes:

- The NTSB Ops Team observed seat-dependant Pre Start checklist procedures and normal taxi and takeoff procedures.
- CVR[3] check is performed by pressing a push-to-test button on the cockpit overhead panel and looking for movement of a green needle. Plugging in a headset to verify CVR audio

[2] Engine Pressure Ratio
[3] Cockpit Voice Recorder.

was an option, but not required for preflight. According to the Pan Am instructor, there is no pre-flight test for the FDR[4].

- A normal brake check is conducted during initial taxi out as aircraft is moving.
- On the ground, the FO runs all checklists until the aircraft begins to move, then the FE will run subsequent checklists.
- Nose wheel steering is conducted via Captain tiller wheel. There is no mechanical linkage between the rudder pedals and the nose gear for ground steering. During takeoff, directional control is maintained by use of the tiller until the 8o knot callout when the PF transfers directional control from the tiller to the rudder pedals as aerodynamic loads on the rudder increase.
- According to the Pan Am instructor, rejected takeoff procedures include first reducing the thrust to idle, followed by full braking, followed by extension of the speed brake handle.
- Normal Pan Am B707 was dated 08/23/1977 (FAA approved 924-10635AB). Non-normal B707 checklist (including the Engine Fire/Sever Damage or Separation checklist) was dated 06/16/1978.
- There is no mechanical linkage from the thrust levers (reverse thrust application) or automatic extension of the speed brakes.
- Normal takeoff profile is an initial pitch up to a target of 16 degrees, speed V2+10 knots. At 1000 feet AGL, pitch is reduced to 7 degrees, and flaps are retracted from 14 degrees to the up position.

3.0 Profile Number 2: V1 cut (6 degrees of aileron input for crosswind)

3.1 Pilot Positions

Captain Seat: Mike Coker (Boeing)
First Officer Seat: Tony James (FAA)
Flight Engineer Seat: Liz McGrath (NTSB)
Test Director: David Lawrence (NTSB)
Simulator Operator: Juan R. Serrano (Pan Am)

3.2 Simulator Set up

Weather: 90-degree right crosswind at 24 knots, clear skies, standard temperature (15 degrees Celsius)
Weight: max landing weight
Configuration: Flaps 14 degrees
Speeds: V1-124, Vr-130, and V2-150
Engine Failure: Flameout of the number 2 engine (left inboard) initiated at 124 knots (V1)
Takeoff thrust: 1.85 EPR - outboard engines, 1.82 - inboard engines (reduced inboard thrust due to normal activation of turbo compressors on inboard engines, resulting in a 0.03 EPR performance penalty. Thrust settings were determined by referencing the B707 Takeoff Performance Chart).

[4] Flight Data Recorder.

3.3 Notes

- Pan am instructor briefed the following crosswind takeoff procedure:
    - Pilot monitoring should hold about 6 degrees right aileron (for a right to left crosswind) into the wind but not more to preclude the possibility of extending flight spoilers. Investigators noted there is no cockpit indication of flight spoiler activation, and angle measurements marks on the control column were worn and unreadable. Pan Am instructor stated that spoiler activation can be confirmed by looking at the utility hydraulic pressure gauge located at the bottom of the FO forward panel (verifying a load induced on the flight spoilers), but was not a taught procedure. Investigators noted that slow movement of the control yoke produced no movement on this gauge.
    - At 80 knot callout, PF would maintain directional control on takeoff roll by transferring control from the tiller wheel to the rudder pedal and holding the control column roll input into the wind.
- Pan Am instructor briefed the following engine failure on takeoff profile:
    - Initial pitch rotation would be that required to maintain a target speed of V2 (instead of V2+10).
    - Obstacle clearance altitude was 800 feet.
    - PF would then reduce pitch to zero climb, accelerate to V2+30 and begin a cleanup of the flaps.
- For V1 cuts, the only way to fail an engine on takeoff is for the instructor to select "Engine Flameout". There is no severe damage or separation selection on the instructor panel. The instructor can introduce an engine fire, but it will not fail the thrust on the engine.
- There is no way for the instructor to simulate a dual engine failure on takeoff.
- There is no aural warning associated with an engine failure or flameout.
- During profile #2 takeoff with a right 24-knot crosswind, PF did not need full rudder during liftoff. Wings remained level with minimal aileron input. Aircraft climbed approximately 50 feet when simulator was placed on position freeze. Aircraft was abeam departure end of runway with the number 4 engine (right outboard) approximately aligned with the left side of the runway.

4.0 Profile Number 3: V1 cut (12 degrees aileron input for crosswind)

4.1 Pilot Positions

Captain Seat: Mike Coker (Boeing)
First Officer Seat: Tony James (FAA)
Flight Engineer Seat: Liz McGrath (NTSB)
Test Director: David Lawrence (NTSB)
Simulator Operator: Juan R. Serrano (Pan Am)

4.2 Simulator Set up

Weather: 90-degree right crosswind at 24 knots, clear skies, standard temperature (15 degrees Celsius)

Weight: max landing weight
Configuration: Flaps 14 degrees
Speeds: V1-124, Vr-130, and V2-150
Engine Failure: Flameout of the number 2 engine (left inboard) initiated at 124 knots (V1)
Takeoff thrust: 1.85 EPR - outboard engines, 1.82 - inboard engines (reduced inboard thrust due to normal activation of turbo compressors on inboard engines, resulting in a 0.03 EPR performance penalty. Thrust settings were determined by referencing the B707 Takeoff Performance Chart).

4.3 Notes

- Crosswind technique used was identical to previous scenario, with the exception that 12 degrees of aileron into the crosswind was used instead of 6 degrees.
- During profile #3 takeoff with a right 24-knot crosswind, PF did not need full rudder during liftoff. Wings remained level with minimal aileron input. Aircraft climbed approximately 50 feet when simulator was placed on position freeze. Aircraft was abeam departure end of runway with the number 3 engine (right inboard) approximately aligned with the left side of the runway.

5.0 Profile Number 4: Dual Engine Failure at V1 (Left inboard and outboard)

5.1 Pilot Positions

Captain Seat: David Lawrence (NTSB)
First Officer Seat: Tony James (FAA)
Flight Engineer Seat: Liz McGrath (NTSB)
Simulator Operator: Juan R. Serrano (Pan Am)

5.2 Simulator Set up

Weather: 90-degree right crosswind at 24 knots, clear skies, standard temperature (15 degrees Celsius)
Weight: max landing weight
Configuration: Flaps 14 degrees
Speeds: V1-124, Vr-130, and V2-150
Engine Failures: A dual engine failure was simulated by reducing thrust to idle on the #1 and #2 engines simultaneously at V1 (there is no way for the instructor to induce a dual engine failure in the Pan Am B707 simulator).
Takeoff thrust: 1.85 EPR - outboard engines, 1.82 - inboard engines (reduced inboard thrust due to normal activation of turbo compressors on inboard engines, resulting in a 0.03 EPR performance penalty. Thrust settings were determined by referencing the B707 Takeoff Performance Chart).

5.3 Notes:

- Normal (6 degrees aileron input) crosswind technique was used.

- Full rudder input was introduced for lateral control. Aileron input needed to maintain wings level was approximately 5 degrees. There was no positive lateral control of the aircraft.
- Aircraft drifted left of centerline after rotation. Aircraft climbed approximately 20 feet. Simulator was placed on position freeze abeam departure end of the runway. Right wingtip was aligned with the left side of the runway.

6.0 Profile Number 5: Dual Engine Failure at 20 feet (Left inboard and outboard)

6.1 Pilot Positions

Captain Seat: David Lawrence (NTSB)
First Officer Seat: Tony James (FAA)
Flight Engineer Seat: Liz McGrath (NTSB)
Simulator Operator: Juan R. Serrano (Pan Am)

6.2 Simulator Set up

Weather: 90-degree right crosswind at 24 knots, clear skies, standard temperature (15 degrees Celsius)
Weight: max landing weight
Configuration: Flaps 14 degrees
Speeds: V1-124, Vr-130, and V2-150
Engine Failures: A dual engine failure was simulated by reducing thrust to idle on the #1 and #2 engines simultaneously at 20 feet (there is no way for the instructor to induce a dual engine failure in the Pan Am B707 simulator).
Takeoff thrust: 1.85 EPR - outboard engines, 1.82 - inboard engines (reduced inboard thrust due to normal activation of turbo compressors on inboard engines, resulting in a 0.03 EPR performance penalty. Thrust settings were determined by referencing the B707 Takeoff Performance Chart).

6.3 Notes:

- Normal (6 degrees aileron input) crosswind technique was used.
- Full rudder input was introduced for lateral control. Aileron input needed to maintain wings level was approximately 5-10 degrees. There was no positive lateral control of the aircraft.
- Aircraft drifted left of centerline immediately after engine failures. Aircraft did not climb beyond 20 feet. Simulator was placed on position freeze abeam departure end of the runway. Right wingtip was aligned with the left side of the runway.

7.0 Profile Number 6: Dual Engine Failure between V1 and Vr (Left inboard and outboard)

7.1 Pilot Positions

Captain Seat: David Lawrence (NTSB)
First Officer Seat: Tony James (FAA)
Flight Engineer Seat: Liz McGrath (NTSB)
Simulator Operator: Juan R. Serrano (Pan Am)

7.2 Simulator Set up

Weather: 90-degree right crosswind at 24 knots, clear skies, standard temperature (15 degrees Celsius)
Weight: max landing weight
Configuration: Flaps 14 degrees
Speeds: V1-124, Vr-130, and V2-150
Engine Failures: A dual engine failure was simulated by reducing thrust to idle on the #1 and #2 engines simultaneously between V1 and Vr (there is no way for the instructor to induce a dual engine failure in the Pan Am B707 simulator).
Takeoff thrust: 1.85 EPR - outboard engines, 1.82 - inboard engines (reduced inboard thrust due to normal activation of turbo compressors on inboard engines, resulting in a 0.03 EPR performance penalty. Thrust settings were determined by referencing the B707 Takeoff Performance Chart).

7.3 Notes:

- Normal (6 degrees aileron input) crosswind technique was used.
- Full rudder input was introduced for lateral control. Aileron input needed to maintain wings level was approximately 5 degrees.
- Aircraft drifted left of centerline after rotation. There was no positive lateral control of the aircraft. Aircraft climbed approximately 10 feet. Simulator was placed on position freeze abeam departure end of the runway. Right wingtip was aligned with the left side of the runway.