NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

December 1, 2014

Attachment 4– Simulator Notes

OPERATIONS GROUP

DCA14FA058

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Memphis, TN
Trans States Airlines (TSA)
Accident
(NTSB # DCA14FA058)

Aircraft:	Embraer 145, Level D, Simulator (4 hours)	
Airport:	St. Louis, MO (FlightSafety – FSI -Training Facility)	
Participants (6):	Simulator Operator:	Michael Boschert – TSA Sim Instructor
	Captain Seat:	Normand Bissonnette - FAA
	First Officer Seat:	Stuart Scott – TSA
	Observers:	Mike Woodbury - TSA
	Test Director:	Albert Nixon – NTSB
Dates:	May 23, 2014 (0800 CDT)	

Notes: KMEM airport was used with the following lengths:

Runway 36R, 9,000 ft. x 150 ft. (2743 x 46 m) dry concrete.

- For the landing scenarios, 41,000 pounds was used (weight freeze).
- Fuel: 7,500 pounds was used (fuel freeze).
- Simulator had no noted discrepancies, was utilized with the motion on and crash inhibit not active.
- Acknowledged: Simulator may not be able to replicate some task configurations/profiles and airplane icing.

Objectives:

1. To document the accident approach and landing parameters to a full stop landing and simulate the icing conditions.

2. To document the accident approach and landing to a full stop profile.

3. To document EMB145 rudder system 1 and 2 inoperative and landing to a full stop.

4. To document EMB145 rudder hardover and landing to a full stop.

5. To document EMB145 incorrect autopilot disconnect procedures and landing to a full stop.

Task 1 - Setup

Time: (in simulator) 00:15
Initial Setup

- FMS Flight plan - Set to arrival ILS approach to runway 36R at KMEM, 3 degrees
- Simulator Position - On approach (8 mile final at 2000 ft., just prior to glideslope intercept)
- Alternate - N/A
- Fuel Weight - 7,500 pounds (fuel freeze)
- Aircraft weights - 41,000 pounds landing weight (weight freeze)
- Autopilot - On initially, then off for landing
- Config - Flaps 45, Gear DN, stabilizer trim as required
- Thrust (thrust idle at 20 ft.) - Set to match accident thrust N1 readings at 100 ft. intervals
- Field elevation - 341 ft.
- Vref (CA/FO) - 117/117
- Vac (CA/FO) - 127/127
- PF/PM - Captain (CA) was Pilot Monitoring (PM) and First Officer (FO) was Pilot Flying (PF)
- Environmental - KMEM - 045055Z AUTO 28007KT 1SM 4OVC 1/M01 A2992
  - Night IMC
- Sim Position - Instructor took a "snapshot" of Task 1 start position

Procedure

1) Provided simulator safety briefing.
2) Observer/pilot occupant cockpit familiarization.

Proc.	Notes
1	Sim motion on.
2	Position Freeze released. Configuration was flaps 45, gear DN, on glideslope, on speed, 8 mile final approach. N1 set to accident FDR parameters based on height above ground level (AGL). Speeds set to match accident approach profile N1 thrust settings. Autopilot off prior to 200 ft. Yaw Damper off prior to 200 ft. Thrust reduction to idle at 20 ft. Roll 30 degrees of right bank at 40 ft. Simultaneously increase pitch to 10 degrees.
3	Other information. Several approaches were flown to simulate the accident approach profile. It was determined that a 50% icing setting with anti-ice circuit breakers pulled (to simulated anti-ice system inoperative) closely maintained the final approach speed with the accident profile power settings taken from the Flight Data Recorder (FDR). The simulator would increase airspeed with the accident profile power settings without the ice setting on. Further, the first approach was flown as "normal" to document a normal landing.

Task 2 - Accident Approach and Landing

Time: (in simulator) 03:00

Initial Setup

- Weight/Weather - Per initial setup
- Autopilot - On, off at 200 ft. for landing
- Config - Flaps 45, Gear DN

Procedure

1) Placed simulator motion to "ON" (FO was PF).
2) Released position freeze and initiated an approach and landing.
3) Documented alerts (aural and visual).
4) Documented accident simulation.

Proc.	Notes
1	Sim motion on.
2	Position Freeze released. Configuration was flaps DN, gear DN, on glideslope, on speed, 8 mile final approach. N1 set to FDR parameters based on height above ground level (AGL). Speeds set to match accident approach profile N1 thrust settings. Autopilot off prior to 200 ft. Yaw Damper off prior to 200 ft. Thrust reduction to idle at 20 ft. Roll 30 degrees of right bank at 40 ft. Simultaneously increase pitch to 10 degrees.
3	**Other Information**: Most of the approaches concluded with a stick shaker and the right wing striking the ground about 25-30 degrees of bank. The landing zone was to the right side of the runway or short of the runway, in the overrun. Accident events occurred quickly after autopilot disconnect. Slow speed occurred during a lot of cockpit actions. Cross wind corrections inputted, pulling power to flight idle, using rudder and aileron to maintain course, visually checking airplane on course and glidepath. In addition, correcting for an earlier slow airspeed callout by the Captain. Low speed cues were not overly noticeable. PLI came into view about 120 agl. Color cues on the airspeed numbers and PLI were marginally effective. Colors changed from green to amber but were barely noticeable. No low speed audio warnings. On some accident profiles the stick shaker was activated but not always noticed by the pilot attempting the recovery. Power settings reflected that with thrust levers at flight idle and then increased to maximum power, a spool up time of several seconds was present. Hard to notice the increased pitch of 10 degrees in simulator.
Proc.	**Notes**

Task 3 - Accident Approach and Landing with Rudder System 1 and 2 Inoperative

Time: (in simulator) 0:15

Initial Setup

- Weight/Weather - Per initial setup
- Autopilot - On then off for landing
- Config - Flaps 45, Gear DN

Procedure

1) Placed simulator motion to "on" (CA was PF).
2) Released position freeze and initiate a normal landing.
3) Documented alerts (aural and visual).
4) Documented malfunction's effect on landing.

Proc.	Notes
1	Sim motion on.
2	Position Freeze released. Configuration was flaps 45, gear DN, on glideslope, on speed, 8 mile final approach. N1 set to FDR parameters based on height above ground level (AGL). Speeds set to match accident approach profile N1 thrust settings. Autopilot off prior to 200 ft. Yaw Damper off prior to 200 ft. Inputted Rudder System 1 and 2 inoperative about 40 ft. Thrust reduction to idle at 20 ft.
3	Other information. Malfunction was slightly noticeable in the rudder pedals but had no major effect on control of the airplane.

Task 4 - Accident Approach and Landing with Rudder Hardover

Time: (in simulator) 0:15

Initial Setup

- Weight/Weather - Per initial setup
- Autopilot - On
- Config - Flaps 45, Gear DN

Procedure

1) Placed simulator motion to "on" (FO was PF)
2) Released position freeze and initiated a normal landing.
3) Documented alerts (aural and visual).
4) Documented malfunction's effect on landing.

Proc.	Notes
1	Sim motion on.
2	Position Freeze released. Configuration was flaps 45, gear DN, on glideslope, on speed, 8 mile final approach. N1 set to FDR parameters based on height above ground level (AGL). Speeds set to match accident approach profile N1 thrust settings. Autopilot off prior to 200 ft. Yaw Damper off prior to 200 ft. Inputted malfunction rudder hardover about 40 ft. Thrust reduction to idle at 20 ft.
3	Other information. Airplane landed safety with minimal effects. Determined that there was probably not enough time available for malfunction to take full effect prior to the landing.

Task 5 - Accident Approach and Landing While Disconnecting the Autopilot Incorrectly

Time: (in simulator) 0:15

Initial Setup

- Weight/Weather - Per initial setup
- Autopilot - On
- Config - Flaps 45, Gear DN

Procedure

1) Placed simulator motion to "on" (FO was PF).
2) Released position freeze and initiate a normal landing.
3) Documented alerts (aural and visual).
4) Documented malfunction's effect on landing.

Proc.	Notes
1	Sim motion on.
2	Position Freeze released. Configuration was flaps 45, gear DN, on glideslope, on speed, 8 mile final approach. N1 set to FDR parameters based on height above ground level (AGL). Speeds set to match accident approach profile N1 thrust settings. Autopilot off prior to 200 ft. Autopilot control stick disconnect button pushed once Yaw Damper off prior to 200 ft. Thrust reduction to idle at 20 ft.
3	Other information. Autopilot control stick disconnect button was pushed only once in order to receive the AP disconnect audio. Audio would come up and repeat itself until corrected. Simulator autopilot push button activation and hold time appeared to sufficiently duplicate the actual system operation.

General Simulator Notes:

- Could not duplicate the intermittent localizer malfunction in the simulator.

- Simulator weight would have to be reset after each approach to ensure appropriate ice settings were present. Ice setting would continue to increase after each approach if not reset.