

NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety Washington, D.C. 20594

February 2, 2015

Attachment 23 – Ypsilanti Simulator Work

OPERATIONAL FACTORS

DCA13MA081

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A. YPSILANTI SIMULATOR WORK

1.0 Simulator Statement of Qualification

Federal Aviation Administration National Simulator Program



Statement of Qualification

The Federal Aviation Administration (FAA) National Simulator Program has evaluated the Flight Simulation Training Device (FSTD) listed below. This FSTD has been found to meet the standards set forth in the qualification document described below:

> Sponsor: Kalitta Air, LLC Location: Ypsilanti Aircraft Typ e: B-747-400 FAA Identification Number: 1234 Qualification Basis: 14 CFR Part 60 Change 1, Appendix A Qualification Level:C

Is sued by the National Simulator Program on June 26, 2012.

GY

Harlan Gray Sparrow III Manager, National Simulator Program Federal Aviation Administration

To maintain qualification, the ESTD must meet all of the standards and specifications of the qualification basis and is subject to the conditions and limitations listed in the hst FAAFSTD Evaluation Report. This certificate is not transferable, and unless, revoked, suspended, or amended, shall remain in effect until <u>July 31, 2013</u>.

> NSP Form 2001 Raw 2: 08/24/2005

| Sponsor Submissi | on 0 als: 06/26/2012 | | |
|---|---|--|---|
| 2.6 | FSTD | Sponsor Information | on |
| Bponcor Name: | ame: Kalitta Air. LLC. FBTD Location . | | bon . |
| Add re cc: | S 15 Willow Run Almort | Phy doal | SS2 Willow Run Alreart |
| aty: | Ypdiant | City: | Yp dianti |
| Biate/Ro wTerr: | Michigan | Btate: | Michigan |
| Country: | United States | Country: | United States |
| DP: | 42 192 | CIP: | 48 188 |
| Bponcorib No: (F.M. Desegnator) | KCBA7 12A | Meare ct Airport: (Ani Code) | Detroit Metro, DTW |
| Local FAA Authori | | L AI | |
| FAA Training Pro | gram Appro tal Au thority? | | CPM Dother: |
| Wame: | RobertKeepan | Office ID: | AGL-FBDO-22 (DTW) |
| Telep hone : | 724-427-7482 | Fas: | 784-487-7221 |
| Email: | Roberty.keegan @ta.gov | 80 | |
| Sponsor Personnel | A CALL AND A CALL | ting of | |
| | n t Representative : | TICK A | |
| FBT D Manageme | Jeff Phelp c | | |
| FBT D Manageme Name: | Jeff Phelp s | | |
| FBT D Manageme Name : Address 1: | Jeff Pholo s Kalitta Air, LLC. | Add m cc 2 | S15 Willow Run Airport |
| FBT D Manageme Name: Address 1: City: | Jeff Phelp s Kalltta Air, LLC. Yection 1 | Address 2 Bitate: | <u>212 Villow Run Airport</u> |
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| National Simulator Program Statement of Qualification | | FSTD ID: Aircraft Type: | | FSTD ID: 1234 Aircraft Type: E7 47 -400 | | | |
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| Statement of Qualification | | | |
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| Except tor <u>Non-Qualified</u> items stated in cection 4 below, tacks, and tunctions il sted in the applicable Q P8 App Additionally, this FBTD is qualified to perform maneuver or 2b, below. <u>Bpecific use of this device in conjunction</u> <u>Training Program Ap</u> | this FBTD is qua tendia, Table s i s, procedure s, ta n with any trainin proval Authority | ill fled to perfor Band 1C of 14 Grig and functi Ig program mu (TPAA) | m all maneu vers, procedur CFR PartéD a camended. oncanno tated in sectons: stbe approved by the FAA |
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| Section | | Alreraft Type: A | FSTD ID: 123 Niccraft Type | 4 : E7 47 -400 |
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| Area/Run | n 3b. Additional Helicopter FSTD Qua (not stated in 1+0 FR Parted) | alified Maneuvers, Appendix (Clorid) Albed | Procedure: | s, Tasks, and Functions : 18) |
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2.0 Simulator Photos



Photo 1: Kalitta Level C full motion simulator



Photo 2: Kalitta IOS Panel – CG display page

| | P30 | 4 - Unusual Attit | uues | |
|----------|---|--|---|---------------------------------|
| | 5 Deg Down Vings Level 180 Knots | 45 Deg Down 60 Deg Right Bank 300 Knots | | |
| | 60 Deg Dn Wings Level 280 Knots | 60 Deg Down 80 Deg Left Bank VMO - 20 KTS | Extreme Wake Turb. Left Bank | |
| | 30 Deg Down 45 Right Bank VMO | 60 Deg Down 80 Deg Right Bank VMO - 20 Kts | Extreme Wake Turb. Right Bank | |
| | 30 Deg Up 15 Deg Left Bank 300 Knots | 60 Deg Up 60 Deg Left bank 300 Knots | User Defined | |
| Storm . | 45 Deg Dn 60 Deg Left Bank VMO - 10 Kts | 10 Deg Up 120 Deg Left bank 300 Knots | Reduced Motion Cues Time Remaining 45.0 Seconds | |
| GLASS I | OUNTAIN | | | 4 = Mild |
| Prezzos | SHT ABOVE ERRAIN: 17 | GLASS MOUNTAIN ACTIVE | TERRAIN RAMP ANGLE (Deg.) 0 | 7 = Normal 10 = Unsurvivable |
| TCAS | | | Failed Stations | |
| 12:21:31 | | | | |
| | | | | |

Photo 3: Kalitta IOS panel – Unusual Attitude preset page

3.0 General Notes

- Simulator is a Level C. Kalitta also has a B747-400 FTD. Both were purchased from ANA Airlines in Japan.
- CG preset only allowed an aft-most setting of 33%. Simulator engineering could bypass the preset to a max of 52.8%.
- National Airlines "dry-leases" Kalitta simulator time, using National Airlines instructors to teach National Airlines pilots.
- National Airlines also utilizes a B747-400 simulator in Denver. The accident crew was trained in the YIP simulator.

4.0 Simulator Test Plan for National Airlines Bagram, Afghanistan Accident

| Boeing 747-400 Simulator (4 hours) | | | | |
|--|--|--|--|--|
| Ypsilanti, Michigan (Kalitta Training Facility) | | | | |
| Simulator Operator: | Reid Sutherland – National Airlines | | | |
| Captain Seat: | Jose Rodriguez – National Airlines | | | |
| F/O's Seat: | Norm Bissonette - FAA | | | |
| Observers: | Mark Barker – DoD (Observer) | | | |
| Test Director: | David Lawrence - NTSB | | | |
| June 7, 2013 | | | | |
| For the departure scenarios, KDEN runway 25L (12,000 feet long, Fi elevation 5352 feet) was used (Bagram was not in the simulator de base) | | | | |
| | Boeing 747-400 Simulator (4 Ypsilanti, Michigan (Kalitta Tr Simulator Operator: Captain Seat: F/O's Seat: Observers: Test Director: June 7, 2013 - For the departure scenari elevation 5352 feet) was us base) | | | |

- Task times were estimates only
- Simulator IOS panel was unable to be set with a CG aft of 52.8% MAC
- Full motion was disabled for CG's greater than 33% MAC

Objectives:

- 1. To document NAL crew procedures for normal and special Bagram departures.
- 2. To document pitch attitudes for normal and aft CG locations at rotation and required elevator/stabilizer trim inputs.
- 3. To document NAL high pitch attitude recovery techniques and capabilities for normal and aft CG locations at rotation.
- 4. To document high pitch attitude recovery techniques defined in the Upset Recovery Training Aid (Section 2.6.3.2 Nose-High, Wings-Level) with various aft CG locations.

4.1 Task 1 - Setup

| Time Estimate: Initial Setup | 20 minutes (00:20/00:20) ¹ |
|---------------------------------|---|
| • FMS Flight plan | - KDEN-KDEN |
| Simulator Position | - End of runway 25L (KDEN) |
| Alternate | - N/A |
| Fuel Weight | - 103,838 pounds |
| Aircraft weights | - ZFW 571,000 pounds |
| | - Takeoff weight 685,000 pounds |
| Autopilot | - Off |
| Config | - Flaps 10, Gear Down, stabilizer trim 3.8 NU |
| Thrust | - TO Full |
| Field elevation | - 5352 feet |
| CG location | - varied with task |
| Vspeeds | - V1=145 |
| | - Vr=149 |
| | - V2=168 |
| • PF/PM | - Captain will be PF ² and F/O will be PM ³ |
| Environmental | - winds 320/17 (Sim was unable to replicate gusts – Level C) (wind |
| | direction replicates 70 degree right crosswind from Bagram ATIS) |
| | - Few 8500, BKN 14000 |
| | - Temp 17/06, Altimeter: 29.92 |
| Sim Position | Instructor took a "snapshot" of Task 1 start position |

Procedure

- 1) Provide simulator safety briefing
- 2) Observer/pilot occupant cockpit familiarization
- 3) Document NAL procedures
 - Weight and Balance form
 - FMS entries
 - Crew briefing
 - Use of required paperwork
- 4) Other information

¹ Time of Task/Total Time in Simulator ² Pilot Flying

³ Pilot Monitoring

Ypsilanti Simulator Work

| Proc. | Notes | | | |
|-------|--|--|--|--|
| 1 | Completed | | | |
| 2 | Completed | | | |
| 3 | NAL Procedures Load master comes to the cockpit and provides crew with computer generated paperwork that includes: ZFW, MAC%, GTW, TO power setting, Stab trim Pilot completes Perf Data using performance analysis Pilot enters ZFW in PERF INIT page Vspeeds are then generated internally by the FMC | | | |
| 4 | Other Information: According to the NAL Check Airman, NAL does not have, nor does it train any special or "tactical" departures. | | | |

Note: Task complete when simulator occupants briefed

4.2 Task 2 - Normal Takeoff

| Time Estimate: | 20 minutes | (00:20/00:40) |
|----------------|------------|---------------|
| | 20 mmates | (00.20/00.40/ |

Initial Setup

- Weight Per initial setup
- CG 33.0%
- Autopilot Off
- Config Flaps 10, TO Full, Gear Down, Trim 4.0NU

<u>Procedure</u>

Note:

- 1) Place simulator motion to "on" (CAP is PF) (Leave simulator on position freeze at end of runway)
- 2) Initiate a normal takeoff. Document call-outs
- 3) Document acceleration times (Note times for brake release, V1, Vr, rotation, time to target pitch)
- 4) Other Information

Note: Task completed when established on climb at target pitch

Notes

Proc.

| 1 | Completed | | | |
|---|---|--|--|--|
| | | | | |
| 2 | Callouts per NAL procedures | | | |
| | NAL takeoff procedures were used | | | |
| | Time was "hacked" a brake release | | | |
| | - Full Thrust at 15 secs | | | |
| | - V1 at 45 secs | | | |
| | - Vr at 49 secs | | | |
| | - liftoff at 54 secs | | | |
| | Target pitch (FDs) was 15 degrees | | | |
| 3 | | | | |
| | Other Information: | | | |
| | Initial climb speed was 182 kts | | | |
| | • Max angle (from CLB page in FMS) was 264 kts | | | |
| | Pilot impressions: | | | |
| 4 | - none – normal takeoff | | | |
| 4 | - none – normal takeoff | | | |

4.3 Task 3 – Nose High Upset Recovery

| Time Estimate: | 20 minutes | (00:20/01:00) |
|----------------|------------|---------------|
| | | |

Initial Setup

| • | Weight | - Per initial setup |
|---|-----------|--|
| • | CG | - 33.0% MAC |
| • | Autopilot | - Off |
| • | Config | - Flaps 10, TO Full, Gear Down, Trim 4.0NU |

<u>Procedure</u>

- 1) Place simulator motion to "on" (CAP is PF) (Leave simulator on position freeze at end of runway). Initiate a normal takeoff. Climb to 10K with level off
- 2) Initiate a training session for upset recovery, nose high attitude (simulator preset)
- 3) Document crew actions during recovery(Pitch inputs, Stab trim inputs, Control column inputs: pitch/trim)
- 4) Compare recovery techniques to those from the Upset Recovery Training Aid (see Reference Section)
- 5) Other observations

NOTE: Task complete when established on climb at target pitch or stall recovery

| Proc. | Notes |
|-------|--|
| | Completed |
| 1 | Completed |
| | |
| 2 | Completed |
| | Visibility reduced to zero (no outside reference) |
| | Maneuver initiated at 250 kts. |
| | IOS preset user defined 60 degrees up wings level |
| 3 | NAL takeoff procedures were used |
| | V1 occurred 42 seconds after brake release |
| | Vr occurred 47 seconds after brake release |
| | Lifoff occurred 54 seconds after brake release |
| | "Positive rate" occurred 57 secs from brake release |
| | "Gear up" call occurred 10 secs after liftoff |
| | Initial recovery technique: |
| | aggressive pitch over to below level flight |
| | recovery began with stick shaker |
| | recovery initiated a secondary stall warning (2nd shaker) |
| | speed slowed to about 203 knots during recovery |
| | pilots are taught not to use the rudder during upset recovery |
| | Separate recovery technique demonstrated: |
| | repeated setup at 10k |
| | - 250 speed |
| | test director manually pulled column to about 50 degrees |
| | pitch |
| | - pilot recovered using bank first instead of pitch, bank to |
| | about 45 degrees and nose to the horizon |
| | - speed slowed to about 230 kts |
| 4 | no stick shaker or secondary stall |

4.4 Task 4 – CG Shift on Takeoff

| Time Estimate: | 20 minutes | (00:20/01:20) | |
|----------------|------------|---------------|--|
|----------------|------------|---------------|--|

Initial Setup

- Weight Per initial setup
- CG 34.3% MAC
- Autopilot Off
- Config Flaps 10, TO Full, Gear Down, Trim 4.0NU

<u>Procedure</u>

- 1) Place simulator motion to "OFF" (CAP is PF) (Leave simulator on position freeze at end of runway). Initiate a normal takeoff.
- 2) Document acceleration times (Note times for brake release, V1, Vr, rotation, time to target pitch)
- 3) Document alerts (aural and visual)
- 4) Document crew actions (Pitch inputs, Stab trim inputs, Control column inputs: pitch/trim)

NOTE: Task complete when established on climb at target pitch or stall

recovery

| Proc. | Notes |
|-------|--|
| | |
| 1 | Completed |
| | V1 occurred 42 seconds after brake release |
| | Vr occurred 47 seconds after brake release |
| | Lifoff occurred 54 seconds after brake release |
| | "Positive rate" occurred 57 secs from brake release |
| | "Gear up" call occurred 10 secs after liftoff |
| 2 | NAL takeoff procedures were used |
| | |
| | EICAS message "STAB GREENBAND" with aural TO warning |
| | alert occurred because TO was initiated outside of the normal |
| 3 | TO trim setting (disabled aural alert via circuit breaker) |
| | |
| | Pilot impressions: |
| | No significant pitch or roll inputs |
| 4 | airplane felt "a little tail heavy" |

4.5 Task 5 – CG Shift at Rotation

Time Estimate: 15 minutes (00:15/1:35)

Initial Setup

- Weight Per initial setup
- CG

- Begin at 33.0% (52.8% MAC at rotation)Off
- Autopilot
- Config Flaps 10, TO Full, Gear Down, Trim 4.0NU

<u>Procedure</u>

- Place simulator motion to "OFF" (CAP is PF) (Leave simulator on position freeze at end of runway). Initiate a normal takeoff. At rotation, full freeze simulator, and reset CG to 52.8%
- 2) Document alerts (aural and visual)
- Document crew actions (Pitch inputs, Stab trim inputs, Control column inputs: pitch/trim)
- 4) Document Speeds (V1/Vr/V2Minimum speed attained)
- 5) Other observations (ie. time for crew reaction)

NOTE: Task complete when established on climb at target pitch or stall

recovery

| - | | | |
|-------|---|--|--|
| Proc. | Notes | | |
| | | | |
| | | | |
| 1 | Completed | | |
| | | | |
| - | | | |
| 2 | None during takeoff | | |
| | | | |
| | | | |
| 3 | None | | |
| | | | |
| | Cimilar to provious takeoffs | | |
| 4 | Similar to previous takeons | | |
| | | | |
| | Airplane experienced a tailstrike | | |
| | | | |
| | Sim position froze after tailstrike, requiring a reset of | | |
| | the simulator | | |
| 5 | | | |

4.6 Task 6 – CG Shift at Rotation (Repeat of Task 5)

Time Estimate: 30minutes (00:15/1:50)

Initial Setup

| • | Weight | - Per initial setup |
|---|-----------|--|
| • | CG | - Begin at 33.0% (52.8% MAC at rotation) |
| • | Autopilot | - Off |
| | Config | Fland 10 TO Full Coar Down Trim 4 ONI |

Config - Flaps 10, TO Full, Gear Down, Trim 4.0NU

<u>Procedure</u>

- Place simulator motion to "OFF" (CAP is PF) (Leave simulator on position freeze at end of runway). Initiate a normal takeoff. At rotation, full freeze simulator, and reset CG to 52.8% (crew asked to rotate slower than in Task 5)
- 2) Document alerts (aural and visual)
- Document crew actions (Pitch inputs, Stab trim inputs, Control column inputs: pitch/trim)
- 4) Document Speeds (V1/Vr/V2Minimum speed attained)
- 5) Other observations (ie. time for crew reaction)

NOTE: Task complete when established on climb at target pitch or stall

recovery

| Broc | Notoc | |
|-------|---|--|
| FIUC. | Notes | |
| | | |
| 1 | Completed | |
| | | |
| | | |
| 2 | None during takeoff | |
| | | |
| _ | | |
| 3 | None | |
| | | |
| 4 | Similar to previous takeoffs | |
| • | | |
| | | |
| | Airplane experienced a tailstrike | |
| | Sim position froze after tailstrike, requiring a reset of | |
| _ | | |
| 5 | the simulator | |

4.7 Task 7 – CG Shift at 50 Feet

Time Estimate: 20 minutes (00:20/2:10)

Initial Setup

| • | Weight | - Per initial setup |
|---|-----------|--|
| • | CG | - Begin at 33.0% (52.8% MAC at 50 feet RA) |
| • | Autopilot | - Off |
| • | Config | Elans 10 TO Full Goar Down Trim 4 ONU |

Config - Flaps 10, TO Full, Gear Down, Trim 4.0NU

Procedure

- Place simulator motion to "OFF" (CAP is PF) (Leave simulator on position freeze at end of runway). Initiate a normal takeoff. <u>At 50 feet RA</u>, full freeze simulator, and reset CG to 52.8%
- 2) Document acceleration times (Note times for brake release, V1, Vr, rotation, time to target pitch)
- 3) Document alerts (aural and visual)
- 4) Document crew actions (Pitch inputs, Stab trim inputs, Control column inputs: pitch/trim)
- 5) Other observations

NOTE: Task complete when established on climb at target pitch or stall recovery

| Proc. | Notes |
|-------|---|
| | |
| 1 | Completed |
| 2 | Similar to previous takeoffs |
| 3 | None |
| 4 | Pilot impressions: nose down pitch required to maintain climb attitude Stab trim required (all the way to zero nose down trim) still required pitch down input with trim to zero no roll input required Pilot stated climb attitude was still "controllable" |
| 5 | (Other Observations) |

4.8 Task 8 – CG Shift at 50 Feet (Repeat of Task 7)

Time Estimate: 20 minutes (0020:/2:30)

Initial Setup

- Weight Per initial setup
- CG Begin at 33.0% (52.8% MAC at 50 feet RA)
- Autopilot Off
- Config Flaps 10, TO Full, Gear Down, Trim 4.0NU

<u>Procedure</u>

Note: MOTION OFF

- Place simulator motion to "OFF" (CAP is PF) (Leave simulator on position freeze at end of runway). Initiate a normal takeoff. <u>At 50 feet RA</u>, full freeze simulator, and reset CG to 52.8%
- 2) Document acceleration times (Note times for brake release, V1, Vr, rotation, time to target pitch)
- 3) Document alerts (aural and visual)
- 4) Document crew actions (Pitch inputs, Stab trim inputs, Control column inputs: pitch/trim)
- 5) Other observations

NOTE: Task complete when established on climb at target pitch or stall

recovery

| Proc. | Notes |
|-------|---|
| | |
| 1 | Completed |
| | |
| 2 | Similar to previous takeoffs |
| | |
| 3 | None |
| | Pilot impressions |
| | nose down pitch required to maintain climb attitude |
| | - Stab trim required (all the way to zero nose down trim) after |
| | full pitch used |
| | forward column pressure required "constantly" |
| | -Pilot stated climb attitude was still "controllable" to maintain |
| 4 | flight director guided pitch |
| | |
| 5 | (Other Observations) |

5.0 Final Notes

- An attempt was made to replicate an aft CG shift with multiple hydraulic failures (Systems 1 and 2, and Systems 1, 2, 3), but data was not recorded because flight characteristics of the simulator where obviously inconsistent with any realistically anticipated flight dynamics (simulator oscillated around the pitch axis and eventually stopped functioning).
- With System 1 and 2 hydraulic failures, the gear handle would only raise to the "Extend/Extended" mid position (half-way up).