**NATIONAL TRANSPORTATION SAFETY BOARD**

Office of Aviation Safety
Washington, D.C. 20594

March 17, 2016

## Attachment 16 – Simulator Testing

# OPERATIONAL FACTORS

**CEN16MA036**

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## A. ACCIDENT

| | |
|---|---|
| Location: | Akron, Ohio |
| Date: | November 10, 2015 |
| Operator: | ExecuFlight, Inc. |
| Time: | 1452 EST |
| Airplane: | Hawker Beech 125-700A (N237WR) |

## B. OPERATIONAL FACTORS GROUP


Captain David Lawrence - Chairman
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National Transportation Safety Board (NTSB)
490 L'Enfant Plaza East, SW

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## C. SUMMARY

On November 10, 2015, about 1452 eastern standard time (EST), a Hawker 125-700A, N237WR, departed controlled flight while on approach to land at the Akron-Fulton International Airport (KAKR) and impacted a 4-plex apartment building in Akron, Ohio. The pilot, co-pilot, and seven passengers were fatally injured; there were no reported ground injuries. The airplane was destroyed during a post-crash fire. The airplane was registered to Rais Group International NC LLC., and operated by Execuflight as a Title 14 Code of Federal Regulations Part 135 on-demand charter flight. Instrument meteorological conditions prevailed at the time of the accident, and the flight was operated on an instrument flight rules (IFR) flight plan. The flight originated from Dayton-Wright Brothers Airport, Dayton, Ohio, at 1413 EST and was destined for KAKR.

## D. SIMULATOR TEST PLAN[2]

**Location:** CAE Simuflite, Dallas TX
**Date:** January 19, 2016 and January 20, 2016
**Time:** 1130-1230 (Day 1); 1000-1130 (Day 2)
**Overall Objectives:**

- Document simulator fidelity, systems and alerts
- Document normal non-precision approach procedures for Hawker 700A
- Document known flight profile characteristics for the accident flight
- Replicate the accident flight (flight below MDA)

**Aircraft:** Hawker 700A simulator
**Airport:** Dallas, Texas
**Participants:** CAE Simulator Operator: Lynn Lanning (Day 1), Catherine Rossi (Day 2)
Captain Seat: John Drago – FAA (Day 1), David Lawrence – NTSB (Day 2)

[1] Captain Recker was unable to attend the CAE interviews and simulator work.
[2] Test plan is designed to be accomplished over the two days the simulator is available.

| | |
|---|---|
| Co-pilot's Seat: | Donnie Shackleford – Execuflight (Day 1), John Drago – FAA (Day 2) |
| Test Conductor: | David Lawrence – NTSB |
| Observer/timing: | Shawn Etcher - NTSB[3] |

**Initial Simulator Setup:**

- Akron Fulton Airport (KAKR) – Localizer 25 approach
- Position freeze: 7 miles from runway, on localizer centerline, 3300 msl (day 1), 2500 msl (day 2).[4].
- Cockpit navigation: per Execuflight procedures (altimeter bugs to msl minimums, radar altimeter - captain's side - to agl minimums).
- Configuration: Landing gear down, flaps as called for in each test run procedure
- Weather:
  - SPECI KAKR 102005Z AUTO 24011KT 1 1/4SM -RA BR OVC006 11/09 A2995 RMK AO2 RAB05 CIG 003V009 P0000 T01060094=
- Captain is Pilot Monitoring (PM), Co-pilot is Pilot Flying (PF)
- Simulator motion was disabled

**Weight and Balance:**

- See Appendix for details

Wind Speed (Knots): 6
Runway Heading (Deg.): 249
Runway condition: Wet

Landing Weight (Lbs).....21665
Landing Distance (Ft).....3280
60% FACT. LANDING DIST (FT)5470
Landing Vref-45deg (Knots)124
Landing Vref-25deg (Knots)129

Flaps 0 Weight Limit (LB).....21964
Flaps 15 Weight Limit (LB).....22000
Flaps 25 Weight Limit (LB).....22000

## 1.0 Run 1: Normal Non-precision Approach

***Procedure***

- Document cockpit:
  a. Cockpit panels
  b. CVR test feature (for Tuccio)

[3] Jim Silliman, NTSB IIC, observed the Day 2 simulator session.
[4] Initial setup for day 1 altitude was a simulator preset 7 miles from runway at 3300 msl. To begin each run, simulator was position froze, pilots descended to 2300/2500 feet, and then the simulator was released.

c. Location of autopilot/vertical speed knob, barometric altimeters (and any bugs on the altimeter), radar altimeter (and any bugs on the RA), engine thrust gauges, EGPWS test and alerts, CVR location and test.

- Normal Non-precision approach procedures (Execuflight)
- Flaps 15 initially, then select flaps 25 at FAF and begin descent to MDA.
- Select flaps 45 once runway assured from MDA
- Vref: 124

| Time | Notes |
|---|---|
| | 1. Cockpit documentation:<br>a. Cockpit panels: photos taken<br>b. CVR test feature (for Tuccio): photos taken<br>c. Location of autopilot/vertical speed knob, barometric altimeters (and any bugs on the altimeter), radar altimeter (and any bugs on the RA), engine thrust gauges, EGPWS test and alerts, CVR location and test: photos taken<br><br>2. SOPs: LOC button on mode control panel used to intercept and track localizer with FD's and autopilot. According to Execuflight pilot, normally the PF (pilot flying) would call for flaps.<br><br>3. Timing:<br>At FAF, initial thrust to 750# FF, then 650# FF.<br>83.2 seconds from FAF to MDA.<br><br>4. Thrust Settings:<br>Flaps 15, 800# FF (fuel flow each side), level flight, Vref+18<br>Flaps 25, 800# FF, Vref<br><br>5. Other:<br>Pilots did not see airport, executed a go-around (sim problem) |

## 2.0 Run 2: Normal Non-precision Approach to Go-around

***Procedure***

- Normal Non-procedure approach procedures (Execuflight) to a go-around
- Flaps 15 initially, then select flaps 25 at FAF and begin descent to MDA.
- Vref: 124
- Execute a go-around at MAP

| Time | Notes |
|---|---|

| | |
|---|---|
| | Run was inconclusive, pilot error in controlling descent.<br>Pilots did not see airport at MDA – sim problem. |

### 3.0 Run 3: Normal Profile

***Procedure***

- Normal Non-procedure approach procedures (Execuflight) callouts
- Position freeze, Flaps 15 initially, then select flaps 25/45 prior to FAF and begin descent to MDA from FAF at flaps 45
- Vref: 124
- Observe airplane flight characteristics at MDA

| Time | Notes |
|---|---|
| | Notes:<br>Thrust setting, level flight:<br>Flaps 15, gear down, FF #750, Vref +6<br>Flaps 25, gear down, FF #850 Vref+6<br>Flaps 45, gear down, FF1250#, Vref+6<br><br>Descent to MDA:<br>Thrust FF850#, Vref, VSI 700-800 FPM<br><br>Go-around climb: normal climb<br><br>Pilots again did not see the runway. Instructor raised ceiling an additional 200 feet for subsequent runs. |

### 4.0 Run 4: Accident Profile (reduced thrust at MDA)

***Procedure***

- Normal Non-procedure approach procedures (Execuflight)
- Position freeze, Flaps 15 initially, then select flaps 25/45 prior to FAF and begin descent to MDA at flaps 45.
- Vref: 124
- Begin vertical speed descent from FAF to MDA initially at 2000 feet per minute.
- At MDA, level off but reduced increase in thrust.

| Time | Notes |
|---|---|
| | Inconclusive sim run.<br><br>Worked on thrust settings for various configurations. |

| | |
|---|---|
| | |

## 5.0 Run 5 (Day 2): Accident Profile (level at MDA, reduced thrust)

***Procedure***

- Normal Non-procedure approach procedures (Execuflight)
- Position freeze, Flaps 15 initially, then select flaps 25/45 prior to FAF and begin descent to MDA at flaps 45 from 2500 msl
- Begin vertical speed descent FAF to MDA initially at 2000 feet per minute.

| Time | Notes |
|---|---|
| | Notes:<br>Timing:<br>2000 fpm initially from FAF to MDA, 4d pitch, FF 400# for Vref, AOA 5.8.<br>Increased thrust to FF 800# to MDA, leveled off with thrust remaining at 800# FF, slow speed decay. 18.1 seconds after level for shaker activation.<br><br>Thrust settings:<br>Level flight:<br>Flaps 15, gear down, pitch 12d, FF 800#, N1 77.4/75.0<br>Flaps 25, gear down, pitch 10.5, FF 850#, N1 79.2/76.2<br>Flaps 45, gear down, pitch 8.0, FF 1150# (AOA .68) |

## 6.0 Run 6 (Day 2): Accident Profile (reduced thrust increase)

***Procedure***

- Normal Non-procedure approach procedures (Execuflight) callouts
- Position freeze, Flaps 15 initially, then select flaps 25/45 prior to FAF and begin descent to MDA from FAF at flaps 45 from 2,500 msl
- Vref: 124
- Begin vertical speed descent at FAF to MDA initially at 2000 feet per minute.
- Level at MDA, reduced thrust increase at MDA
- Observe airplane flight characteristics at MDA at reduced level thrust

| Time | Notes |
|---|---|
| | Notes:<br>2000 fpm descent from FAF, then reduced to 500 fpm near MDA.<br>At MDA leveled off, thrust to 800# FF. |

| | |
|---|---|
| | 12.6 seconds to stick shaker (112 knots) |

## 7.0 Run 7 (Day 2): Accident Profile (no thrust increase at MDA)

***Procedure***

- Normal Non-procedure approach procedures (Execuflight)
- Pre-position 5 miles from FAF
- Position freeze, Flaps 15 initially, then select flaps 25/45 prior to FAF and begin descent to MDA at flaps 45
- Vref: 124
- Begin vertical speed descent from FAF to MDA initially at 2000 feet per minute.
- At MDA, level off but do not increase thrust

| Time | Notes |
|---|---|
| | Notes:<br><br>No thrust increase at MDA.<br>5.6 seconds for speed to decay to stick shaker. |

## 8.0 Run 8 (Day 2): Accident Profile (level at MDA, reduced thrust)

***Procedure***

- Normal Non-procedure approach procedures (Execuflight)
- Position freeze, Flaps 15 initially, then select flaps 25/45 prior to FAF and begin descent to MDA at flaps 45 from 2500 msl
- Begin vertical speed descent FAF to MDA initially at 2000 feet per minute.
- Initiate a go-around at the MAP for the LOC25.

***Objectives***

1. Observe procedures (SOPs) and note callouts required on standard NPA.
2. Observe timing for approach based on SOP flap settings (flaps 45 FAF to impact)
3. Observe thrust settings required for level flight (flaps 45; descent to MDA at flaps 45; level flight at MDA flaps 25; thrust setting to descend from MDA to runway)
4. Observe flight characteristics of go-around

| Time | Notes |
|---|---|
| | Level flight:<br>Flaps 15, gear down, Vref +25, pitch 7d, FF 800#, AOA .45.<br>Flaps 25, gear down, Vref+20, pitch 7.5-8.0, FF 850#, AOA 5.5.<br>Flaps 45, gear down, pitch 8.0, FF 1150#, AOA .68.<br><br>From FAF to MDA, 2000 fpm, level at MDA increased thrust to 800# FF, (N1 72.0/69.2). Stick shaker was noted at 23.2 seconds<br>At 115 knots (just prior to stick shaker, executed a go-around |

| | |
|---|---|
| | (with APR armed – 4% more thrust).<br>Go-around performance was normal and climb initiated. 18 degrees of pitch. |

## 9.0 Run 9 (Day 2): Accident Profile (2000 fpm descent from FAF through MDA to ground)

***Procedure***

- Normal Non-procedure approach procedures (Execuflight)
- Position freeze, Flaps 15 initially, then select flaps 25/45 prior to FAF and begin descent to MDA at flaps 45 from 2500 msl
- Begin vertical speed descent FAF to MDA at 2000 feet per minute.
- Maintain 2000 fpm to impact, log distance relative to runway.

| Time | Notes |
|---|---|
| | Last run.<br>2000fpm descent from 2500 msl across FAF to impact. On impact, DME showed 3.1 on the localizer. |

# E. APPENDIX

## 1.0 Weight and Balance[5]

Wind Speed (Knots): 6
Runway Heading (Deg.): 249
Runway condition: Wet

Landing Weight (Lbs).....21665
Landing Distance (Ft).....3280
60% FACT. LANDING DIST (FT)5470
Landing Vref-45deg (Knots)124
Landing Vref-25deg (Knots)129

Flaps 0 Weight Limit (LB).....21964
Flaps 15 Weight Limit (LB).....22000
Flaps 25 Weight Limit (LB).....22000

[5] Source: Execuflight.

TAKEOFF EFT1526 Chavez Marchese KMGY KAKR 11.10.15

Field Elevation (Feet): 957
Bar. Press (in. Hg or HPa): 2996
Pressure Altitude (Ft): 917
Temperature (Deg. C): 14
Wind Direction (Deg.): 230
Wind Speed (Knots): 6
Runway Heading (Deg.): 206
Runway Length (Feet): 5000
% Runway Slope (+/-): -.42
FLAPS: FLAPS 15
Anti-Ice: Off

None
MAX. ALLLOWABLE T.O.G.W (Lbs)...23165
TAKEOFF DISTANCE (Ft).....4866
INITIAL 2ND SEG GRAD% (NET)2.3
INITIAL 2ND SEG GRAD% (GRS)3.1
V1 (Knots).....123
VR (Knots).....124
V2 (Knots).....125
VFTO (Knots).....152
VSE (Knots).....169
Takeoff Thrust (%) APR ARMED99.1
LANDING DISTANCE (FT)2760
LANDING FIELD LENGTH (FT)4600
Vref (45 DEG) (Knots)128
Vref (25 DEG) (Knots)133
WEIGHT & BALANCE

ZERO FUEL:
Zero Fuel Weight: 15465 lbs
18% FWD 26 %MAC 29.8% AFT

TAKEOFF:
Takeoff Weight: 23165 lbs
20.8% FWD 26.9 %MAC 36.3% AFT

LANDING:
Landing Weight: 21665 lbs
19.3% AFT 25.9 %MAC 30.8% AFT

Seat 1: 200 lbs
Seat 2: 200 lbs
Seat 3: 200 lbs
Seat 4: 200 lbs
Seat 5: 200 lbs
Seat 6: 200 lbs
Seat 7: 200 lbs
Seat J: 0 lbs

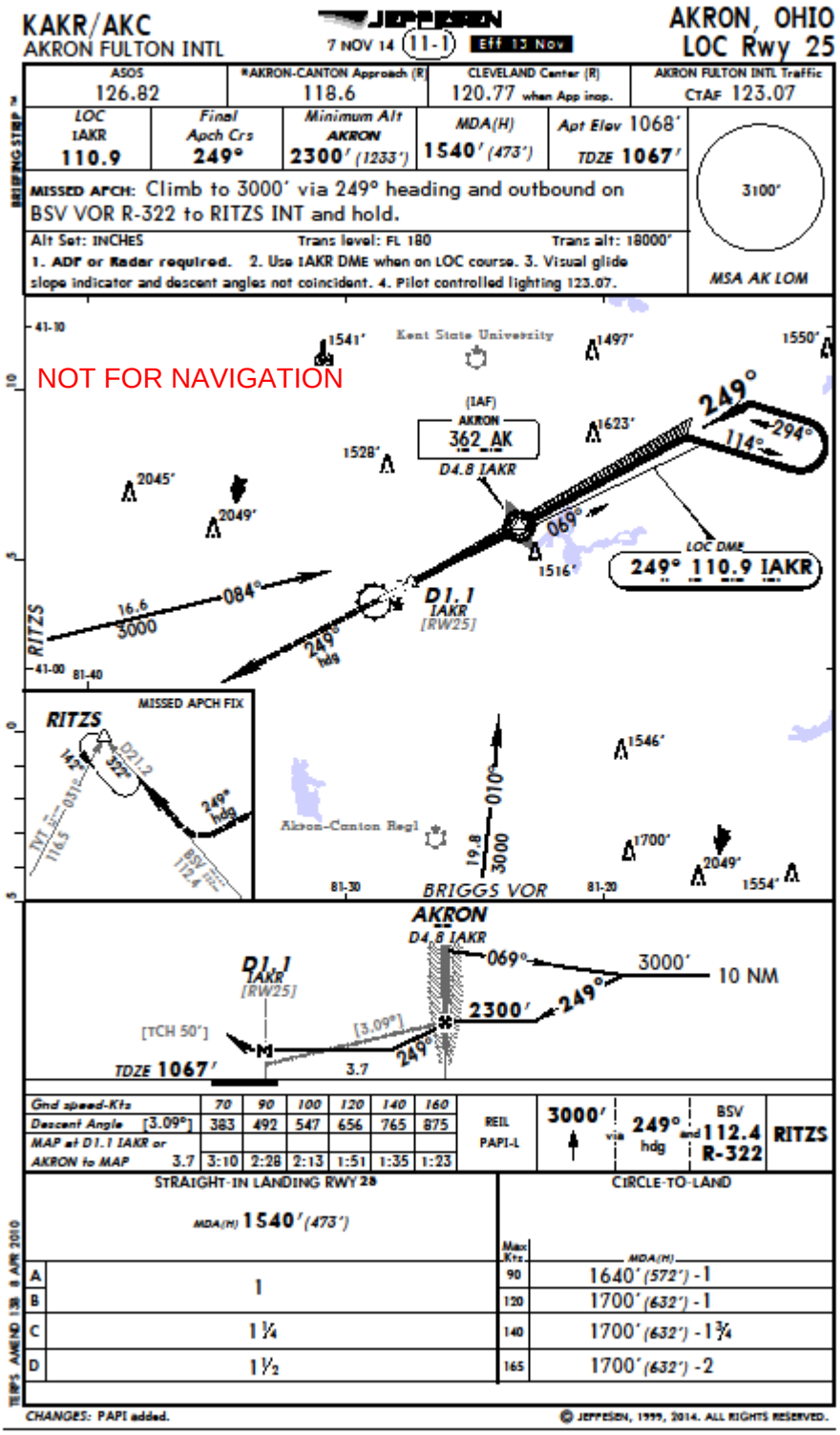
Bag. 1: 250 lbs
Bag. 2: 0 lbs

FUEL:..... 7700 lbs
FUEL BURNED: 1500 lbs
VENTRAL FUEL: NO
DORSAL FUEL: NO

LANDING

Field Elevation (Feet): 1068
Bar. Press (in. Hg or HPa): 2996
Pressure Altitude (Ft): 1018
Temperature (Deg. C): 15
Wind Direction (Deg.): 240

## 2.0 KAKR Localizer 25 Chart[6]




[6] Source: Jeppesen.

## 3.0 Execuflight Hawker Non-precision Approach Procedures[7]

### Non-Precision Approach

PNF

**Prior to Initial Approach Fix**

**ACTION** Complete Approach checklist.

**CALL** "Approach checklist complete."

**After Level-Off on Intermediate Approach Segment**

**CALL** "Flaps selected 15."

When flaps indicate 15°, "Flaps indicate 15."

**At Initial Convergence of Course Deviation Bar**

**CALL** "Localizer/course alive."

**When Annunciators Indicate Course Capture**

**CALL** "Localizer/course captured."

[7] Source: Execuflight Part 135 Training Manual – Standard Operating Procedures (HS-125-700).

## Non-Precision Approach (continued)

**PNF**

**Prior to FAF**

**CALL** "____ (number) miles/minutes from FAF."

**CALL** "Gear selected down."

When gear indicates down,
"Gear indicates down."

**ACTION** Complete Landing checklist except for full flaps, main air valves, and autopilot/ yaw damper.

## Non-Precision Approach (continued)

| | PNF |
|---|---|
| **At FAF** | |
| | **CALL** "Outer marker." or "Final fix." |
| | **ACTION** ▪ Start timing<br>▪ Visually crosscheck that both altimeters agree.<br>▪ Set MDA (or nearest 100 ft above) in altitude alerter.<br>▪ Check PF and PNF instruments.<br>▪ Call FAF inbound. |
| | **CALL** "Flaps selected 25."<br>When flaps indicate 25°, "Flaps indicate 25." |
| | **CALL** "Altimeters check." |
| **At 1,000 Ft Above MDA** | |
| | **CALL** "1,000 ft to minimums." |
| **At 500 Ft Above MDA** | |
| | **CALL** "500 ft to minimums." |
| **At 200 Ft Above MDA** | |
| | **CALL** "200 ft to minimums." |
| **At 100 Ft Above MDA** | |
| | **CALL** "100 ft to minimums." |

## Non-Precision Approach (continued)

| | PNF |
|---|---|
| **At MDA** | |
| | **CALL** "Minimums. _____ (time) to go." or "Minimums. _____ (distance) to go." |
| **At Point Where PNF Sights Runway or Visual References** | |
| | **CALL** "Runway (or visual reference) _____ o'clock." |
| | **CALL** "Flaps selected 45." When flaps indicate 45°, "Flaps indicate 45." |

## Non-Precision Missed Approach

| | PNF |
|---|---|
| **At MAP** | |
| | **CALL** "Missed approach point. Missed approach." |
| | **ACTION** Assist PF in setting power for go-around. |
| | **CALL** "Flaps selected 15." When flaps indicate 15°, "Flaps indicate 15." |
| **At Positive Rate of Climb** | |
| | **CALL** "Positive rate." |
| | **CALL** "Gear selected up." When gear indicates up, "Gear indicates up." |
| | **ACTION** Announce heading and altitude for missed approach. |
| **At $V_{REF}$ + 30 and 400 Ft Above Airport Surface (Minimum)** | |
| | **CALL** "Flaps selected UP." When flaps indicate UP, "Flaps indicate UP." |

PNF

**At 1,500 Ft (Minimum) Above Airport Surface and Workload Permitting**

**ACTION** Complete Missed Approach checklist.

**CALL** "Missed Approach checklist complete."

## 4.0 Execuflight Stable Approach Criteria[8]

**NOTE:** An approach window has the following parameters:

- within one dot CDI deflection or 5° bearing
- IVSI less than 1,000 fpm
- IAS within $V_{AP}$ +10 kts (no less than $V_{REF}$ or 0.6 AOA, whichever is less)
- no flight instrument flags with the landing runway or visual references not in sight
- landing configuration, except for full flaps (non precision or single engine approaches).

When within 500 ft above touchdown, the aircraft must be within the approach window. If the aircraft is not within this window, a missed approach must be executed.

[8] Source: Execuflight Part 135 Training Manual – Standard Operating Procedures (HS-125-700).

## F. Hawker Power Management Table[9]

CAE Training Centers

Hawker 700,800,800XP  Energy management  21,000lbs. to 22,00lbs.

### MANEUVERS

| Phase | Speed | Pitch | Flaps | Gear | N1 | Fuel Flow |
|---|---|---|---|---|---|---|
| Level Flight | 220 kts. | +3° | UP | UP | 70% | 700 lbs. ± |
| Steep Turns | 220 kts. | 14° | UP | UP | 76% | 800 lbs. ± |
| * Approach to Stalls, Clean | | +14° | Up | UP | IDLE | |
| * Approach to Stalls, Departure | | +14° | 15° | UP | IDLE | |
| * Approach to Stall, Landing | | +14° | 45° | DOWN | 65% | |
| * Discontinue Trimming at Vref+20 | | | | | | |

### Non Precision Approach

| | | | | | | |
|---|---|---|---|---|---|---|
| Approach Vectors Level | 180 kts. | −3° | Up | Up | 60% | 600 lbs. ± |
| Non Precision Approach | 160 kts. | +3° | 15° | UP | 68% | 700 lbs. + |
| Non Precision Approach Level | Vref+25 | +3° | 15° | Down | 65% | 750 lbs. ± |
| FAF° Inbound Descent | Vref+20 | 0° | 25° | Down | 58% | 600 lbs. + |
| Level to Step Down Fix | Vref+20 | +3° | 25° | Down | 70% | 900 lbs. ± |
| Landing Assured | Vref+10 | 0° | 45° | Down | 55% | 550 lbs. ± |

### Precision Approach

| | | | | | | |
|---|---|---|---|---|---|---|
| Approach Level | 160 kts. | +3° | 15° | Up | 63% | 700 ± |
| Glideslope Alive 1.5 Dot Up | Vref +25 | +3° | 15° | Down | 65% | 750 ± |
| Glideslope Intercept | Vref +20 | +3° | 25° | Down | 67% | 800 ± |
| Maker Inbound | Vref+10 | +3° | 45° | Down | 70% | 850 ± |

**Note:**

*The N1 and fuel flow are to be considered reference points. From these items one should only have to make small adjustments.*

9/13/2012

[9] Source: CAE Simuflite.

## G. Simulator Photos[10]


**Photo 1: Captain's instrument panel.**

[10] Photos taken by David Lawrence and Shawn Etcher – NTSB.


**Photo 2: Co-pilot's instrument panel.**

**Photo 3: Engine instruments.**

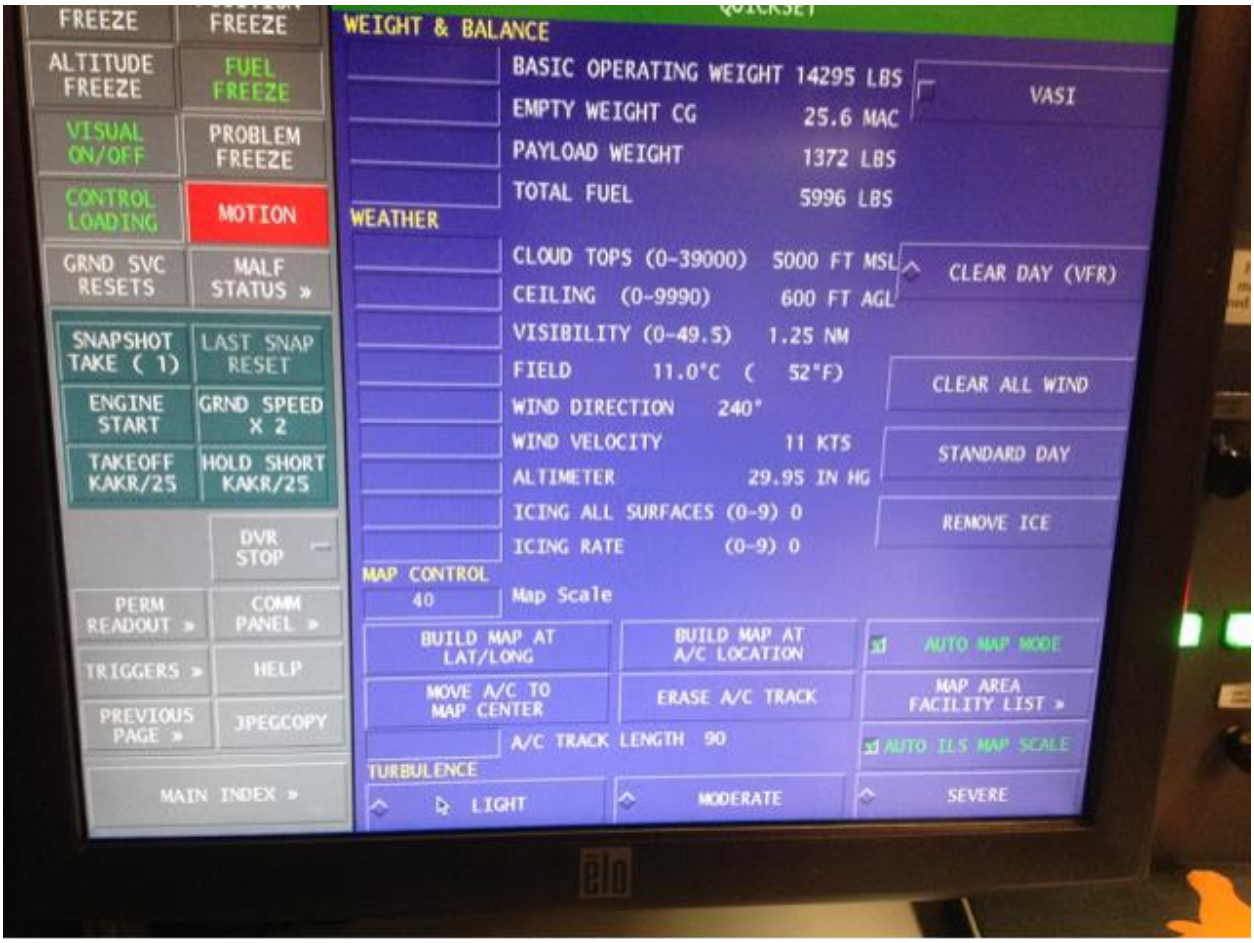



**Photo 4: Simulator instructor panel (1).**


**Photo 5: Simulator instructor panel (2).**

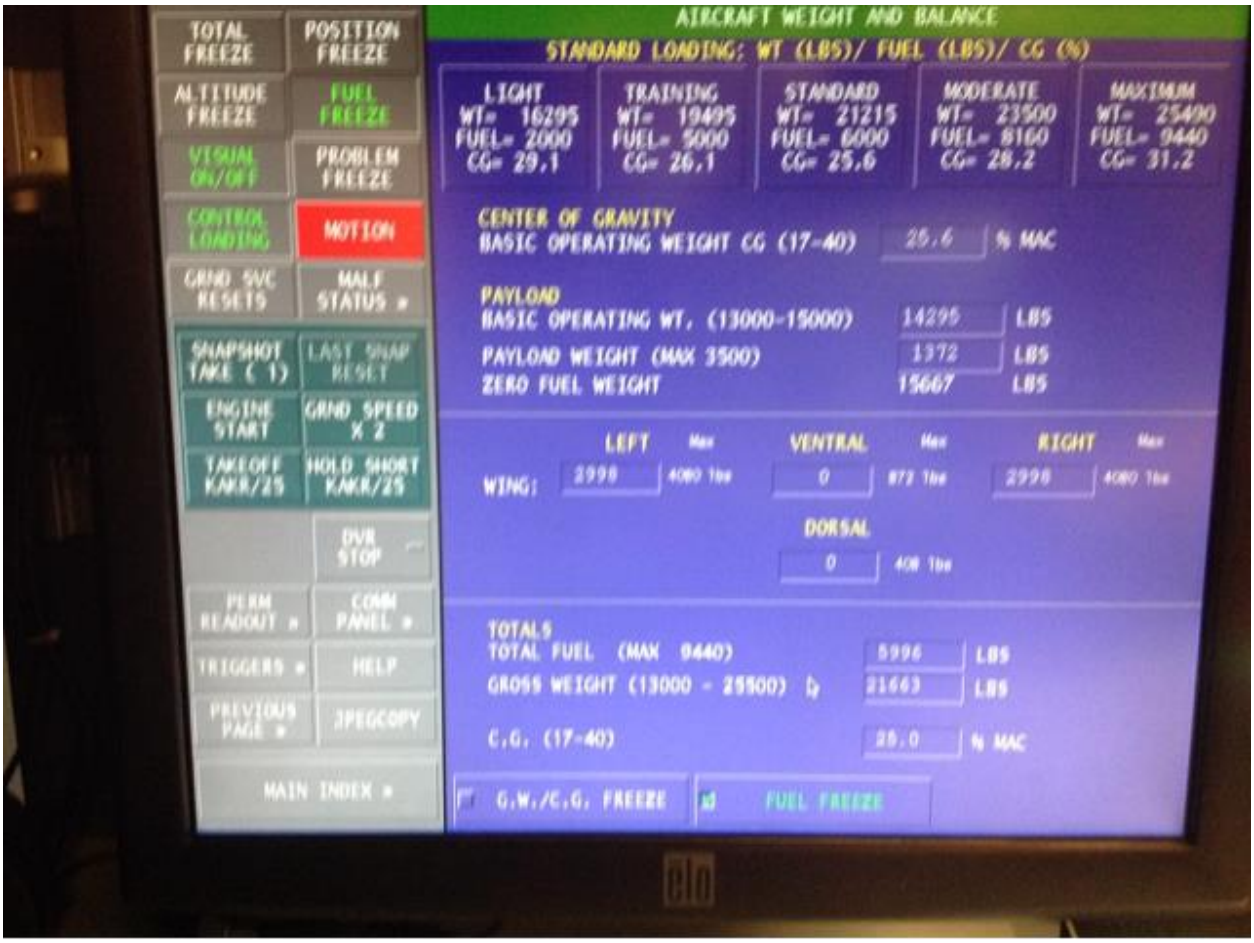



**Photo 6: Simulator instructor panel (3).**

**Photo 7: Captain's Attitude Director Indicator (ADI).**

**Photo 8: Co-pilot's ADI.**


**Photo 9: Hawker Flight Guidance Panel (FGP).**

**Photo 10: Captain's instrument panel (2).**


**Photo 11: Overhead panel.**

**Photo 12: Seat belt sign switch (overhead panel).**

**Photo 13: Photo 13: Cockpit panoramic view (captain's side).**

**Photo 14: Cockpit panoramic view (co-pilot's side).**

**Photo 15: Photo 13: Cockpit panoramic view (2) (captain's side).**


**Photo 16: Hawker 700 simulator cockpit.**


**Photo 17: Captain's instrument panel (3).**

**Photo 18: Co-pilot's instrument panel (3).**

**Photo 19: Center console.**