Factual Report – Attachment 18

CEN17MA183 - TEB Simulator Observation

OPERATIONAL FACTORS

CEN17MA183

Table Of Contents

A. ACCIDENT

Location: Teterboro, New Jersey (NJ)
Date: May 15, 2017
Time: 1530 eastern standard time (EST)
Airplane: Gates Learjet 35A, (N452DA)
Operator: Trans-Pacific Jets

B. SUMMARY

On May 15, 2017 about 1530 EST, a Gates Learjet 35A, N452DA, operated by Trans-Pacific Jets, was destroyed when it impacted terrain while on approach. The airline transport pilots and commercial pilot were fatally injured. Day visual meteorological conditions prevailed and an instrument flight rules flight plan was filed. The flight originated at Philadelphia International Airport (PHL), Philadelphia, PA, and was destined for Teterboro Airport (TEB), Teterboro, NJ. The positioning flight was conducted under the provisions of 14 *Code of Federal Regulations* (CFR) Part 91.

C. SIMULATOR TEST PLAN

Simulator Setup

Location: CAE/Simuflite Training Center, Dallas TX
Date: June 11, 2017
Time: 1330-1530 CST
Overall Observations:

- Observe simulator systems and alerts
- Observe normal Trans-Pacific ILS and circle-to-land procedures
- Observe late turn/descent capabilities
- Observe Lear 35 stall warnings/alerts
    - Normal and accelerated stalls

Aircraft: Lear 35 (Level C)
Participants: [1]

Simulator Operator:	CAE Instructor
Captain (Left) Seat:	David Lawrence (NTSB)
FO (Right) Seat:	Jim Warniers (FAA)
Test Conductors:	David Lawrence and Bill Bramble (NTSB)
Observers:	Jim Silliman (NTSB – IIC)

Initial Simulator Setup:

- TEB ILS06
- Position freeze 5 miles outside the FAF (TORBY) on ILS, 1,300 feet msl
- Vref: 119 knots
- Configuration: Gear down, Flaps 20, Vref+20
- Autopilot ON (LOC/GS, HDG, ALT hold modes used)
- Position/configuration for future runs
- Approach Procedures/configurations: Per Trans-Pacific
- Weather: (wind set to 15 knots, visibility set to 10 miles, no ceiling) [2]
- Left seat pilot will be Pilot Monitoring (PM), right seat pilot will be Pilot Flying (PF)
- Simulator motion: OFF
- Assumption: All turns made at standard rate (except where noted)

Weight and Balance:

Basic empty weight	10,173
Pilot weights	366[3]

[1] Captain Leif Iverson (Trans-Pacific) of the Ops group was invited to participate in the simulator testing but was unable to travel to DFW.
[2] Note: the CAE simulator was not able to replicate wind gusts, so wind speed was sustained at 15 knots for the simulator runs.
[3] Pilot weights based on most recent FAA 8410 medical applications.

Add'l	50
Fuel weight	2,600[4]
Total est. landing weight	13,189

1.0 Run #1: Normal ILS – Procedures

Objectives
Observe normal ILS procedures to landing

Procedure

a. Observe cockpit (ILS setup, alerts/warnings if any, wind readouts, etc.)
b. Release position freeze, fly ILS 06
c. Execute normal ILS to landing
    1. Observe SOP procedures
    2. Observe configuration changes
    3. Observe callouts
    4. Monitor descent rate
d. Position freeze after rollout on landing

Time	Notes
	1. Cockpit documentation: - Received briefing on cockpit layout, AOA gauge, stall warning locations and stall switches (for additional information, see Stall series runs). Cycled the stall switches, and master caution flashed and Stall L/R annunciators illuminated. Also AOA gauge went inactive with no indication. Documented location of GA (go-around) throttle switches. Learned that FD chevron and AP only sync on the captain's PFD. 2. Observe SOPs: - Normal ILS, flown to the G/S intercept at flaps 20, Vref+20. Gear typically extended about 1 mile from FAF (G/S intercept). Instructor informed that at G/S intercept, the call was "flaps 40, before landing checklist" 3. Observe configuration changes: See above 4. Reviewed callouts: See above 5. Note descent rate:

[4] The estimated fuel at TO from PHL was 3,400 pounds. Fuel burn from PHL-TEB at 4,000 feet msl and 250 KIAS was 800 pounds. Total fuel for the approach was estimated at 2,600 pounds.

	- Descent rate on ILS was generally 600-700 fpm 6. Other: - Airplane was on glidepath at 500 feet, 1.6 dme - After G/S intercept, speed allowed to reduce to Vref+10 for the approach. At 1000', descent rate was 600 fpm. Calls were made at 1000 above minimums, 500 above, 200 above 100 above. The aircraft aural altitude callouts were based on "agl" (radar altimeter).

2.0 Run #2: Normal ILS06, Circle-to-Land runway 01

Objectives
Observe normal circle to land procedures

Procedure

e. Reposition/reconfigure to snapshot in initial setup/ position freeze (starting position was 7.05 dme from TEB on ILS06, 1,290 feet)
f. Observe any cockpit changes from Run #1 (ILS setup, alerts/warnings if any, wind readouts, etc.)
g. Release position freeze, fly ILS 06
h. At TORBY, initiate a right turn to circle to runway 01
    1. Observe SOP procedures
    2. Observe configuration changes
    3. Observe callouts
    4. Note descent rate to runway 01
    5. Note position when aligned with runway 01 (distance/altitude)
i. Position freeze after rollout on landing

Time	Notes
	7. Cockpit documentation: same 8. Observe SOP procedures: - Instructor briefed participants to begin the approach at flaps 20, Vref +20 and, once aligned with runway, select flaps 40 and continue at Vref+10 9. Observe configuration changes: - Starting altitude for the turn was 1310' msl. - Approach to the FAF was flown at gear down, flaps

	20, Vref +20 knots. Approach was hand flown raw data. - Heading was 45 degrees to the right from TORBY to begin circle maneuver to runway 01. After rollout, it appeared a 45-degree turn was not sufficient to align with runway 01 and roll out at an appropriate distance. - There is no configuration change of the airplane on a circle approach from the FAF until ready to leave MDA for the landing runway, then pilot selects flaps 40, allows speed to decrease to Vref+10 and descends to cross threshold at Vref. 10. Observe callouts: - For circle approaches, the instructor briefed that the before landing checklist is called at gear extension, which occurs prior to reaching the FAF, and crews are instructed to call out "holding on flaps". 11. Note descent rate to runway 01: - Alignment was late due to the 45-degree turn from the FAF.

3.0 Run #2a: Normal ILS06, Circle-to-Land runway 01

Objectives
Observe normal circle to land procedures

Procedure

j. Reposition/reconfigure to snapshot in initial setup/ position freeze
k. Observe any cockpit changes from Run #1 (ILS setup, alerts/warnings if any, wind readouts, etc.)
l. Release position freeze, fly ILS 06
m. At TORBY, initiate a right turn to circle to runway 01
    1. Observe SOP procedures
    2. Observe configuration changes
    3. Observe callouts
    4. Note descent rate to runway 01
    5. Note position when aligned with runway 01 (distance/altitude)
n. Position freeze after rollout on landing

Time	Notes
	12. Cockpit documentation: same 13. Observe SOP procedures: same 14. Observe configuration changes: - turn for this run at TORBY to start the circling approach was made to a heading of 105 degrees. The turn was still insufficient to ensure flying around Giants stadium prior to aligning with runway 01. - Approach was flown on autopilot. 15. Observe callouts: same 16. Note descent rate to runway 01: 17. Note position when aligned with runway 01: - Center of base leg was about 2.8 dme, airplane was aligned with runway 01 at 1.81 dme. White/white on VASI. Descent at flaps 40 required up to 1700 fpm to reach the runway.

4.0 Run #2b: Normal ILS06, Circle-to-Land runway 01

Objectives
Observe normal circle to land procedures

Procedure

o. Reposition/reconfigure to snapshot in initial setup/ position freeze
p. Observe any cockpit changes from Run #1 (ILS setup, alerts/warnings if any, wind readouts, etc.)
q. Release position freeze, fly ILS 06
r. At TORBY, initiate a right turn to circle to runway 01
    1. Observe SOP procedures
    2. Observe configuration changes
    3. Observe callouts
    4. Note descent rate to runway 01
    5. Note position when aligned with runway 01 (distance/altitude)
s. Position freeze after rollout on landing

Time	Notes
	18. Cockpit documentation: same 19. Observe SOP procedures: same 20. Observe configuration changes: - Turn began at TORBY to start the circling approach. Base leg was flown on a heading of 125 degrees to ensure flying around Giants stadium prior to aligning with runway 01. - Circling maneuver flown with the autopilot on using heading and altitude hold modes. Middle of base leg was about 3.4 DME. 21. Observe callouts: same 22. Note descent rate to runway 01: - after alignment to runway 01, descent rate reached 1500 fpm initially before stabilizing at 800 fpm just prior to landing. Landing was normal. 23. Note position when aligned with runway 01: - When aligned with runway 01 centerline, airplane was at 2.27 dme to TEB at 860 feet, flaps 40, white/white on VASI. 24. Other: - Noted by the instructor: the Lear 35 autopilot is slaved to the left side. FO side does not follow the F/D on the left side, and must be entered on the center pedestal to mimic the F/D's on the left side. According to the instructor, typically the FO side is displaying raw data as a backup to the autopilot.

5.0 Run #2c: Normal ILS06, Circle-to-Land runway 01

Objectives
Observe normal circle to land procedures

Procedure

t. Reposition/reconfigure to snapshot in initial setup/ position freeze
u. Observe any cockpit changes from Run #1 (ILS setup, alerts/warnings if any, wind readouts, etc.)
v. Release position freeze, fly ILS 06
w. At TORBY, initiate a right turn to circle to runway 01
    1. Observe SOP procedures
    2. Observe configuration changes
    3. Observe callouts
    4. Note descent rate to runway 01
    5. Note position when aligned with runway 01 (distance/altitude)
x. Position freeze after rollout on landing

Time	Notes
	25. Cockpit documentation: same 26. Observe SOP procedures: same 27. Observe configuration changes: - Standard rate turn at TORBY to heading of 125 degrees, Vref+20, gear down. Middle of base leg was about 3.3 DME. - Autopilot on, heading and altitude hold modes - In the judgment of the participating pilots, this was about as close to the airport as one would want to execute the circling maneuver to feel comfortable with the approach 28. Observe callouts: same 29. Note descent rate to runway 01: - normal descent rates 30. Note position when aligned with runway 01: - after aligning with runway 01 centerline, VASI was red/white, 2.63 dme TEB. Descent to runway was normal.

6.0 Run #3: Normal ILS – Circle-to-Land Procedures (turn at 2.3 DME)[5]

Objectives
Observe normal circle to land procedures with a late turn off the ILS

Procedure

y. Reposition/reconfigure to snapshot in initial setup/ position freeze
z. Observe any cockpit changes from Run #2 (ILS setup, alerts/warnings if any, wind readouts, etc.)
aa. Release position freeze, fly ILS 06
bb. At MDA (820 feet) and 2.3 DME TEB, initiate a right turn to circle to runway 01 (45-degree banked turn)[6]
    1. Observe SOP procedures
    2. Observe configuration changes
    3. Observe callouts
cc. When aligned/abeam centerline with runway 01, position freeze
    a. Note position of the airplane (altitude, heading, runway to aircraft position, etc.)

Time	Notes
	31. Cockpit documentation: same 32. Observe SOP procedures: same 33. Observe configuration changes: same 34. Observe callouts: same 35. Note position of the airplane to runway 01 - At 2.15 dme TEB, froze simulator to view position to runway 06 prior to turn

[5] TEB DME distance is approximate and based on preliminary radar data of accident flight.
[6] Banked turn was limited to 45 degrees per CAE instructor, who stated that pilots were only trained for steep turns to 45 degrees per PTS standards, and simulator modeling greater than 45 degrees may not be accurate.

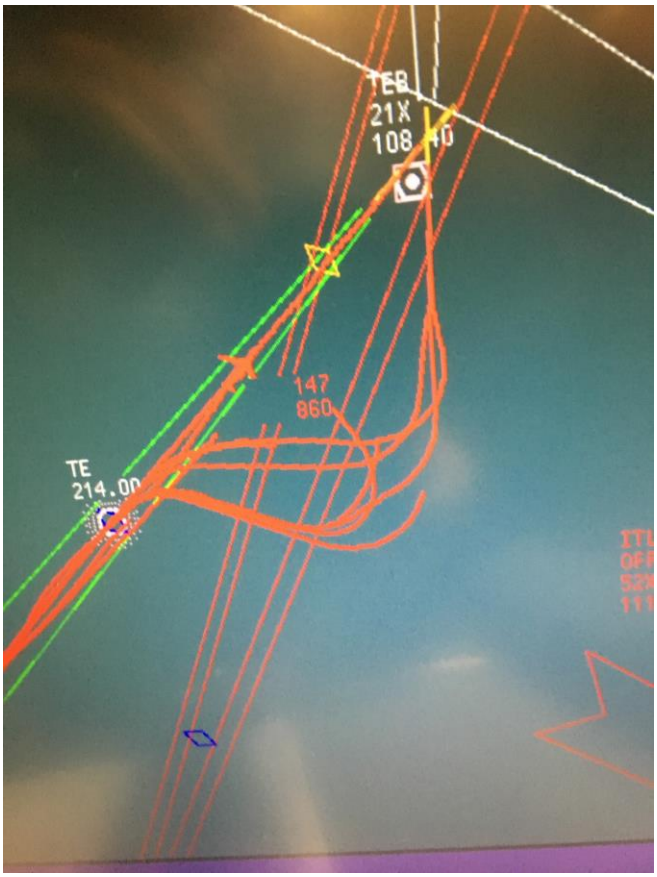


Photo 1: Simulator Instructor Panel display snapshot at 2.15 dme TEB prior to right turn.

- Visibility brought up to 25-mile visibility
- Initiated a 45-degree banked turn to a heading of 150 degrees (90 degree turn from runway 06 course)
- No aural bank angle alert was noted during the turn
- On rollout to 150-degree heading, froze simulator

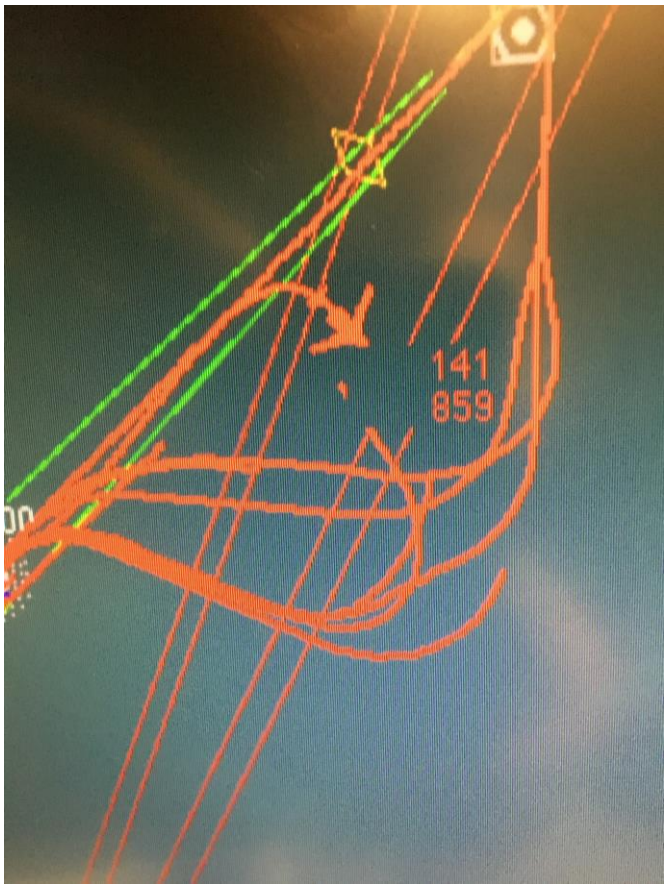


Photo 2: Simulator Instructor Panel display snapshot after rollout to 150 heading.

- Position was 1.62 dme TEB at 860 feet, Vref+20
- Released simulator and stayed on 150 heading until centerline to runway 01.

- Froze simulator. Position was 2.07 dme TEB, altitude 800 feet, Vref+20, VASI was white/white.

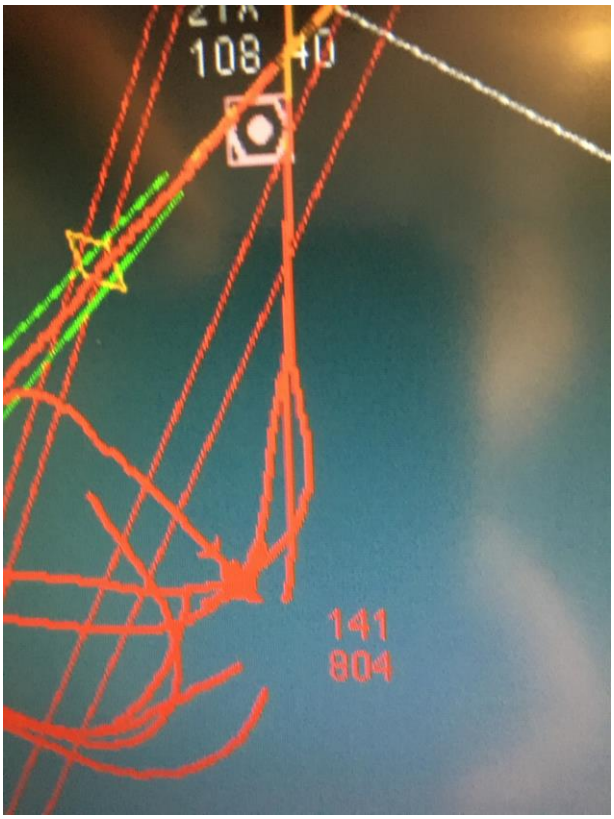


Photo 3: Simulator Instructor Panel display snapshot after approaching runway 01 centerline.

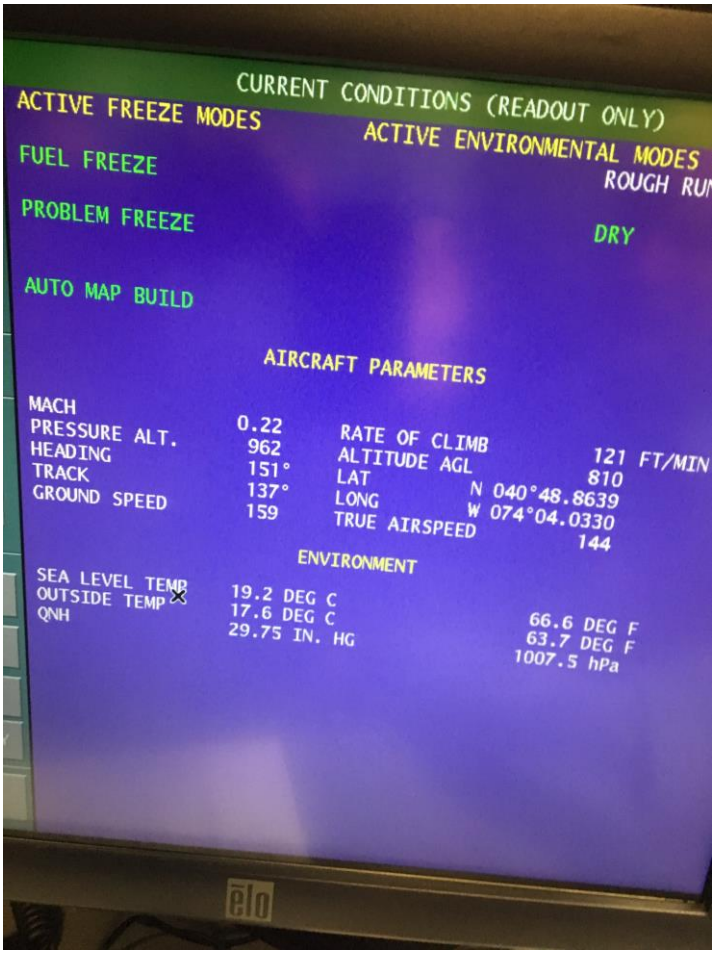


Photo 4: Simulator Instructor Panel display snapshot showing environmentals approaching runway 01 centerline.

- Ground speed was noted to have increased to 159 kts due to tailwind component. Airspeed was 144 kts TAS.

7.0 Run #4a: Normal Stall Characteristics (straight)

Objectives
Observe normal stall alerts/warnings

Procedure

dd. Reposition/reconfigure to snapshot in initial setup/ position freeze
ee. Configure airplane for landing
ff. Release position freeze, conduct a straight-ahead stall to stick shaker/pusher

1. Note aural/visual alerts
2. Note stick shaker and pusher activation
3. Observe stall characteristics (i.e. wing drop)

gg. Position freeze on stall recovery

Time	Notes
	36. Aural/visual alerts: - When AOA indicator enters the yellow band, the red master caution light on Captain and FO sides illuminate, the red Stall L and R lights on the annunciator panel illuminate, and the stick shaker activates - The stick shaker was relatively quiet, but it was quite noticeable when holding the yoke - When AOA indicator entered the red band, the red master caution lights remained illuminated, the red Stall L and R annunciator lights remained illuminated, and the stick pusher activated momentarily (about 1 second) - Stall speed was noted to be about Vref-30 knots - According to the CAE instructor, the stick pusher activates until Gz reaches ½ G. This resulted in relatively brief pusher activations. - The stall switches were in the on position 37. Stick shaker/pusher: see above 38. Stall characteristics: - Straight ahead stall, no wing drop-off

8.0 Run #4b: Normal Stall Characteristics (turning)

Objectives

Observe normal stall alerts/warnings in a turn

Procedure

hh. Reposition/reconfigure to snapshot in initial setup/ position freeze

ii. Configure airplane for landing

jj. Release position freeze, conduct a standard rate right turn until stall to stick shaker/pusher

1. Note aural/visual alerts
2. Note stick shaker and pusher activation
3. Observe stall characteristics (i.e. wing drop)

kk. Position freeze on stall recovery

Time	Notes
	39. Aural/visual alerts: same 40. Stick shaker/pusher: same 41. Stall characteristics: - No wing drop-off noted

9.0 Run #4c: Normal Stall Characteristics (accelerated)[7]

Objectives
Observe normal stall alerts/warnings in an accelerated turn

Procedure

ll. Reposition/reconfigure to snapshot in initial setup/ position freeze
mm. Configure airplane for landing
nn. Release position freeze, conduct 45-degree banked right turn with a pull to load the airplane until stick shaker/pusher activation
    1. Note aural/visual alerts
    2. Note stick shaker and pusher activation
    3. Observe stall characteristics (i.e. wing drop)
oo. Position freeze on stall recovery

Time	Notes
	42. Aural/visual alerts: same 43. Stick shaker/pusher: - increased loading of the airplane prior to stall (about 1.5 indices in the green band prior to yellow band) showed the stick shaker and stick pusher activating almost simultaneously. - Speed decay was quicker when the airplane was loaded by pitch 44. Stall characteristics: - Same. No wing drop-off noted

[7] Test run can be altered to accommodate CAE accelerated stall training scenario, if available.

10.0 Additional Run: VOR 04L Circle 31R at JFK.

- This was the circling approach presented to the accident pilots during their training and check ride.
- The approach was presented at night with a cloud ceiling located 100 feet above minimums.
- During the circling approaches performed at TEB, the landing runway was out of sight during the base leg and could not be viewed until the airplane turned back toward the airport. This occurred due to limitations in the simulator's field of view and it was also the case for the JFK approach. However, the presence of an intervening runway threshold at JFK made it much easier to maintain awareness of one's position relative to the airfield and determine when to make the turn to final.

TEST COMPLETE[8]

[8] Bill Bramble and Jim Warniers flew one JFK VOR runway 04L, circle to runway 31R approach (used in CAE training and evaluation) for reference of the visuals.

D. PHOTOS

Photo 1: Lear 35 Simulator Cockpit.

Photo 2: Captain's instrument panel with AOA gauge.

Photo 3: Stall switches (located on lower Captain's side forward panel).

Photo 4: Close of AOA gauge with Master Caution light illuminated.

Photo 5: Location of GA (go-around) buttons on throttles.

Photo 6: View of ILS06 from Captain's window.

Photo 7: Simulator instructor's map display (1).

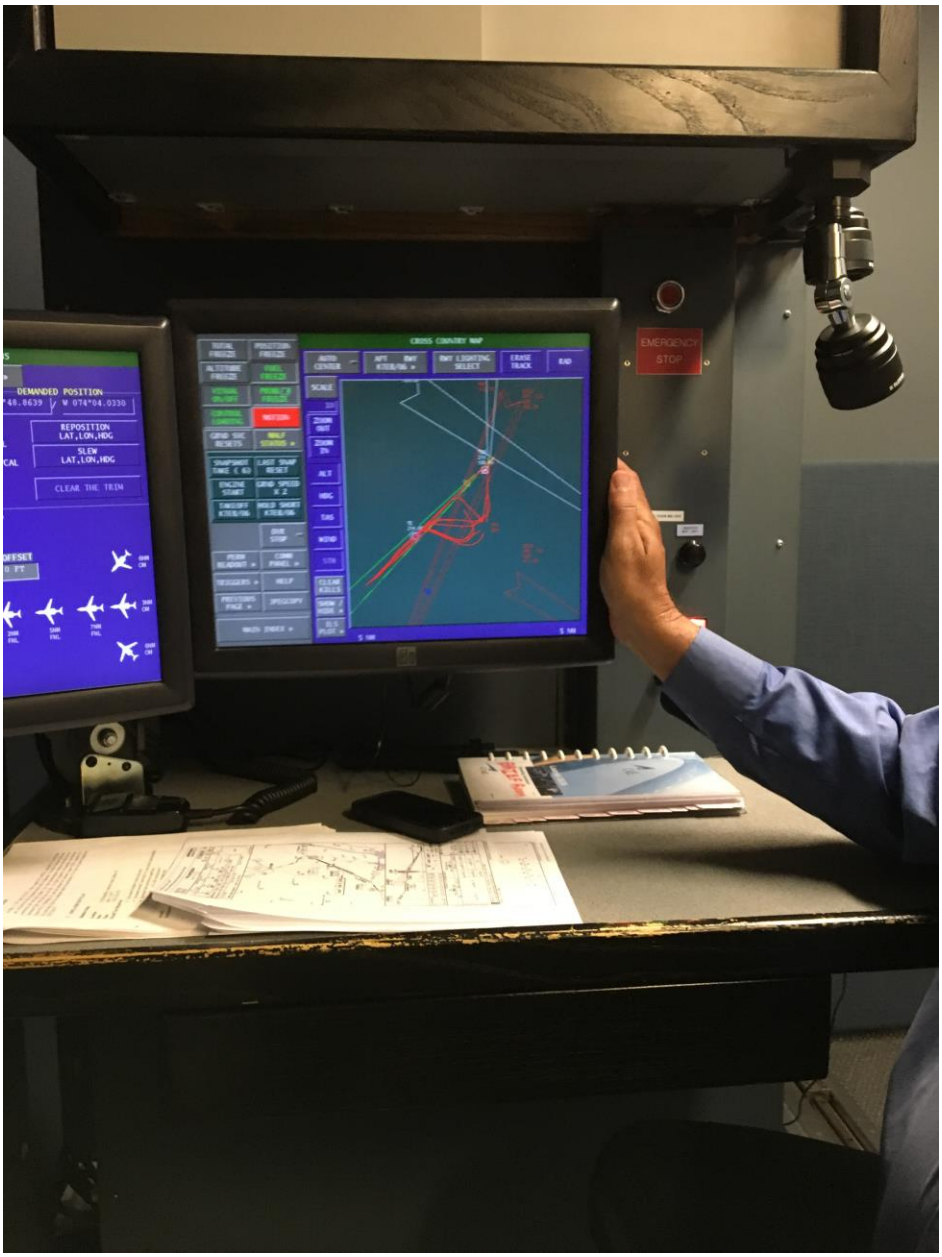
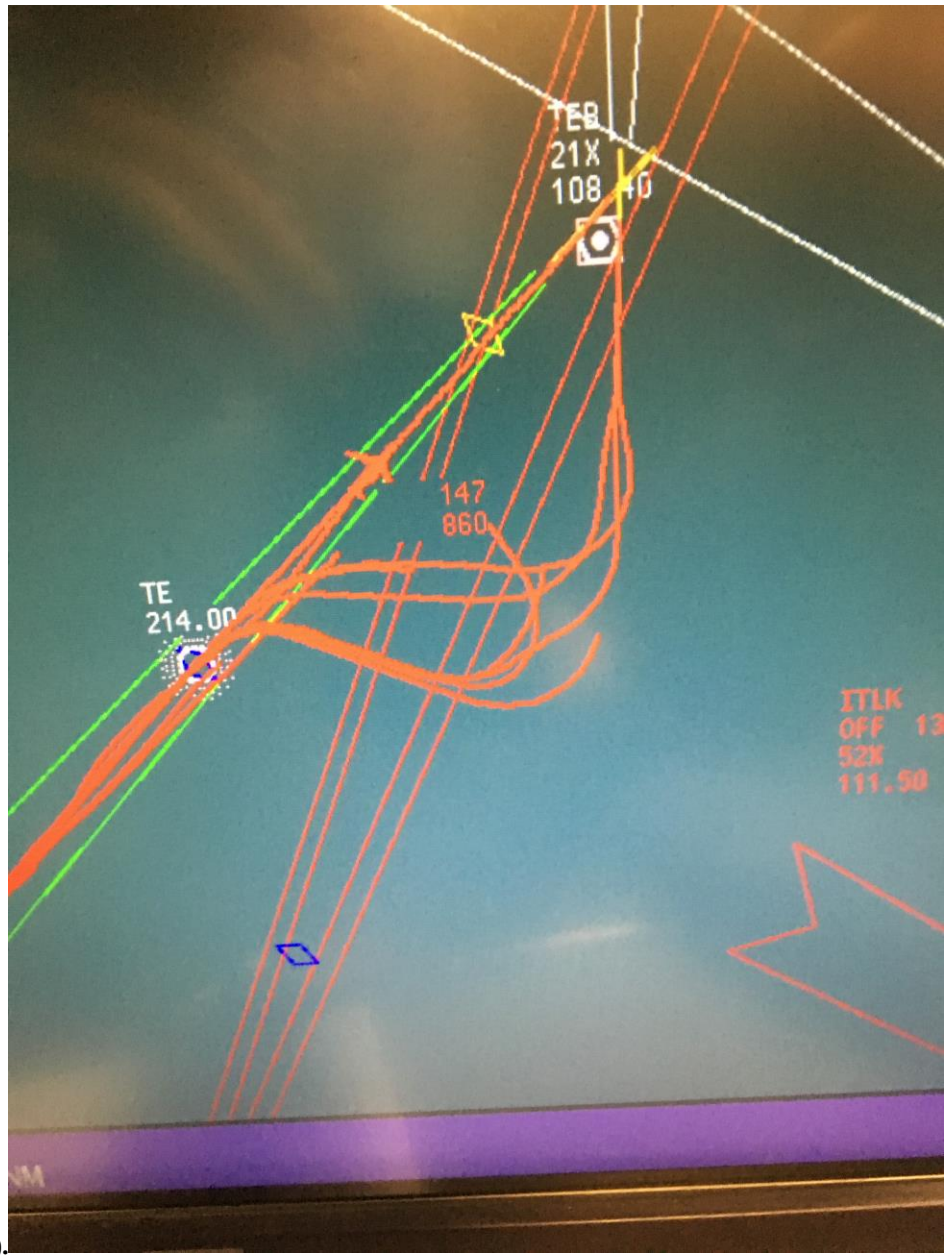


Photo 8: Simulator instructor's map display (2).

Photo 9: Simulator instructor's map display



(3).

Photo 10: Simulator instructor's map display (4).

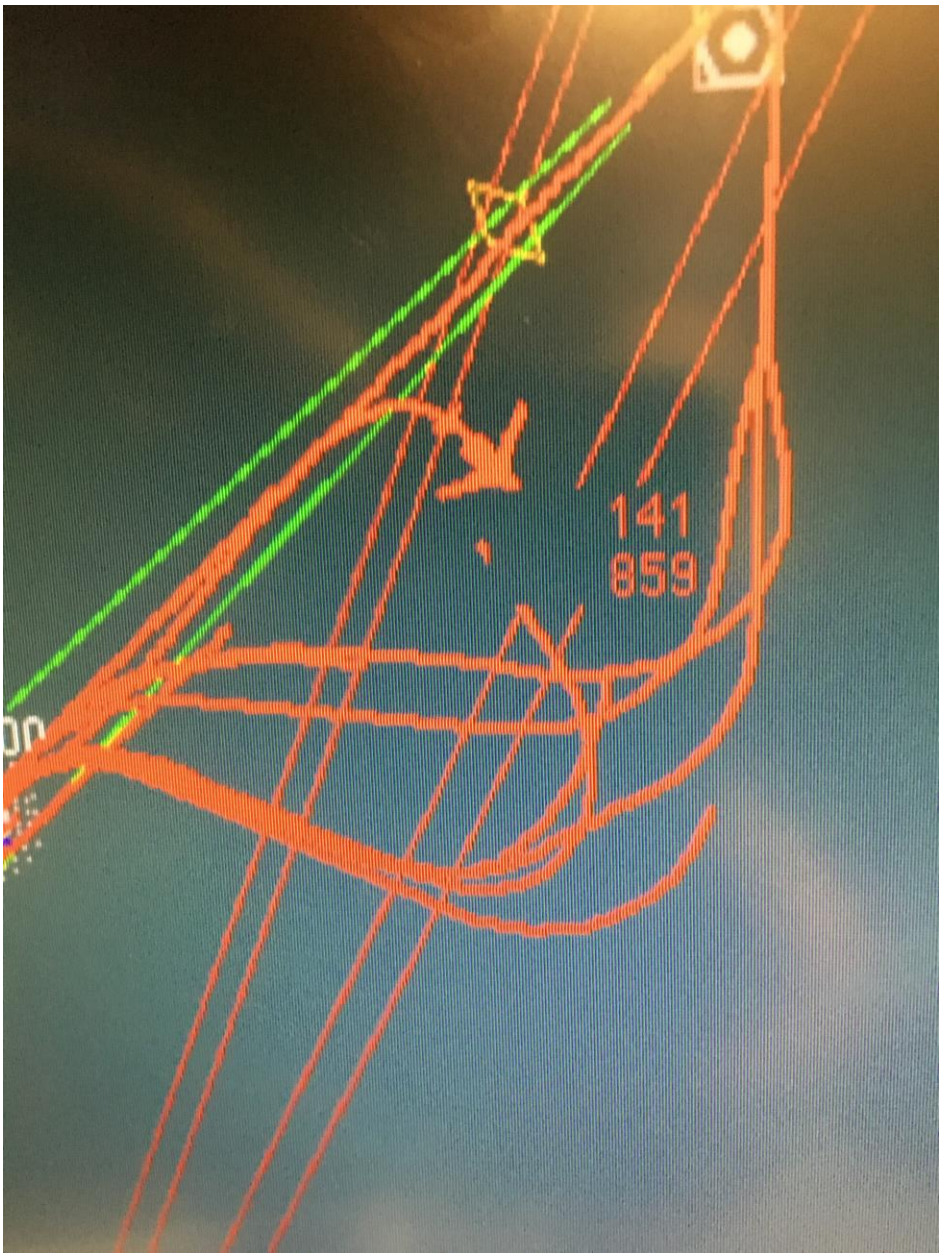


Photo 11: Simulator instructor's map display (5).

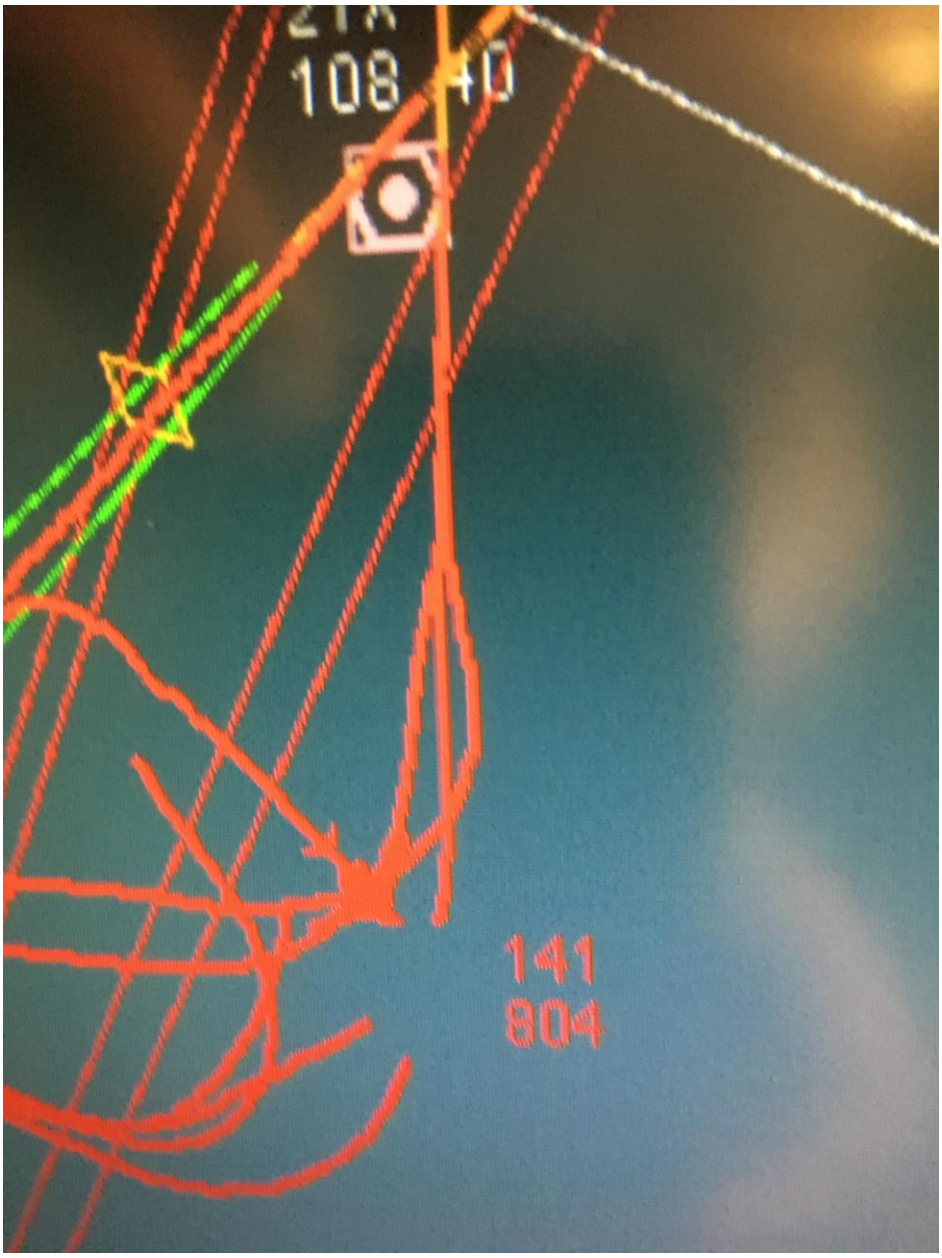


Photo 12: Simulator instructor's map display (6).

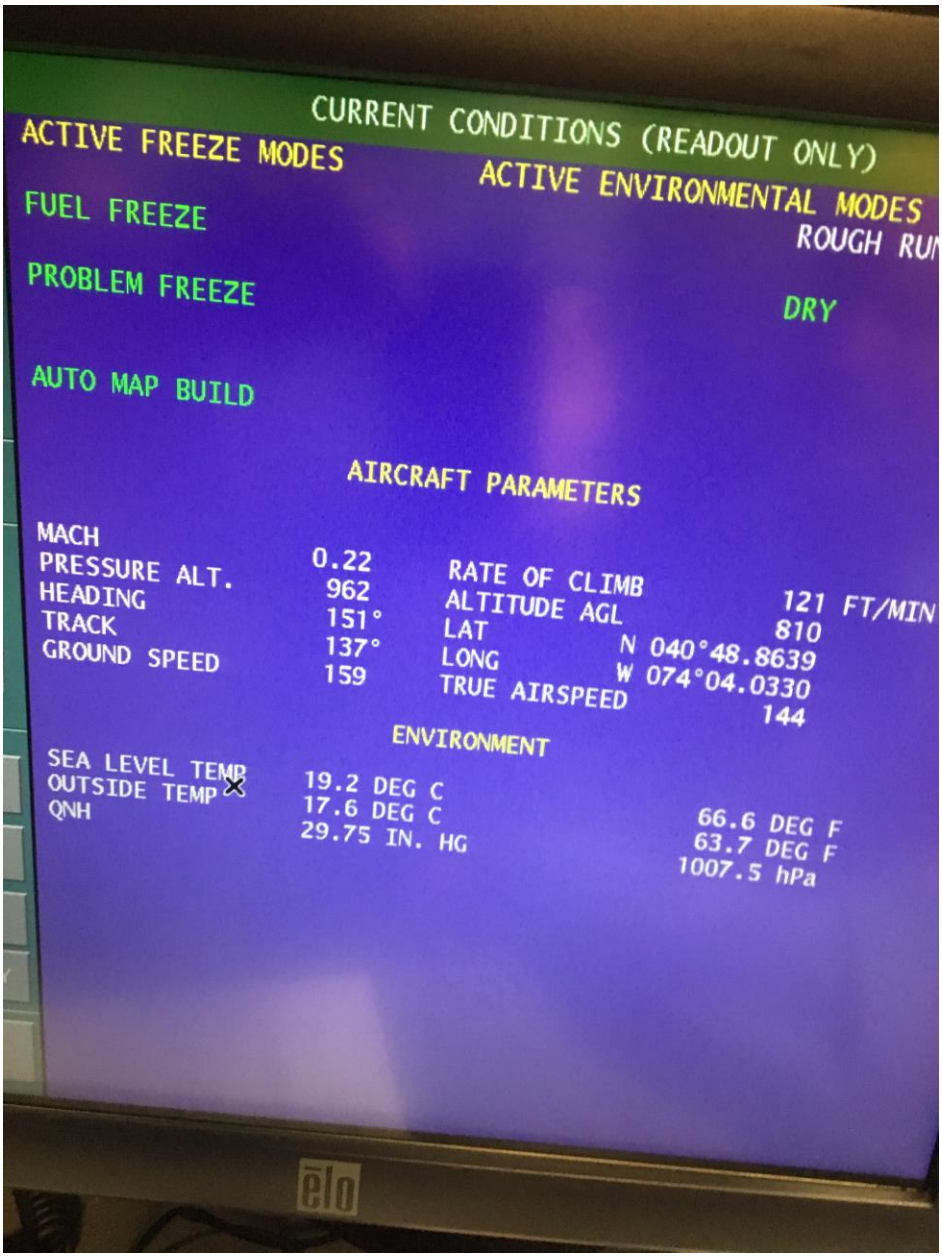


Photo 13: Simulator instructor's current conditions display.