NATIONAL TRANSPORTATION SAFETY BOARD
Office of Aviation Safety
Washington, D.C. 20594

September 30, 2003

Group Chairman's Factual Report

OPERATIONAL FACTORS

NYC03FA080

A. Accident

Operator:	GAE Express, Inc. (GAE)
Location:	Toledo Express Airport (TOL)
Date:	April 8, 2003
Time:	1350 Eastern Daylight Time (EDT)[1]
Airplane:	Falcon DA-20, N183GA, Serial # 147

B. Operational Factors Group

Captain Dave Kirchgessner
Group Chairman
Operational Factors (AS-30)
National Trans. Safety Board
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Captain David Pankratz
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[1]All times are eastern daylight time based on a 24-hour clock, unless otherwise noted. Actual time of accident is approximate.

C. Summary

On April 8, 2003, about 1350 eastern daylight time, a Dassault Aviation, DA-20, N183GA, operated by Grand Aire Express, Inc, was destroyed when it struck trees while on an instrument approach to Toledo Express Airport (TOL), Swanton, Ohio. The two certificated airline transport pilots, and pilot rated passenger were fatally injured. Instrument meteorological conditions prevailed for the instructional flight, which originated from Cherry Capital Airport (TVC), Traverse City, Michigan. The flight was conducted on an instrument flight rules flight plan under 14 CFR Part 91.

D. Details of the Investigation

The Operational Factors Group convened in Swanton, Ohio, on April 16, 2003, to begin the initial field phase of the accident investigation. The following interviews and activities were conducted at GAE headquarters located at the Toledo Express Airport:

- 04/16/03: Interviewed the GAE chief executive officer/owner and the director of operations (DO).

- 04/17/03: Interviewed two former Federal Aviation Administration (FAA) principal operations inspectors (POI) assigned to GAE when the Cleveland flight standards district office (FSDO) had oversight responsibility for the GAE operating certificate, three GAE pilots, one captain and two first officers, and one GAE dispatcher.

- 04/18/03: Interviewed one GAE Captain, one GAE dispatcher and one former FAA operations supervisor assigned to the Cleveland FSDO when that office had oversight responsibility for the GAE operating certificate.

- 04/21/03: Interviewed the current GAE POI and one unit supervisor assigned to the Detroit FSDO, the GAE business manager, and conducted a follow-up interview with the GAE DO.

- 04/22/03: Interviewed one former FAA maintenance supervisor assigned to the Cleveland FSDO when that office had oversight responsibility for the GAE operating certificate.

The group chairman requested data, records, manuals and other pertinent information from GAE and the FAA.

The Operational Factors Group concluded the initial field phase of the investigation on April 24, 2003.

E. History of Flight

The accident flight, GAE Express 183 (GAE183), was scheduled as a Part 91 positioning flight from TOL-GRR (Grand Rapids, Michigan), a Part 135 revenue flight (with cargo) from GRR-TVC and as a Part 91 positioning/training flight for the third segment from TVC-TOL[2]. The airplane departed TOL (without cargo) at about 0600 for the estimated 33 minute flight to Grand Rapids, Michigan (GRR). The airplane was loaded with cargo at GRR and departed for the estimated 34 minute flight to TVC at about 0715. The cargo was off loaded at TVC and the airplane departed about 1220 for the estimated 50 minute return flight to TOL.

A flight service station (FSS) weather briefing audio tape, provided by air traffic control (ATC), indicated that the first officer in training filed the flight plan for the TVC-TOL flight segment. There was no indication on the tape that the FO received or updated current weather conditions at TOL. He informed the briefer that the flight was planned for 40 minutes, had 1 hour and 45 minutes of fuel on board and the estimated time of departure (ETD) was 1220. According to ATC, GAE183 was cleared for takeoff from TVC at 1231.

The flight crew consisted of a pilot-in-command (CA) and a second-in-command (FO). The company chief pilot, a designated checkairman, was the captain for the flight and occupied the left seat during all three flight segments. An FO in training initially occupied the cockpit jumpseat. He was to observe the first two flight segments from the jumpseat and then occupy the right seat on the return flight to TOL and receive additional FO training. The current and qualified FO, who had originally occupied the right seat for the first two flight segments, would occupy the jumpseat on the third flight segment.

According to the DO, the flight from TVC-TOL would be the FO's final training period prior to his checkride. Each new FO in the Falcon 20 received ten hours of initial equipment flight training prior to a checkride administered by a company checkairman. The DO stated that although the chief pilot had previously given checkrides in the Falcon to other GAE pilots, this was the first time that he had given a new FO the complete ten hours of initial equipment training.

The investigation did not reveal anything unusual during the preflight, taxi, takeoff or enroute stops made by the accident flight. ATC and company conversations and transcripts with the pilots appeared to be normal.

About 1324:03, upon initial contact with Toledo West Radar Approach Control (WR), GAE183 was at 11,000 feet mean sea level (MSL) and requested two separate approaches, a non-directional beacon (NDB) approach to runway 07 followed by the instrument landing system (ILS) approach to runway 07.

About 1325:19, GAE 183 contacted WR and changed their initial request for two separate approaches and asked only for the ILS 07 approach to a full stop landing. WR instructed the accident flight to fly heading 180 and descend and maintain 3,000 feet MSL.

[2] See Attachment 8.

About 1328:25, GAE183 again changed their request and asked for the NDB approach to runway 07 after executing the ILS to runway 07. WR acknowledged the request. It was unclear at this point whether GAE would make a full stop landing or if they would execute the ILS 07 missed approach procedure.

About 1333:38, WR advised the accident flight that they were nine miles from Tophr[3] and instructed GAE183 to turn left to 100 degrees, maintain 2,300 feet MSL until established on the localizer, and then cleared the flight for the ILS runway 07 approach. GAE183 acknowledged that approach clearance.

About 1334:38, WR asked GAE183 if they would like radar vectors for the NDB approach or if they wanted to do the procedure turn following the ILS approach. GAE183 advised that if there was no traffic, they would like the full approach but if WR was busy, they would take radar vectors.

About 1335:34, GAE183 made initial contact with Toledo Local Control[4] (LC) and requested the "option"[5] to ILS runway 07.

About 1339:28, while the accident flight was executing the ILS 07 missed approach, GAE183 advised LC that they would be unable to execute the NDB approach and would like another ILS approach. Airport weather at that time was reported to be 300 overcast and one mile visibility. Additionally, several aircraft had reported icing conditions in the area. WR provided radar vectors for another ILS approach to runway 07. Communications between the accident flight and WR appeared normal.

About 1346:08, WR advised the accident flight that they were four miles from Tophr and instructed GAE183 to turn right to a heading of 050 degrees, maintain 2,300 feet MSL until established on the localizer, and then cleared the flight for the ILS runway 07 approach. The flight was further instructed to maintain 180 knots until Tophr. GAE183 acknowledged that approach clearance.

About 1348:50, LC asked WR to try switching GAE183 over to the LC frequency again.

About 1348:51, WR instructed GAE183 to contact the tower.

About 1348:54, GAE183 acknowledged that instruction to contact the tower.

About 1349:13, LC cleared GAE183 to land and advised that the wind was 050 degrees at eight knots and the runway visual range (RVR) for runway 07 was 6,000 feet.

[3] Tophr is the outer marker for the ILS 07 approach.
[4] Toledo Local Control was the ATC Control Tower located at the airport.
[5] An option approach permits the pilot to land and make a full stop, or execute a touch-and-go landing, or execute a missed approach.

When LC did not receive a call from GAE 183, LC asked WR if the accident flight acknowledged the frequency change and was told that they had acknowledged.

About 1351:48, WR asked GAE183 if they were on the frequency. GAE183 did not acknowledge that query and there were no further transmissions between GAE183 and WR/LC.

The airplane impacted trees, and came to rest on level ground, 1.57 nautical miles from the approach end of runway 07. The airplane and debris trail were on a magnetic heading of 060 degrees. The post-accident investigation determined that the landing gear was extended and the flaps and leading edge devices were retracted.

F. Flight Crew Information

The captain was a company checkairman and he was certificated, current and qualified in the DA-20 in accordance with GAE and FAA requirements. The first officer was receiving initial equipment training in the DA-20 and was certificated in accordance with GAE and FAA requirements. A review of FAA accident/incident and enforcement records of both flight crewmembers indicated that there was no history of certificate actions filed against either pilot.

1.0 Captain: James Wallis Bouldin

Date of Hire:	02/19/1996
FAA Certificates:	**Airline Transport Pilot** (Airplane Multi-Engine Land, DA-20) Commercial Privileges (Airplane Single Engine Land, Rotorcraft-Helicopter, Instrument Helicopter) **Mechanic** (Airframe, Powerplant)

Captain Bouldin received his private pilot airplane single engine land certificate in November 1987.

He received a notice of disapproval following an FAA flight check for his private pilot single engine land instrument airplane rating in July 1988. The notice of disapproval was due to unsatisfactory performance in VOR approaches. He was subsequently issued his instrument rating after passing a second FAA flight check later that same month.

Captain Bouldin received his commercial pilot certificate for airplane single engine land/instrument airplane in March 1989. He added multiengine land, rotorcraft-helicopter, and instrument helicopter ratings to his commercial pilot certificate in February 1995.

He received a notice of disapproval following an FAA flight check for his flight instructor single engine land airplane certificate in June 1990. The notice of

disapproval was due to "failure to instruct" required material. He received a second notice of disapproval following another FAA flight check for this same rating in May 1991. That notice of disapproval was due to "lack of instruction". He was subsequently issued his flight instructor single engine land airplane certificate after passing a third FAA flight check in July 1991. He added an instrument rating to his flight instructor certificate in July 1993 and an airplane multiengine land rating in February 1997. He was reissued his flight instructor certificate with all appropriate ratings in August 2000.
Note: Flight instructor certificates must be renewed by the FAA every two years.

According to documentation provided by the company, Captain Bouldin had logged 889 hours as an instructor pilot as of May 1, 2002. Those 889 hours were documented as being conducted in single engine airplanes. The documentation did not indicate whether or not Captain Bouldin had previously conducted any pilot instruction in multi-engine airplanes.

He received a notice of disapproval following an FAA flight check for his airline transport pilot multiengine land certificate in January 1995. The FAA inspector noted that the entire flight portion of the checkride was unsatisfactory. Captain. Bouldin was subsequently issued an airline transport certificate with a DA-20 type rating in April 2000.

Captain Bouldin received his FAA authorization as Checkairman – All Checks in the PA-60 on August 9, 2000. He received his FAA authorization as Check Pilot – All Checks in the DA-20 on October 7, 2002. There was no documentation that indicated the amount of instructional hours that Captain Bouldin had conducted in the DA-20 after he received his authorization on October 7, 2002.

At the time of the accident, Captain Bouldin held a First Class medical certificate dated April 2, 2003, with no restrictions.

According to GAE employment and flight records, Captain Bouldin had accumulated/completed the following flight times and training prior to the accident:

Total flight time:	4,829 hours
Total time with company:	2,598 hours
Total pilot-in-command (PIC) time:	4,463 hours
Total PIC with Company:	2,289 hours
Total DA-20 flight time:	1,179 hours
Total GAE DA-20:	1,179 hours
Total GAE DA-20 PIC:	1,150 hours
Total flying time last 24 hours:	002 hours
Total flying time last 30 days:	028 hours
Total flying time last 60 days:	065 hours
Total flying time last 90 days:	082 hours

Initial DA-20 Training:	04/22/00
Most recent recurrent ground training prior to the accident:	05/03/02
Most recent proficiency check prior to the accident:	01/03/03
Most recent line check prior to the accident:	01/03/03

Total duty time (day of accident):	008 hours
Total duty time last 24 hours:	011 hours
Total duty time last 48 hours:	011 hours
Total duty time last 72 hours:	011 hours

2.0 First Officer: Steven William Forshay

Date of Hire:	05/05/2001
FAA Certificates:	**Airline Transport Pilot** (Airplane Multi-Engine Land, EMB120) Commercial Privileges (Airplane Single Engine Land) **Senior Parachute Rigger** (Back)

First Officer Forshay received his private pilot airplane single engine land certificate in December 1989. He added an instrument rating to that certificate in December 1990.

He received his commercial pilot airplane multiengine land certificate in April 1991 and added airplane single engine land/instrument to this certificate in May 1991.

First Officer Forshay received his flight instructor airplane single engine land certificate in February 1997.

He received a notice of disapproval following an FAA flight check for an EMB-120 type rating on May 2, 2000. The notice of disapproval was due to an unsatisfactory single engine approach. He was subsequently issued his EMB-120 type rating after passing a second FAA flight check on May 10, 2000.

At the time of the accident, First Officer Forshay held a First Class medical certificate dated February 27, 2003, with no restrictions.

He was hired by GAE as an SA-226 (Metroliner) pilot in command. He began training as a second in command in the DA-20 in March 2003.

According to GAE employment and flight records, First Officer Forshay had accumulated/completed the following flight times and training prior to the accident:

Total flight time:	5,026 hours
Total time with company:	0550 hours
Total pilot-in-command (PIC) time:	2,526 hours
Total PIC with Company (SA-226):	0550 hours
Total DA-20 flight time:	0009 hours
Total GAE DA-20:	0009 hours
Total GAE DA-20 PIC:	0000 hours
Total flying time last 24 hours:	0001 hours
Total flying time last 30 days:	0021 hours
Total flying time last 60 days:	0038 hours
Total flying time last 90 days:	0063 hours

Most recent recurrent ground training prior to the accident:	12/18/02
Most recent proficiency check prior to the accident:	12/18/02

Total duty time (day of accident):	009 hours
Total duty time last 24 hours:	009 hours
Total duty time last 48 hours:	009 hours
Total duty time last 72 hours:	009 hours

G. Airplane Information – Weight and Balance[6]

Operating Empty Weight (OEW)	16040
Passenger Weight	00200
Baggage/Cargo Weight	0040
Zero Fuel Weight	16280
Maximum Zero Fuel Weight	22000
Fuel Weight	4720 (Leaving TVC)
Ramp Weight	21000 (Indicated on TOLD[7] card recovered at accident site.)
Maximum Ramp Weight	28660
Taxi Fuel Burn	0200 (10 Minutes)
Actual Takeoff Weight	20800
Maximum Takeoff Weight	28660
Estimated Fuel Burn TVC-TOL	3700 (1 hour 20 minutes)
Estimated Landing Weight	16,900
Maximum Landing Weight	27320
Takeoff Center of Gravity (CG)	20.1% MAC
Takeoff CG Limits	20%-28.5% MAC
Landing Flap Setting	0 at time of impact
Approach Speed (landing flaps/0 flaps)	Vref 104K/Vref +25

H. Training

[6] See Attachment 12.
[7] See Attachment 14, page S-17.

1.0 The investigation determined that at the time of the accident, the entire GAE Falcon 20 pilot training curriculum was conducted in the airplane. In the past, the company had contracted with Simuflite and Flight Safety International and utilized their Falcon simulators for pilot training. According to the DO, the simulator could only be used to complete one half of the required Falcon 20 flight training curriculum and the rest had to be accomplished in the actual airplane. That requirement had previously been stipulated by the CLE FSDO and was still valid at the time of the accident.

2.0 GAE routinely conducted training/checkrides during Part 91 flight segments when the airplane did not have revenue cargo aboard or when it was returning to TOL. According to the DO, training/checkrides were not permitted to be conducted on any Part 135 revenue flight.

Subsequent to the accident, the company established the following training policies by the issuance of a Training Memo[8] dated April 16, 2003:

- All initial PIC and SIC equipment qualification training would be conducted at a simulator facility.
- All recurrent PIC flight training requirements would be conducted at a simulator facility.
- All recurrent SIC flight training would be conducted at the company in the airplane in which the pilot was current. Any pilot that served as an SIC beyond two years would receive recurrent training at a simulator facility. SIC training would then alternate annually between the airplane and simulator.

3.0 There was no Part 135 FAR requirement for a GAE on-demand PIC to complete the initial operating experience (IOE) that was required for a Part 135 commuter[9] PIC. There was also no Part 61 FAR requirement for IOE since the company's training program was conducted in the airplane[10]. However, according to the DO, the company established a supervised operating experience (SOE)[11] program in April 2003 for newly assigned Metroliner PICs. The SOE program allowed a new captain to complete 25 flight hours with a current and qualified Metroliner PIC who had at least 75 hours as a GAE PIC in that airplane. The SOE program was designed to familiarize the new PIC with the company's procedures and his responsibilities commensurate with the position as an aircraft commander.

I. Standard Operating Procedures (SOPs)

[8] See Attachment 10.
[9] Commuter denotes scheduled service.
[10] Part 135 requires IOE if training and checking is done entirely in a simulator.
[11] See Attachment 11.

Flight operations depend on standard operating procedures (SOPs) that are developed for each type of airplane within a company's fleet. The objective is to provide guidance to the pilots that ensure safe, logical and efficient flight-operations. SOPs provide the flight crew with step-by-step guidance for completing all phases of ground and flight operations.

The GAE standard operating procedures were documented in the company's Air Carrier Operations Manual (ACOM), section S, pages S1-S18[12]. Specific areas addressed by the SOPs were, in part:

- Checklists and Flows;
- Altitude Changes;
- Airplane Configuration Changes;
- Approach Callouts;
- Approach Briefing;
- Use of Airbrakes; and
- Approach Reference Speed Calculations.

According to the ACOM, GAE flight crewmembers were expected to comply with company SOPs. SOPs were provided to increase awareness regarding crewmembers' responsibilities and to improve standardization, safety and efficiency. If deviations from the SOPs were necessary, the crewmember would make every effort to inform the other crewmembers of the deviation before it occurred.

J. Precision Approach (ILS) Procedures

1.0 Standard Approach Flight Profiles

Standard approach flight profiles for the Falcon 20 and the company's turboprops/multi-engine airplanes were depicted in the GAE General Training Manual, Appendix A, pages A22-C20. According to the DO, those flight profiles were generally standardized but somewhat different for each airplane type in the company's fleet. Appendix A, page A23[13] depicted the Falcon 20 approach flight profile for an ILS approach and included airspeeds, flap settings and missed approach procedures.

According to the Falcon 20 ILS approach flight profile, following completion of the approach checklist, the airspeed should be 160-180 knots and flaps should be extended to 15 degrees as the airplane entered a base leg or when a final approach vector was issued by ATC. At the first indication of glide slope needle movement on the pilot's glideslope receiver, flaps should be extended to 25 degrees. When the flight path was one dot above glide slope intercept on the pilot's glide slope receiver, the landing gear should be extended and the Before

[12] See Attachment 14.
[13] See Attachment 17.

Landing Checklist completed. When the glide slope was intercepted, flaps should be extended to 40 degrees. The pilot should then establish a rate of descent that would maintain the glideslope. The appropriate approach speed (V_{AP}), based on the weight/configuration of the airplane would be flown until arriving at the decision height (DH) or the runway was in sight. The airplane should cross the runway threshold at reference speed (V_{ref}) and a height of 50 feet.

Note: Approach speeds would be calculated[14] by the pilots and then entered on the Takeoff and Landing Data (TOLD) Card[15] along with other pertinent information such as, fuel remaining, landing weight and runway length.

According to the company's SOPs, all GAE flight crews were expected to follow the standard approach profiles specific to the airplane type and the approach to be flown. Those profiles were not just for pilot training. Any planned deviations from the standard profiles would be briefed in advance.

2.0 Stabilized Approach Concepts

The GAE General Training Manual, Appendix A, pages A19-A20[16], stated that the pilot's decision making process during an approach was simplified by maintaining a stable approach speed, descent rate, vertical flight path and configuration during the final stages of an approach. This *Stabilized Approach Concept* was essential for safe operations with turbojet airplanes and must be established prior to the final approach fix during a precision approach in instrument flight conditions.

3.0 Approach Callouts

The GAE standard operating procedures documented in the company's ACOM stated the required crew callouts[17] during a precision approach. The pilot not flying (PNF) shall announce any deviations outside of the following "approach window parameters":

- One dot deflection for the localizer and glide slope;
- Vertical speed 1,000 feet per minute or less;
- Airspeed within plus or minus 10 knots of V_{AP} but no less than $V_{ref;}$
- No red flags on the flight instruments; and
- Flaps 40 degrees except during non-precision and single-engine approaches.

  Note: If the airplane was not within this approach window when within 500 feet above touchdown, a missed approach must be executed. Additionally, the pilot flying (PF) shall acknowledge all callouts made by the PNF.

K. No Flap Approach and Landing

[14] See Attachment 14, page S-16.
[15] See Attachment 14, page S-17.
[16] See Attachment 16.
[17] See Attachment 14, page S-8.

The GAE General Training Manual contained the following pertinent information:

> Section 5, page 5-14[18], indicated that a landing with a flap/slat malfunction was a required pilot training maneuver in the Falcon 20.
>
> Section 8, page 8-4[19], indicated that a pilot-in-command (PIC) was required to complete a no flap approach as part of the FAR 135.293 competency check in the Falcon 20.
>
> Appendix Z, page Z-11[20], indicated that a zero flap landing was part of the curriculum when a simulator was used for flight training.

According to the accident first officer's Falcon 20 training documentation[21], he satisfactorily completed three no flap landings on April 1-2, 2003. Those landings and all of the first officer's training in the Falcon 20 were completed by the GAE chief pilot.

According to the GAE director of operations, Falcon 20 training did not include instruction for a flaps-up landing. That maneuver was not required because the flaps could be extended by an alternate method.

The post accident investigation determined that the airplane impacted the ground with the landing gear extended and the flaps in the retracted position.

L. Minimum Fuel Policy

According to pilot meeting notes that were dated March 3, 2003, the pilots were "doing a great job returning to TOL with minimum fuel and cost control was critical to the survival of the company."

According to the DO, when asked if the pilots were pressured to return to Toledo with minimum fuel, he said he wanted them to return with legal reserves but not a lot of extra fuel. If the weather was good, there was no need to overload the airplane with fuel and it was cheaper in TOL. He said that there had never been a fuel emergency declared because of that policy. He told the pilots that he did not want them to land with only fuel in the feeder tanks[22] and reiterated that they must have their legal reserves.

According to one company captain, management did not want the pilots to purchase fuel at out stations from non-contract vendors because it was too expensive. He said the pilots were told to return to TOL with the very minimum. He acknowledged that

[18] See Attachment 2.
[19] See Attachment 3.
[20] See Attachment 13.
[21] See Attachment 6.
[22] The accident airplane had two feeder tanks which each held about 440 pounds of fuel.

this meant the fuel should be down in the feeder tanks. He said that if a pilot returned to TOL with more than minimum fuel, he would receive a call from the CP or DO reminding him that he returned with too much fuel. He said he was not aware of any pilot who was terminated because of this policy. He said the pilots were instructed to only buy fuel from contract vendors and then only the minimum. He further stated that he never had to declare a fuel emergency but he heard that other captains had experienced a fuel emergency. He said landing at TOL with minimum fuel meant you had about 20-25 minutes of flight time remaining. According to this captain, the less fuel you landed with made you a "better captain" in the eyes of the company.

According to another company captain, if weather, traffic or anything else indicated a need for additional fuel but the payload would not allow it, a fuel stop would be planned. He said the company would not complain if he planned a fuel stop and he would never allow company pressure to influence his decision.

Another company captain stated that fuel was cheap. Even if he had enough fuel to complete a trip, if he was not weight restricted, he would top off the airplane with fuel.

According to a company first officer, he experienced a flight that had to divert because of low fuel due to the weather. However, he said the last thing he would ever worry about was the price of fuel when fuel was required.

According to another company first officer, he had made unscheduled fuel stops in both the Falcon and the Metroliner. He said the captains would make fuel stops as necessary.

Using information gathered during the investigation, the accident airplane was calculated to have around 800 pounds of fuel remaining. The calculations were based on a best case scenario and only considered the average fuel burn for a one hour and twenty minute flight and 10 minutes of taxi time. Training maneuvers, icing conditions and winds were not taken into account.

M. Crew Resource Management (CRM)

The GAE General Training Manual contained the following pertinent information:

Section 7, page 7-10, outlined the CRM training module that included the following subject areas:

- Captain's Authority;
- Crew Climate;
- Communication;
- Decision Making;
- Workload Management;
- Situational Awareness; and

- Use of Resources.

The courseware stated for this training module was the Jeppesen Flight Time Video "CRM – Exploring the Human Element."

The completion standards stated for the CRM training module were as follows: "The individual shall complete an oral examination given by an instructor to determine adequate knowledge of how human factors contribute to aircraft accidents."

According to the GAE owner, all pilots would attend a meeting regarding CRM on April 21, 2003, and all new pilots would receive crew resource management training. He said that the company found a CRM breakdown in another recent accident that occurred in Detroit. The owner said that following the accident, a formal CRM training program was developed and that curriculum was in the training manual.

According to the DO, CRM was a separate training class and not part of recurrent training. The new CRM training module would be an eight-hour class, however, that curriculum was not yet in the training manual. After the CRM curriculum was refined, it would be added to the ground and flight training programs.

According to a GAE first officer, he received CRM training at a former employer. He had not received CRM training at GAE although he said there had been discussions at the company regarding a CRM class.

According to another GAE first officer, he had not received any formal CRM training at GAE.

According to a GAE captain, CRM training was supposed to occur next week.

According to a former FAA principal operations inspector assigned to the GAE certificate, CRM at Grand Aire Express was satisfactory. She described the pilots' use of checklists as better than she had seen at other companies.

N. Flight in Icing Conditions

1.0 The Falcon 20 Airplane Flight Manual (AFM) contained the following pertinent information:

> Section 1, sub-section 20, page 2[23], indicated that *wing* anti-ice must be switched on as a preventive means IN FLIGHT when the indicated total temperature was below +5 degrees Celsius and when icing conditions were anticipated. That section also indicated the *engine* anti-ice must be switched on as a preventive means when the total indicated temperature was below +5 degrees Celsius and icing conditions were anticipated.

[23] See Attachment 4.

Section 4, sub-section 40, page 1[24], contained a chart for determining the minimum engine thrust required when the engine and wing anti-icing systems were activated.

The post accident investigation determined that the wing anti-ice valve on the number one engine was in the closed position[25] and the engine nacelle anti-ice valve gate assembly was found in the closed position on both engines. The investigation determined that the right engine was not running prior to impact.

2.0 A Shuttle America Flight crew that landed just prior to the accident flight reported light to moderate icing during the approach. A Mesaba Airlines Saab 340 flight crew reported moderate rime ice between 2,500-3,000 MSL at about the time the accident occurred. A GAE Falcon 20 that departed about 10 minutes after the accident reported no significant icing during the climb out.

3.0 Subsequent to the accident, the company instituted the following policy[26]:

Training/Checking flights would be terminated in the vicinity of any weather phenomena (e.g. icing, thunderstorms or low-level windshear) that may adversely affect the safety of flight.

O. Aerodrome Information

The elevation at TOL was 684 feet MSL. The airport had an ATC control tower and approach/departure radar services.

Runway 07 at TOL was 10,600 feet long and 150 feet wide. The runway surface was constructed of asphalt and had precision instrument approach runway markings and lighting.

P. Weather

A special weather observation taken at 1333 and broadcast as automated terminal information service (ATIS) Victor reported current field conditions as: wind 020 degrees at 9 knots, visibility 1 mile, sky overcast at 300 feet with mist, temperature 0 degree Celsius, dew point minus 1 degree Celsius, altimeter 30.25 inches hg and a surface visibility of 1¼ statute miles[27].

Q. Company Summary

1.0 General Information

[24] See Attachment 5.
[25] For further information, see the Powerplants Group Chairman Factual Report.
[26] See attachment 10.
[27] For further information, see the Meteorology Group Chairman's Factual Report.

GAE, Inc. was a holding company headquartered in Toledo, Ohio, and provided charter management services that included aircraft charter, trucking, loading/unloading, airport services, customs and other related services. The company supported a wide variety of industries including Automotive OEMs (original equipment manufacturers), Package Delivery, Computer, Life Flight, and Executive Travel. In the past, the company has had freight contracts with both Federal Express (FedEx) and United Parcel Service (UPS).

GAE, Inc. was affiliated with two air charter carriers: Grand Aire Express (GAE) and Executive Aire Express (EAE). GAE operated one of the largest Part 135 fleets of cargo aircraft in North America prior to 2001. The fleet was originally made up of nearly 30 aircraft of four different types, ranging from twin piston to medium jets. However, according to the owner, due to the turndown in the economy for the past few years, GAE currently had 10 pilots and operated five Falcons and three Metroliners at the time of the accident.

Executive Aire Express offered a variety of executive passenger aircraft including twin piston, twin turbo-prop, and business class jets and catered to charter customers.

According to the owner of GAE, Inc., Grand Aire Express supported cargo operations and Executive Aire Express supported passenger transport operations.

2.0 Accident/Incident History

The NTSB defined an accident as an occurrence in which any person suffered death or serious injury, or in which the aircraft received substantial damage.

The NTSB defined an incident as an occurrence involving one or more aircraft in which a hazard or a potential hazard to safety was involved but not classified as an accident due to the degree of injury and/or extent of damage. An incident could affect the safety of operations and covered a broad range of events that might include:

- Damage to an aircraft (other than an accident);
- Runway incursion;
- Pilot deviation; or
- Near mid air collision (NMAC)

From December 8, 1989 until April 4, 1994, GAE, Inc. had one accident and 11 incidents involving various types of airplanes within the company's fleet.

From March 20, 1995, until July 18, 2001, GAE, Inc. had the following eight accidents/incidents:

- 03/20/1995: Linden, Tennessee. During a visual approach, a Piper PA-60 overran the runway and collided with a concrete wall and trees. There was one minor injury[28]
- 09/16/1995: South Bend, Indiana. While practicing an engine out approach, a Swearingen SA-226 Metroliner struck trees at the departure end of the runway when power was applied for the go-around. The two pilots were uninjured[29].
- 01/27/1996: Mount Storm, West Virginia. Following the loss of one engine, an Aerostar 601 encountered icing and was unable to maintain altitude. The airplane impacted mountainous terrain and there was one serious injury[30].
- 05/12/1998: Monroe, Michigan. A Falcon 20 aborted takeoff when the pilot was unable to move the flight controls. The two pilots were uninjured[31].
- 04/04/2000: Opa Locka, Florida. A Falcon 20 rolled off the runway while landing. The two pilots were uninjured. The NTSB said the pilot failed to properly lower the landing gear and that GAE had not complied with a suggested repair[32].
- 06/13/2000: Peterborough, Canada. A Falcon 20 crashed into a field after an aborted landing. The two pilots suffered minor injuries[33].
- 08/28/2001: A Falcon crashed during an emergency landing at Detroit City Airport. The pilot said a cargo door opened during takeoff at the airport and forced the landing.
- 07/18/2001: Columbus, Indiana. A Piper PA-60 crashed during landing fatally injuring the pilot[34].

Note: Including this accident in Toledo and the ditching in St. Louis that occurred on the same day, GAE, Inc. had a total of five accidents/incidents involving the Falcon 20 since April 4, 2000.

Between April 14, 1994, and December 11, 2001, GAE, Inc. had an additional 16 incidents involving various types of airplanes within the company's fleet.

R. Transfer of the GAE Part 135 FAA Operating Certificate

1.0 Company Perspective

1.0.1 According to the GAE owner, when the company physically moved their headquarters from Monroe, Michigan, to Swanton, Ohio, in 1999, the

[28] For further information, see NTSB accident number ATL95LA068.
[29] For further information, see NTSB accident number CHI95LA341.
[30] For further information, see NTSB accident number BFO96LA040.
[31] For further information, see NTSB accident number CHI98LA151.
[32] For further information, see NTSB accident number MIA00IA128.
[33] For further information, see NTSB accident number NYC00WA161.
[34] For further information, see NTSB accident number CHI02FA197.

FAA advised that the DTW FSDO would continue to maintain oversight responsibility for the GAE Part 135 operating certificate. However, following the move, the FAA transferred oversight responsibility for the certificate to the CLE FSDO.

Shortly after the certificate was transferred, the company began receiving letters of investigation from the CLE FSDO regarding numerous airworthiness violations discovered during FAA inspections. According to the owner, most of those letters of investigation were because company documentation regarding airplane mechanical interruption reports[35] was filed late. A mechanical interruption report was required to be filed with the FAA whenever a scheduled flight had to be delayed or cancelled due to an airworthiness discrepancy. Even though repairs were made to the airplane prior to its use in revenue service, the company was fined for each flight segment that the airplane had flown during the time that the mechanical interruption report remained outstanding. The company also received violation notices when company mechanics did not properly document their repairs.

According to the owner, after the FAA principal maintenance inspector (PMI)[36] had completed an inspection at the company, the owner queried him and asked for a debriefing on any discrepancies that were noted. The PMI would comment that no discrepancies had been found. However, shortly after the PMI returned to the FSDO, the company would receive a letter of investigation regarding discrepancies found during the inspection that was just by the PMI.

According to the owner, in the first six months following the transfer of the certificate to the CLE FSDO, the FAA filed numerous violations against the company. The fines associated with those violations totaled over $750,000 and were mostly in the area of airworthiness. He further stated that the company was not given enough time to correct problems and there was very little communication between the FAA PMI and company personnel.

According to the owner, if the discrepancies discovered by the PMI had been expressed to the company's director of maintenance, they would have been corrected. However, because of the lack of communication with the PMI, the company kept receiving fines on a regular basis. The lack of communication with the PMI was the company's biggest complaint.

There continued to be meetings between the FAA and the company in an attempt to find a workable solution to the airworthiness discrepancies and lack of communication with the PMI. According to the owner, he contacted the manager

[35] Monthly reports required to be submitted to the FAA regarding each interruption to a flight, unscheduled stop or diversion from a route, caused by known or suspected mechanical difficulties or malfunctions that are not required to be reported under FAR 135.415 (Mechanical Reliability Reports). Additionally, all inflight prop featherings must also be included in the report.
[36] See Attachment 20.

of the CLE FSDO and requested a new PMI but that request was never granted. The owner said he finally spoke to FAA headquarters personnel in Washington, DC, and also FAA personnel in the regional flight standards office regarding the CLE FSDO issues. Shortly after those conversations in 2001, the certificate was transferred back to the DTW FSDO.

1.0.2 According to the GAE business manager, when the company moved their base of operations to Swanton, Ohio, it was understood that the certificate oversight responsibility would remain with the DTW FSDO. However, after the company moved, they received a letter from the FAA informing them that oversight for the certificate would be transferred to the CLE FSDO. Several meetings were held at the Cleveland FSDO to meet the principal inspectors.

During the summer following the transfer of the certificate, the company received many letters from the CLE FSDO concerning airworthiness discrepancies. According to the business manager, the principal maintenance inspector found many paperwork issues and if he had of expressed those issues to the director of maintenance, they would have been corrected. However, the company kept receiving fines on a regular basis. Most of the fines were regarding mechanical interruption reports that were not filed on time or mechanics citing the wrong name of the airplane reference manual used during the repairs. However, according to the business manager, the repairs were performed correctly and proper procedures were followed.

According to the business manager, the company realized that they were not getting along with the FAA in November 1999 and scheduled a meeting with the Cleveland FSDO office that was attended by the FAA regional counsel. The company requested that issues be communicated to their management and they also gave the FAA additional contacts to use in the event of problems. He said that the meeting was very confrontational.

According to the business manager, the company's biggest complaint concerning the principal maintenance inspector was that he would not communicate with them.

The company asked the manager of the Cleveland FSDO for another principal maintenance inspector but that request was never granted. According to the business manager, the company tried hard to clean up issues that developed over their rapid expansion and even hired outside maintenance consultants. All of the violations were filed between August 1999 and the beginning of 2000. The company kept the FAA advised on how the cleanup of the company was going and they received flying colors following a regional inspection conducted by the FAA.

2.0 FAA Perspective

2.0.1 According to the current CLE FSDO manager, who was the maintenance unit supervisor when the GAE certificate was assigned to the CLE FSDO, the office inspectors followed "the book" closely. If an operator could not live with FAA policies, then the certificate should be moved elsewhere.

From 1999-2001, inspections were conducted at GAE, airworthiness deficiencies found, and then the identical items would be found again on another airplane during a subsequent inspection. The previous deficiencies that were identified during the last inspection still had not been repaired. He further said that GAE ignored FSDO recommendations that were designed to bring the company into regulatory compliance.

According to the CLE FSDO manager, communications with GAE were confrontational and difficult because the owner insisted that all communications go through him or his lawyers rather then through company maintenance personnel. He said the PMI informed GAE of his surveillance findings and then would follow up with a letter. He did not feel that the PMI shut down either written or verbal communications with the company.

He was contacted by the regional office flight standards manager and was advised that it would be in the best interest of both the CLE FSDO and the company if the GAE certificate were returned to the Detroit FSDO.

2.0.2 According to a former CLE FSDO inspector, assigned as the GAE POI from March 1999 until September 1999, the maintenance at GAE was sub-standard. She believed that the PMI filed many violations against GAE and the company was not cooperating with him. She felt that the airworthiness violations filed by the PMI were valid and described GAE's lack of cooperation with the PMI as an economic issue.

Her concerns with GAE when she left the POI position were the lack of trend monitoring, exceeding engine overhaul times, and the airworthiness condition of the Metros. She did not have any operational concerns with GAE.

According to this inspector, she felt that the transfer of the GAE certificate to the DTW FSDO occurred because of too much scrutiny by the PMI.

2.0.3 According to another former CLE FSDO inspector, assigned as the GAE POI from September 1999 until 2001, the company was not cooperating with the PMI and there were numerous changes in the director of maintenance position during the same time frame that he was the POI. It finally reached a point where the company wanted to move their certificate back to Detroit.

When asked if the PMI discovered safety of flight issues or just paperwork errors, he said that if an operator could not produce the required paperwork, it was difficult to prove that an airplane was safe.

This inspector's position was that an inspector could find a violation at any company on any day but he did not feel that the PMI took advantage of that situation. The PMI never gave him the feeling that he was "after" the operator. If an airworthiness deficiency was found, the PMI would write it up; there was no vendetta against the company.

According to this inspector, he personally believed that the transfer of the certificate back to DTW was unwarranted.

2.0.4 According to the current CLE FSDO operations supervisor, who was the operations unit supervisor when the GAE certificate was assigned to the CLE FSDO, the certificate was transferred back to DTW because the owner had "political clout" and he was not happy with the manner in which the Cleveland office was overseeing the certificate, especially in the airworthiness area.

According to this inspector, he thought that it was unusual for the FAA to transfer the certificate of a locally based operator to another FSDO, but that was a decision made at the regional level. He thought the communication between the company and the airworthiness inspectors could have been better, however, he personally did not think the certificate should have been transferred.

S. FAA Enroute Inspections at Grand Aire Express

According to FAA Order 8400.10, the Air Transportation Operations Inspector's Handbook, the primary objectives of FAA cockpit enroute inspections (Program Tracking and Reporting System code 1624) were observation and evaluation of a certificate holder's inflight operations. The order further stated that enroute inspections were one of the most effective methods for accomplishing surveillance objectives and responsibilities and could be conducted from either the forward observer's seat in the cockpit (jumpseat) or a forward cabin seat if no jumpseat was available.

According to FAA Order 8400.10, the following elements could be observed and evaluated during an enroute inspection:

- Crewmember proficiency;
- Operator manuals and checklists;
- Use of minimum equipment list (MEL);
- Use of configuration deviation list (CDL);
- Operational control functions (dispatch/flight following/flight locating);
- Use of checklists, approved procedures, and safe operating practices;
- Crew coordination/crew resource management (CRM);
- Cabin safety;
- Aircraft condition and servicing; and
- Training program effectiveness.

Note: Those items were not all-inclusive but represented the types of items that should be evaluated during a cockpit enroute inspection.

FAR 135.75 (b) stated that a forward observer's seat on the flight deck (jumpseat) or forward passenger seat with headset or speaker must be provided for use by the Administrator while conducting enroute inspections.

FAA Order 8400.10 stated that the POI was responsible for coordinating with his assigned operators to ensure that there were established procedures to be used by FAA inspectors for scheduling the jumpseat/forward passenger seat. The POI was to ensure that the operator's procedures allowed inspectors to have free and uninterrupted access to the jumpseat/forward passenger seat. Additionally, the POI was to ensure that the operator's procedures were flexible and permitted use of an available jumpseat/forward passenger seat on short notice.

According to the current Grand Aire POI and two former Grand Aire POIs, enroute inspections were rarely, if ever, conducted due to the operator's on-demand status, which made it difficult to schedule the inspection. According to the current POI, she did not conduct enroute inspections but ensured that cockpit discipline and standardization were maintained by conducting checkrides in the Metroliner. She did not possess a type rating in the Falcon 20.

T. FAA Enforcement History

Integrated Safety Information Subsystem (ISIS) enforcement information records, provided by the FAA, documented the following FAA violations at GAE:

1.	**02/01/1995 – FAR135.439(c)**	Availability of maintenance records for FAA inspections. Status: Closed.
2.	**07/10/1995 – FAR 91.417**	Maintenance records. Status: Closed.
3.	**07/19/1996 – FAR 43.9**	Maintenance records. Status: Closed.
4.	**01/06/1997 – FAR 43.13(b)**	Airplane performance rules. Status: Closed.
5.	**01/06/1997 – FAR 135.415 (a) (12)**	Service difficulty reports. Status: Closed.
6.	**01/06/1997 – FAR 91.417(a)**	Maintenance records. Status: Closed.

Note: The above six violations were filed by the DTW FSDO.

1. **02/16/199 - FAR 135.421(a)** Compliance with the manufacturer's recommended maintenance programs. Status: Pending.

2. **04/15/1999 - FAR 43.9(a)** Maintenance records. Status: Closed.

3. **04/21/1999 - FAR 135.421(a)** Compliance with the manufacturer's recommended maintenance programs. Status: Pending.

4. **07/09/1999 - FAR 91.405(a)** Required maintenance inspections. Status: Closed.

5. **08/10/1999 - FAR 135.417** Mechanical interruption summary reports. Status: Pending.

6. **08/11/99 - FAR 91.403(b)** Unauthorized maintenance. Status: Closed.

7. 0**8/17/1999 - FAR 91.13(a)** Careless or reckless operation. Status: Pending.

8. **11/04/1999 – FAR 91.7(a)** Airworthiness condition of aircraft. Status: Pending.

9. **12/07/1999 – FAR 135.63(d)** Disposition of load manifest. Status: Pending.

10. **12/22/1999 – FAR 39.3** Airworthiness directives. Status: Closed.

11. **12/24/1999 – FAR 91.13(a)** Careless or reckless operation. Status: Pending.

12 **01/10/2000 – FAR 135.417(a)** Mechanical interruption summary reports. Status: Pending.

13. **02/10/2000 – FAR 135.417(a)** Mechanical interruption summary reports. Status: Pending.

14. **03/08/2000 – FAR 135.179(a)** Minimum equipment list (MEL) Status: Pending.

15. **04/10/2000 – FAR 135.417(a)** Mechanical interruption summary reports.

Status: Pending.

16. **05/12/2000 – FAR 135.63(b)** Record keeping requirements.
Status: Closed.

17. **05/31/2000 – FAR 91.7(a)** Airworthiness condition of aircraft.
Status: Closed.

18. **12/01/2000 – FAR 135.25(a1)** Aircraft manual requirements.
Status: Closed.

19. **12/01/2000 – FAR 45.11(d)** Airworthiness certificates.
Status: Closed.

20. **12/01/2000 – FAR 135.25(a1)** Aircraft manual requirements.
Status: Closed

21. **12/01/2000 – FAR 135.25(a1)** Aircraft manual requirements.
Status: Closed.

22. **12/01/2000 – FAR 91.417(a2)** Maintenance records.
Status: Closed.

23. **01/29/2001 – FAR 135.21(e)** Currency of employee manuals.
Status: Closed.

24. **01/20/2001 – FAR 135.327(b2)** Authorized training devices.
Status: Closed.

25. **01/29/2001 – FAR 135.21(d)** Availability of employee manuals.
Status: Closed.

26. **01/29/2001 – FAR 135.83(a3)** Cockpit availability of aeronautical charts.
Status: Closed.

27. **01/29/2001 – FAR 135.343** Crewmember training requirements.
Status: Closed.

28. **01/29/2001 – FAR 135.83(a3)** Cockpit availability of aeronautical charts.
Status: Closed.

29. **01/29/2001 – FAR 119.9(a)** Use of business name.
Status: Closed

30. **02/01/2001 – FAR 119.47(b)** Maintenance base location change.
Status: Pending.

Note: These 30 violations were filed by the CLE FSDO.

1. **08/28/2001 – FAR 39.3** Airworthiness directives.
   Status: Closed.

2. **07/03/2002 – FAR 43.13(a)** Airplane performance rules.
   Status: Closed.

3. **07/18/2002 – FAR 119.49(c9)** Required maintenance items.
   Status: Closed.

Note: These three violations were filed by the DTW FSDO.

U. FAA Oversight

1.0 The FAA principal operations inspector (POI) assigned to GAE had oversight responsibility for seven Part 135 on demand cargo carriers, the largest of which was Auto Air Charter. Additionally, she was assigned two FAA Part 91 pipeline patrol operators, a Part 61 aviation school, two Part 91 deviation holders, and one Part 125 operator. The airplanes operated by those companies included a DC9, Saab 2000, Challengers, Gulfstreams, and Hawkers. She also had oversight responsibility for approximately 31 check airmen. Each checkairman was required to have an FAA observation at least every two years.

According to the current GAE POI, her workload was heavy but said she was multi-task oriented, worked four 10-hour days, and always completed her work assignments. She stated that many of her certificates were able to manage themselves by conducting their own internal audit process.

When the GAE certificate was transferred from the Cleveland office to Detroit, she became the principal operations inspector but did not know the reason for the certificate transfer. However, she said she was aware that there were some airworthiness issues.

Her initial review of GAE included inspecting operations manuals, conducting ramp and facility inspections, and interviews with the director of operations and chief pilot. Her assessment of GAE was that the airplanes were "not pretty" but all required equipment was on board. The principal maintenance inspector told her he had no major complaints with the airworthiness of the airplanes. GAE employees were always very courteous and professional.

2.0 Integrated Safety Information Subsystem (ISIS) inspection reports provided by the FAA indicated that the DTW FSDO completed the following surveillance inspections at GAE:

05/01/2001 - 12/30/2001:

1. One main base facility inspection.
2. Three line station inspections.
3. Two manual/procedures inspections.
4. Eight ramp inspections.
5. Two training program inspections.
6. One crew/dispatcher records inspection.
7. One trip records inspection.
8. Three facility inspections.
9. One flight locating inspection.
10. Two deice inspections.
11. Three checkairman observations as they conducted a pilot oral exam.
12. Three checkairman observations as they conducted a pilot line check.
13. Four checkairman observations as they conducted training in an aircraft.

Note: Due to multiple inspections conducted during a single company visit, the above 34 inspections were completed in 16 days.

01/01/2002 - 11/30/2002:

1. One operator field office in-depth inspection.
2. Two operator main base facility inspections.
3. One line station inspection.
4. Two manuals/procedures inspections.
5. Nine ramp inspections.
6. One training program inspection.
7. One crew/dispatcher records inspection.
8. One trip records inspection.
9. Three facility inspections.
10. Eight deice inspections.
11. One checkairman observation as he conducted a pilot oral exam.
12. Three checkairman observations as they conducted training in an aircraft.
13. One checkairman observations as he conducted training in a simulator.
14. Three checkairman observations as they conducted a pilot line check.

Note: Due to multiple inspections being conducted during a single company visit, the above 36 inspections were completed in 14 days.

02/20/2003:

1. One main base facility inspection.
2. One ramp inspection.
3. One deice inspection.
4. One checkairman observation as he conducted a pilot oral exam.
5. One checkairman observations as he conducted training in an aircraft.

6. One checkairman observation as he conducted a pilot line check.

Note: The above six inspections were conducted and completed during a single company visit.

V. Office Safety Inspection Program

FAA personnel from the DTW FSDO conducted an Office Safety Inspection (OSIP) at GAE from September 16, 2002, until September 26, 2002.

According to a letter[37] (dated November 13, 2002) provided by the company, there were a total of three operational findings that were discovered during the OSIP:

- Finding 1.02.01 – No crew training segment could be found addressing single long-range communication system (SLRCS) and the possible loss of SLRCS while enroute.

- Finding 1.03.01 – Training in fire fighting is considered unsatisfactory. The operator uses a small cardboard mock-up of a flame, which is attacked with a handheld water extinguisher. This does not provide adequate training for all classes of fires; see 14 CFR Section 135.331 (b) (2) (iii).

- Finding 1.04.01 – Requalification, paragraph (B), states the Director of Operations, DO, must notify the POI of all failures. This is a requirement of Order 8400.1 Page 3-358, paragraph 631 (B). The DO stated that this is not being complied with. There was no documentation of file to indicate that GAE was in compliance.

The company acknowledged the findings and provided the FAA with the necessary corrective actions as noted in the above letter.

W. Simulator Evaluations

The Operational Factors Group reconvened at Flight Safety International (FSI), Dallas, Texas, on July 23, 2003, to observe company procedures in a Falcon 20 simulator.

The Operational Factors Group observed the following:

- The FSI simulator was an FAA certified Level "D" Falcon 20 full motion simulator and was equipped with GE CF 700-2D2 engines. It had similar cockpit controls and displays similar to the accident airplane with some minor differences. Note: Even though Level "D" simulators are the most sophisticated and have the highest fidelity, airplane handling characteristics are not totally recreated in the stall regime.

[37] See Attachment 18.

- The simulator was pre-programmed with the following parameters: Landing weight – 17,450 pounds, Fuel – 1,000 pounds (for second ILS), CG 21.7. The simulator was programmed for an ILS approach to Runway 07. However, the simulator did not have the capability of displaying the Toledo Express Airport or the surrounding terrain. An FSI instructor operated the simulator during the evaluations.

- A Falcon 20 PIC from GAE occupied the right seat and a Dassault Falcon 20 PIC occupied the left seat. The FO piloting the accident airplane was receiving training and is assumed to have been the flying pilot.
  Note: All of the simulator scenarios were flown by the GAE PIC in the right seat utilizing raw data.

- Flight characteristics were observed during slow flight, stall recovery and various airplane configurations. Numerous ILS 07 approaches were executed to observe company procedures and pilot techniques that included approach briefing, preparation and execution of the ILS 07 approach. Particular attention was focused on cockpit set-up, PF duties, PNF duties, call-outs, checklist usage and CRM.

- Normal takeoff, departure, approach procedures and callouts appeared to be normal and in accordance with GAE's checklists and procedures. The simulator exhibited normal airplane characteristics during slow flight and stall maneuvers. The simulator recovered immediately from stalls upon increase of power. The airplane is stable in the stall and does not break either right or left. With gear down and full flaps, the stall warning horn sounded at 100 knots IAS and this was prior to any buffet. During execution of a clean stall, the warning horn sounded at 100k with the onset of the buffet at 95k and entered a deep stall buffet at 90k at which time the igniter lights illuminated. During execution of a stall with the gear down and the flaps retracted, the horn sounded at 120k followed by the buffet at 117k and a 2,500 fpm descent.

- A demonstration was performed with the airbrakes deployed to observe the higher power settings necessary to maintain airspeed. The airbrakes retracted from full extension to the stowed position in 3 seconds.

- Three consecutive ILS 07 approaches were conducted, with the FO flying, to observe crew workload:

  1. The first approach was flown in VFR conditions to acclimate the flight crew to the handling characteristics of the simulator.

  2. The second and third approaches were flown using normal company procedures in IFR conditions. The anti-ice systems were activated and the approach ended with the execution of a missed approach. The approach required the use of the airbrakes to maintain airspeed because of activation of

the anti-ice systems. Using normal procedures, the second approach was uneventful to a full stop landing.

3. The fourth approach was flown with anti-ice systems off and an approximate ¼ inch of ice degradation. The pilots were instructed to extend the gear, use the airbrakes as necessary but keep the flaps retracted and maintain 180k to the OM, establish Vref + 10 (120k) and land.

   Observations: Company procedure was to turn on the igniters at the OM or soon thereafter when in icing conditions. 90% N1 was required to maintain 180k until the OM. Stall horn sounded momentarily at 130k. Dassault recommends 150k approach speed with airbrakes extended and flaps retracted. The trim setting noted after landing was 3.0. It was not necessary to use emergency trim. Both fuel transfer lights were on and a very high nose attitude was observed during the approach.

4. The fifth approach was performed using the same parameters as #3 above but with trim set to 4.5. At the OM, the power was set to idle and a stall was initiated 3½ miles from the runway. The pilot recovered with power, retraction of the airbrakes and incurred an altitude loss of about 150 feet.

5. The sixth approach was performed using the same parameters as #4 but the pilot was instructed not to use any airbrakes during the approach. The simulator entered a stall at around 2 miles from the runway from which the pilot was unable to recover.

6. The seventh approach the pilot was instructed to cross the OM at 140k, gear down and trim set to 4.5. There was still ¼ inch ice degradation. He was told the right engine would fail at 3 miles from the runway. The pilot was able to recover using max power on the left engine and then was able to execute a missed approach.

7. The eighth approach was flown at 190k, 2 miles from the OM to see if the simulator could achieve 133k, 3 miles from the runway after the power was reduced to idle. (This was the speed profile provided by the NTSB performance group chairman) At 3 miles, a speed of 135k was observed.

8. The ninth approach had the anti-ice systems off. At 190k 2 miles from the OM, power was reduced to idle and the gear extended. The approach speed at the OM was observed to be about 150k. The right engine was failed 3½ miles from the runway and at a speed of 133k. With the pilot attempting to maintain the glide slope, the simulator entered a stall and rapidly lost 500 feet of altitude and a speed of 103k was observed about 2 miles from the runway.

9. The final approach was the same as #8 above but with no ice degradation. Speeds were 5-10 knots faster at all points during the approach.

Note: The final 3 approaches were flown with the trim set to 4.5. This was the setting found on the accident airplane.

The Operational Factors Group concluded simulator evaluations and observations on July 23, 2003.

Submitted by:

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Dave Kirchgessner
Air Safety Investigator, Operations
September 30, 2003