NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

April 2, 2015

Group Chairman's Factual Report

SURVIVAL FACTORS

ERA14MA271

A. ACCIDENT

Operator	:	Arizin Ventures LLC
Airplane	:	Gulfstream Aerospace G-IV [N121JM]
Location	:	Bedford, MA
Date	:	May 31, 2014
Time	:	2140 eastern daylight time (EDT)[1]
NTSB #	:	ERA14MA271

B. SURVIVAL FACTORS GROUP[2]

Chairman	:	Peter Wentz National Transportation Safety Board Washington, DC
Member	:	Ted Costa Massachusetts Port Authority / Logan Boston, MA
Member	:	Phillip Davenport Federal Aviation Administration Washington, DC
Member	:	Keith Leonhardt Massachusetts Port Authority Bedford, MA

C. SUMMARY

On May 31, 2014, about 2140 eastern daylight time, a Gulfstream Aerospace Corporation G-IV, N121JM, operated by Arizin Ventures, LLC, crashed after a rejected takeoff and runway excursion at Laurence G. Hanscom Field (BED), Bedford, Massachusetts. The two pilots, a flight attendant, and four passengers were fatally injured. The airplane was destroyed by impact forces and a postcrash fire. The personal flight, which was destined for Atlantic City International Airport (ACY), Atlantic City, New Jersey, was conducted under the provisions of 14 *Code of Federal Regulations Part 91*. An instrument flight rules flight plan was filed. Night visual meteorological conditions prevailed at the time of the accident.

[1] All times in this report are eastern daylight time, based on a 24-hour clock.
[2] Not all group members were present for all activities.

D. DETAILS OF THE INVESTIGATION

1.0 Airplane Configuration

The airplane was a Gulfstream Aerospace G-IV [N121JM] configured with 2 pilot seats, 8 single passenger seats and 2 triple passenger divans. There was a stowable flight deck observation seat located in a compartment aft of the cockpit on the right side. The airplane had 6 exits, 5 for emergency evacuation and 1 for loading/unloading baggage[3]. The main entry door was a Type I exit located on the left side of the airplane just aft of the cockpit. Four overwing Type III (equivalent) emergency exits were located over the wings, with 2 on each side of the airplane (figure 1). The baggage compartment door was accessible through the cabin lavatory with its external door located under the left engine and could be used as a supplementary emergency exit at the direction of the crew as shown in the excerpt from the passenger safety information card (figure 2).

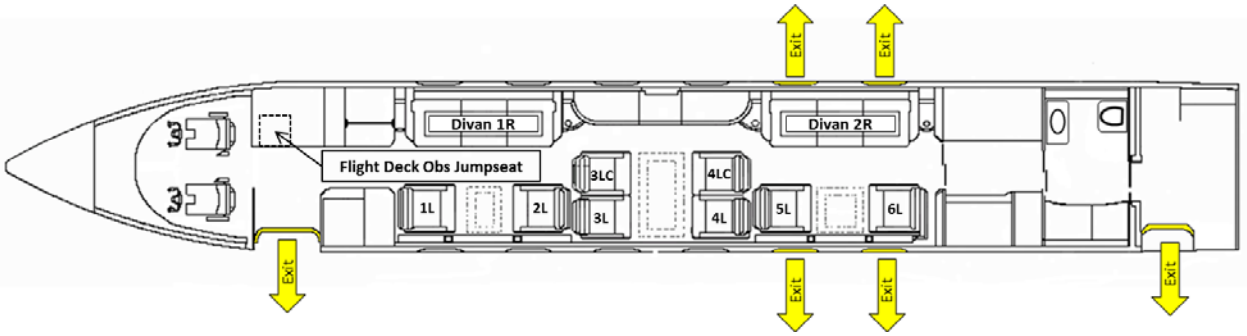


Figure 1. Gulfstream Aerospace G-IV [N121JM] seating configuration.

Figure 2. Excerpt from passenger safety information card showing the baggage door supplementary emergency exit.

[3] Referenced from Gulfstream IV Operating Manual 2A-52-20 page 4 Rev 2/1/07.

2.0 On-scene Documentation

2.1 Cockpit Seats

2.1.1 Left Seat

The left cockpit seat was manufactured by Ipeco Inc., P/N 1159SCF213-1 (figure 3). The cockpit seats are mounted to seat tracks that are attached to the cockpit floor. Each seat can be manually adjusted forward and aft, as well as vertically for pilot comfort and positioning.

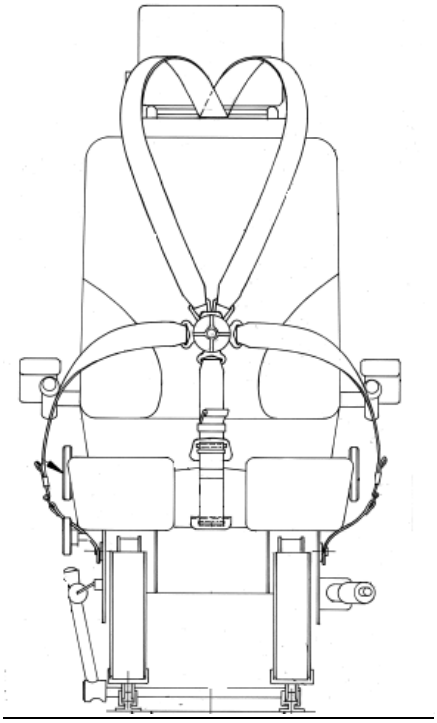


Figure 3. Left cockpit seat.

The left cockpit seat was found with the seatback and seatpan cushions attached to the frame. The seatback cushion fabric was destroyed by fire while the foam portion remained attached to the seat with thermal damage to the entire cushion. The seatpan cushion (photograph 1) was covered in soot with thermal damage on the forward right corner. The seat frame was fully intact (photograph 2) with signs of thermal damage and found locked in the seat tracks aft-most position measuring 5 ¼ inches from the aft seat frame to the aft cockpit wall. Both armrests were found in the up position with the seatbelt insert tab and webbing located between the seatback and inboard armrest. The left cockpit restraint was a 5-point restraint (photograph 3) manufactured by Pacific Scientific Co. An identification code #45402 was stamped into the central rotatory buckle. The part number was illegible. Both shoulder harnesses had retracted into the stowed position and were damaged by the post-crash fire; the inertia reel was not functional. The outboard lap restraint was adjusted to a measurement of 24 ½ inches from the seatbelt attach point and the end of the rotary buckle. The inboard lap restraint was adjusted to a measurement of 25 inches from the seatbelt attach point and insert tab. The crotch strap was adjusted to a measurement of 16 ¾ inches from the seat attach point to the insert tab.

Photograph 1. Left cockpit seatpan cushion.

Photograph 2. Left cockpit seat frame.

Photograph 3. Left cockpit seat 5-point restraint.

2.1.2 Right Seat

The right cockpit seat was manufactured by Ipeco Inc., P/N 1159SCF213-2. It was found with the seatback and seatpan cushions attached to the frame. The upper portion of the seatback cushion fabric was destroyed by fire with thermal damage to the foam cushion. The lower portion of fabric and foam cushion remained attached to the seat with thermal damage to the midsection of the cushion. The bottom of the seatback cushion fabric was not burnt. The seatpan cushion (photograph 4) was covered in soot with thermal damage on the forward right and forward left corners. The frame was fully intact with signs of thermal damage and found locked in the seat tracks aft-most position measuring 5 1/8 inches from the aft seat frame to the aft cockpit wall (photograph 5). The outboard armrest was found in the down position with the female rotatory buckle and webbing hanging over the armrest. The inboard armrest was found in the up position. The right cockpit restraint was a 5-point restraint manufactured by Pacific Scientific Co. An identification code #45402 was stamped into the central rotatory buckle. The part number was illegible. Both shoulder harnesses had retracted into the stowed position and were damaged by the post-crash fire; the inertia reel was not functional. The outboard lap restraint was adjusted to a measurement of 22 inches from the seatbelt attach point and the end of the rotary buckle. The inboard lap restraint was adjusted to a measurement of 17 ½ inches from the seatbelt attach point and insert tab. The crotch strap was adjusted to a measurement of 12 ¾ inches from the seatbelt attach point to the insert tab.

Photograph 4. Right cockpit seatpan cushion.

Photograph 5. Right cockpit seat frame.

2.2 Passenger Cabin

The passenger cabin was configured with 8 single passenger cabin seats and 2 triple passenger divans to accommodate a total of 14 occupants.

2.2.1 Passenger Cabin Seating

The passenger cabin seats were individual captain style seats covered in leather (photograph 6) and were manufactured by Aircraft Modular Products, model 2524, under FAA Technical Standard Order C39b. All eight single passenger cabin seats were found attached to the floor tracks. Three of the eight were heavily damaged by fire (seats 3L, 3LC and 4L). Six of the eight seats (1L, 2L, 3L, 3LC, 4L and 4LC) were removed from the airplane by Hanscom Air Force Base (AFB) Fire/Rescue to extricate the fatally injured occupants. The two divans were manufactured by Decrane/ERDA, model A13439, under FAA Technical Standard Order C39b. Table 1 identifies the part numbers (P/N) for seats and seat cushions.

Seat Position	Seat P/N	Seatback Cushion P/N	Lumbar Cushion P/N	Seat bottom Cushion P/N
1L	2524-014-000201-3	Damaged by fire	GC42208201-07	Illegible
2L	2524-014-000201-5	GC42208201-09	GC42208201-07	Destroyed by fire
3L	Illegible	Destroyed by fire	Destroyed by fire	Destroyed by fire
3LC	Illegible	Damaged by fire	Damaged by fire	Damaged by fire
4L	Illegible	Destroyed by fire	Destroyed by fire	Destroyed by fire
4LC	Illegible	Destroyed by fire	Destroyed by fire	Destroyed by fire
5L	Illegible	Destroyed by fire	Destroyed by fire	Destroyed by fire
6L	2524-014-000201-2	Damaged by fire	GC42208201-07	Illegible
Divan 1R	Illegible	Destroyed by fire	N/A	Destroyed by fire
Divan 2R	A13439(B-151A,F)	Destroyed by fire	N/A	Destroyed by fire

Table 1. Cabin seat locations[4], seat and seat cushion part numbers.

Photograph 6. Exemplar passenger cabin seat (photo from aircraft serial number 1399 provided by Gulfstream Aerospace Corp from original outfitting in 2000).

2.1.1.1 Seat 1L

Seat 1L (photograph 7) was found in its original position on the aircraft attached to the floor seat tracks. Hanscom AFB Fire/Rescue cut all four seat posts to remove the seat. The seat

[4] Seats 1L-6L were located next to the left cabin sidewall. Seats 3LC and 4LC were located on the left center position as shown in figure 1.

cushions and armrest showed signs fire damage. The seat frame remained intact, with fire damage.

Photograph 7. Seat 1L frame.

2.2.1.2 Seat 2L

Seat 2L (photograph 8) was found in its original position on the aircraft attached to the seat tracks. Hanscom AFB Fire/Rescue cut all four seat posts to remove the seat. The seat cushions and armrest showed signs fire damage. The seat frame remained intact, with fire damage.

Photograph 8. Seat 2L.

2.2.1.3 Seat 3L

Seat 3L was found in its original position. The seat fabric and cushions were destroyed by fire. The seat frame was attached to the seat tracks. Hanscom AFB Fire/Rescue cut all four seat posts to remove the seat.

2.2.1.4 Seat 3LC

Seat 3LC was found in its original position. The seat fabric and cushions were destroyed by fire. The seat frame was attached to the seat tracks. Hanscom AFB Fire/Rescue cut all four seat posts to remove the seat.

2.2.1.5 Seat 4L

Seat 4L was found in its original position (photograph 9). The seat fabric and cushions were destroyed by fire. The seat frame was attached to the seat tracks. Hanscom AFB Fire/Rescue cut all four seat posts to remove the seat.

Photograph 9. Seat 4L frame outlined in red.

2.2.1.6 Seat 4LC

Seat 4LC was found in its original position (photograph10). The seat fabric and cushions were destroyed by fire. The seat frame was attached to the seat tracks. Hanscom AFB Fire/Rescue cut all four seat posts to remove the seat.

Photograph10. Seat 4LC frame.

2.2.1.7 Seat 5L

Seat 5L (photograph 11) was found in its original position on the aircraft. The seat cushions and armrest showed signs of fire damage. The seat frame remained intact and attached to the seat tracks, with fire damage.

Photograph 11. Seat 5L outlined in red.

2.2.1.8 Seat 6L

Seat 6L (photograph 12) was found in its original position on the aircraft. The seat cushions and armrest showed signs of fire damage. The seat frame remained intact and attached to the seat tracks, with fire damage.

Photograph 12. Seat 6L outlined in red and partially obstructed by burnt debris**.**

2.2.1.9 Divan 1R

Divan 1R (photograph 13) was found in its original position. The divan fabric and cushions were destroyed by fire. The divan frame was attached to the seat tracks.

Photograph 13. Divan 1R outlined in red.

2.2.1.10 Divan 2R

Divan 2R (photograph 14) was found in its original position on the aircraft. The seat cushions and armrest showed signs of fire damage. The seat frame remained intact and attached to the seat tracks, with fire damage.

Photograph 14. Divan 2R frame outlined in red.

2.2.2 Passenger Cabin Seat Restraints

The 14 passenger cabin seatbelts were all destroyed by fire. The 8 single passenger cabin seats were equipped with a 2-point lapbelt restraint, while the 2 divans were equipped with a 3-point seatbelts. Portions of the seatbelts were found within the wreckage, no data tags were identified. Of the 14 seatbelt buckles, three insert tabs, eight 2-point buckles and two 3-point buckles were recovered from the accident site.

2.2.3 Emergency Equipment

An automatic defibrillator, first aid kit, oxygen walk-around bottle and a bottle that resembled a 2.5 lb. fire extinguishing unit were identified near the forward entry closet. Figure 4 is an excerpt of the passenger information safety card showing the stowage locations of the emergency equipment on the accident airplane. The left cockpit seat oxygen mask compartment was found in the open position with the mask removed and lying in front of the seat (photograph 15). The right cockpit seat oxygen mask compartment was found closed and the mask was stowed. The remaining emergency equipment was not located at the accident site during the initial on-scene documentation.

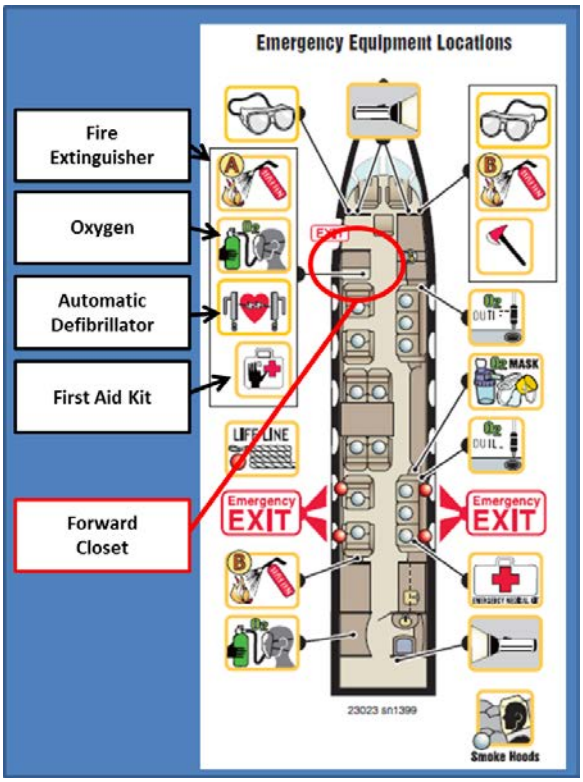


Figure 4. Excerpt from the passenger safety information card showing the emergency equipment location onboard the accident airplane.

Photograph 15. Left cockpit seat oxygen compartment.

2.2.4 Galley and Lavatory

The galley was located aft of the passenger cabin and divided by a cabin door. The lavatory was located aft of the galley and forward of the cargo compartment. The galley, lavatory and cargo compartment were heavily damaged by fire.

2.3 Doors and Overwing Exits

2.3.1 Main Entrance Door[5]

The main entrance door was a Type I exit, measuring 36 by 62 inches, and was located on the left side of fuselage, aft of the cockpit and forward of the wing leading edge. It was the primary access to the airplane. The door was hinged at the bottom and equipped with a folding stairway and handrails integrated into the interior of the door structure. The integrated stairway folded at mid-point, allowing the stairs to extend from the entranceway threshold to just above ground level (figure 5). The handrails unfold as the stairway extends, locking into position at full stairway extension. When in its closed position, interior controls to operate the door included a secondary latch release and main entrance door handle positioned approximately 58 inches above the door sill (photograph 16). The door is secured in the door frame by the movement of the inner or outer locking handles that position six bayonet-type fittings from the door into openings in the door frame. The bayonet fittings lock the door in place and close micro-switches within the door frame openings. The micro-switches provide electrical inputs to the door warning system. The micro-switches are connected in series so that each switch must be in the correct position in order to generate the proper signal.

Opening the door from the inside is a 2-handed operation requiring the lifting of the secondary latch release followed by pushing up on the main entrance door interior handle (photograph 17), before pushing the door open (the door is designed to then free fall open) as shown in the passenger safety information card (figure 6) From the outside of the airplane, the door is opened by first pressing the secondary latch release, which causes release of the main entrance door exterior handle so it can be lifted to unlock the door (photograph 18). The mechanical door latches and locks are interconnected within the door. This allows the respective interior and exterior handles to move together at the same time during door operation.

[5] Referenced from Gulfstream IV Operating Manual – Doors, 2A-52-20, pages 1-2 Rev 2/2007.

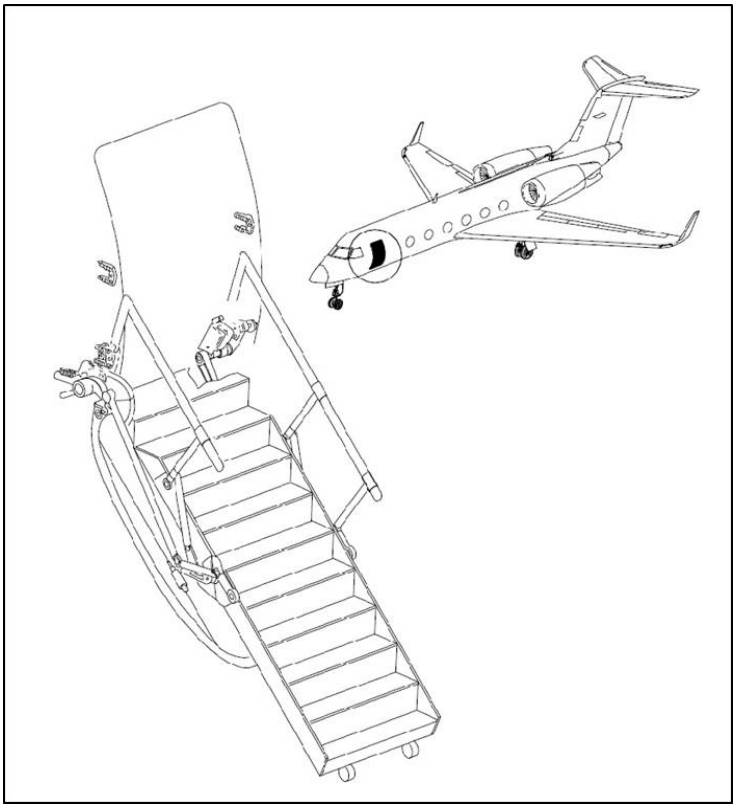
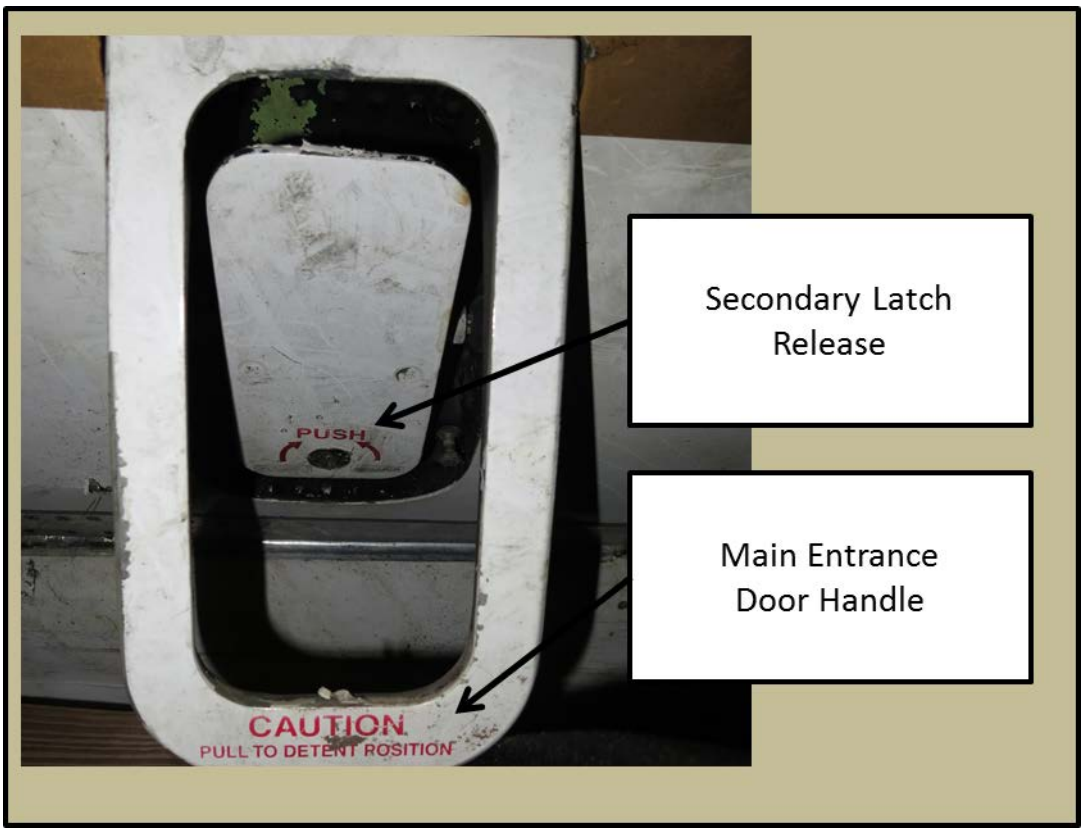


Figure 5. G-IV main entrance door and folding stairway.

Photograph 16. G-IV main entrance door interior handle and secondary latch release.

Photograph 17. G-IV main entrance door opening procedure.

Figure 6. Excerpt from the passenger safety information card showing main entrance door operation.



Photograph 18. G-IV main entrance door exterior handle.

The accident airplane's main entrance door remained closed during the accident sequence and post-crash fire. Recorded radio communications from Hanscom AFB Fire/Rescue indicated that Hanscom AFB firefighters first opened the main entrance door at 2351:42, about 2 hours and 11 minutes after the accident. According to firefighters' statements, a Halligan tool was used to depress the secondary latch release on the lower exterior door. Firefighters then pulled the handle open and the door free fell to a partially-opened position, (photograph 19) terrain obstructions prevented it from opening further.

Photograph 19. Main entrance door.

On July 21, 2014, the survival factors team examined the door at Anglin Aircraft Recovery Services in Clayton, DE. Members of the Gulfstream service engineering and a FBI Evidence Response Team from the Baltimore Field Office were also present. During recovery of the occupants the main entrance door stair had been fully extended and locked in place. As a result, to conduct the exam the door stair was unlocked and folded back into the stowed position to expose the door handle, locking lever and interior forward door stair cover. Gulfstream engineering used a lock release tool on the over-center latch to release the latch and allow the stair to rotate into the closed position (photograph 20). Once the over-center latch was released the stair folded back in alignment with the upper portion of the stair as designed. Further examination of the door locking mechanism showed that both inside and outside handles moved in unison as designed for door opening/closing operation. The FBI removed the interior main entry door handle and secondary latch release along with the main entry door stair cover and left cockpit seat oxygen mask from the accident airplane to examine for latent fingerprints. A letter (attachment 1) from the FBI dated September 2, 2014 stated the test resulted in negative findings for any latent fingerprints.

Photograph 20. Main entrance door stair folded at over center latch.

2.3.2 Emergency Overwing Exit Window[6]

The accident airplane was equipped with 4 Type III (equivalent) emergency overwing exit windows, 2 on the right side and 2 on the left side of the airplane. Three steps are required to operate the emergency overwing exit windows from the cabin: 1) remove the "Emergency Exit" cover from above the window; 2) pull the "T" handle down (figure 7); and 3) pull the window into the airplane. To open the overwing window exit from outside the airplane, An exterior handle for each overwing window exit is accessible through a panel beneath each exit; and placards (photograph 21) adjacent to the access panel provide instructions for access and handle rotation to open the corresponding overwing window exit.

[6] Referenced from Gulfstream IV Operating Manual – Doors, 2A-52-00, page 4 Rev 2/2007.

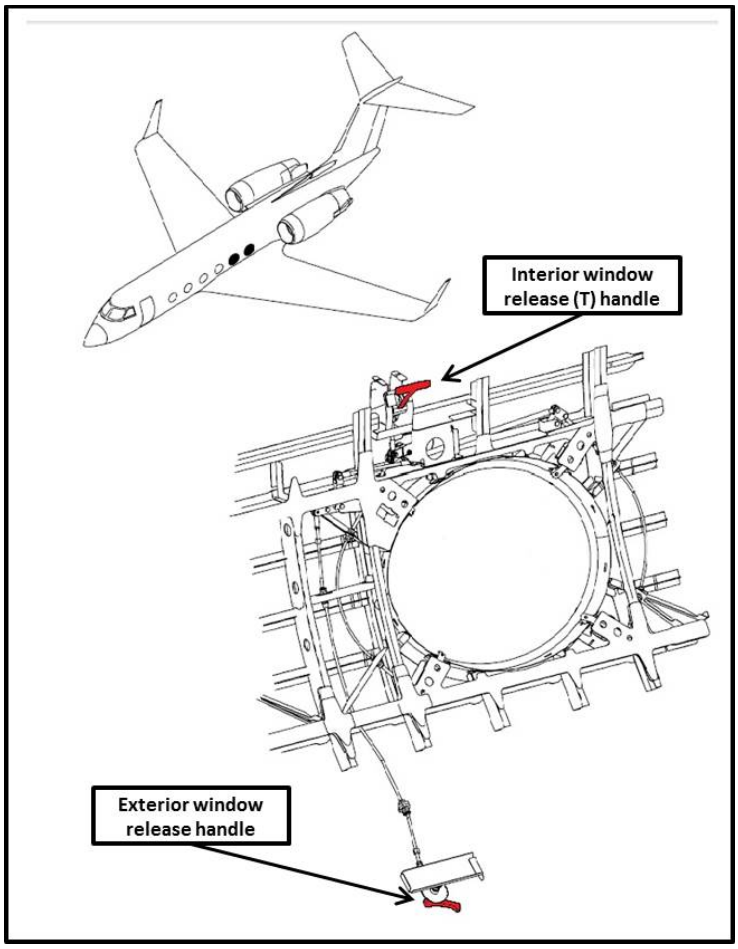


Figure 7. G-IV emergency overwing exit windows interior and exterior release handles.

Photograph 21. Emergency overwing exit window placard.

The left side emergency overwing exit windows were totally consumed by fire. The right side forward emergency overwing exit window was found locked in positon (photograph 22); and the right side aft emergency overwing exit window was mostly consumed by fire with ¼ of the bottom window frame remaining in position in the airplane's window plug hole opening (photograph 23).

Photograph 22. Right side forward emergency overwing exit window outlined in red.

Photograph 23. Right side aft emergency overwing exit windows (outlined in black) depicting the locking mechanism, window opening and remaining window exit frame.

2.3.3 Baggage Compartment Door

The baggage compartment, located in the aft part of the pressurized section of the fuselage, is accessible via an interior door in the passenger cabin, and through an exterior door fitted into the left side of the fuselage below the left engine pylon (figure 8). The exterior door opens inward and upward to provide access for loading and unloading baggage. Mechanically linked interior and exterior handles rotate to open the door. Like the main entrance door, the baggage compartment door is fitted with four bayonet-type plungers that lock the door and position micro-switches to provide the circuitry for door warning. The baggage door may be used as a supplementary emergency exit from the airplane since the baggage compartment is accessible from the cabin. The baggage compartment and door was destroyed by fire.

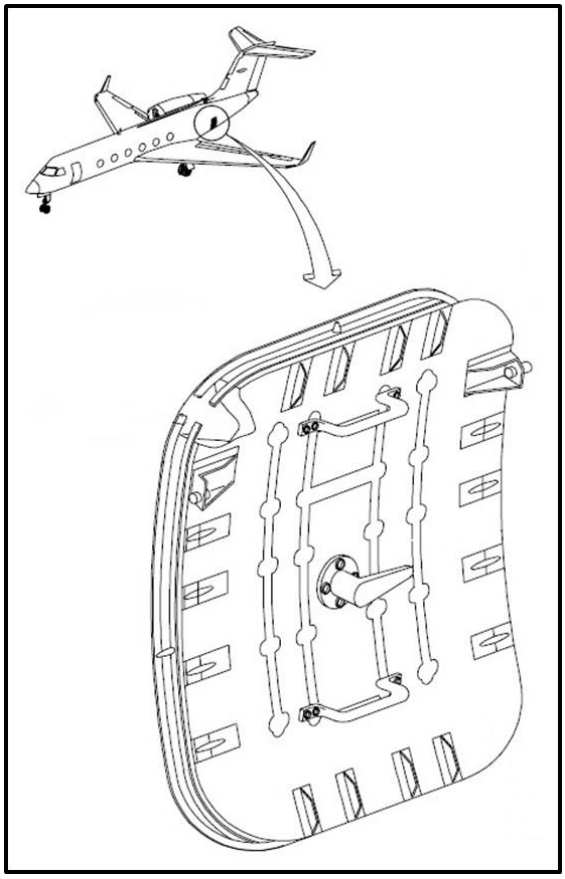


Figure 8. G-IV baggage compartment door.

3.0 Medical and Pathological Information

3.1 Fatalities

The accident airplane had a total of 7 occupants including 2 pilots, 1 flight attendant and 4 passengers. All occupants were fatally injured. Their injuries and cause of death for each occupant is shown in attachment 2. The Commonwealth of Massachusetts Chief Medical

Examiner's Office provided final autopsy reports for 5 of the 7 occupants.[7] The Commonwealth of Massachusetts State Police Forensic Services Group provided toxicological results for all of the occupants. In addition the NMS Lab of Willow Grove, PA performed toxicology testing for occupant E at the request of the medical examiner. The FAA Civil Aerospace Medical Institute's Bioaeronautical Sciences Research Laboratory performed additional toxicology testing for fatalities A and B. Results of the toxicology testing are described in attachment 3. Figure 9 shows the approximate location and orientation for each occupant.[8]

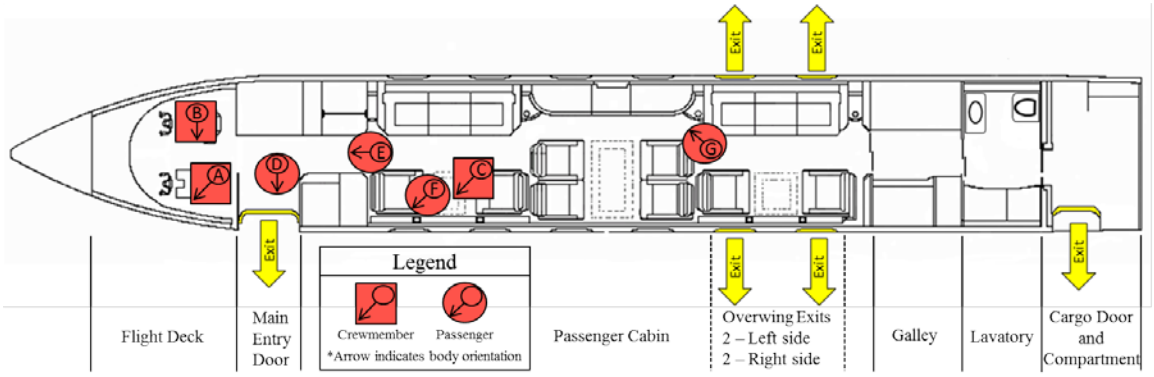


Figure 9. Occupant location and orientation.

4.0 Training

The accident flight was operated under 14 Code of Federal Regulations Part 91. SK Travel LLC[9] published a Flight Operation Manual (FOM) effective March 23, 2012. The FOM's organizational chart depicts the flight attendant as a direct report to the chief pilot / director of maintenance. Section 1.3.5 is referenced in the SK Travel FOM pages 1-5 & 1-6 and describes to whom the flight attendant reports, their responsibilities, duties and qualifications (attachment 4).

4.1 Flight Attendant Training

The SK Travel flight attendant attended Flight Safety's Corporate Cabin Attendant recurrent training course (attachment 5) at the Teterboro Learning Center and satisfactorily completed the training on August 13, 2013. The course consisted of a total of 15.5 total hours training including 11.5 hours of ground classroom training and 4.0 hours of airplane simulator training with door and overwing exit operation and evacuation drills. Table 2 lists the topics addressed in the classroom ground training and the airplane simulator training. Flight Safety provides each Corporate Flight Attendant with a handbook that provides guidance in emergency checklist, passenger briefings and crew duties.

[7] Two of the families objected to autopsies by the Commonwealth of Massachusetts Chief Medical Examiner's Office and only external
[8] Occupant location and orientation documented from survival factors group chairman's on scene photographs.
[9] SK Travel was the registered owner of the airplane.

Ground Classroom Training	Airplane Simulator Training
Decompression	Evacuation Scenario Drills
Aircraft Fires & Fire Fighting	Sea Survival Drills
Ditching & Survival Equipment	G550 Evacuation Crew Training
Hijacking & Security	Dassault Emergency Exit
Illness & Injury	Bombardier Emergency Exit
Emergency Equipment	Gulfstream Evacuation Training
Evacuation Procedures	G650 Evacuation Training
Accidents/Incidents	
CRM	
HAZMAT	
Review/Exam	
Surface Contamination	
G650 Evacuation Training	

Table 2. Flight attendant training curriculum.

4.2 Pilot Training

Both pilots attended Flight Safety International's recurrent training for Gulfstream GIV/G300/G400 Pilot. The left seat pilot attended training September 12 - 16, 2013. The right seat pilot attended training September 16 - 20, 2013. In Section 8 of the pilot ground training program for emergency procedures, item (c) Emergency Evacuation covers the main entry door and overwing exit operation. According to an email from Flight Safety center manager, the last time each pilot physically operated a training door was September 2011. Each pilot also operated the actual airplane door during normal airplane operations.

5.0 Airport

Laurence G. Hanscom Field (BED) is located 1.5 miles southwest of Bedford, Massachusetts at an elevation of 132 feet mean sea level (figure 9). The airport has an air traffic control tower (ATCT) with service from 0700-2300. The airport is certificated under Title 14 Code of Federal Regulations (CFR) Part 139, Class I, Index B aircraft rescue and firefighting (ARFF) capabilities[10].

BED runway 11 is grooved asphalt 7011 feet in length and 150 feet wide with a 0.1% gradient. At the end of the runway is a paved blast pad measuring 1039 feet in length and 200 feet in width; which is part of the runway safety area (RSA) measuring 1000 feet in length and 500 feet in width[11]. Runway 11 is marked as a precision instrument approach runway and

[10] CFR 139.315 (b)(2) determines an index B airport to include aircraft at least 90 feet but less than 126 feet in length. CRF 139.317 (b)(1) determines index B ARFF requirements to include one vehicle carrying at least 500 pounds of sodium-based dry chemical, Halon 1211, or clean agent and 1,500 gallons of water and the commensurate quantity of AFFF for foam production.
[11] RSA length dimensions taken from the Bedford Airport Certification Manual, section 5-1.

equipped with high-intensity runway edge lights (HIRL). A medium intensity approach lighting system with runway alignment indicator lights (MALSR) exists on the approach ends of both runway 11 and 29. A localizer antenna was located on the centerline approximately 1700 feet from the end of runway 11 (photograph 24). The BED airport is owned by Massachusetts Port Authority and overseen by a full-time director.

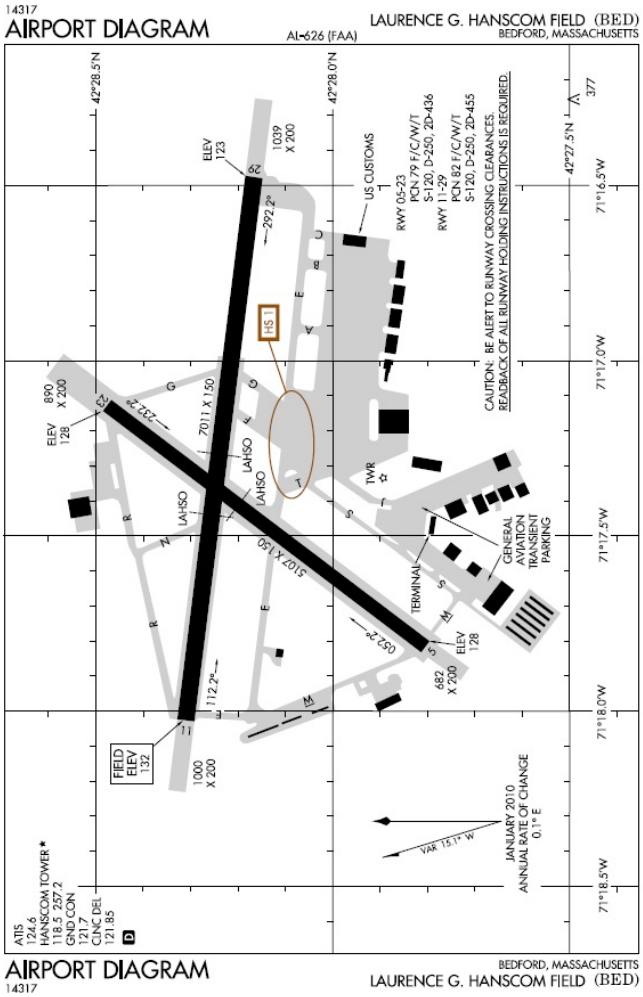


Figure 10. Laurence G. Hanscom Field (BED) airport diagram.

Photograph 24. Departure end of runway 11 BED.

As a result of the accident, part of the approach lighting system, localizer antenna and 39 sections of the airport perimeter fence were destroyed (photograph 25). The lighting system and localizer antenna were located between the runway safety area and perimeter fence and constructed with 2.5 inch aluminum poles, bolted to concrete pillars. The airport perimeter fence was replaced by the airport operator. The FAA replaced the localizer antenna and MALSR light stations with a new lightweight system, anchored with frangible bolts to new concrete pillars.

FAA Advisory Circular Airport Design AC-150/5300-13A sets the standards for RSA length determined by aircraft approach category (AAC) and airplane design group (ADG). The minimum approved RSA length is 240 feet while the maximum RSA is 1000 feet. An RSA is defined in AC-150/5300/13A as a surface surrounding the runway prepared or suitable for reducing the risk of damage to aircraft in the event of an undershoot, overshoot, or excursion from the runway. In FAA Advisory Circular Frangible Connections AC-150/5220-23 it states that equipment located in airfield safety areas (such as RSAs or taxi safety areas (TSAs) must be mounted on frangible supports to ensure the structure will break, distort, or yield in the event of an accidental impact by an aircraft. The lighting system, localizer antenna and perimeter fence are located outside the RSA on the departure end of runway 11 at BED. Although frangible bolts were not required by AC-150/5220-23 outside an RSA, the FAA field maintenance manager stationed at Bedford stated frangible bolts were used to attach each new component to enhance safety.

Photograph 25. Accident airplane path from runway 11 through airport perimeter fence.

5.1 DoD Contract

The Department of Defense (DoD) and the Federal Aviation Administration (FAA) have reached agreement on a process (attachment 6) that FAA inspectors will use to evaluate compliance with Part 139 ARFF requirements at airports where DoD provides DoD ARFF services. This process is necessary because DoD policy and Federal statute do not permit the FAA to inspect DoD controlled airfields or DoD ARFF facilities, equipment, and records at airports where the DoD provides ARFF services for civil Part 139 airports.

According to the FAA, airport operators must comply with each section of Part 139. Where a DoD ARFF unit provides the ARFF services, the civil airport operator is still responsible for ensuring compliance with Part 139 ARFF requirements. To help the airport operator show the FAA it meets these Part 139 requirements, the DoD and FAA have developed a process to assure the civil airport operator that the DoD ARFF services meet or exceed DoD and National Fire Protection Association standards. To develop this process, the DoD provided the FAA with its ARFF standards, training, and inspection standards and procedures for review. The FAA determined those standards and procedures are equivalent to the ARFF requirements in Part 139. Under the agreed-upon process, airport operators will receive documentation from their DoD ARFF providers every January to demonstrate compliance with the ARFF requirements.

In addition to the annual documentation, civil airport operators will also request that their DoD ARFF providers update this information prior to the civil operator's annual FAA safety inspection. According to the FAA, the civil airport operator must provide this documentation to the FAA Airport Certification Safety Inspector (ACSI) during the annual Part 139 inspection to demonstrate compliance with the ARFF requirements. The data provided will include: (1) A summary of the last annual self-inspection. This will focus on the ARFF requirements under Part 139; (2) The date and result of the last major outside inspection (i.e., Major command, staff, Inspector General, or Center for Public Safety Excellence); (3) An ARFF vehicle report that lists at least the type and status of all ARFF vehicles needed to satisfy the Part

139 requirements, but may list all ARFF vehicles; (4) A summary of training dates for specific items required under Part 139. This summary may be produced electronically from automated systems or prepared manually using a spreadsheet; (5) Additional information in accordance with the standard operating procedures.

According to the FAA, its inspectors review the documents provided for completeness and work with the civil airport operator to resolve any issue or concerns. FAA inspectors coordinate with the civil airport operator and not the DoD provider. All communication about ARFF services are between the DoD provider and the civil airport operator. The FAA inspectors will not inspect DoD vehicles, equipment, or facilities, nor will they conduct timed drills.

In a letter dated December 23, 2011 (attachment 7) the FAA provided Massport's airport director clarification of their responsibilities as the airport sponsor under Part 139. It stated that starting January 2012 the airport operators holding an FAA Airport Operating Certificate must comply with each section of the 14 CFR Part 139. The letter noted that although, the DoD unit provides the ARFF coverage at the airport, the airport sponsor is responsible for ensuring compliance with 14 CFR Part 139 ARFF requirements; and the airport sponsor would collect the required documents from the DoD and provide them to the FAA prior to their annual inspection. The letter stated that its clarifications did not change any current procedures or agreements the airport operators have with local DoD ARFF providers; and it only applies to the documentation that the airport sponsor must provide the FAA ACSI during the Part 139 inspection demonstrating ARFF compliance. The airport certificate holder (airport sponsor) is the liaison between the DoD ARFF provider and the FAA Part 139 inspector. All agreed upon correspondence per the contract between the DoD and FAA is delivered through the airport sponsor. Any discrepancy the FAA has with the Part 139 inspection is routed through the airport sponsor to the DoD provider and back to the FAA until a result agreed upon by all parties is achieved. Attachment 8 is the amendment to support agreement for ARFF services between Hanscom AFB and Massport Bedford.

5.2 FAA Part 139 Inspection

The airport's most recent FAA annual certification inspection occurred March 25 & 27 2014. BED provided copies of FAA inspections and Letters of Correction resulting from those inspections from March 2014. Discrepancies noted in the report were the failure to properly maintain taxiway markings and a safety recommendation was made that Massport consider paving a portion of the gravel roadway in the non-movement area. Massport paved that portion of the gravel roadway. Both items were resolved in August 2014.

5.3 Airport Required Exercise

Each Class I[12] certificate holder is required by CFR 139.325 to at least once every 12 consecutive calendar months review the Airport Emergency Plan (AEP) with all parties with whom the plan is coordinated and to every 36 months hold a full scale AEP exercise.

[12] Class I, II, and IV airports are those that currently hold Part 139 Airport Operating Certificates.

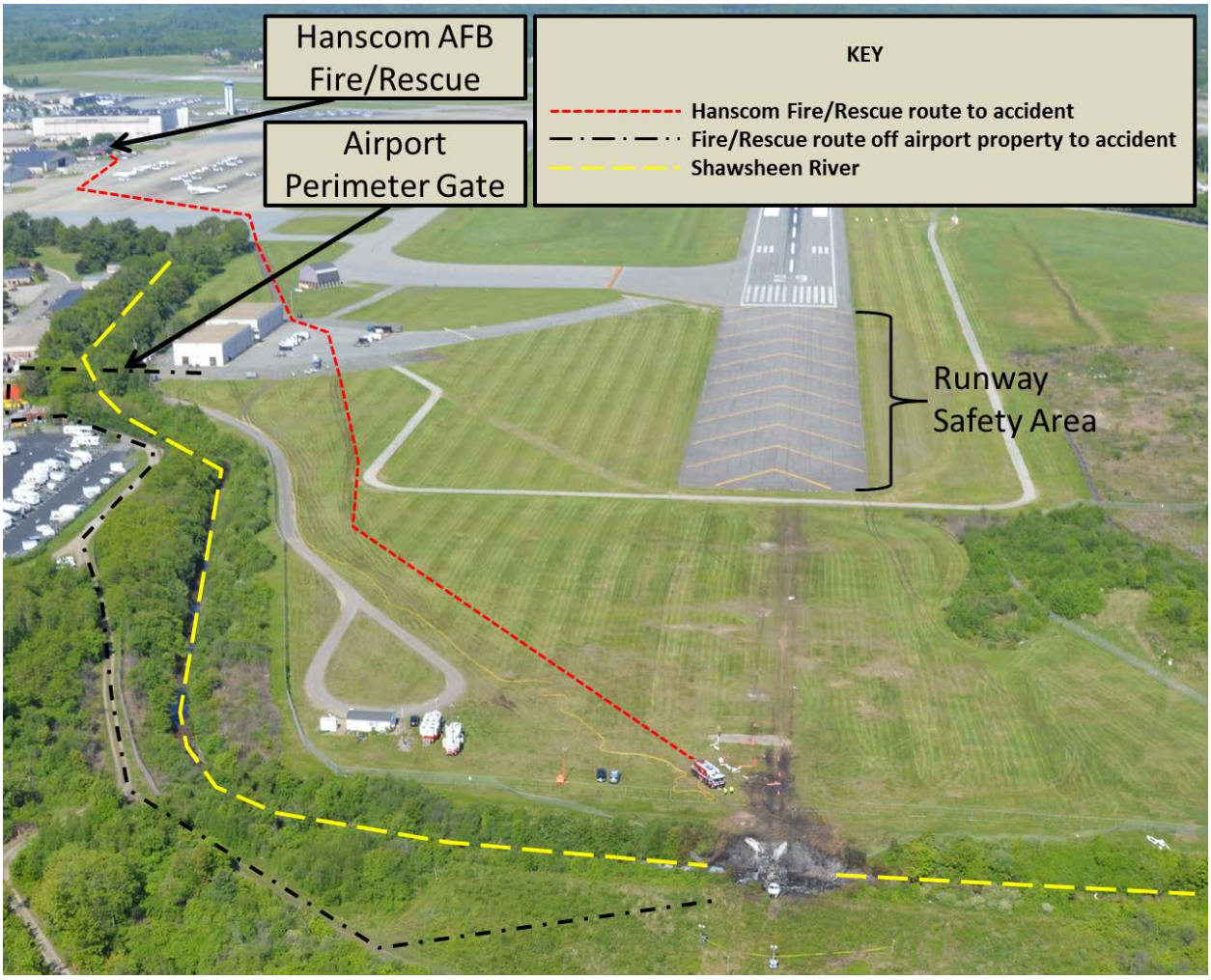
BED airport held its last two Triennial full scale exercises on June 7, 2011 and May 20, 2014. It reviewed the AEP with tabletop exercises on June 22, 2012 (attachment 9) and June 21, 2013.

The May 20, 2014 triennial exercise consisted of a scenario involving a Boeing 737 landing on runway 23 BED. In the exercise the airplane experienced a collapsed left main gear and subsequent skid to the departure end of runway 5. Fire erupted on the left side of the fuselage between door 1L and the wing. Some passengers self-evacuated while others were incapacitated. The exercise was confined to the airport property. According to the triennial exercise sign in sheet, 65 people attended the event, in addition to all parties with responsibilities under the AEP. The BED Massport airport manager of operations and maintenance stated in an email that due to the accident on May 31, 2014, a final report of the May 20, 2014 exercise had not been created.

6.0 Emergency Response

According to the Hanscom AFB Fire Chief the initial apparatus that responded to the May 31, 2014 accident was Rescue 3, Engine 4 and Crash 9 and Crash 10, followed by Engine 6, Tanker 7 and the foam trailer. Attachment 10 identifies all vehicles and personnel involved in the response. Each vehicle traveled approximately 4750 feet from the Hanscom AFB fire station to the accident site (photograph 26). Additional support for firefighting was supplied by mutual aid from the surrounding towns of Bedford, Lexington and Lincoln.

6.1 Fire/Rescue Emergency Response Route



Photograph 26. Fire/Rescue routes to the accident site.

6.2 Fire/Rescue Response Timeline

A timeline was constructed from the dispatch radio communications received from Hanscom AFB dispatcher, May 31, 2014 at 2140:23 thru June 1, 2014 0039:50 (attachment11).

6.3 Emergency Response Narrative

At 2140:23 on May 31, 2014 the Bedford ATCT initiated an alert 3 stating "Runway 11 crash crash crash…departure end of runway 11". At 2140:32 Hanscom AFB Fire/Rescue (AF) replied "fires on" and ATCT stated "crash departure end of runway 11". Eight seconds later AF replied "fire copies". ATCT called the AF back at 2140:58 and stated "all right you got that"

and AF replied “no I don’t have it, I haven’t heard a thing” ATCT then stated “departure end of 11, crash” and AF replied “copy, fire has it”.

At 2141:49, Rescue 3 reported leaving the station and about 3 seconds later reported there was fire and smoke in the air and visible fire near the FAA building. Upon arriving at the accident scene personnel from Rescue 3 conducted a primary search of the area up to the bank of the river for victims.

At 2142:56, Crash 10 reported leaving the station enroute to the crash site. About 1 minute later, the fire officer from Engine 4 reported that the airplane was on the other side of the airport perimeter fence and added, “we need that crash truck real quick.” About 2145:07 both Crash 10 and Crash 9 reported, “fighting the fire”. Firefighters on scene characterized the airplane as engulfed in flames on both sides of the Shawsheen River, with the tail of the airplane on the airport side of the river and the cockpit on the AF Base side of the river. According to personnel from Crash 10, when they arrived at the scene the truck was maneuvered to be in range of its roof turrets and it began applying agent on the fire. A firefighter in Crash 10 exited the truck and went to the edge of the ravine to assess the situation and yelled loudly to potential survivors but there was no response to his calls and he retreated back to the truck as minor secondary explosions were ongoing. Personnel on Crash 9 stated they applied agent to spot fires on the grass area on their way to the crash site and then applied foam to the main body of the fire until it was knocked down to a point where fire crews could get closer to the scene.

Efforts were needed to resupply the trucks with foam and water. For example, about 2207 Crash 9 reported it was out of foam and shut down; and about 2210 Crash 10 reported running out of water, “again.” Engine 4 was sent to the hydrant by the FAA building to lay a 1200 foot line to supply Tanker 7. During this period, at about 2208 it was reported that no water was being applied on the fire. About 2224 Crash 9 had been resupplied with water and firefighting operations resumed.

Hand lines had been deployed to fight the ground fire in the grass area that the airplane had passed through, the fire in the wooded area around the airplane, and also to apply additional foam to the airplane. According to personnel from Rescue 3 they worked with Rescue 32 to search closer to the airplane on the runway-side of the river, however they were not able to cross the river due to fire on the airplane and in the river. About 2212:44 command requested personnel at the scene to back away to the front of Crash 9 because of explosions in the water.

Mutual Aid from Bedford and Lincoln were requested to drive the length of the runway at 2226:17 searching for victims.

Numerous attempts by Hanscom, Lexington and Lincoln fire departments were made to put personnel and equipment on the other side of the river. At 2228:53 Engine 6 advised command that they, “will be going on the outside thru Hartwell to see if they can get on the backside of this aircraft”, but did not confirm if they made it the other side of the river. At 2243:59 the fire officer from Engine 4 relayed to command there was no way to gain entry to the cockpit because it was, “too steep debris in the way”. At 2319:09 Command advised that the Lexington ladder truck will attempt to use their ladder as a bridge over the river to gain access to

the cockpit. At 2322:47 the fire officer from Engine 4 reported Lexington Company on the opposite side of the ridge making their way down; and about 6 minutes later it was reported Lincoln fire was attempting to gain access to the cockpit. At 2331:33 Lexington requested assistance with entry into the cockpit from the fire officer from Engine 4. The fire officer from Engine 4 explained to command that he and a firefighter would need a vehicle to drive around to the cockpit. About 2340:40 the fire officer from Engine 4 arrived on the other side joining Lexington, and 6 minutes later he reported being at the nose of the airplane.

At 2351:04 it was reported on radio that the main entrance door was opened. According to the Engine 4 fire officer the door was opened using the pick head on a Halligan tool to depress the button on the door to access the handle; and after the handle was lifted he heard "all the dogs release" and the door opened freely.[13] The Engine 4 hand lineman wrote in a statement that, "[he] used the pick end of the [Halligan] tool to pop out the door handle. There was little to no resistance to lift up on the handle freeing the door locks."

At 00:39:50 firefighting / rescue operations ended.

6.4 Interviews and Statements

Attachment 12

E. LIST OF ATTACHMENTS

Attachment 1: FBI Finger Print Report
Attachment 2: Injury Chart and Occupant Location
Attachment 3: Pilot Toxicology Reports
Attachment 4: SK Travel Flight Operations Manual
Attachment 5: Flight Attendant Training Certificates
Attachment 6: DoD/FAA Agreement on Inspection of DoD Firefighters at Joint Use Airfields
Attachment 7: Dec 23, 2011 letter from FAA to Massport
Attachment 8: DoD / Massport contract for ARFF Service
Attachment 9: 2012 Airport Table Top Exercise
Attachment 10: Hanscom AFB ARFF Apparatus and Personnel
Attachment 11: ARFF Timeline
Attachment 12: Interviews and Statements

[13] In his written statement the Engine 4 fire officer stated, "I instructed my hand lineman to take a [Halligan] bar and put the pointed end against the silver dot and had the Lexington firefighter hit it with a flat axe."