



National Transportation Safety Board Aviation Accident Final Report

Location:	Baltimore, MD	Accident Number:	ERA15LA292
Date & Time:	07/23/2015, 2045 EDT	Registration:	N765A
Aircraft:	ISRAEL AIRCRAFT INDUSTRIES 1125 WESTWIND ASTRA	Aircraft Damage:	Substantial
Defining Event:	Dragged wing/rotor/float/other	Injuries:	7 None
Flight Conducted Under:	Part 91: General Aviation - Business		

Analysis

After the passengers boarded the airplane, the pilot monitoring closed the cabin door and stated that he visually checked that the main entry door was secure and locked. Throughout the start, taxi, and takeoff procedures the CABIN DOOR and CABIN DOOR SEAL lights were not illuminated. Then, immediately after takeoff, the flight crew identified that the CABIN DOOR, CABIN DOOR SEAL, and MASTER CAUTION lights were illuminated. During the return to the airport for landing, the main entry door opened. The crew subsequently declared an emergency and landed uneventfully. The airplane incurred substantial damage to the door and airframe during the landing; the passengers and crew were not injured.

Examination of the door and the locking mechanisms revealed that when the door was latched with the locking pin in the stirrup, the door was secured. However, when the locking pin was resting on the stirrup, and not in the stirrup, the CABIN DOOR warning light would not illuminate. The light would illuminate on the warning annunciator when the locking mechanism was pulled away from and not in contact with the stirrup. Furthermore, the self-locking air springs on the door did not function. Without the self-locking feature, the door lacked a secondary safety feature that could have prevented the accident. It is likely that when the pilot monitoring closed the cabin door, the locking pin rested on the stirrup and did not fully engage, and the pilot monitoring did not visually check that the locking mechanism was secure in the stirrup. Since the CABIN DOOR light would not illuminate if the locking pin was resting on the stirrup, the crew was not alerted to the unsecured position of the main entry door. According to maintenance records, the most recent inspection of the door and its locking mechanism was completed about one month before the accident. It could not be determined whether the failure of the air springs occurred before the most recent inspection and was not identified, or if the failure occurred after the inspection.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be:

The flight crew's failure to visually ensure that the cabin door locking pin was in place before takeoff.

Findings

Aircraft	Passenger/crew doors - Incorrect service/maintenance (Factor) Passenger/crew doors - Inadequate inspection (Factor) Passenger/crew doors - Not inspected (Cause)
Personnel issues	Lack of action - Flight crew (Cause)

Factual Information

HISTORY OF FLIGHT

On July 23, 2015, about 2045 eastern daylight time, an Israel Aircraft Industries 1125 Westwind Astra, N765A, returned to land at Baltimore-Washington International Thurgood Marshall Airport (BWI), Baltimore, Maryland, after the main entry door (MED) opened in flight. Both airline transport pilots and the five passengers were not injured. The airplane was registered to GMH Capital, LLC, and operated under the provisions of Title 14 *Code of Federal Regulations* Part 91, as a business flight. Visual meteorological conditions prevailed and an instrument flight rules flight plan was filed for the flight destined for Chicago Executive Airport (PWK), Chicago, Illinois. The flight was originating at the time of the accident.

According to the pilot monitoring (PM), after the passengers boarded the airplane he closed, locked, and visually checked to verify that the MED handle pin was engaged in the handle lock. He then proceeded to the cockpit in order to begin the flight. During the starting procedures, the red warning CABIN DOOR annunciator light remained extinguished. Furthermore, throughout the engine start, taxi, and takeoff, the red warning CABIN DOOR light, the amber CABIN DOOR SEAL caution light, and the MASTER CAUTION light remained off. Then, immediately after the airplane departed, the flight crew identified that the red CABIN DOOR light, amber CABIN DOOR SEAL, and MASTER CAUTION lights were illuminated. The PM requested to return to the airport. The pilot flying (PF) began to maneuver the airplane in order to return to the airport when the MED opened in flight. The flight crew declared an emergency; however, could not hear the air traffic controller's response due to the noise resulting from the open door. They were contacted through light gun signals and given clearance to land. Upon landing, the open MED contacted the runway, but remained attached to the door frame.

Examination of the airframe revealed that both the MED and the airframe structure surrounding it were substantially damaged during the accident sequence.

AIRCRAFT INFORMATION

According to Federal Aviation Administration records, the airplane was manufactured in 1986 and was registered to a corporation in 2013. The most recent continuous airworthiness inspection was a 1000-hour inspection, or "C" inspection, which was performed on June 22, 2015, at a total time of 8668.6 hours. During that inspection, a mechanic initialed that the "Passenger/Crew Door – Check" was performed.

According to the airplane maintenance manual, the MED was located on the left forward side of the airplane. The door was a semi-plug-type door, which was composed of 10 stop pins, locking cams, a mechanical stirrup, and a handle to secure it in place. The door rotated around two lower hinges and incorporated fixed boarding steps for access to cabin level. Door locking was achieved by superimposing a vertical translation in addition to the rotating movement of the hinges, thereby inserting 10 stop pins rigidly mounted on the door, 5 pins on each side of the door, into stop pads firmly anchored to the machined side frames of the airplane structure.

The locking movement also rotated two locking cams and would bring them against pads incorporated in the door frame. The cams prevented the door from being raised (unless the handle was rotated) and thus eliminated inadvertent opening of the door in case of mechanical failure of the door mechanism.

As the door was transitioned into the closed position, the pin on the handle would contact and displace the spring-loaded stirrup and as the pin slid by, it would release the stirrup allowing it to spring back into position, securing the handle in the closed position. Locking the handle in a "safe guarded" position protected against inadvertent raising of the handle and subsequent opening of the door. The spring-loaded stirrup mechanism had to be manually displaced before being capable of rotating the handle upward and subsequently unlocking the door. Once the airplane was pressurized, the stirrup mechanism could only be actuated when cabin pressurization fell, due to the pressure interlock mechanism. An additional safety measure of the MED handle locking mechanism was a set of air springs that provided a "self-locking" feature. The internal door handle was assisted to the locked position with the air springs. The air springs, as an over-centering device, would move the door handle into the locked position with the stirrup if it was released 10 to 15 degrees prior to contacting the stirrup. Furthermore, the air-springs were a maintenance item when performing the Passenger/Crew Door check.

There were 3 micro-switches that monitored the door's closed and locked position; the "seal pressure switch" which provided feedback to the amber DOOR SEAL annunciator, as well as the "door switch" and "door lock switch," which provided feedback to the red CABIN DOOR annunciator panel light. Should either switch toggle from locked to unlocked, the CABIN DOOR annunciator would illuminate.

The cockpit annunciator panel, located on the center of the instrument panel and consisted of 60 different notification lights arranged in 4 columns and 15 rows. The panel provided numerous system notifications to the crew. The CABIN DOOR annunciator light (colored red) was located in the second column of annunciator lights, in third row from the bottom. The CABIN DOOR SEAL annunciator light (colored amber) was located in the third column of lights, in the fourth row from the bottom.

PERSONNEL INFORMATION

The pilot flying held an airline transport pilot certificate with ratings for airplane single and multi-engine land, and type ratings for G-100, IA-1125, and IA-JET. The pilot's most recent first-class medical certificate was issued in September 2014. He reported 3,265 hours of total flight experience, 273 hours of which were in the accident airplane make and model.

The pilot monitoring held an airline transport pilot certificate for airplane single and multi-engine land, and type ratings for EMB-505, G-100, and an IA-1125. His most recent first-class medical certificate was issued in June 2015. He reported 5,724 hours of total flight experience, 182 hours of which were in the accident airplane make and model.

METEOROLOGICAL INFORMATION

At 2054, the recorded weather at BWI included calm wind, a few clouds at 6,000 feet, scattered clouds at 25,000 feet, 10 miles visibility, temperature 23 degrees C, dew point 13 degrees C, and an altimeter setting of 29.95 inches of mercury.

FLIGHT RECORDERS

The airplane was equipped with a cockpit voice recorder, which was retained and auditioned in the NTSB Vehicle Recorders Laboratory. Audition of the recorder revealed a series of events, consistent with the flight crews' statements. While taxiing, the pilot flying noted "cabin door is closed." Then while waiting to depart, the flight crew completed the before departure checklist and did not note any anomalies.

TESTS AND RESEARCH

The door was removed from the airplane and shipped to the manufacturer for further examination. A detailed examination of the door revealed that when the locking mechanism was engaged into the stirrup, the door remained secured and locked. However, the locking mechanism air-springs "self-locking" feature did not function when tested. The door locking handle could be released at any point in its travel and the handle would remain in place. The handle could be moved without effort, but the air-springs did not force the handle into the inner stirrup position. The air-springs were removed and exhibited no output forces or "spring" action that would contribute to "self-locking" feature of the door locking mechanism was noted. Furthermore, the original air-springs were replaced with mock-up air-springs and the "self-locking" feature of the door operated without anomaly.

In addition, the CABIN DOOR annunciator light switch and internal wiring were tested. There were no anomalies with the internal wiring that would have precluded normal operation prior to the accident. Operational checks of the switch found that the switch would deactivate, allowing the CABIN DOOR annunciator light to extinguish, when the locking mechanism was resting on the stirrup, however, was not fully engaged and locked. The switch would activate, illuminating the CABIN DOOR annunciator light, when the locking mechanism handle was pulled away from, and not in contact with the stirrup.

There were no anomalies with the door securing mechanism that would have precluded normal operation prior to the accident.

ADDITIONAL INFORMATION

According to the Airplane Flight Manual, in the Normal Procedures, the Before Taxiing checklist indicated that the pilots were to perform the following actions:

CABIN DOOR – CLOSED; "physically verify that two door locks and stops are in place and handle pin is latched and locked."

CABIN DOOR (red) light - OUT

According to the Quick Reference Handbook, it stated in the Before Taxiing Checklist:

CABIN DOORCLOSED

(Physically verify that two door locks and stops are in place and handle pin is latched and locked. Verify CABIN DOOR amber annunciator is out.)

According to the airplane Maintenance Manual, a 1000-hour inspection included the following items to be checked:

"Passenger/Crew Door – Check:"

Lock door from inside.

- Slowly release internal MED handle 10 – 15 degrees before locking position.
- Verify inner air-springs lock door automatically (self-locking).
- Ensure inner locking handle is locked and cannot be rotated unless stirrup is depressed.

"Door Warning System – Operational Test:"

- Verifies cabin door annunciation light extinguishes.
- Verifies cabin door seal annunciation light extinguishes.

"Passenger/Crew Door Microswitch – Adjustment/Test:"

- This procedure adjusts the microswitch with door closed but not locked down and latched.

History of Flight

Initial climb	Cabin safety event
Landing	Off-field or emergency landing
Landing-landing roll	Dragged wing/rotor/float/other (Defining event)

Co-Pilot Information

Certificate:	Airline Transport	Age:	39, Male
Airplane Rating(s):	Multi-engine Land; Single-engine Land	Seat Occupied:	Right
Other Aircraft Rating(s):	None	Restraint Used:	4-point
Instrument Rating(s):	None	Second Pilot Present:	Yes
Instructor Rating(s):	Airplane Multi-engine; Airplane Single-engine; Instrument Airplane	Toxicology Performed:	No
Medical Certification:	Class 1 With Waivers/Limitations	Last FAA Medical Exam:	06/24/2015
Occupational Pilot:	Yes	Last Flight Review or Equivalent:	07/21/2015
Flight Time:	5724 hours (Total, all aircraft), 182 hours (Total, this make and model), 4956 hours (Pilot In Command, all aircraft), 72 hours (Last 90 days, all aircraft), 32 hours (Last 30 days, all aircraft), 2 hours (Last 24 hours, all aircraft)		

Pilot Information

Certificate:	Airline Transport	Age:	28, Male
Airplane Rating(s):	Multi-engine Land; Single-engine Land	Seat Occupied:	Left
Other Aircraft Rating(s):	None	Restraint Used:	4-point
Instrument Rating(s):	Airplane	Second Pilot Present:	Yes
Instructor Rating(s):	Airplane Multi-engine; Airplane Single-engine; Instrument Airplane	Toxicology Performed:	No
Medical Certification:	Class 1 With Waivers/Limitations	Last FAA Medical Exam:	09/23/2014
Occupational Pilot:	Yes	Last Flight Review or Equivalent:	07/21/2015
Flight Time:	3265 hours (Total, all aircraft), 273 hours (Total, this make and model), 2758 hours (Pilot In Command, all aircraft), 106 hours (Last 90 days, all aircraft), 45 hours (Last 30 days, all aircraft), 2 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Manufacturer:	ISRAEL AIRCRAFT INDUSTRIES	Registration:	N765A
Model/Series:	1125 WESTWIND ASTRA	Aircraft Category:	Airplane
Year of Manufacture:	1986	Amateur Built:	No
Airworthiness Certificate:	Transport	Serial Number:	011
Landing Gear Type:	Retractable - Tricycle	Seats:	10
Date/Type of Last Inspection:	06/22/2015, Continuous Airworthiness	Certified Max Gross Wt.:	25000 lbs
Time Since Last Inspection:		Engines:	2 Turbo Fan
Airframe Total Time:	8668.6 Hours as of last inspection	Engine Manufacturer:	Honeywell
ELT:	C91A installed, not activated	Engine Model/Series:	TFE-731-3C-20
Registered Owner:	GMH CAPITAL LLC	Rated Power:	3700 lbs
Operator:	Mountain Air Services LLC	Operating Certificate(s) Held:	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual Conditions	Condition of Light:	Dusk
Observation Facility, Elevation:	BWI, 155 ft msl	Observation Time:	2054 EDT
Distance from Accident Site:	1 Nautical Miles	Direction from Accident Site:	231°
Lowest Cloud Condition:	Few / 6000 ft agl	Temperature/Dew Point:	23°C / 13°C
Lowest Ceiling:	None	Visibility	10 Miles
Wind Speed/Gusts, Direction:	Calm	Visibility (RVR):	
Altimeter Setting:	29.95 inches Hg	Visibility (RVV):	
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Baltimore, MD (BWI)	Type of Flight Plan Filed:	IFR
Destination:	CHICAGO, IL (PWK)	Type of Clearance:	IFR
Departure Time:	2045 EDT	Type of Airspace:	

Airport Information

Airport:	BALTIMORE/WASHINGTON INTL THUR (BWI)	Runway Surface Type:	Asphalt
Airport Elevation:	143 ft	Runway Surface Condition:	Dry
Runway Used:	28	IFR Approach:	ILS; Visual
Runway Length/Width:	10502 ft / 199 ft	VFR Approach/Landing:	Forced Landing

Wreckage and Impact Information

Crew Injuries:	2 None	Aircraft Damage:	Substantial
Passenger Injuries:	5 None	Aircraft Fire:	None
Ground Injuries:	N/A	Aircraft Explosion:	None
Total Injuries:	7 None	Latitude, Longitude:	39.174167, -76.671389 (est)

Administrative Information

Investigator In Charge (IIC):	Heidi Moats	Adopted Date:	01/25/2018
Additional Participating Persons:	Karl Tubbs; FAA/FSDO; Baltimore, MD Kimberly Lascell; Gulfstream Aerospace; Savannah, GA		
Publish Date:	01/25/2018		
Note:	The NTSB did not travel to the scene of this accident.		
Investigation Docket:	http://dms.nts.gov/pubdms/search/dockList.cfm?mKey=91684		

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