Aviation Investigation Final Report

Location:	Huntsville, Alabama	**Accident Number:**	ERA14FA300
Date & Time:	June 18, 2014, 14:24 Local	**Registration:**	N793BG
Aircraft:	ISRAEL AIRCRAFT INDUSTRIES 1124A	**Aircraft Damage:**	Destroyed
Defining Event:	Miscellaneous/other	**Injuries:**	3 Fatal
Flight Conducted Under:	Part 91: General aviation - Other work use		

Analysis

A pilot proficiency examiner (PPE) was using the airplane to conduct a pilot-in-command (PIC) proficiency check for two company pilots. Before the accident flight, one of the two company pilots on board received a PIC proficiency check, which terminated with a full-stop landing and reverse thrust application; no discrepancies with either thrust reverser were discussed by either flight crewmember. The pilot being examined then left the cockpit, and the accident pilot positioned himself in the left front seat while the PPE remained in the right front seat. The flight crew then taxied to the approach end of the runway to begin another flight.

Data from the enhanced ground proximity system (EGPWS) revealed that, the flight began the takeoff roll with the flaps retracted, the thrust reversers armed, and both engines stabilized at 96 percent N2. About 2 seconds later, the cockpit voice recorder (CVR) recorded the "V1" call while on the airplane was on the runway; acoustic analysis indicated that the N2 speed of one engine, likely the right, decreased; the N2 speed of the other engine remained constant. This decrease in N2 speed was consistent with the PPE retarding right engine thrust to flight idle with the intent of simulating an engine failure. The takeoff continued, and, while the airplane was in a wings-level climb at an airspeed of 148 knots about 18 ft radar altitude, the CVR recorded the pilot command that the landing gear be retracted. The landing gear remained extended, and, about 1 second after the command to retract the landing gear, or about 3 seconds after becoming airborne, while about 33 ft above the runway and at the highest recorded airspeed of 149 knots, the CVR recorded the beginning of a rattling sound, which was consistent with the deployment of the right thrust reverser, and it continued to the end of the recording.

About 1.5 seconds after the rattling sound began, the CVR recorded the PPE asking, "…what happened," which indicates that the deployment was likely not annunciated in the cockpit. The right engine N2 speed continued to gradually decrease, and the airplane rolled slightly left, back to a wings-level position. The airplane continued climbing with the landing gear extended as pitch changes continued to occur. During this time, the flight crew exchanged comments about their lack of

understanding about what was occurring. While flying 10 knots above V2 speed with the left engine N2 speed remaining steady and the right engine N2 speed decreasing at a slightly greater rate than previously, the airplane began a right roll with a corresponding steady decrease in airspeed from about 144 knots. About 9 seconds after the original call to retract the landing gear, the CVR recorded the PPE requesting that the landing gear be retracted, which occurred 1 second later. The airplane then continued in the right turn with the airspeed steadily decreasing, and about 11 seconds after the PPE asked "…what happened", the EGPWS sounded a bank angle alert. At that time, the airplane was in a right roll of about 30 degrees, and the airspeed was about 132 knots. The right roll continued to a maximum value of about 39 degrees, which was the last valid bank angle value recorded.

The airplane impacted the ground off the right side of the runway in a nose- and right-wing-low attitude. The landing gear and flaps were retracted, and there was no evidence of preimpact failure or malfunction of the flight controls for roll, pitch, and yaw; nor was there any evidence of a mechanical failure or malfunction of either engine. A definitive reason for the deployment of the right thrust reverser could not be determined. No previous instances of inadvertent in-flight thrust reverser deployment were documented by the operator of the accident airplane or by the airframe manufacturer for the accident airplane make and model.

Certification flight testing of an airplane with the same thrust reverser system determined that the airplane remained controllable with the right thrust reverser deployed and throttle retarder system functioning. The flight testing also included application of a momentary, peak burst of right engine thrust, again with no controllability issues noted. It was also noted that with the installed throttle retarder system, in the event of inadvertent thrust reverser deployment, that the engine's thrust should have been reduced to idle within 4 to 8 seconds. Acoustic analysis of the accident flight indicated that the lowest recorded N2 rpm value was about 84 percent and that the reduction in rpm occurred over a period of about 8.5 seconds, after the right thrust reverser deployed. No determination could be made as to why the throttle retarder system did not reduce the right engine thrust to flight idle as designed. Additionally, no determination could be made as to why the flight crew was not able to maintain directional control of the airplane following deployment of the right thrust reverser.

Although the PPE had severe coronary artery disease, which placed him at risk for an acute coronary event that would cause symptoms like chest pain, shortness of breath, or sudden unconsciousness, the CVR recorded no evidence of impairment. Neither the heart disease nor the medications he was taking to treat it would have impaired his judgement or physical functioning. Therefore, it is unlikely any medical condition or substance contributed to the PPE's actions. Additionally, there was no evidence that any medical condition would have impaired judgement or physical functioning of the pilot being examined.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The flight crew's inability to maintain airplane control during initial climb following deployment

of the right thrust reverser for reasons that could not be determined because postaccident examination of the airframe and engine thrust reverser system did not reveal any anomalies. Contributing to the accident was the excessive thrust from the right engine with the thrust reverser deployed for reasons that could not be determined during postaccident examinations and testing.

Findings

Aircraft	(general) - Malfunction
Not determined	(general) - Unknown/Not determined
Aircraft	Lateral/bank control - Not attained/maintained
Not determined	(general) - Unknown/Not determined

Factual Information

History of Flight

Takeoff	Miscellaneous/other (Defining event)
Initial climb	Loss of control in flight
Uncontrolled descent	Collision with terr/obj (non-CFIT)
Post-impact	Fire/smoke (post-impact)

On June 18, 2014, about 1424 central daylight time, an Israel Aircraft Industries (IAI) 1124A, N793BG, impacted terrain during an attempted takeoff from Huntsville International Airport-Carl T. Jones Field (HSV), Huntsville, Alabama. The FAA-authorized Pilot Proficiency Examiner (PPE), airline transport rated pilot, and airline transport pilot-rated passenger were fatally injured. The airplane was destroyed by impact forces and a post-crash fire. The airplane was registered to and operated by SynFuels Holdings Finance LLC, under the provisions of 14 Code of Federal Regulations (CFR) Part 91 as a pilot proficiency check flight. Visual meteorological conditions prevailed at the time and no flight plan was filed for the flight, which was originating at the time of the accident.

According to the company's Chief Pilot, the purpose of the flights that day was to conduct pilot-in-command (PIC) proficiency checks for two company contract pilots, as required by 14 CFR Part 61.58.

Earlier that day, the flight departed from Birmingham-Shuttlesworth International Airport (BHM), Birmingham, Alabama, for a proficiency check of one pilot. After takeoff, airwork was performed for about 30 to 45 minutes, followed by instrument airwork. The flight was then vectored for an instrument landing system (ILS) approach to runway 18 right at HSV, which terminated with a landing and subsequent increased noise that was recorded by the cockpit voice recorder (CVR). After landing the CVR recorded the sound of two "click clacks," similar to stowing the piggy back levers of the thrust reversers, followed by a discussion by the flight crew about the aircraft's brakes.

The CVR recorded the PPE advising the ground controller at 1415:06, that they were "…going back for another [stammer] round." The ground controller issued taxi instructions, but at 1415:18, the CVR recorded the PPE advising the ground controller they wanted to stop on the taxiway to change pilots. The controller informed the flight crew where to position their airplane and while taxiing, the CVR recorded more conversation between the PPE and pilot about the brake system. The airplane was brought to a stop, and at 1417:57, the CVR recorded the PPE's request to let the other pilot into the cockpit. The CVR recorded multiple sounds including those from seatbelt usage consistent with a pilot change, and at 1419:16, the CVR recorded the PPE stating, "okay. call it one-twenty. ah one-eighteen one twenty one, and ah one-seventy five", to which the new pilot responded, "all…alright [stammering]." The CVR recorded the PPE stating that the V2 speed would be 121 knots, and at 1419:58, the PPE advised the ground controller that they were taxiing. The flight crew was advised by the controller to contact the tower when ready, and at 1420:19, the PPE stated, "before takeoff check. I got it right here." The PPE indicated the airspeed bugs were set, the lift dumps are off, reversers are on, annunciator panel was clear, engine anti-ice and windshield heat are on with the simultaneous sound of

two clicks, and battery with the sound of a click and press. The PPE then stated "line up check" followed by, "we got the. the ignition. pitot heat's on. ignition's on, and ah…" followed by, "and the ah [sound of click] the reversers will be armed." The PPE advised the pilot that they will be ready at the end when he was ready, to which he replied in the affirmative.

The CVR recorded the PPE asking the pilot if he wanted to perform instrument approaches to start, or perform airwork first, to which he replied, "oh whatever you think. ah." The PPE then told the pilot they would perform instrument approaches first, to which the pilot replied "okay. that'll be fine." The pilot asked the PPE how to get the heading bug over followed by, "well okay. we've got flaps and", but the PPE indicated, "checklist is completed. except for the ignition and the arming of the reversers." The then stated, "okay. we're ready for takeoff I guess" to which the PPE replied "alright." The PPE then told the pilot to "pull up here and stop."

At 1422:33, the CVR recorded the PPE advised the local controller that they were ready to depart and that they wanted to perform instrument approaches before departing the area. The controller asked the flight crew to confirm they wanted to execute a couple ILS approaches, to which the PPE replied, "…we want two ILS's and then we'll depart back towards uhm Birmingham." About 1423, the controller cleared the flight for takeoff runway 18R, and provided the wind as from 280 at 5 knots, which was acknowledged by the PPE. At 1423:11, the CVR recorded the sound of multiple clicks over the next 7 seconds, and a comment from the pilot that, "…lights coming on."

Airport security video depicted the airplane taxiing onto the runway at the approach end of runway 18R, and beginning the takeoff roll; the video clearly depicted the left side of the airplane during the takeoff roll. The CVR recorded a sound of increased noise similar to engine power increasing, followed by multiple thumps similar to the nose wheel travelling over runway centerline lighting. At 1423:51, the CVR recorded the pilot stating, "airpseed's alive, followed by the PPE stating, "(split) power," followed by the pilot indicating, "power's set." At 1423:57, the CVR recorded the PPE call out 80 knots, and about 1 second later, acoustic analysis of the CVR recording indicated that both engines' N2 readings stabilized at 96 percent. About 1424:04, the PPE called, "v-one rotate", and according to data from the Enhanced Ground Proximity Warning System (EGPWS), the airplane had reached 118 knots calibrated airspeed (KCAS). At that point the airplane was about 2,051 feet down the runway and slightly right of runway centerline. About 1424:07, while on the ground at about 130 KCAS, acoustic analysis indicateed a divergence of N2 speeds, though it could not be conclusively determined whether the left or right engine N2 rpm was decreasing. It was noted that the opposite N2 speed remained nearly stable for the remainder of the recording.

Data from the EGPWS indicated the airplane accelerated to about 135 KCAS when a change in radio altimeter at about 1424:09 depicted a climb and the acoustic analysis indicated the N2 speed of one engine continued to decrease. The air traffic controller who cleared the flight for takeoff later reported seeing the airplane rotate about half way down the runway. While climbing 18 feet above the runway and 148 KCAS, at 1424:11, the CVR the pilot commanded gear-up. Less than 1second later, about 1424:11.8, while at 149 KCAS (the highest recorded airspeed by the EGPWS) and 33 feet radio altitude in a wings level attitude, the CVR recorded a rattling sound beginning which continued until the end of the recording. Acoustic analysis of the sound indicated it was consistent with thrust reverser deployment. At 1424:13.3, while in a left bank of 0.7 degrees and 147 KCAS at 53 feet, the PPE asked what happened, followed by a peak in background noise increase about 1.5 seconds later. At that same

time the acoustic analysis indicated one engine was operating at 96 percent N2, and the other engine had decreased to 92 percent N2. The CVR recorded the pilot exclaim, "…ohh-hh" followed by a slight decrease in background noise.

The controller who cleared the flight to takeoff stated that when the flight was about 50 feet above ground level, he noted, "…the airplane's right wing [dipped] a little but the pilot seemed to correct the airplane." About 11 seconds after the first EGPWS recorded data point, or about 1424:16, a right roll of 0.7 degree was noted; the airplane at that time was 83 feet above the runway centerline about 4,650 feet down the runway at 142 KCAS. At 1424:17.7, while at 88 feet flying at 139 KCAS, in a 7 degree right bank with the landing gear extended, with one engine at about 96 percent N2 and the other engine at about 91 percent N2, the pilot to asked, "what'd you do. what happened (to us)", to which the PPE replied in a strained voice, "I don't know." The airplane continued to climb while drifting to the right of the runway centerline.

At 1424:20.2, one engine was operating at about 96 percent N2 and the other engine was operating at about 84 percent N2, while at 104 feet and a right bank of 8.4 degrees at 137 KCAS. Due to the level of ambient noise, no further analysis of the decelerating engine and its N2 speed could be performed. At this time the PPE to indicated in a strained voice to get the gear up; the EGPWS data indicated the landing gear was retracted 1 second later. The airplane climbed to a maximum altitude of 108 feet while drifting to the right, and then 1 second later while at 1424:22, the flight was over the western edge of the runway at 107.5 feet in a 20-degree right bank, flying at 132 KCAS with one engine indicating 96 percent N2. The right bank angle continued to increase from this point to the end of the EGPWS recorded data, while slight airspeed variation occurred.

At 1424:24.5, while west of the western edge of the runway in a right bank of 26 degrees at 132 KCAS and about 86 feet, the CVR recorded a bank angle warning. About 1 second later, the background noise was noted to increase until the end of the recording, and the second to last data point of the EGPWS depicted a right roll value of 38.7 degrees, while the last data point depicted the pitch as negative 9.1 degrees. At 1424:26.9, the CVR recorded another bank angle warning, followed about 1.5 seconds later by the sound of impact.

There were no distress calls made by any occupant of the airplane. The controller who witnessed the impact called an Alert 3.

Witnesses on the airport reported seeing the airplane climb to altitudes estimated between 50 and 200 feet above ground level (agl), with the landing gear retracted. Both flight crewmembers of an airline flight that was on final approach to runway 18R later reported seeing the airplane climb steeply after becoming airborne, then observed the airplane rolling to the right. The first officer (F/O) of the airline flight (pilot not flying) reported the right bank angle was between 70 and 90 degrees. By all witness accounts, the airplane was observed to roll to the right to about a 90-degree right bank, and impact west of the runway. The F/O of the airline flight also reported the airplane impacted the ground with the right wing first while in a 45 degree nose-low attitude. He immediately saw black smoke, and a billowing cloud of dust, smoke and flames. First responders responded to the accident site and extinguished the fire.

Flight instructor Information

Certificate:	Airline transport; Commercial; Flight instructor	**Age:**	70,Male
Airplane Rating(s):	Single-engine land; Single-engine sea; Multi-engine land	**Seat Occupied:**	Unknown
Other Aircraft Rating(s):	Glider; Helicopter	**Restraint Used:**	Unknown
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):	Airplane multi-engine; Airplane single-engine; Instrument airplane	**Toxicology Performed:**	Yes
Medical Certification:	Class 2 With waivers/limitations	**Last FAA Medical Exam:**	November 11, 2013
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	April 18, 2013
Flight Time:	28421 hours (Total, all aircraft), 1816 hours (Total, this make and model)		

Pilot Information

Certificate:	Airline transport; Commercial	**Age:**	68,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Unknown
Other Aircraft Rating(s):	None	**Restraint Used:**	Unknown
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 2 With waivers/limitations	**Last FAA Medical Exam:**	July 1, 2013
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	May 28, 2013
Flight Time:	20200 hours (Total, all aircraft), 850 hours (Total, this make and model), 25 hours (Last 90 days, all aircraft), 10 hours (Last 30 days, all aircraft)		

The PPE, age 70, held an airline transport pilot (ATP) certificate with airplane single and multi-engine land, airplane single engine sea ratings, with type ratings in 25 different make and model aircraft including the IA-JET, which was the type designation for the accident airplane make and model airplane, as well as for the Aero Commander 1121 Jet Commander and Commodore Jet 1123. He last obtained a type rating in an IA-1125 (IAI Astra) on April 18, 2013. He held a commercial pilot certificate with glider and rotorcraft helicopter ratings, and a flight instructor certificate with airplane single and multi-engine, and instrument airplane ratings. He also held a ground instructor certificate with basic rating, and an mechanic certificate with airframe and powerplant ratings. He held a second-class medical certificate issued November 11, 2013, with a limitation, "Must wear corrective lenses." On the application for this last medical certificate, he listed a total flight time of 20,000 flight hours, and he weighed 225 pounds.

Review of the PPE's FAA Blue Ribbon airman file, revealed he obtained type ratings in AC-1121 and CJ 1123 airplanes (current type designation IA-JET) at the commercial pilot level on the same day in January 1975. A review of the application for the add-on ratings indicated at that time he had 2,000 flight hours as pilot-in-command. On July 30, 1986, he obtained an airline transport pilot certificate with airplane multi-engine land rating, and also type designation IA-JET. On the application for the rating he

indicated having 3,500 hours in that make and model aircraft.

According to information from the PPE's website, obtained the day of the accident, he listed a total flight time of 28,421 hours, 14,830 hours in multi-engine turbo propeller and jet aircraft, and 1,816 hours in IA-JET aircraft.

The PPE was designated as an Orlando, Florida FAA Flight Standards District Office (FSDO), Pilot Proficiency Examiner on February 1, 1999. As part of the recent renewal of designation process, an annual briefing and observation were required. According to documents from the Orlando FSDO, the PPE's annual observation check performed on July 24, 2013, and resulted in a disapproval with resulting suspension of his PPE. On August 28, 2013, he was retested, approved, and his PPE privileges were restored. According to the program manager, the PPE was unfamiliar with the avionics package of the aircraft used for the July 2013 test. His most recent Certificate of Authority Letter (COA) from the Orlando FSDO Manager was issued February 24, 2014; the letter indicated he was authorized to act as PPE in 7 different airplanes, including the IA-JET.

The pilot, age 68, held an ATP certificate with airplane multi-engine land rating. He also held a commercial pilot certificate with airplane single engine land rating. At the ATP level, he was type rated in 9 different make and model aircraft including IA-JET. He also held a flight instructor certificate with airplane single and multi-engine, instrument airplane. He held a second-class medical certificate with a limitation, "Must wear corrective lenses" issued on July 1, 2013. On the application for this most-recent medical certificate he listed 19,900 flight hours, and he weighed 165 pounds. There was no record of enforcements, accidents, or incidents. His last recurrent ground and flight testing in an Israel Aircraft Industries (IAI) 1124A (Westwind II) occurred on May 28, 2013; the training was performed by the same PPE.

Review of the pilot's FAA Blue Ribbon airman file, revealed he obtained type rating in AC-1121 (current type designation IA-JET) at the airline transport pilot level in June 1988.

The operator's chief pilot, who had flown the airplane since 2003, reported that he had been given PIC proficiency checks by the accident PPE, in the accident airplane. During those flights the PPE would be seated in the right seat. In his experiences, the PPE would give an engine cut after V1 speed was attained, when the flight was in a positive rate of climb either between 10 to 15 feet agl, or 20 to 30 feet agl. During those times, he would ease the thrust lever back. The chief pilot reported to an FAA inspector that the PPE would reach down to raise the landing gear, and then would retard the right thrust lever. He also indicated that since owning the airplane, there have been no issues with the thrust reverser system of either engine.

Aircraft and Owner/Operator Information

Aircraft Make:	ISRAEL AIRCRAFT INDUSTRIES	**Registration:**	N793BG
Model/Series:	1124A	**Aircraft Category:**	Airplane
Year of Manufacture:	1983	**Amateur Built:**	
Airworthiness Certificate:	Transport	**Serial Number:**	392
Landing Gear Type:	Retractable - Tricycle	**Seats:**	11
Date/Type of Last Inspection:	July 22, 2013 Continuous airworthiness	**Certified Max Gross Wt.:**	23500 lbs
Time Since Last Inspection:		**Engines:**	2 Turbo fan
Airframe Total Time:	7571 Hrs as of last inspection	**Engine Manufacturer:**	Garrett
ELT:	C126 installed, activated, did not aid in locating accident	**Engine Model/Series:**	TFE731-3-1G
Registered Owner:	SYNFUELS HOLDINGS FINANCE LLC	**Rated Power:**	3700 Lbs thrust
Operator:	SYNFUELS HOLDINGS FINANCE LLC	**Operating Certificate(s) Held:**	None

The airplane was manufactured in 1983 by Israel Aircraft Industries Ltd., as model 1124A, and was designated serial number 392. An export Certificate of Airworthiness issued on November 27, 1983, specified that the airplane was examined, tested, and found to conform to the type design approved under the FAA Type Certificate No. A2SW. It was powered by two Honeywell TFE731-3-1G turbofan engines rated to 3,700 pounds of thrust, both of which were equipped with an independently operated thrust reverser system designed by Grumman Aircraft Engineering Corporation for ground use only.

Each hydraulically-powered thrust reverser (T/R) consisted of upper and lower clamshell doors attached to the aft engine nacelle. The doors pivoted near the nacelle centerline and rotated aft to form a target deflecting the exhaust forward, producing reverse thrust. An accumulator in the reverser system permitted one complete cycle of the reversers in case of aircraft hydraulic system failure. The reverser on each engine was separately controlled by an electrical system, provided with safety features. Indicator lights were provided in the flight compartment to allow monitoring of system operation. A throttle retarder system was provided to automatically retard the throttle to IDLE position in case of reverser door deployment if throttle was not set to IDLE before deployment.

With electrical power available, and circuit breakers engaged, by placing the THRUST REVERSER control switch located on the control pedestal in the ON position, the thrust reverser system was armed and the ARM indicating light, located on the center instrument panel illuminated. After placing the power lever in the IDLE position, the piggy back lever for each respective engine control could be lifted to the DEPLOY position. This operated the secondary latch to unlock the thrust reverser doors, and activated the hydraulic control valve to send pressure to internally unlock the thrust reverser hydraulic actuator and operate the thrust reverser doors to the DEPLOY position. When lifting the piggy back lever, the UNSAFE indicating light illuminated and stayed on until doors were fully deployed. Then the UNSAFE light extinguished and the REV THRUST indicating light illuminated. After the T/R doors

were fully deployed, a piggy back lever lock solenoid-operated pin was withdrawn, and the piggy back lever could be further pulled to the REVERSE THRUST position, increasing engine speed to 75 percent thrust in reverse thrust operation.

A throttle retarder system of the thrust reverser system was installed so that in the event that the engine is not at idle during thrust reverser deployment, the retarder system will automatically do so. Additionally, during reverse thrust operation, if the reverser doors should return to the stow position inadvertently, the piggy back lever will automatically be returned to the IDLE DEPLOY position by the retarder system. The retarder system consisted of forward and aft telescopic units, a single lead (aft) 100-tooth control box, a double lead (forward) control box, cables and rigid casings, which was connected to and operated by the lower thrust reverser door. The retarder system units were located on each engine nacelle outer rear side and were accessible through panels on the nacelle outer skin.

The airplane was based at BHM, and was maintained by Jet Harbor, Inc., located in Fort Lauderdale, Florida.

The airplane's latest maintenance records were reportedly in the airplane at the time of the accident; however, copies of records documenting the latest maintenance inspection were provided by the FAA certified repair station that maintained the airplane. A review of the records revealed the airplane was last inspected in accordance with 200 Hour "A" and 400 Hour "B" inspections (both include inspections of thrust reverser components), and 150/250 hour airframe inspections in accordance with the airplane manufacturer maintenance manual. Also completed was a 36 month lubrication of the thrust reverser feedback cables. The airframe logbook entry was signed off approving the airplane for return to service on July 22, 2013. The airplane total time at that time was reported to be 7,571.0 hours, while the total landings were reported to be 5,779. A review of the copies of the entries for the left and right engines revealed both were signed off for return to service on July 22, 2013; both were inspected in accordance with a 150/200 hour inspection interval, and spectrometric oil analysis program (SOAP) samples were taken for both engines. The SOAP testing results for both engines were reported to be normal. The maintenance facility indicated there was no further maintenance performed to the airplane.

Further review of the available maintenance records revealed that the last 800 hour inspection, which includes an operational test of the thrust reverser system including the throttle retarder feedback control, was performed on December 22, 2010. The airplane total time at that time was recorded to be 7,153.4 hours and the total cycles were 5,392. The next estimated 800 hour inspection due date per the Computerized Aircraft Maintenance System (CAMS) was August 7, 2014.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	HSV,629 ft msl	**Distance from Accident Site:**	
Observation Time:	14:43 Local	**Direction from Accident Site:**	
Lowest Cloud Condition:	Scattered / 4900 ft AGL	**Visibility**	10 miles
Lowest Ceiling:	Broken / 25000 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	4 knots / None	**Turbulence Type Forecast/Actual:**	/ None
Wind Direction:	250°	**Turbulence Severity Forecast/Actual:**	/ N/A
Altimeter Setting:	30.1 inches Hg	**Temperature/Dew Point:**	33°C / 20°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Huntsville, AL (HSV)	**Type of Flight Plan Filed:**	None
Destination:	Huntsville, AL (HSV)	**Type of Clearance:**	None
Departure Time:	14:24 Local	**Type of Airspace:**	

Before clearing the flight to takeoff, the controller informed the flight crew that the wind was from 280 degrees at 5 knots, resulting in a 1 knot tailwind component.

An aviation surface observation weather report taken at HSV at 1443, or about 19 minutes after the accident indicated the wind was from 250 degrees at 4 knots, the visibility was 10 statute miles, and scattered clouds existed at 4,900 and 6,500 feet. Broken clouds existed at 25,000 feet, the temperature and dew point were 33 and 20 degrees Celsius respectively, and the altimeter setting was 30.10 inches of mercury, resulting in a pressure altitude of 449 feet.

Airport Information

Airport:	Huntsville International Arpt HSV	**Runway Surface Type:**	Asphalt
Airport Elevation:	629 ft msl	**Runway Surface Condition:**	Dry;Water-glassy
Runway Used:	18R	**IFR Approach:**	None
Runway Length/Width:	12600 ft / 150 ft	**VFR Approach/Landing:**	None

The HSV Airport was a tower controlled, public-use airport equipped in part with a 12,600-foot-long by 150-foot-wide asphalt grooved runway, designated 18R.

The airport was also equipped with movable security cameras that recorded and retained video images.

Airport Operations personnel performed a sweep of the runway after the accident and did not find/observe any parts, nor did they report finding any bird carcasses.

Wreckage and Impact Information

Crew Injuries:	2 Fatal	**Aircraft Damage:**	Destroyed
Passenger Injuries:	1 Fatal	**Aircraft Fire:**	On-ground
Ground Injuries:	N/A	**Aircraft Explosion:**	Unknown
Total Injuries:	3 Fatal	**Latitude, Longitude:**	34.631668,-86.785835

The airplane crashed in a field planted with crop located on airport property. The main wreckage which consisted of the cockpit, cabin, full span of left wing, attached section of the right wing, aft fuselage, and horizontal stabilizer with attached elevator and elevator trim tab was located about 1.3 nautical miles and 188 degrees from the approach end of runway 18R.

Examination of the accident site revealed several impact scars, the first of which closest to the western edge of the runway was noted about 7,500 feet and 186 degrees from the approach end of runway 18R. An energy path oriented on a magnetic heading of 246 degrees was noted in the dirt of the field when viewed from the first impact point to the resting position of the main wreckage. The deepest ground scar was along the energy path from the first impact point and contained windshield pieces.

Wreckage and debris was noted along the energy path consisting of window frame and window pieces, instruments, avionics, switches, interior items, and the nose landing gear assembly. The oxygen tank was located ahead of the resting position of the main wreckage; the valve was in the fully open position. The right tip tank, portion of the right wing from wing station (WS) 247 inboard to WS 177, and section of the right aileron were noted on the left side of the energy path when viewed from the initial impact point looking towards the resting location of the main wreckage. The main wreckage came to rest about 384 feet from the initial impact point. Also located along the energy path was the vertical stabilizer with the attached rudder and rudder trim tab.

Examination of the main wreckage revealed the cockpit was in an upright position, but the fuselage from about fuselage station (FS) 240 to FS 355 with attached left wing and section of the right wing was inverted. This section exhibited extensive fire damage. Rotation of electrical wires in the area of the cabin door was consistent with the rotation of the cockpit. Examination of the fuselage with attached left wing and section of right wing revealed both main landing gear were in the wheel wells, and both flaps were attached. Fire damage was noted to the cockpit, cabin, aft fuselage, empennage, left wing, and attached section of the right wing. No fire damage was noted to the separated section of the right wing, right aileron, or right tip tank.

The fuselage was nearly completely fractured about FS 355, but was continuous from that point to FS 554. This section was also inverted and exhibited fire damage. Both engines remained attached to the engine pylons, and the horizontal stabilizer with attached elevators remained partially attached to the structure.

Examination of the left wing revealed it was nearly consumed by fire from wing station (WS) 156 to the end of the tip tank, but also exhibited fire damage from WS 156 inboard to the wing root. The tip tank was resting on the ground adjacent to the horizontal stabilizer. Both flap actuators were in the flaps

retracted position, and the aileron trim tab actuator was in the neutral position. The landing gear was in the wheel well and the inner gear door was closed. About 18.5 inches of aileron remained attached at the inboard hinge, the remaining portion was heat damaged. The speedbrake and both lift dumpers were retracted.

Examination of the right wing revealed it exhibited extensive fire damage from WS 156 inboard to the wing root, and also impact damage near WS 156; the skin was displaced aft about 45 degrees. The outer portion of the wing from WS 247 to WS 268.50 consisting of the tip separated from the airplane and was facing nearly 180 degrees of the energy path heading. The dump valve was in the closed position. A section of wing from WS 247 inboard to WS 177 was also separated. Review of this section revealed the aft tip tank attach remained secured but the forward tip tank attach was separated; the hardware was fractured. The right flap was fully attached to the wing; both flap actuators were in the flaps retracted position. The landing gear was in the wheel well and the inner gear door was closed. The speedbrake and both lift dumpers were retracted. The separated aileron consisted of 2 pieces and the full span was accounted for.

Examination of the vertical stabilizer with attached rudder and rudder trim tab revealed the rudder trim tab actuator was fully extended tab trailing edge right. The rotating beacon was separated from the top of the vertical stabilizer, and the rudder counterweight remained attached to the rudder.

Examination of the horizontal stabilizer revealed the left horizontal stabilizer trim actuator rod end and upper portion of the actuator was separated from the actuator but remained attached to the attach point on the spar. The right rod end pulled and fractured from the attach point on the fitting attached to the spar. The horizontal stabilizer was positioned 2.03 degrees plus or minus 0.10 degree airplane nose-up.

Examination of the cockpit revealed it was fragmented and was nearly consumed by the postcrash fire. Flight and engine instruments were separated from their respective attach points and also exhibited fire damage. The throttle quadrant which remained only connected by electrical wires was inspected which revealed the left and right thrust levers were ¾ forward. The left thrust lever was bent to the right, and the piggy-back lever was ½ travel towards the deploy detent, while the right piggy back lever was in close proximity from the deploy position. Further examination of the right thrust lever revealed a gouge on the right side of the slot of the throttle quadrant associated with the adjacent securing nut. The location of the gouge correlated with the thrust lever being 2/3 travel range. Further examination of the right thrust reverser piggy back lever and adjacent portion of the throttle quadrant revealed a linear gouge on the right side of the quadrant slightly aft of the deploy detent. The gouge was parallel to the resting position of the piggy back lever. Examination of the pilot's side airspeed indicator which remained secured inside the separated instrument panel revealed the needle was captured at 104 knots, and the speed bug was set to 122 knots. Another airspeed indicator that was found separated from the instrument panel was found positioned to 150 knots; the needle was free to move.

Examination of the left engine revealed the upper and lower thrust reverser clamshell doors were fully stowed. Initial examination of the fuel control unit revealed the power lever angle was indicating 95 degrees as viewed through the sight glass. The left engine was removed from the pylon and components of the thrust reverser consisting of the actuator and control valve were removed for examination and/or testing. The electronic engine control (EEC) was examined and was found to be loose in its mounting tray but still retained by the 'swing bolts" and rear connector; the forward 'swing bolts' were not firmly

attached and could be loosened by hand. The PT2 pressure line and main electrical connector was tightly secured. The engine and the EEC were sent to the manufacturer's facility for examination with NTSB oversight. Examination of the engine revealed no evidence of preimpact failure or malfunction.

Examination of the right engine revealed the upper and lower thrust reverser clamshell doors were partially deployed. Aircraft debris about 38 inches long and 24 inches wide comprised of metal skins and stringers with foam type insulation was lodged in the upper clamshell door. A VOR antenna was noted among the debris, and one of the stringers was marked with 313165X4-B. Examination of the upper and lower secondary latch hooks revealed no damage or deformation; the upper and lower latch hook receivers also did not exhibit any damage. The thrust reverser teleflex throttle retarder feedback cable, which was about 51.2 inches long, was intact. All of the connections at the forward and end control boxes appeared to be intact with the safety wire in place. Initial examination of the fuel control unit revealed the power lever angle was indicating 65 degrees as viewed through the sight glass. Following disconnection of the Teleflex throttle retarder cable from the thrust reverser, movement of the cable simulating opening of the thrust reverser translated to movement of the power lever angle as viewed through the sight glass. The EEC was examined and was found to be loose in its mounting tray but still retained by the 'swing bolts" and rear connector; the forward 'swing bolts' were not firmly attached and could be loosened by hand. The PT2 pressure line was loose about 1/2 turn or 3 flats of the B-nut, and the main electrical connector was tightly secured. The right engine was removed from the pylon and components of the thrust reverser consisting of the actuator and control valve were removed for examination and/or testing. The engine and EEC were sent to the manufacturer's facility for examination with NTSB oversight. Examination of the engine revealed no evidence of preimpact failure or malfunction.

Examination and Testing of Thrust Reverser Actuators

Following removal of the left and right thrust reverser actuators and control valves, they were subjected to x-ray computer tomography (CT) scanning to document their internal conditions. The results of the CT scanning of the left thrust reverser actuator revealed the actuator appeared to be in the extended position and the pawls appeared to be extended out over the piston sleeve. The actuator switch moving contacts appeared to be in contact with the lower switch arm. The results of the CT scanning of the right thrust reverser actuator revealed the actuator was in a non-extended position and the pawls were retracted within the piston sleeve. The actuator switch moving contacts appeared to be in contact with the upper switch arm. Also, a crack was noted in the right actuator switch housing. No indications of particles or other obstructions were noted in either thrust reverser control valve passages, and the moving seals of both thrust reverser control valves were in contact with their respective mating surfaces.

Following CT scanning of the left and right thrust reverser actuators, testing and disassembly examination was performed at the manufacturer's facility with NTSB oversight. The examination of the left thrust reverser actuator revealed that when it was placed on a test bench, the indicator lights indicated the locking pawls were in the locked position. Operational testing revealed no evidence of preimpact failure or malfunction. Following bench testing it was disassembled which revealed one end of the retaining ring key was missing. The locking pawls were all in place and had normal wear marks. The examination of the right thrust reverser actuator revealed that when it was placed on a test bench, the indicator lights indicated the locking pawls were in the unlocked position. Operational testing revealed no evidence of preimpact failure or malfunction. Following bench testing it was disassembled

which revealed the locking pawls were all in place and had normal wear marks.

Communications

The flight crew was in contact with the Huntsville Air Traffic Control Tower, there were no communicating difficulties.

Flight recorders

The accident airplane was equipped with a Fairchild GA100 CVR designed to record 30 minutes of analog audio on a continuous loop tape in a four-channel format. One channel was for each flight crew member, and one channel is for the cockpit area microphone. The CVR was removed from the airplane and sent to the NTSB Vehicle Recorder Division in Washington, D.C. for read-out. Attendees for the CVR read-out included personnel from FAA, IAI, Honeywell, and the operator. Although the CVR had sustained heat damage, the tape was removed and the audio was extracted from the recorder normally, without difficulty. A full transcript was prepared of the 30 minute recording.

A Sound Spectrum Study of the CVR recording was performed to determine engine performance and thrust reverser deployment during the previous full-stop landing and during the accident takeoff. The Study also included plots with sound analysis data combined with EGPWS data and generic CVR transmissions.

The accident airplane was also equipped with an Allied Signal EGPWS. The EGPWS was recovered from the wreckage and shipped to the NTSB Vehicle Recorders Laboratory, where initial examination revealed the device was exposed to extreme heat. The unit was disassembled to inspect the condition of the internal circuit boards, which were found to have minimal damage, including the chip containing non-volatile memory, which was intact. The appropriate internal boards were installed into a surrogate unit, and the unit was downloaded normally without any reported difficulty.

A total of 23 seconds of valid data associated with the accident flight were recorded by the EGPWS, and all but the last data point recorded data consisting of latitude and longitude, calibrated airspeed, groundspeed, uncorrected altitude, tactical altitude, radar altitude, terrain elevation, altitude rate or rate of descent, true track, true heading, pitch, roll, gear position, flap selector position, and whether the squat switches on the landing gear detected the airplane was on the ground or in the air. The roll value for the last data point was not recorded.

Correlation of the data downloaded from the EGPWS and select comments recorded by the CVR was

performed by NTSB in an effort to align the data and time. This was done because the EGPWS recording system operated on an independent time scale, and the CVR records in elapsed time. Before the alignment of the EGPWS and CVR occurred, the elapsed time of the CVR was correlated with the time by the air traffic control recording, converting CVR elapsed time to local time.

Medical and Pathological Information

Postmortem examinations of the occupants were performed by the Alabama Department of Forensic Science. The cause of death for all was listed as blunt force injuries. According to the autopsy report for the PPE, heart disease was identified including coronary artery disease with 75 to 80 percent stenosis of the left anterior descending artery and enlargement with a heart weight of 500 gram (average for a man of his weight is 403gm with a range of 305 to 531gm). The heart was otherwise described as normal.

Forensic toxicology testing was performed for all occupants by the FAA Bioaeronautical Sciences Research Laboratory, Oklahoma City, Oklahoma. The results of testing for the PPE revealed testing for cyanide was not performed, and the results were negative for carbon monoxide and volatiles. Unquantified amounts of Atenolol and Diltiazem were detected in the urine and liver specimens, and an unquantified amount of Atorvastatin was detected in the liver specimen. All three are prescription medications and are not considered impairing: atenolol and diltiazem are used to treat high blood pressure and atorvastatin is used to treat high cholesterol.

The results of toxicology testing results for the pilot were negative for carbon monoxide and volatiles. No drugs were detected in the submitted urine specimen, and testing for cyanide was not performed.

The results of toxicology testing results for the pilot-rated passenger were negative for carbon monoxide and volatiles. Unquantified amounts of Amlodipine and Losartan were detected in the heart blood and urine specimens, and testing for cyanide was not performed.

Tests and Research

Aircraft Certification and Accident History

According to FAA Type Certificate Data Sheet No. A2SW, the airplane was certificated in the Transport category, in accordance with Civil Air Regulation (CAR) 4b, titled, Airplane Airworthiness; Transport Categories, with an effective date of December 31, 1953, including specified amendments. The certification basis also included compliance up to and including Amendment 25-34 of 14 CFR Part 25.831 thru 25.843, 25.901 thru 25.1203, 25.1305, 25.1521, and 25.1309 with respect to the reverse thrust installation.

A review of Amendment 25-11 to 14 CFR Part 25.933, titled Reversing Systems, dated June 4, 1967, in effect when the airplane received its Type Certification, revealed that reversing systems intended for

ground operation only must be designed so that no single failure or malfunction of the system will result in unwanted reverse thrust under any expected operating condition. Failure of structural elements need not be considered if the probability of this kind of failure was extremely remote. Additionally, each turbojet reversing system must have means to prevent the engine from producing more than idle forward thrust when the reversing system malfunctions, except that it may produce any greater forward thrust that is shown to allow directional control to be maintained, with aerodynamic means alone, under the most critical reversing condition expected in operation.

A review of Amendment 25-23 to 14 CFR Part 25.1309, titled, Equipment Systems and Installations, dated May 8, 1970, in effect when the airplane received its Type Certification, revealed that the equipment, systems, and installations whose functioning was required by this subchapter, must be designed to ensure that they perform their intended functions under any foreseeable operating condition, and (b) The airplane systems and associated components, considered separately and in relation to other systems, must be designed so that:

(1) The occurrence of any failure condition which would prevent the continued safe flight and landing of the airplane is extremely improbable, and
(2) The occurrence of any other failure conditions which would result in injury to the occupants, or reduce the capability of the airplane or the ability of the crew to cope with adverse operating conditions is improbable

(c) Warning information must be provided to alert the crew to unsafe system operating conditions, and to enable them to take appropriate corrective action. Systems, controls, and associated monitoring and warning means must be designed so that crew errors that would create additional hazards are improbable.

(d) Compliance with the requirements of paragraphs (b) and (c) of this section must be shown by analysis, and where necessary, by appropriate ground, flight, or flight simulator tests. The analysis must consider:

(1) Possible modes of failure, including malfunctions and damage from external sources.
(2) The probability of multiple failures and undetected failures.
(3) The resulting effects on the airplane and occupants, considering the stage of flight and operating conditions, and
(4) The crew warning cues, corrective action required, and the capability of detecting faults.

A representative of the airframe manufacturer reported that they were not aware of any reported cases of inadvertent in-flight thrust reverser deployment on the accident make and model airplane. A review of the NTSB database for accidents and incidents involving the 1124 series aircraft from 1982 to present was performed. Excluding the accident airplane, there were a total of 21 accidents or incidents, which included U.S. led investigations and investigations performed by foreign governments in which the NTSB had assigned an Accredited Representative. Of the 21 accidents or incidents, 15 occurred in the U.S. and were investigated by NTSB. Of the 15 accidents or incidents, none listed thrust reverser as the probable cause, a factor, or finding.

Aircraft Performance Calculations

Section II of the flight manual, titled Emergency Procedures, contained a section for inadvertent thrust reverser (T/R) deployment (unsafe light on; thrust lever retarded). The checklist indicated that during takeoff above V1 speed or in flight, to take immediate command of the flight controls, "to suppress tendency for aircraft to pitch up, roll and yaw in direction of deployed T/R." It indicated to maintain 150 knots or below, and a note indicated that deployment with or without engine operating would be accompanied by moderate airframe/control system vibrations.

Weight calculations were performed using the latest empty weight (13,430.95 pounds), the weights of the pilot and PPE per their last medical applications of 165 pounds and 225 pounds, respectively. The results also include the weight of the pilot-rated passenger per his last medical certificate (190 pounds). Additional weight included soft drinks and water. For the purposes of the calculations, the pilot-rated passenger was estimated to be seated at the forward seat of the couch, or at an arm of 106 inches aft of datum. The zero fuel weight was calculated to be 14,010.95 pounds. With respect to the amount of fuel on-board, the chief pilot reported fueling the airplane at BHM, bringing the total fuel capacity to 4,800 pounds. Allowing for 160 pounds of fuel burn for taxi, the takeoff weight from BHM was estimated to be 18,706 pounds. Allowing for a fuel consumption of about 1,500 pounds-per-hour, based on the elapsed flight time between BHM and HSV, or 1.36 hours, the estimated fuel consumption would have been about 2,050 pounds. Subtracting that amount from the takeoff weight at BHM, the estimated airplane weight at touchdown at HSV was about 16,656 pounds. Accounting for the fuel burn while on the ground at HSV, the estimated gross weight at takeoff of the accident flight was about 16,609 pounds.

A review of the performance charts from the airplane flight manual revealed that based on the estimated takeoff weight of about 16,609 pounds, the stall speed with the flaps retracted and the landing gear either up or down was 106 KCAS. The calculated engine failure recognition speed (V1) of 118 knots was based on the flaps retracted position, environmental conditions (33 degrees Celsius and 449 feet pressure altitude), estimated gross weight (16,609 pounds), wind component (1 knot tailwind), and runway slope (-0.1 percent). Based on the gross weight, the rotation speed (Vr) and safety speed (V2) with the flaps retracted were about 128 and 131 knots indicated airspeed, respectively.

Based on the ambient conditions at the time of the accident, the target N1 RPM was determined to be about 98 percent.

Engine Deceleration Data

Although the engine manufacturer did not have N1 and N2 deceleration curve test cell data for the subject model engines, they did have the data for a generic TFE731 model engine which utilized the same power section. The test cell data was derived with a setup that utilized a servo adjacent to the fuel control for near sudden decrease of input at the fuel control. A review of the data revealed that with the fuel control suddenly moved to flight idle, it took about 8 seconds for the N2 speed to decrease from 100 percent to flight idle.

Additional Information

PPE Accident History

The PPE was involved in two previous accidents, none of which occurred while he was acting in the capacity as a PPE. The first accident occurred on November 18, 2003, involving a Cessna 550 airplane in Mineral Wells, Texas, that occurred during a flight for a type rating. The NTSB case number assigned to the investigation was FTW04FA024. He (PPE) provided training to the type rating applicant, and was asked by the FAA Designated Pilot Examiner (DPE) to occupy the right seat during the practical flight test; therefore he was the second-in-command. According to NTSB interview of the PPE and a statement from the DPE, after performing airwork while on approach to an airport, the DPE instructed him (PPE) to reduce the left thrust lever to simulate a single-engine approach. One hundred feet prior to the minimum descent altitude at 2 knots above Vref, the DPE instructed the PIC to restore left engine power. The airplane began descending, and the DPE felt the airplane sinking rapidly and yelled out for, "…max power, pull the nose up to go-around", and then felt the airplane impact the ground. The airplane impacted about 350 feet short of the intended runway and was destroyed by a post-impact fire; no mechanical deficiencies were noted. The NTSB determined on June 30, 2004, that the probable cause of the accident was, "The pilot-in-command's failure to maintain control of the airplane while executing a simulated engine failure on final approach. A factor was the wind shear."

The second accident occurred on June 18, 2013, involving an Israel Aircraft Industries 1124 airplane in Cincinnati, Ohio. During this flight he was seated in the right seat and providing type certificate training to a pilot-rated student. The NTSB case number assigned to the investigation was CEN13LA366, and according to the NTSB Factual Report for that case, an ILS approach had been performed by the left seat occupant while he (PPE) requested from air traffic control a clearance for the "option." Immediately after touchdown, the CVR recorded the CFI to state, "no, no, no we're not stopping." A pilot-rated passenger in the airplane reported the airplane became airborne then banked to the right and the right wingtip contacted the runway. The airplane came to rest upright with the left main landing gear collapsed. Postaccident examination of the landing gear system revealed no evidence of preimpact failure or malfunction. The Brief of Accident indicates that it is likely that the lack of damage to components of the landing gear and no anomalies with the landing gear system indicate it is likely that the landing gear handle had been moved to the "up" position during the takeoff sequence. The NTSB determined that the probable cause of the accident was the, "Loss of control due to insufficient airspeed on takeoff and premature landing gear retraction, which resulted in the collapse of the left landing gear as the airplane impacted the runway."

Airframe Manufacturer's Flight Test Report

According to the airplane manufacturer, compliance with 14 CFR Part 25.1309 titled Equipment Systems and Installations pertaining to the thrust reverser system installation was shown by Failure Mode and Effects Analysis (FMEA) and also demonstrated by flight testing of a Westwind 1124, which utilized the same thrust reverser system as the accident airplane model. Demonstration of controllability was confirmed in the case of inadvertent thrust reverser deployment; therefore, no reliability analysis was performed to identify any single point failure that could allow for deployment of the thrust reverser.

A review of the Engineering Report No. 4820/10483, titled, "Westwind Model 1124 – Dynamic Aircraft

Response to Inadvertent Inflight Thrust Reverser Deployment", dated March 25, 1976, indicated that calculations and analysis were performed for takeoff and cruise configurations to predict the airplane's flight behavior and controllability in response to thrust reverser deployment in-flight. The analysis concluded that the aircraft's longitudinal and lateral motions were not coupled, and that the lateral motions were only slightly affected by thrust reverser deployment and readily controllable by the pilot and/or autopilot. The focus of the analysis and calculations was therefore to determine the effect of thrust reverser deployment for the aircraft's longitudinal motions. The calculations were predicated on full deployment of the thrust reverser taking 1 second, and pilot application of pitch control to counter the pitching moment when the thrust reverser was fully deployed. The calculations were considered to be conservative because it was assumed that prompt pitch corrective control input would occur after sensing pitching velocity of 1.0 to 2.0 degrees per second, which would occur before the 1.0 seconds it takes for full thrust reverser deployment. The report notes that in the case of unwanted deployment of a thrust reverser at power greater than idle, an automatic system entered into operation ½ second after the onset of thrust reverser and reduced the power to idle in 4 seconds. Calculations and analysis were performed for an inadvertent thrust reverser deployment during takeoff for the following configuration: a) flaps 12 extension, b) gross weight of 15,000 pounds, c) center of gravity at 28 percent of mean aerodynamic chord, and d) velocity of 120 knots. The analysis indicated that the airplane would be controllable with a perturbation in the angle of attack of less than 4 degrees.

According to the Flight Test Report No. 3189/102 (included as part of Engineering Report No. 4820/10483), the flight testing involved deployment of the right thrust reverser by activation of a special in-flight deployment switch and method to close the thrust reverser buckets once deployed. Prior to flight, maximum reverse thrust was checked and found to be 75 percent. Flight testing was performed at varying speeds and airplane configurations at 15,000 feet and also included a landing with the right thrust reverser deployed. Steady state testing was performed with the right engine cut or at idle. Some tests involved adding power to the right engine in short bursts. The landing with the right thrust reverser deployed was performed with the right engine at idle. One test was performed with the right thrust reverser deployed at 150 knots indicated airspeed (KIAS) and the left engine power N1 at about 92 percent. The airplane was reported to be easily controlled though more left rudder deflection and force were required to maintain balanced flight and maximum left rudder trim was not quite sufficient to keep the ball in the middle; the pitch change was negligible. Flight testing was also performed with the right thrust reverser deployed and the airplane slowed to 130 KIAS, and then accelerated to 200 KIAS with application of left engine thrust to 98 percent N1. The airplane was controllable and it was noted that as the speed increased above 170 KIAS, the low frequency noise diminished and the higher frequency node appeared. Thrust applications in bursts were also performed to the right engine with the thrust reverser deployed, with the throttle advanced and then rapidly reduced to idle to simulate the action of the throttle retarder mechanism (as noted earlier, an automatic system should reduce the power to idle in 4 seconds after an inadvertent thrust reverser deployment). The flight test was performed at 150 KIAS and the power lever advanced to 50 percent N1, then repeated with peaks of 63 and 72 percent N1. The airplane reaction to all bursts and rapid recuctions was mild with the airplane pitching up during the burst and pitching down during the reduction. The airplane was easily controlled and the airframe buffeting at 72 percent was "quite strong."

Administrative Information

Investigator In Charge (IIC):	Monville, Timothy
Additional Participating Persons:	Porter Mayberry; FAA/FSDO; Birmingham, AL Bill Siegel; SynFuels Holdings Finance; Birmingham, AL John Eller; Honeywell Aerospace; Phoenix, AZ Dan Helfman; IAI Nina McBride; FAA/FSDO; Vestavia Hills, AL
Original Publish Date:	July 12, 2016
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=89471