



AVIATION



HIGHWAY



MARINE



RAILROAD



PIPELINE

Aviation Investigation Final Report

Location:	Yukon, Oklahoma	Accident Number:	CEN19FA104
Date & Time:	March 18, 2019, 15:31 Local	Registration:	N4MH
Aircraft:	Israel Aircraft Industries 1124	Aircraft Damage:	Destroyed
Defining Event:	Loss of control in flight	Injuries:	2 Fatal
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The two commercial pilots were conducting a personal, cross-country flight. A video surveillance camera at the airport captured their airplane's approach. Review of the video revealed that, as the airplane approached the approach end of the landing runway, it began to climb, rolled left, became inverted, and then impacted terrain.

The left thrust reverser (T/R) was found open and unlatched at the accident site. An asymmetric deployment of the left T/R would have resulted in a left roll/yaw. The lack of an airworthy and operable cockpit voice recorder, which was required for the flight, precluded identifying which pilot was performing pilot flying duties, as well as other crew actions and background noises, that would have facilitated the investigation.

Postaccident examination of the airplane revealed that it was not equipped, nor was required to be equipped, with a nose landing gear (NLG) ground contact switch intended to preclude in-flight operation of the thrust reverser (T/R). The left T/R door was found unlatched and open, and the right T/R door was found closed and latched. Further, electrical testing of the T/R left and right stow microswitches within the cockpit throttle quadrant revealed that the left stow microswitch did not operate within design specifications. Disassembly of the left and right stow microswitches revealed evidence of arc wear due to aging. Based on this information, it is likely that the airplane's lack of an NLG ground contact switch and the age-related failure of the stow microswitches resulted in an asymmetric T/R deployment while on approach and a subsequent loss of airplane control. Also, there were additional T/R system components that were found to be unairworthy that would have affected the control of the T/R system.

Operational testing of the T/R system could not be performed due to the damage the airplane incurred during the accident.

Toxicology testing results of the pilot's specimens indicated that the pilot had taken diazepam, which is considered impairing at certain levels. However, the detected amounts of both diazepam and its metabolite nordiazepam were at subtherapeutic levels, and given the long half-life of these compounds, it appears that the medication was taken several days before the accident; therefore, it is unlikely that the pilot was impaired at the time of the accident and thus that his use of diazepam was a not factor in the accident.

Probable Cause and Findings

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

The airplane's unairworthy thrust reverser (T/R) system due to inadequate maintenance that resulted in an asymmetric T/R deployment during an approach to the airport and the subsequent loss of airplane control.

Findings

Aircraft	(general) - Failure
Aircraft	(general) - Not installed/available

Factual Information

History of Flight

Initial climb	Loss of control in flight (Defining event)
Uncontrolled descent	Collision with terr/obj (non-CFIT)

On March 18, 2019, at 1531 central daylight time, an Israel Aircraft Industries (IAI) Westwind 1124 airplane, N4MH, was destroyed when it was involved in an accident near Yukon, Oklahoma. Both pilots sustained fatal injuries. The airplane was operated as a Title 14 *Code of Federal Regulations* Part 91 personal flight.

A video surveillance camera at Sundance Airport (HSD), Yukon, Oklahoma, captured the airplane's approach. Review of the video revealed that, as the airplane approached the approach end of the runway, it began to climb, rolled left, became inverted, and then impacted terrain.

Pilot Information

Certificate:	Airline transport; Commercial; Flight instructor	Age:	60, Male
Airplane Rating(s):	Single-engine land; Single-engine sea; Multi-engine land	Seat Occupied:	Left
Other Aircraft Rating(s):	Glider	Restraint Used:	
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 1 Without waivers/limitations	Last FAA Medical Exam:	April 13, 2018
Occupational Pilot:	Yes	Last Flight Review or Equivalent:	March 9, 2019
Flight Time:	5872 hours (Total, all aircraft)		

Co-pilot Information

Certificate:	Airline transport; Commercial; Flight instructor	Age:	43,Female
Airplane Rating(s):	Single-engine land; Single-engine sea; Multi-engine land	Seat Occupied:	Right
Other Aircraft Rating(s):	None	Restraint Used:	
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 1 None	Last FAA Medical Exam:	January 24, 2019
Occupational Pilot:	Yes	Last Flight Review or Equivalent:	
Flight Time:	5259 hours (Total, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Israel Aircraft Industries	Registration:	N4MH
Model/Series:	1124	Aircraft Category:	Airplane
Year of Manufacture:	1978	Amateur Built:	
Airworthiness Certificate:	Transport	Serial Number:	232
Landing Gear Type:	Retractable - Tricycle	Seats:	9
Date/Type of Last Inspection:	February 4, 2019 Continuous airworthiness	Certified Max Gross Wt.:	23500 lbs
Time Since Last Inspection:		Engines:	2 Turbo fan
Airframe Total Time:	11030.1 Hrs as of last inspection	Engine Manufacturer:	Garrett AiResearch
ELT:	Installed, activated, did not aid in locating accident	Engine Model/Series:	TFE731-3D-1G
Registered Owner:	Sundance Airport FBO LLC	Rated Power:	
Operator:	Sundance Airport FBO LLC	Operating Certificate(s) Held:	None

The airplane was not equipped with a nose landing gear (NLG) ground contact switch, which is intended to preclude the in-flight operation of the thrust reverser (T/R). IAI Service Letter WW-2419, dated September 30, 1977, "Thrust Reverser Arming Activation," provided instructions for the removal of the NLG ground contact switch. The letter stated that compliance was at the "owner's discretion."

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	Condition of Light:	Day
Observation Facility, Elevation:	HSD	Distance from Accident Site:	0 Nautical Miles
Observation Time:	15:25 Local	Direction from Accident Site:	
Lowest Cloud Condition:	Clear	Visibility	10 miles
Lowest Ceiling:	None	Visibility (RVR):	
Wind Speed/Gusts:	7 knots / None	Turbulence Type Forecast/Actual:	None / None
Wind Direction:	180°	Turbulence Severity Forecast/Actual:	N/A / N/A
Altimeter Setting:	30.25 inches Hg	Temperature/Dew Point:	20°C / -2°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Panama City, FL (ECP)	Type of Flight Plan Filed:	IFR
Destination:	Oklahoma City, OK (HSD)	Type of Clearance:	VFR;IFR
Departure Time:	13:33 Local	Type of Airspace:	

Airport Information

Airport:	Sundance Airport HSD	Runway Surface Type:	Concrete
Airport Elevation:	1193 ft msl	Runway Surface Condition:	Dry
Runway Used:	18	IFR Approach:	Visual
Runway Length/Width:	5001 ft / 100 ft	VFR Approach/Landing:	Straight-in

Wreckage and Impact Information

Crew Injuries:	2 Fatal	Aircraft Damage:	Destroyed
Passenger Injuries:		Aircraft Fire:	None
Ground Injuries:		Aircraft Explosion:	None
Total Injuries:	2 Fatal	Latitude, Longitude:	35.604442,-97.705558(est)

The airplane impacted terrain about 1,472 ft down, and 209 ft west of, runway 18. The nose and main landing gear were locked into the extended position. The cockpit landing gear control handle was bent left and nearly flush with the instrument panel and was positioned toward the top limit of travel allowed by the handle's housing, which sustained impact damage. Flight control continuity from the control surfaces to the cockpit controls was confirmed. The left- and right-wing flaps were extended. The

cockpit flap selector handle was in an approximate mid-range position. The flap selector handle was bent toward the left and a piece of the right side of the handle was missing. The housing surrounding the flap selector handle sustained impact damage. The left- and right-wing flap inboard actuators were extended about 9 $\frac{3}{4}$ inches, and the outboard actuators were extended about 6 $\frac{1}{2}$ inches. Extension measurements were taken from a dark colored area consistent with dirt/grease at the aft end of the pistons to the actuator housing. The dark colored area was about $\frac{1}{2}$ inch in length. The left and right engines were attached to their respective pylons, which were attached to the fuselage. Both engines' fan spinners exhibited circumferential scoring. Both engines' fan blades exhibited chordwise scratches and leading-edge damage. Both engines' bypasses, bypass exhausts, and engine exhaust areas contained earthen debris consistent in color with that of the earth near the accident site.

Examination of the airplane revealed that the left T/R door was unlatched and open and the right T/R door was closed and latched. The right and left L-shaped latch hooks that engaged into the left T/R door did not exhibit bending or tearing.

The throttle quadrant exhibited impact damage, and the throttle control levers were bent rightward. The throttle quadrant's housing exhibited impact damage. The throttle control levers were found in the "shutoff" position, and the T/R controls were found in the "stowed" position. Engine control continuity from the cockpit throttle quadrant to the left and right engine fuel control units was established. Left and right T/R control continuity from the throttle quadrant to the T/R doors was established. The T/R switches were in the "ON" position.

Electrical testing of the left and right T/R stow microswitches within the cockpit throttle quadrant revealed that the left stow microswitch did not operate within design specifications. Disassembly of the left and right stow microswitches revealed evidence of arc wear due to aging.

According to the airplane manufacturer, the electrical wiring of the left T/R were found to be not conformal with the electrical drawings (wire numbers are not correct), missing connections on the terminal board, terminal board cover was missing, wires are not held with correct rope, excessive length of electrical wires. A computed tomography scan of the left actuator "OUT OF STOW" switch revealed an internal broken rivet that according to the airplane manufacturer would not have led to a short circuit.

The left T/R retarder Aft Control Box was positioned about 75% of its travel, more than 50% of its stroke. The mechanism could be pushed back to 100% travel (max power) but got stuck when pushed back to 75% travel where the system jammed using hand pressure. Removal of the Teleflex cable allowed the Aft Control Box to move freely.

The left T/R Teleflex cable was displayed resistance to movement by hand relative to the right T/R Teleflex cable. At a certain point of travel of the left cable, the cable became jammed. Examination of the left cable revealed that the cable sheath fluoropolymer liner was damaged within the length, where the cable tip was bound. There was a 3.37 inch-length of the liner that was missing, consistent with wear loss, mechanical removal, and fracture. The opposite end of the sheath liner exhibited course fibrils, consistent with monotonic fracture in overstress. The grease at the opposite end exhibited undisturbed particulate matter on top of the grease deposit.

According to the airplane maintenance manual, parts of the Teleflex system were to be lubricated with Dow Corning DC33 – a white grease, suitable for low temperatures. NTSB Materials Laboratory examination of the left T/R Teleflex cables revealed black grease within the cable sheath. Most of the cable lacked grease.

Operational testing of the T/R system could not be performed due to the damage the airplane incurred during the accident.

Damage to Aircraft

The airplane was destroyed.

Flight recorders

The airplane cockpit voice recorder (CVR) was part of the airplane type certificate and was required to be operational. Part 91 required turbine multiengine aircraft with six or more passenger seats and requiring two pilots manufactured prior to April 7, 2010, and operated under Part 91, must be equipped with a CVR that records a minimum of the last 30 minutes of aircraft operation; this is accomplished by recording over the oldest audio data. The accident aircraft was manufactured in 1978. When the CVR is deactivated or removed from the airplane, it retains only the most recent 30 minutes. Download of the CVR by the National Transportation Safety Board Vehicle Recorders Division. The CVR had not sustained any heat or structural damage, and the audio information was extracted from the recorder normally, without difficulty. The last recording on the CVR was on November 7, 2007. The accident flight was not recorded.

Additional Information

A pilot, who had previously owned the accident airplane and had flown Westwind airplanes since the mid-to-late 70s, reported that he attended Westwind flight training in 1978 and has attended training at the same facility every year since then for training primarily in Westwind airplanes. The training facility had a Westwind throttle quadrant, which was used to demonstrate that the throttle quadrant T/R control could unlock with “aggressive” movements of the throttle control toward idle, which would be a “problem” during landing because it would arm the T/Rs. He had previously flown a Westwind airplane to 10,500 ft for a pressurization check, during which he “snatch[ed]” the throttle to idle, and the piggyback came out of its detent. After landing the airplane, he attempted to duplicate the piggyback coming out of its detent by moving the throttle toward idle, but he was unable to do so. He said that a lot of flight training facilities did not teach that the piggyback could come out of its detent but that it was taught at the flight training facility that he attended. He said he discussed the uncommanded deployment of the T/Rs with the accident pilot, who he had trained, before the accident pilot attended the training facility.

The accident airplane throttle quadrant was not manipulated by hand during the post-accident examination to unlock the T/R control with “aggressive” movements of the throttle control toward idle due to accident damage of the throttle quadrant.

Administrative Information

Investigator In Charge (IIC):	Gallo, Mitchell
Additional Participating Persons:	Melvin Devore; Federal Aviation Administration; Oklahoma FSDO; Oklahoma City, OK Matt Rigsby; Federal Aviation Administration, Office of Accident Investigation, AVP-100; Washington, DC Jay Eller; Honeywell; Phoenix, AZ D. Smith; US Department of Transportation, Transportation Safety Institute; Oklahoma City, OK Dan Helfman; IAI Itzhak Raz; Ministry of Transport Gad Regev; Ministry of Transport
Original Publish Date:	June 10, 2021
Last Revision Date:	
Investigation Class:	Class 3
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.nts.gov/Docket?ProjectID=99131

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