



National Transportation Safety Board Aviation Accident Final Report

Location:	Ridgecrest, CA	Accident Number:	WPR15FA021
Date & Time:	10/24/2014, 0900 PDT	Registration:	N456FR
Aircraft:	SLINGSBY T67M 260	Aircraft Damage:	Substantial
Defining Event:	Loss of control in flight	Injuries:	2 Fatal
Flight Conducted Under:	Part 91: General Aviation - Instructional		

Analysis

The flight instructor and student, who was receiving instruction as part of a Flight Test Engineer program, departed with the intent of completing a flight card that called for 10 maneuvers, 4 of which included spins for a certain amount of rotations. The program allowed students to fly the airplane if they felt comfortable; however, it did not require that the student fly the airplane. A camera mounted inside the airplane provided a view of the right wing. Review of the recorded video revealed that the flight performed two left spins and one right spin with uneventful recoveries before the accident sequence.

The video showed that, during the accident sequence, the airplane entered a right spin, consistent with a maneuver on the flight card, which called for a six-rotation right spin with aileron inputs before recovery. Throughout the spin sequence, little-to-no aileron input was observed. As the airplane completed about 21 revolutions, the student made an altitude call of "6,000 ft," which was the specified bailout altitude. Shortly after, a callout of "5,500 ft" was made during revolution 22, and the canopy was opened between revolutions 24 and 25. Reflections within the canopy showed the student standing while grabbing the upper canopy rail between revolutions 29 and 30 and subsequently jumping from the right wing between revolutions 33 and 34. At the time of ground impact, the airplane had completed about 34 revolutions. The delayed egress from the airplane below the specified egression altitude and just before impact likely contributed to the student's fatal injuries. Little-to-no movement of the flight instructor was observed on the video; thus it is likely he did not attempt to bailout of the airplane.

Postaccident examination of the airframe and engine revealed no evidence of any preexisting mechanical malfunctions that would have precluded normal operation. In addition, the airplane was found to be within weight-and-balance and center-of-gravity limits. Further, a recent inspection of the airplane's rigging revealed that it was within limits prior to the accident flight. The accident circumstances are consistent with the pilots' failure to recover from a spin; however, the reason for this could not be determined.

Although the flight instructor's toxicology testing detected ethanol in the kidney, the absence of ethanol in the muscle suggests the identified ethanol was likely from postmortem production rather than ingestion. Although the autopsy of the flight instructor identified left ventricular hypertrophy, which is most often associated with hypertension, age, or regular, vigorous exercise and may be associated with an increased risk for acute cardiovascular events, only mild coronary artery disease and no significant atherosclerosis were noted. However, if a cardiovascular event or loss of consciousness from any other cause (such as a seizure or neurogenic syncope) occurred in the few minutes before the flight instructor's death, it would have left no evidence on autopsy.

Probable Cause and Findings

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

The pilots' failure to recover from a spin for reasons that could not be determined based on available information. Contributing to the student's fatal injury was his delayed egress from the airplane below the specified egression altitude.

Findings

Personnel issues	Delayed action - Student pilot (Factor)
Not determined	Not determined - Unknown/Not determined (Cause)

Factual Information

History of Flight

Maneuvering-aerobatics	Loss of control in flight (Defining event) Collision with terr/obj (non-CFIT)
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On October 24, 2014, about 0900 Pacific daylight time, a Slingsby T67M-260, N456FR, impacted terrain near Ridgecrest, California. The flight instructor and student were fatally injured, and the airplane sustained substantial damage. The airplane was registered to L'Avion, Inc., Mojave, California, and was being operated by the National Test Pilot School (NTPS) as a 14 Code of Federal Regulations Part 91 instructional flight. Visual meteorological conditions existed near the accident site about the time of the accident, and no flight plan was filed. The local flight originated from Mojave Airport, Mojave, California, about 0832.

NTPS representatives provided information to the National Transportation Safety Board (NTSB) investigator-in-charge (IIC) that indicated that the flight was part of the Flight Test Engineer Training Program, which includes the Basic Flight Awareness Program (BFAP). The purpose of the flight was to perform a series of stalls and spins. After air traffic controllers lost radar and radio contact with the airplane, a search was initiated, and the wreckage was subsequently located by a pilot in a company aircraft. Review of radar data provided by the Federal Aviation Administration (FAA) revealed that the airplane was at an altitude of about 11,800 ft mean sea level (msl) before it began a spin sequence and crashed.

Another flight instructor reported that he had flown with the student 3 days before the accident in a different airplane of the same make and model. The instructor stated that the flight was BFAP Flight 9 (F9) and that the student was flying the airplane during a phase-c stall, which included a 3-second application of full left rudder and full aft control stick inputs. During the maneuver, the airplane did not recover as expected, and the instructor ordered the student to initiate recovery from a spin per the flight manual procedures. Following two more rotations and proper recovery technique by the student, the airplane continued in a left spin. The flight instructor took control of the airplane and applied spin recovery control inputs. The airplane continued to spin an additional two rotations before the instructor applied full opposite rudder and full aft stick, reinitiating the flight manual recovery procedure with the use of more forward stick inputs at a faster rate.

The instructor further reported that, following two additional revolutions, the airplane did not recover, and that he immediately applied full aft stick, full opposite aileron, and "slammed" the control stick full forward in an effort to recover from the spin. The instructor stated that the airplane went into an almost 90°-nose-down attitude and that he recovered about 200 ft above the minimum bailout altitude. The instructor terminated the flight and returned to the departure airport. During the return flight, the instructor noted no evidence of any flight control binding or interference.

The President of NTPS reported that, due to the instructor's difficulty recovering from the spin,

the school grounded both of its T67M-260 airplanes to verify their flight control rigging. He reported that the T67M-260 that the student had flown 3 days before the accident was found to be at the maximum rigging limits. Maintenance personnel corrected the rigging, and the airplane was returned to service. He reported that the rigging on the accident airplane was found to be well within limits and that it was subsequently returned to service. He further reported that the accident airplane had been spun hundreds of times by various flight instructors and students with no issues before the accident flight. The NTPS Chief of Operations further reported that, when the accident airplane was returned to service, he had scheduled the student with the accident flight instructor, who had vast experience with spins in propeller-driven aircraft.

Flight Instructor Information

Certificate:	Airline Transport	Age:	68, Male
Airplane Rating(s):	Multi-engine Land; Single-engine Land	Seat Occupied:	Left
Other Aircraft Rating(s):	Helicopter	Restraint Used:	Unknown
Instrument Rating(s):	Airplane; Helicopter	Second Pilot Present:	No
Instructor Rating(s):	Airplane Single-engine; Helicopter	Toxicology Performed:	Yes
Medical Certification:	Class 2 Without Waivers/Limitations	Last FAA Medical Exam:	01/16/2014
Occupational Pilot:	Yes	Last Flight Review or Equivalent:	09/10/2013
Flight Time:	(Estimated) 7845 hours (Total, all aircraft), 59.4 hours (Last 90 days, all aircraft), 14 hours (Last 30 days, all aircraft)		

The flight instructor, age 68, held an airline transport pilot certificate with an airplane multiengine land rating with commercial pilot privileges for airplane single-engine land, rotorcraft helicopter, and instrument helicopter. The flight instructor was issued a second-class airman medical certificate on January 16, 2014, with no limitations. At the time of his most recent medical application, the flight instructor reported that he had accumulated a total flight time of 7,845 hours.

Review of the pilot's logbook with entries dated from December 5, 2012, to October 8, 2014, revealed that his most recent flight review was completed on September 10, 2013, in a Piper PA-34. Between January 1, 2014, and October 8, 2014, the flight instructor had logged a total of 160.3 flight hours, which included 49.9 hours in airplanes, 5.3 hours of which were in the accident make/model airplane, and 94.6 hours in helicopters. Within the 90 days before the accident, the flight instructor had logged 2.3 hours in the accident airplane on October 7 and 8, 2014. Per an entry dated April 15, 2014, the flight instructor flew the accident airplane for 1 hour, with "spins" noted in the comment section. It could not be determined how much total flight time the flight instructor had in the accident make/model airplane. NTPS representatives

reported that the flight instructor had previous military flight experience in both fixed-wing aircraft and rotorcraft. As part of his military flight experience, he was a primary flight instructor in T-34C airplanes. In addition, the flight instructor had been employed with NTPS since January 2006.

The student did not hold any flight or medical certificates. However, the student was a student of the Flight Test Engineer training program, which allowed nonpilot-rated students to conduct the specified maneuvers if they felt comfortable doing so. It could not be determined how much actual flight experience the student accumulated while enrolled in the program.

Aircraft and Owner/Operator Information

Aircraft Make:	SLINGSBY	Registration:	N456FR
Model/Series:	T67M 260 M260	Aircraft Category:	Airplane
Year of Manufacture:	1996	Amateur Built:	No
Airworthiness Certificate:	Aerobatic; Normal	Serial Number:	2257
Landing Gear Type:	Tricycle	Seats:	2
Date/Type of Last Inspection:	08/06/2014, Annual	Certified Max Gross Wt.:	
Time Since Last Inspection:		Engines:	Reciprocating
Airframe Total Time:	5104.8 Hours as of last inspection	Engine Manufacturer:	Lycoming
ELT:	C91A installed, activated, aided in locating accident	Engine Model/Series:	AEIO-540-D4A5
Registered Owner:	L'AVION INC	Rated Power:	
Operator:	On file	Operating Certificate(s) Held:	None

The two-seat, low-wing, fixed-gear airplane, serial number (S/N) 2257, was manufactured in 1996. It was powered by a 260-horsepower Lycoming AEIO-540-D4A5 engine, serial number L-25838-48A, and was equipped with a three-bladed Hoffman adjustable-pitch propeller. Review of airframe and engine logbook records revealed that the most recent annual inspection was completed on August 6, 2014, at an airframe total time of 5,104.8 hours.

Using the reported weights of both occupants and full fuel, the airplane was found to be within weight-and-balance and center-of-gravity limits.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual Conditions	Condition of Light:	Day
Observation Facility, Elevation:	K9L2, 2278 ft msl	Distance from Accident Site:	27 Nautical Miles
Observation Time:	1555 UTC	Direction from Accident Site:	196°
Lowest Cloud Condition:	Clear	Visibility	10 Miles
Lowest Ceiling:	None	Visibility (RVR):	
Wind Speed/Gusts:	Calm /	Turbulence Type Forecast/Actual:	/
Wind Direction:		Turbulence Severity Forecast/Actual:	/
Altimeter Setting:	30.09 inches Hg	Temperature/Dew Point:	15° C / -4° C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Mojave, CA (MHV)	Type of Flight Plan Filed:	None
Destination:	Mojave, CA (MHV)	Type of Clearance:	VFR
Departure Time:	0832 PDT	Type of Airspace:	

At 0855, recorded weather from a station located about 27 miles southwest of the accident site reported calm wind, visibility 10 statute miles, clear sky, temperature 15° C, dew point -4° C, and an altimeter setting of 30.09 inches of mercury.

Wreckage and Impact Information

Crew Injuries:	1 Fatal	Aircraft Damage:	Substantial
Passenger Injuries:	1 Fatal	Aircraft Fire:	None
Ground Injuries:	N/A	Aircraft Explosion:	None
Total Injuries:	2 Fatal	Latitude, Longitude:	35.412778, -117.713611 (est)

Representatives of the FAA and NTSB conducted an on-scene examination of the accident site on October 24 and 25, 2014.

Examination of the accident site revealed that the airplane impacted open desert terrain about 12 miles south of Ridgecrest. The airplane came to rest upright oriented on a magnetic heading of about 027° at a GPS elevation of 2,345 ft msl. Wreckage debris, which included plexiglass, rudder, and portions of the engine cowling, remained within about 10 ft of the main wreckage. Vegetation, about 12 to 18 inches high and located immediately to the left and right of the aft area of the fuselage, appeared to be undamaged.

The left wing remained attached to the fuselage. The left aileron remained attached to its

respective mounts. The outboard portion of the left flap was separated and located about 1 ft aft of the left wing. The inboard portion of the flap remained attached via the inboard attachment point. The right wing remained attached to the fuselage. The right aileron remained attached to its respective mounts. The outboard portion of the right flap was separated at the outboard attachment mount and remained attached to the inboard portion of the flap. The inboard portion of the flap remained attached via the inboard attachment point.

The empennage remained intact. The left and right horizontal stabilizers remained attached. The left and right elevators remained attached via their respective mounts. The trim tab remained attached via its respective mount. The rudder was separated from the vertical stabilizer at the upper hinge attachment point, and the separated portion of the rudder was located about 1 ft aft of the main wreckage. The bottom portion of the rudder, which included the rudder bellcrank, remained attached to the vertical stabilizer.

Flight control continuity was established from the cockpit controls to all primary control surfaces. No breaks or separations were observed within the entire flight control system.

The fuselage appeared to be intact with displaced portions of the composite structure aft of the cockpit area, consistent with impact-related forces. An additional separation of the fuselage (crack) was observed immediately aft of the seats. Dirt/sand was observed on the right side of the cowling, and it was built up higher than on the wing's left side.

Documentation of the cockpit area revealed that both the left and right seat five-point restraints remained attached to the fuselage attachment points; however, all harnesses were separated from the clasp assembly. The left seat shoulder restraint metal clasp was found partially embedded in the outside portion of the fuselage.

The cabin area remained intact, and the canopy was separated. The aft canopy slide mechanism was located in an "aft" position, consistent with the canopy being in an "open" position. The canopy slide lock was found in the "unlocked" position.

The wreckage was recovered to a secure location for further examination; both wings, horizontal stabilizers, and elevators were removed to facilitate transport of the wreckage. Examination of the recovered wreckage was conducted at the facilities of Air Transport, Phoenix, Arizona, on December 11, 2014, by the NTSB IIC and a representative from Lycoming Engines.

No evidence of binding or restricted travel was observed. The left seat control stick was fractured at the base. The fracture surfaces exhibited signatures consistent with overload separation.

Examination of the recovered engine revealed that all engine accessories remained attached to the engine except for the right magneto, oil filter, vacuum pump, and fuel control servo. The rocker box covers, left magneto, and top spark plugs were removed. The crankshaft was rotated using a hand tool attached to one of the accessory case drive pads. Rotational continuity was established throughout the engine and valve train, and thumb compression was obtained on all six cylinders. Both the left and right magnetos were intact and produced spark on all posts

when the magneto drive shafts were rotated using a hand drill.

For further information regarding the airframe and engine examination, see the NTSB Accident Site, Airframe, and Engine Examination Summary Report within the public docket for this accident.

Medical And Pathological Information

Flight Instructor

According to the Kern County Coroner's autopsy report, the flight instructor's cause of death was "multiple blunt force trauma," and the manner of death was "accident." Examination of the body identified left ventricular hypertrophy, which is most often associated with hypertension, age, or regular, vigorous exercise. When identifiable by electrocardiogram, LVH may be associated with an increased risk for acute cardiovascular events, such as sudden cardiac death, stroke, and heart attacks. Mild focal areas of coronary artery disease were noted (not further described in the autopsy report), no significant atherosclerosis was noted, and the remainder of the heart evaluation was unremarkable. No other significant natural disease was identified.

The FAA's Bioaeronautical Research Laboratory conducted toxicology testing of specimens from the flight instructor. The testing identified 0.013 gm/dl of ethanol in the kidney, but no ethanol was identified in the muscle tissue. After absorption, ethanol is quickly distributed throughout the body's tissues and fluids fairly uniformly. The distribution pattern parallels the water content and blood supply of each organ. Ethanol may also be produced by postmortem microbial activity in the body.

Student

According to the Kern County Coroner's autopsy report, the student's cause of death was "multiple blunt force trauma," and the manner of death was "accident."

The FAA's Bioaeronautical Research Laboratory conducted toxicology tests on specimens from the student. The results were negative for carbon monoxide and volatiles and positive for salicylate in the urine.

Additional Information

Flight Test Procedures

Review of the BFAP F9 flight card for the accident flight revealed that 10 maneuvers were to be conducted. The first four maneuvers involved unusual attitudes and a stall series that included

straight ahead, left, and right turn 1-g stalls with delayed subsequent recoveries from 1 to 3 seconds.

Maneuvers 5 through 8, which included spins, stated the following:

Maneuver 5: Right spin, three turns, flight manual recovery

Maneuver 6: Left spin, three turns, flight manual recovery

Maneuver 7: Right spin, six turns, two turns ailerons neutral, additional two turns left aileron, additional two turns right aileron, flight manual recovery

Maneuver 8: Left spin, six turns, two turns ailerons neutral, additional two turns right aileron, additional two turns left aileron, Flight manual recovery

Maneuvers 9 and 10 included a loop and roll before returning to the airport.

The flight card stated that the stall series and three-turn spin series were to be executed at an altitude of 9,000 ft msl and that the six-turn spin series was to be executed at 10,000 ft msl. In addition, the card noted that all recoveries should be initiated by 7,500 ft msl and that the bailout altitude was 6,000 ft msl.

Video Examination

A GoPro Hero 3 camera, enclosed in a watertight case, was located in the wreckage and subsequently sent to the NTSB Vehicle Recorders Laboratory for review. Examination of the camera revealed that the memory card contained various recordings and had captured video showing the airplane located on the ramp at the departure airport through the time the accident occurred. The camera appeared to have been mounted on the right side of the airplane's canopy and provided a view of the right wing, including the right flap and aileron. Additionally, reflections on the canopy were observed throughout various portions of the recording. The reflections included those of the passenger, who was seated in the right seat and was wearing a green flight suit, and the flight instructor, who was seated in the left seat and was wearing a blue flight suit. Throughout the recordings, some muffled vocal comments, cockpit noises, and muffled engine noises were heard.

The video showed that, about 11 minutes after takeoff, the flight instructor and student conducted a stall, consistent with maneuver 2 on the flight card, and that maneuvers 1 and 3 were not flown. Upon completion of maneuver 2, the airplane entered maneuver 4, and a left 2-revolution spin was performed. About 4 minutes later, the airplane performed maneuver 5, which incorporated a 4-revolution right spin with a normal recovery. About 5 minutes later, the airplane performed a left 4.5-revolution spin, consistent with maneuver 6.

The airplane then entered a right spin, consistent with maneuver 7. As the airplane completed about 21 revolutions, the student reported an altitude of "6,000 ft" followed by another announcement of an altitude of "5,500 [ft]" 1 revolution later. It could not be determined whether the word "bailout" was said after "5,500" was announced. The canopy was opened between revolutions 24 and 25. Reflections within the canopy showed the instructor's right arm grabbing the canopy between revolutions 27 and 28, while the student was observed standing while grabbing the upper canopy rail between revolutions 29 and 30. The student subsequently jumped from the right wing between revolutions 33 and 34; little-to-no movement of the flight

instructor was observed. At the time of ground impact, the airplane had completed about 34 revolutions.

For further information regarding the captured video, see the Onboard Image Recorder Factual Report in the public docket for this accident.

Spin Procedures

Review of the Pilot's Operating Handbook for the accident make/model airplane, Section 4, "Normal Procedures, Spin Recovery," stated that the following steps were to be taken to recover from a spin:

1. Throttle- IDLE
2. Flaps – Raise (If lowered)
3. Hold control stick back with ailerons neutral
4. Check direction of rotation of spin by external visual reference and the turn indicator needle
5. Apply and maintain full rudder to oppose the direction of spin
6. Pause – One Second
7. Move control stick, with the ailerons neutral, progressively forward until the spin stops
8. Immediately [when] the spin stops, centralize the rudder and fly the aircraft in a straight line, out of the dive with a 3-g pullout.

Warning – A high rotation rate spin may occur if the correct recovery procedure is not followed; particularly if the control column is moved forward, partially, or fully before the application of full anti-spin rudder. Such out of sequence control actions will delay recovery and increase the height loss. If the aircraft has not recovered within 2 (two) complete rotations after application of full anti-spin rudder and fully forward control column, the following procedure may be used to expedite recovery.

1. Check that full ant-spin rudder is applied.
2. Move the control column FULLY AFT – then slowly forward until the spin stops.
3. Centralize the controls and recover to level flight (observing the 'g' limits).

Administrative Information

Investigator In Charge (IIC): Joshua Cawthra **Report Date:** 05/23/2017

Additional Participating Persons: Frank Motter; Federal Aviation Administration; Van Nuys, CA
Mark Platt; Lycoming Engines; Williamsport, PA
William Korner; Flight Research Inc.; Mojave, CA
Gregory Lewis; National Test Pilot School; Mojave, CA
Will Stewart; National Test Pilot School; Mojave, CA
Alen Peterson; National Test Pilot School; Mojave, CA
Scott Glaser; Flight Research Inc.; Mojave, CA

Publish Date: 05/23/2017

Note: The NTSB traveled to the scene of this accident.

Investigation Docket: <http://dms.ntsb.gov/pubdms/search/dockList.cfm?mKey=90299>

The National Transportation Safety Board (NTSB), established in 1967, is an independent federal agency mandated by Congress through the Independent Safety Board Act of 1974 to investigate transportation accidents, determine the probable causes of the accidents, issue safety recommendations, study transportation safety issues, and evaluate the safety effectiveness of government agencies involved in transportation. The NTSB makes public its actions and decisions through accident reports, safety studies, special investigation reports, safety recommendations, and statistical reviews.

The Independent Safety Board Act, as codified at 49 U.S.C. Section 1154(b), precludes the admission into evidence or use of any part of an NTSB report related to an incident or accident in a civil action for damages resulting from a matter mentioned in the report. A factual report that may be admissible under 49 U.S.C. § 1154(b) is available [here](#).