Aviation Investigation Final Report

Location:	ROCK, Kansas	**Accident Number:**	CHI99FA023
Date & Time:	November 4, 1998, 20:58 Local	**Registration:**	N5LN
Aircraft:	Mitsubishi MU-2B-60	**Aircraft Damage:**	Destroyed
Defining Event:		**Injuries:**	2 Fatal
Flight Conducted Under:	Part 91: General aviation		

Analysis

The airplane's left engine had been overhauled and required an in-flight Negative Torque Sensing (NTS) check. The procedures required that the left engine be shut down during the test flight. The test flight was conducted at night. The pilots were briefed that there was icing and moderate rime icing mixed below 15,000 feet in clouds and precipitation. The cloud bases were between 2,500 to 2,900 feet agl. After departure, the pilot reported to ATC that they were clear and on top of the clouds at about 6,500 feet msl. N5LN was assigned a 180 degree heading at an assigned altitude of 8,000 feet. Without notification to ATC, N5LN turned to a southeast heading, descended from 7,700 feet to about 5,500 feet, and decelerated from about 182 kts to about 138 kts. ATC assigned N5LN a block altitude of 6,000 to 8,000 feet and a VFR-On-Top clearance. ATC instructed N5LN to turn right to stay in the assigned airspace. N5LN turned right but continued to descend from about 5,500 feet to the last radar indication of 4,500 feet. The airplane impacted the ground in a steep attitude. The inspection of the wreckage indicated the landing gear was down, and with full right rudder trim and about six degrees nose up trim. The examination of the engines indicated both engines were rotating and operating at the time of impact. The examination of the airframe and propellers found no pre-existing anomalies that would have precluded normal operation.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: the pilot failed to maintain control of the aircraft and made an improper evaluation of the weather. Additional factors were flying a test flight at night with the icing conditions in the clouds.

Findings

Occurrence #1: LOSS OF CONTROL - IN FLIGHT
Phase of Operation: CRUISE

Findings
1. (C) AIRCRAFT CONTROL - NOT MAINTAINED - PILOT IN COMMAND
2. (C) WEATHER EVALUATION - IMPROPER - PILOT IN COMMAND
3. IFR PROCEDURE - NOT FOLLOWED - PILOT IN COMMAND
4. (F) LIGHT CONDITION - NIGHT
5. (F) WEATHER CONDITION - ICING CONDITIONS
6. (F) WEATHER CONDITION - CLOUDS

Occurrence #2: IN FLIGHT COLLISION WITH TERRAIN/WATER
Phase of Operation: DESCENT - UNCONTROLLED

Factual Information

HISTORY OF FLIGHT

On November 4, 1998, at 2058 central standard time (all times cst), a Mitsubishi MU-2B-60, operated by L. W. Aviation was destroyed when it impacted the ground near Rock, Kansas. The private pilot and an airline transport pilot certificated copilot received fatal injuries. The 14 CFR Part 91 flight departed Augusta Municipal Airport (3AU), Augusta, Kansas, on a local flight to conduct a maintenance test flight. Visual meteorological conditions prevailed and the flight had received a VFR-On-Top clearance.

At 2018, the pilot of N5LN requested a weather briefing for the 3AU area from the Federal Aviation Administration's (FAA) Wichita Automated Flight Service Station. The weather briefer said the cloud tops were at 8,200 feet mean sea level (all altitudes msl) in the area, and that there was icing and moderate rime icing mixed below 15,000 feet in clouds and precipitation. The pilot reported to the briefer that they needed to do some checks on the airplane and that they needed to determine whether to go on top or do the check beneath the ceiling. The pilot said they would be returning to the same airport. He then filed an IFR flight plan requesting 8,000 feet. The briefer said that he provided a standard briefing. The pilot said N5LN would be departing from 3AU and communicating with the Wichita Tower from the ground at 3AU.

N5LN, while still on the ground at 3AU, contacted the Wichita Air Traffic Control Tower, Flight Data position at 2034:16. N5LN reported they were an IFR flight staying in the area and requested 3,000 feet. Flight Data asked what N5LN needed to do, and then said, "I show you requesting eight thousand." N5LN replied that they wanted to stay in the area and do an engine-out test, and then land. Flight Data issued the clearance, "... via Augusta direct to Wichita direct, maintain 3,000 feet, expect 8,000 feet one zero minutes after departure, departure control frequency will be 134.8, squawk 4776, and hold for release." The pilot of N5LN repeated the clearance, and then asked the controller about radar vectors. The controller then said that they could expect radar vectors to stay in the area.

At 2035:35, N5LN reported to the tower that they were ready to depart on runway 36. At 2035:48, the controller issued the clearance, "...entering controlled airspace fly heading three six zero, released for departure, advise airborne 134.8."

At 2037:46, N5LN reported to the Wichita radar east controller that they were climbing to 3,000 feet. The controller acknowledged and told the flight to maintain 8,000 feet. The controller reported he was not receiving the transponder signal, and asked N5LN to recycle the transponder and push the transponder identification button. N5LN acknowledged at 2038:48.

At 2041:00, the radar data indicated that N5LN was about 6,300 feet and climbing at about 130

nautical miles per hour (kts) true airspeed (all speeds TAS), and on a heading of about 010 degrees.

At 2041:01, the controller reported the flight in radar contact six miles north of 3AU, and asked if the flight wanted to maneuver towards the VOR [Wichita].

At 2041:09, N5LN replied, "uh yes sir we could move maneuver a little bit away from the VOR will be fine we're just we're in uh we're in uh clear weather on top here now we're gonna shut down an engine to do an NTS check and then we'll be through."

At 2041:28, the controller asked the flight if it wanted to continue on a heading for the test. N5LN responded, "kay that'd be fine yea."

At 2041:29, the controller then told N5LN to continue on the present heading, and said "Wichita altimeter's three zero zero four."

At 2042:41, the radar data indicated N5LN was about 7,800 feet at about 147 kts and on about a 009 degree heading.

At 2043:40, the controller told N5LN to turn right and to fly heading one eight zero. At 2043:44, N5LN repeated the heading.

At 2043:40, the radar data indicated N5LN was about 7,500 feet at about 160 knots on about a 004 degree heading, and in about a 500 foot per minute (fpm) rate of descent.

At 2044:40, the radar data indicated N5LN was about 7,200 feet at about 152 kts on about a 189 degree heading, and in about a 150 fpm rate of descent.

At 2046:20, the radar data indicated N5LN was about 7,800 feet at about 190 kts on about a 189 degree heading, and in about a 0 fpm rate of climb.

At 2047:20, the radar data indicated N5LN was about 7,800 feet at about 203 kts on about a 188 degree heading, and in about a 150 fpm rate of descent.

At 2047:37, the radar data indicated N5LN was about 7,700 feet at about 185 kts on about a 177 degree heading, and in about a 400 fpm rate of descent.

The radar data indicated N5LN had maintained a southerly heading from 2044:37 to about 2047:37. N5LN then made a left turn to a southeasterly heading, and N5LN's airspeed decelerated from about 182 kts to about 138 kts. N5LN did not notify ATC of the heading change, and N5LN did not notify ATC of the change in airspeed.

While on the southeasterly heading between about 2047:37 and 2053:38, N5LN descended from about 7,700 feet to about 5,500 feet, with an average descent rate of 365 fpm. N5LN did

not notify ATC of the altitude change.

At 2049:00, the radar data indicated N5LN was about 6,700 feet at about 158 kts on about a 153 degree heading, and in about a 750 fpm rate of descent.

At 2049:03, the controller asked N5LN if it wanted VFR-On-Top.

At 2049:07, the pilot replied, "...we'd like a block altitude for this testing, maybe from six to eight thousand."

At 2049:12, the controller transmitted, "...roger, maintain VFR-On-Top, altitude your discretion, VFR."

At 2052:00, the radar data indicated N5LN was about 5,900 feet at about 136 kts on about a 138 degree heading, and in about a 200 fpm rate of descent.

At 2052:49, the controller asked the pilot to take up a westerly heading to "keep you in my airspace."

At 2052:53, N5LN replied, "okay I tell ya we'd like be a very, very slow turn." Radar data indicated that at that time the mode C altitude was 5,800 feet, and the flight was descending.

There were no more transmissions from N5LN.

While in a right turn between about 2053:38 and 2056:09, N5LN descended from about 5,500 feet to about 4,500 feet, with an average descent rate of 395 fpm.

At 2053:00, the radar data indicated N5LN was about 5,800 feet at about 126 kts on about a 115 degree heading, and in about a 300 fpm rate of descent.

At 2054:00, the radar data indicated N5LN was about 5,200 feet at about 135 kts on about a 196 degree heading, and in about a 400 fpm rate of descent.

At 2055:00, the radar data indicated N5LN was about 5,000 feet at about 135 kts on about a 230 degree heading, and in about a 250 fpm rate of descent.

The last radar return was at 2056:10 and it indicated N5LN was about 4,500 feet on about a 245 degree heading.

The airplane impacted the ground about 5 miles east of Rock, Kansas, at coordinates N 37 degrees 27.745 minutes, W 96 degrees 53.663 minutes.

PERSONNEL INFORMATION

The pilot held a private pilot certificate with the ratings and limitations of an airplane multi-engine land, single-engine land and sea, helicopter, and airplane instrument pilot.

He held a FAA third-class medical certificate dated January 9, 1998. His medical records revealed a history of myocardial infraction and coronary artery disease that required bypass graft surgery in 1988 and aortic valve replacement surgery in 1992.

The pilot had accumulated about 3,136 total flying hours. He had flown about 298 hours in the make and model aircraft. He had flown about 29 hours in the accident airplane in the last 90 days.

The pilot was a medical doctor, but he also owned and operated L. W. Aviation. From about 1991 until the summer of 1997, L. W. Aviation operated a Beech King Air B-90. The pilot had accumulated about 926 flight hours in the B-90 airplane.

In 1997 the pilot purchased N5LN, a MU-2B-60, s/n 799SA. He attended the Howell Enterprises, Inc. Initial Mitsubishi MU-2 Training Course which included ground school and flight training in August 1997. On August 27 and 28, 1998, he and the accident copilot attended FlightSafety International's MU-2 Pilot Recurrent Course located in Houston, Texas.

The pilot's personal flight logbook indicated that on August 26, 1998, N5LN was flown from 3AU to HOU (Houston-William P. Hobby Airport). The flight lasted 2.2 hours. The logbook indicated the pilot received training in a simulator for 1.5 hours on August 27 and 1.5 hours on August 28. The pilot wrote in the Remarks section of his logbook that covered those two days the following statements:

" *(un-legible mark) Jack Casey. SELdg-ADF, ILS, VOR approach. NTS (Negative Torque Sensing) air check."

The pilots logbook indicated N5LN flew from HOU to 3AU on August 28, 1998. The flight lasted 2.2 hours. The pilot wrote in the Remarks section of his logbook that covered the flight the following statement:

"air NTS check-rt. eng inop X10 min"

The copilot held an airline transport pilot certificate with the ratings and limitations of airplane multi-engine land and a type rating in a Beech BE-300. He was commercially rated in single-engine land, and was a Certified Flight Instructor for multi-engine and single-engine land airplanes. He held a FAA first-class medical certificate dated July 7, 1998.

The copilot was a simulator instructor pilot for FlightSafety International in Wichita, Kansas. He instructed in Beech 300 and Beech 350 simulators.

According to an insurance application dated September 4, 1998, the copilot had accumulated

about 22,770 total flying hours. He had flown about 420 hours in the make and model airplane in the last 5 years. He had flown the accident airplane about 16 hours in the last 90 days.

The L. W. Aviation Flight Logs indicated the copilot flew with the pilot on August 26, 1998, from 3AU to HOU, and on the return flight to 3AU on August 28, 1998.

AIRCRAFT INFORMATION

The airplane was a twin engine Mitsubishi MU-2B-60, serial number 799SA. The airplane seated nine and had a maximum gross weight of 11,575 pounds. The engines were 715 horsepower AlliedSignal TPE-331-10 engines. The last 100 hour inspection was conducted on July 30, 1998. The airplane had flown about 30 hours since the last inspection and had a total time of 4,712 hours.

On September 12, 1998, the airplane was flown from 3AU to Lakefront Airport (NEW), New Orleans, Louisiana, before its planned flight to the country of Belize in Central America, where the pilot had a personal residence. During takeoff from NEW to Belize, N5LN ingested a bird into the airplane's left engine. The airplane returned to NEW to assess the damage from the bird ingestion.

The left engine was removed from the airplane for inspection and was subsequently overhauled. The left propeller was placed on a tire on the hangar floor when the left engine was removed from the airplane. A storm flooded the New Orleans area and the hangar where the airplane was parked. The watermark on the fuselage of the airplane indicated the water level in the hangar was about 18 inches deep. The left propeller was overhauled as a result of the water damage. The engine and left propeller were re-installed on the airplane on October 23, 1998. The October 23, 1998, engine logbook entry contained the following information:

"Engine functional test c/w by Intercontinental Jet. Engine re-installation L/H side of MU-2B-60 s/n 799SA, N5LN. Ground run, rig, & leak check c/w. This engine requires soap sample within 25 hours. NTS test flight required before return to service."

The L. W. Aviation Flight Log and Manifest indicated that the accident pilot flew the airplane from NEW back to 3AU on October 25, 1998. The mechanic from the fixed base operator where the airplane was hangared reported the pilot flew it by himself at night. The witness reported the pilot told him that he was not flying the airplane back to a maintenance facility, but that he was flying it back to Kansas, and later the accident copilot would fly it to a maintenance facility.

The L. W. Aviation Flight Log and Manifest indicated that the accident copilot flew N5LN from 3AU to Tulsa International Airport (TUL), Tulsa, Oklahoma, on October 26, 1998, for required maintenance. Maintenance records indicated repairs were made to the landing gear system. The maintenance facility's Discrepancy Report form had the following entries:

October 26, Discrepancy and BY: "Gear won't retract."

October 28, Discrepancy and By: "OPS check of landing gear."

October 28, Action Taken and By: "OPS checked L.G. after getting in water. Checked OK per maint manual."

A witness at the maintenance facility reported the landing gear would not retract when the airplane arrived for maintenance on October 26, 1998. He reported the landing gear was thoroughly checked. He reported the airplane's "belly panels" were removed. He reported that no water was in the pressure vessel nor was there water in any of the belly panels. He reported both engines were run to compare the two. He reported that as a normal course of action an un-feather pump NTS check is performed during a ground engine run.

The L. W. Aviation Flight Log and Manifest indicated the accident copilot flew N5LN back to 3AU from TUL on October 29, 1998.

METEOROLOGICAL INFORMATION

The November 4, 1998, surface weather observations at Wichita (KICT), Kansas, located about 28 nautical miles east-southeast of the accident site at an elevation of 1,321 feet, indicated the following:

At 1956, the observation was ceiling 2,900 feet overcast; visibility 9 miles; temperature 4 degrees C; dew point 1 degree C; winds 360 degrees at 8 knots; altimeter setting 30.24 inches of Hg.

At 2056, the observation was few clouds at 1,900 feet, ceiling 2,500 feet overcast; visibility 9 miles; temperature 4 degrees C; dew point 1 degree C; winds 020 degrees at 6 knots; altimeter setting 30.24 inches of Hg.

At 2156, the observation was few clouds at 1,500 feet, ceiling 2,400 feet overcast; visibility 6 miles; mist; temperature 4 degrees C; dew point 2 degrees C; winds 010 degrees at 9 knots; altimeter setting 30.24 inches of Hg.

The following AIRMET was in effect for the time and area of the accident: AIRMET Zulu Update 3 for ice (CHIZ WA 042045) issued November 4, 1998, 1445 and valid until November 4, 1998, 2100, occasional moderate rime or mixed icing in cloud and in precipitation above the freezing level to 15,000 feet. Freezing level surface to 4,000 feet.

The upper air data indicated that at 2100 on November 4, 1998, the temperature at 2,034 feet was about 35 degrees F with a relative humidity of 89 percent. The temperature at 3,459 feet was about 30 degrees F with a relative humidity of 84 percent.

The National Center for Atmospheric Research (NCAR) reported the Integrated Icing Diagnostic Algorithm (IIDA) for November 4, 1998, 2100, showed a high probability of potential icing (greater than 70%) from about 3,000 feet altitude to about 8,000 feet altitude in the KICT area. A second layer from about 9,000 feet to about 13,000 feet exhibited a high probability of potential icing. No Supercooled Large Drop (SLD) icing potential was indicated in the KICT area.

According to NCAR, IIDA icing potential means that some supercooled liquid water exists. A high potential means that it is very likely that some liquid water exists there, but it is not an indication of icing severity. (See Meteorological Factual Report)

WRECKAGE AND IMPACT INFORMATION

The airplane impacted the ground in a flat, soft dirt field on a heading of about 082 degrees. A ground fire consumed the airplane's cockpit and much of the fuselage, and empennage. Fire and impact forces destroyed the cockpit instrumentation, avionics, annunciator panel and system controls.

The main cabin door was found about 147 feet behind and to the left of the main wreckage. No fire damage was found on the main cabin door. Fuel spillage was observed over an area about 120 feet forward and 45 degrees to the left of the main wreckage.

A position light bulb was found unbroken on the left tip tank. The bulb's filament was found stretched in a down and forward direction of about 45 degrees, and stretched in an inboard direction about 45 degrees from vertical.

The center section of the wing was destroyed by fire. The upper wing center section skin was found about 109 feet forward and about 60 degrees to the left of the main wreckage. This wing skin section did not exhibit fire damage. The left and right wings' leading edges were crushed, flattened and embedded in the ground. Both wing tip tanks had made about 3 foot indentations in the ground. The forward 1/2 of the right tip tank was buried in the ground. The aft section of the right tip tank was found about 65 feet aft of the main wreckage. The left tip tank was found adjacent to the left wing. The tip tanks did not show evidence of ground fire damage.

All four flap sections were found at the accident site. The jack nuts were found against the forward stop, indicating flaps in the full up position.

The electrically driven trim ailerons were found in the neutral (zero) position. The witness holes between the bellcrank bracket and bellcrank were in alignment.

The empennage was found in the inverted position and exhibited extensive ground fire damage. The right horizontal tail, right elevator outboard section, and most of the vertical tail and rudder were destroyed by fire. The left horizontal tail and elevator remained intact but

exhibited impact damage. The left horizontal stabilizer leading edge was undistorted. The left elevator balance weight was still attached to the left elevator. All cable runs to the elevator and rudder bellcranks were attached and the keepers were safety wired in place.

The elevator trim indicator in the cockpit read slightly over five degrees. The measurement (3/32") from the aft end of the traveling nut in the trim control system indicated the trim was set to about 6.4 degrees nose up.

The rudder and vertical tail were found under the remains of the horizontal stabilizer and were almost completely consumed by fire. The rudder balance weight and the rudder trim were found burned away from the attaching structure.

The measurement of the rudder trim actuator was approximately one inch from neutral alignment which indicated right rudder trim. The measurement of the rudder trim traveling nut in the pedestal showed the traveling nut was against the aft stop, indicating full nose right trim.

The main landing gear were found in the extended position. Both main landing gear drag struts were found in the retracted position. The struts retract during landing gear extension and extend during landing gear retraction. The traveling nut in the landing gear stopper/indicator assembly was found in the full forward position. The nut moves forward during gear extension.

The left main landing gear door was found about 41 feet to the left and aft of main wreckage. The main landing gear door exhibited no fire damage. The pieces of the nose landing gear outer wheel halves were found 133 feet aft of the main wreckage.

The left and right engines were buried about six feet in the ground in a near vertical position. The gear cases were separated from the power section of both engines.

All eight propeller blades were found at the accident site. One blade from each propeller assembly was found separated from the hub. The remaining blades were found buried in the crater with their respective engines. (See Wreckage Diagram and Photographs)

The left and right engines were sent to Honeywell Product Safety and Investigation Laboratory in Phoenix, Arizona, for teardown inspections. The teardown and examinations of both engines revealed that the type and degree of damage was indicative of engine rotation and operation at the time of impact with the ground. No pre-existing conditions were found on either engine that would have interfered with normal operation. (See Honeywell Teardown Report)

MEDICAL AND PATHOLOGICAL INFORMATION

Autopsies of the pilot and copilot were not performed due to impact forces and fire damage.

A Forensic Toxicology Fatal Accident Report was prepared by the FAA Civil Aeromedical Institute. The report concerning the pilot indicated the following results:

Carbon monoxide: Not performed due to lack of suitable specimen.

Cyanide: Not performed due to lack of suitable specimen.

No ethanol detected in muscle.

No drugs detected in muscle.

SURVIVAL ASPECTS

At 0630, November 5, 1998, the FAA's Wichita TRACON supervisor received a call from "Butler County 911" concerning N5LN. The caller said that the aircraft had been missing since the previous evening. A search of the previous day's flight progress strips was initiated and a call to Wichita Automated Flight Service Station (ICT AFSS) was made to determine if Wichita Tower had worked the aircraft. The flight progress strips were located, and the supervisor made several calls to area airports initiating ramp searches. Search and rescue was also initiated. The previous day tape recordings were reviewed. The supervisor contacted Airways Facilities personnel to begin a data extraction. The Kansas City Air Route Traffic Control Center (ARTCC) was contacted to issue an alert notice (ALNOT). The last radar return position was determined from the data extraction. The supervisor then went to the east satellite position at the TRACON, and had the controller relay last-position data to the helicopter that was already en-route. At about 0943 the pilot of Lifeguard helicopter N1LW reported finding the wreckage of an aircraft. The TRACON supervisor then contacted "Butler County 911" to advise them that the wreckage was located. The TRACON was advised that there were two fatalities. (See Air Traffic Control Group Chairman's Factual Report)

TESTS AND RESEARCH

NTS Components Tests

The Negative Torque Sensing (NTS) system components were examined. The NTS or "Lee" check valve and orifice assembly were tested at the Lee Check Valve Company and were found to be operational.

The NTS transfer tube was examined and it was found to be clear and unobstructed. The depth of the NTS transfer tube retention boss was measured and found to be within manufacturing specifications.

The feather valve was examined and tested satisfactorily. The NTS regulator was tested and found to test satisfactorily.

The NTS pressure switch was sent to the manufacturer, Hydra-Electric, in Burbank, California. The torque sensor could not be tested due to impact damage. No pre-existing anomalies were found that would have prevented operation prior to impact.

Metallurgical Examinations

Metallurgical examinations of the left and right engine components were conducted at the Honeywell metallurgical laboratory in Phoenix, Arizona. The components examined included the left engine main shaft, left engine torsion shaft, left engine 1st stage turbine blades and nozzle segments, and the right engine 1st stage turbine blades, and the right engine 1st and 2nd stage nozzle segments. (See Honeywell Teardown Report)

MHIA Flight Test

Mitsubishi Heavy Industries America, Inc. (MHIA) conducted a flight test of a MU-2B-60 airplane on September 30, 1999. The flight test was conducted near 3AU and the airplane was in communication with the Wichita Approach Control during the test.

During one flight test sequence, FT #5, the test airplane climbed to and leveled off at 8,000 feet at 180 kts with the landing gear and flaps retracted. The left engine was shutdown and an airborne NTS check was performed. After the NTS check was completed, an in-flight engine restart was accomplished. The airplane maintained about 8,000 feet msl altitude and a constant heading during the test sequence. (See MHIA Flight Test)

MU-2B-60 Airplane Flight Manual

The Mitsubishi MU-2B-60 Airplane Flight Manual (AFM) requires that a Feather Valve Check be performed prior to the first flight of the day and before every flight during which an intentional engine shutdown is planned. The check must also be performed before every flight after feather linkage was adjusted and/or maintenance of the feathering system was conducted.

The AFM requires that a Negative Torque Sensing (NTS) check be performed prior to the first flight of the day and anytime intentional engine shutdowns are to be performed. The NTS must also be checked after maintenance or system adjustment.

A WARNING in the AFM reads:

IF ENGINE FAILS NTS CHECK, CORRECT PRIOR TO FLIGHT.

The AFM states the following CAUTION concerning FEATHERING OPERATIONS:

CAUTION:

IF PRACTICE ENGINE SHUTDOWN AND AIRSTARTS ARE PLANNED, OVERSPEED GOVERNOR

(OSG) AND NEGATIVE TORQUE SENSOR (NTS) CHECKS MUST BE ACCOMPLISHED PRIOR TO FLIGHT.

AlliedSignal (Honeywell) Engine Information

The AlliedSignal Aerospace Company issued a Pilot Advisory Letter dated March 18, 1996, titled, "NTS SYSTEM, PROP FEATHER VALVE AND FUEL SHUTOFF VALVE FUNCTIONAL CHECKS." The letter stated the purpose of the NTS system as the following: "During an in-flight engine power loss, the unfeathered propeller may "windmill" and actually drive the failed engine. This condition is considered to be a negative torque situation which will generate undesirable propeller drag. However, all Allied Signal TPE331 series engines incorporate an NTS System. In the event of an engine failure, this system provides for an automatic propeller drag reduction, referred to as "NTS-ing", while allowing the pilot additional time to decide whether to restart the failed engine or feather the propeller."

The advisory letter stated that there are limitations to the NTS system ground checks, since it does not test the whole system. An in-flight NTS check must be performed to complete the system test.

The AlliedSignal Aerospace Company Maintenance Manual, Garrett TPE-331-10 (Report No. 72-00-27) TEMPORARY REVISION NO. 72-119, dated Sept 4/97, contains information concerning engine operational checks. The maintenance manual requires that an in-flight NTS check be performed after installation of an engine or installation or adjustment of the torsion spline (quill) shaft.

The Temporary Revision No. 72-119 required a series of NTS system ground checks be performed prior to the in-flight check. Steps 1 through 4 of the procedure specified what ground checks must be performed before the in-flight test. The procedures listed for the in-flight portion of the NTS check are the following:

5. Fly aircraft at safe single engine altitude. Refer to Aircraft Flight Manual.

6. Reduce power on test engine and stabilize engine temperature for 1 minute.

Note: Following instructions refer to the engine under test only.

7. Actuate engine stop switch to close electrical fuel shutoff solenoid.

CAUTION:

IF AIRCRAFT YAWS EXCESSIVELY FEATHER PROPELLER.

IF AIRCRAFT CONTINUES TO YAW EXCESSIVELY, SET THE POWER LEVER FULLY FORWARD (BETA FOLLOWING POSITION) TO MINIMIZE PROPELLER DRAG.

8. Note time engine rpm decelerates to approximately 35 percent rpm. Feather propeller at approximately 35 percent rpm or at 1 minute.

CAUTION: DO NOT ALLOW ENGINE TO WINDMILL IN RPM RANGE BETWEEN 18 AND 28 PERCENT.

9. Engine rpm shall decelerate to approximately 35 percent rpm in less than 60 seconds.

10. Conduct normal air start in accordance with Aircraft Flight Manual.

11. If NTS check not satisfactory, refer to 72-00-00, Trouble Shooting.

The Allied Signal Aerospace Company issued a Pilot Advisory Letter dated August 5, 1996, titled, "IN-FLIGHT BETA-MODE IS PROHIBITED, unless the airplane is certificated for such use." The advisory letter stated in-flight beta events had occurred and it provided the following information:

"In order to prevent inadvertent PL (power lever) settings below FI (flight idle) in flight, the airframe manufacturer provides a physical barrier, typically referred to as a "FI gate". Only deliberate actions will enable the pilot to retard the PL below FI (past the FI gate). However, since some FI gate designs are subject to wear or other malfunctions, pilots must check that the FI gates function properly prior to each flight in accordance with procedures outlined in the approved flight manual.

In summary, the use of beta-mode in-flight is prohibited because placing one or more power levers below the FI gate sets the corresponding propeller blades at an angle lower than certified for in-flight conditions. Moreover, setting one or more PLs below FI in-flight produces high drag conditions (resulting in an excessive airspeed deceleration), may induce an uncontrollable roll rate (due to asymmetric thrust and drag), and could block elevator airflow, which would inhibit stall avoidance and recovery." (See AlliedSignal Pilot Advisory Letters)

Hartzell Propeller Report

The propellers were examined by Hartzell Propellers, Inc. The Hartzell report stated that the propellers impacted symmetrically and at a steep angle, but there was a notable absence of symmetry in the damage to the two propellers. The left propeller had some rotational marking on the camber (forward) side of the blades from soil/mud. The right propeller blades had indications that they were developing power at impact. This is evidenced by the "corkscrew" appearance, S-bending, twisting toward low pitch, and lead edge tearing of the blades. The left propeller blades were also bent with two blades clearly twisted toward low pitch. The damage to the left propeller blades was generally similar, but less severe than that to the right propeller blades.

The propeller blade butt-end impressions were measured using templates to derive blade angle calculations. The report sites the following results:

Left Propeller Blades

1 not measured, but very low # 2 -20.5 degrees # 3 -11.3 degrees (average of 3 indications) # 4 -15.5 degrees

Right Propeller Blades # 1 -13.5 degrees (average of 2 indications) # 2 -6.5 degrees # 3 not measured # 4 81.5 degrees, 87.0 degrees (2 indications)

The report stated that the propeller start locks were examined and contradictory evidence was found. One of the start lock plates (attached to the blade clamp) from the left propeller was damaged, possibly from pin engagement. Another of the start lock pins from the left prop was jammed in the position of normal operation at high RPM. (See Hartzell Propeller Report)

Sound Spectrum Analysis

The National Transportation Safety Board examined the radio transmissions from the accident airplane that were recorded during the airplane's initial climb and maneuvering. (See Group Chairman's Factual Report of Investigation Air Traffic Control Recording)

ADDITIONAL INFORMATION

MHIA issued a "MU-2 Service News" No. 120 (JCAB T.C.) and 074/05-005 (FAA T.C.) on January 8, 1999, concerning Maintenance Flight Checks. The letter stated the following:

"Maintenance and rigging of the engine propeller systems are specified in the applicable Allied Signal and Mitsubishi Maintenance Manuals to assure that the certified flight characteristics are realized in service. Ground and flight checks are required to verify that proper rigging has been achieved, and that the Negative Torque Sensing system (NTS) and flight idle fuel flow are within manufacturer specifications. With properly adjusted engine/propeller controls these test are uneventful and have been conducted on all TPE-331 engine installations for over 20 years."

The letter stated further:

"For flight checks, weather conditions must be favorable. Common sense precludes tests in marginal weather (high wind, rain, low cloud layers, obscured horizon, above an overcast, low daylight or nighttime, away from a suitable landing site, etc.). The pilot must be prepared for the flight characteristics of the airplane in event of an unsuccessful check. Recovery procedures must be planned ahead of time for all eventualities (for example, what will you do if the NTS system fails to operate or if the engine fails to relight after shutdown). Be sure to conduct the tests at a safe altitude and continually monitor the airspeed to maintain large

margins from the minimum control and stalling speeds. Each operator must set its own limits for conducting maintenance flight checks so that the maintenance manual requirements are accomplished safely." (See MHIA's "MU-2 Service News," No. 120 (JCAB T.C.) and 074/05-005 (FAA T.C.) dated January 6, 1999)

The parties to the investigation included the FAA, Mitsubishi Heavy Industries America, Inc., Honeywell, and Hartzell Propeller, Inc.

The aircraft wreckage was released to Howe Associates, Wichita, Kansas.

Pilot Information

Certificate:	Private	**Age:**	58,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 3 Valid Medical--w/ waivers/lim	**Last FAA Medical Exam:**	January 9, 1998
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:	3136 hours (Total, all aircraft), 298 hours (Total, this make and model), 29 hours (Last 90 days, all aircraft), 4 hours (Last 30 days, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Mitsubishi	**Registration:**	N5LN
Model/Series:	MU-2B-60 MU-2B-60	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Utility	**Serial Number:**	799SA
Landing Gear Type:	Retractable - Tricycle	**Seats:**	9
Date/Type of Last Inspection:	July 30, 1998 100 hour	**Certified Max Gross Wt.:**	11575 lbs
Time Since Last Inspection:	30 Hrs	**Engines:**	2 Turbo prop
Airframe Total Time:	4712 Hrs	**Engine Manufacturer:**	ALLIED SIGNAL
ELT:	Installed	**Engine Model/Series:**	TPE-331-10
Registered Owner:	L. W. AVIATION	**Rated Power:**	715 Horsepower
Operator:		**Operating Certificate(s) Held:**	None
Operator Does Business As:		**Operator Designator Code:**	

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Night/dark
Observation Facility, Elevation:	ICT ,1332 ft msl	**Distance from Accident Site:**	22 Nautical Miles
Observation Time:	20:56 Local	**Direction from Accident Site:**	350°
Lowest Cloud Condition:	Unknown	**Visibility**	9 miles
Lowest Ceiling:	Overcast / 2500 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	6 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	200°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30 inches Hg	**Temperature/Dew Point:**	38°C / 33°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	AUGUSTA , KS (3AU)	**Type of Flight Plan Filed:**	IFR
Destination:		**Type of Clearance:**	IFR;Cruise
Departure Time:	20:35 Local	**Type of Airspace:**	Class E

Airport Information

Airport:		**Runway Surface Type:**	
Airport Elevation:		**Runway Surface Condition:**	
Runway Used:	0	**IFR Approach:**	
Runway Length/Width:		**VFR Approach/Landing:**	

Wreckage and Impact Information

Crew Injuries:	2 Fatal	**Aircraft Damage:**	Destroyed
Passenger Injuries:		**Aircraft Fire:**	On-ground
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	2 Fatal	**Latitude, Longitude:**	

Administrative Information

Investigator In Charge (IIC):	Silliman, Jim
Additional Participating Persons:	STEVE WEST; WICHITA , KS RALPH SORRELLS; ADDISON , TX DAVE CHAPEL; PHOENIX , AZ TOM MCCREARY; PIQUA , OH
Original Publish Date:	August 13, 2001
Last Revision Date:	
Investigation Class:	Class
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=45244