National Transportation Safety Board

Washington, DC 20594

Safety Recommendation

Date: October 23, 2014

In reply refer to: A-14-96 through -98
A-13-13 (Reiteration)

The Honorable Michael P. Huerta
Administrator
Federal Aviation Administration
Washington, DC 20590

The National Transportation Safety Board (NTSB) urges the Federal Aviation Administration (FAA) to take action on the safety recommendations issued in this letter. These recommendations address operational training and checklist usage for Mitsubishi MU-2B series airplanes. They are derived from the NTSB's investigation of a Mitsubishi MU-2B-25 airplane accident in Owasso, Oklahoma. As a result of this investigation, the NTSB has issued four new safety recommendations, three of which are addressed to the FAA. Information supporting these recommendations is discussed below.

On November 10, 2013, about 1546 central standard time, a Mitsubishi MU-2B-25 (MU-2B) twin-engine airplane, N856JT, impacted wooded terrain while maneuvering near Owasso, Oklahoma. The commercial pilot, who was the sole occupant of the airplane, was fatally injured. The airplane was destroyed. The airplane was registered to Anasazi Winds LLC, Tulsa, Oklahoma, and was operated by the pilot under the provisions of 14 *Code of Federal Regulations* (CFR) Part 91 as a personal flight. Visual meteorological conditions prevailed for the flight, and an instrument flight plan had been filed. The flight departed Salina Regional Airport, Salina, Kansas, about 1500 and was en route to Tulsa International Airport, Tulsa, Oklahoma (TUL).[1]

The airplane was not equipped, and was not required to be equipped, with a flight data recorder or cockpit voice recorder. According to air traffic control (ATC) communications and radar data, about 3.3 minutes before the accident, the pilot contacted the TUL tower controller and was cleared to land on runway 18L; he was also instructed to reduce the airplane's airspeed to 150 knots or less to maintain distance from an airplane departing from runway 18L. The pilot acknowledged the clearance and speed reduction. About 2 minutes before the accident, between 1543:10 and 1543:27, radar data showed the airplane level off momentarily at 2,200 ft mean sea level while its airspeed decreased from 180 through 150 knots. At 1543:27, the airplane began a

[1] More information about this accident, NTSB case number CEN14FA046, is available at http://www.ntsb.gov/aviationquery/index.aspx.

descent to about 1,100 ft (at an average rate of descent of 1,180 ft per minute) and slowed to about 95 knots.

About 1544:00, the airplane began a left turn that continued to the end of the radar data, with the airplane almost completing a full 360° turn, while maintaining an approximate airspeed of 95 knots. After the airplane had turned left approximately 140º from the original heading, the TUL tower controller queried the pilot, and the pilot reported, "I've got a control problem." The airplane continued the left turn, and the controller then cleared the pilot to maneuver to the west and asked if he needed assistance. The pilot informed the controller, "I've got a left engine shutdown." The controller then declared an emergency for the pilot and asked about the number of persons onboard and the fuel remaining. No further communications were received from the pilot.

The accident site was located in wooded terrain about 5 mi north of TUL. The main wreckage area consisted of all major airplane structure and components. The landing gear was found in the extended position, and the flaps were in the 20º position. The left engine propeller blades were found in a feathered position, and the left engine fuel shutoff valve (FSOV) was in the closed position, consistent with the engine being in an inoperative condition.[2] As examined, the airplane was not configured in accordance with the airplane flight manual engine shutdown and single-engine landing procedures, which indicate that the landing gear and flaps should remain retracted until landing is assured.

Postimpact fire consumed most of the fuselage and wing structure. Thermal damage to the cockpit instrumentation precluded determination of the preimpact position of the fuel control and engine switches. Examination and testing of the left engine found no failures or malfunctions that would have precluded normal operation. Calculations indicate that the airplane should have been flyable in a one-engine-inoperative condition and that the final descent of the airplane into the ground followed an aerodynamic stall. The day visual meteorological conditions at the time of the accident do not support a loss of control due to spatial disorientation. Therefore, the evidence indicates that the pilot did not appropriately manage a one-engine-inoperative condition, leading to a loss of control from which he did not recover.

Because the airplane was not equipped with any type of crash-resistant recorder, the exact movements and trim state of the airplane remain unknown, and other details of the airplane's performance (such as power settings) could only be estimated. In addition, the pilot's control and system inputs and other actions are unknown. The NTSB determined that the probable cause of this accident was "the pilot's loss of airplane control during a known one-engine-inoperative condition. The reasons for the loss of control and engine shutdown could not be determined because the airplane was not equipped with a crash-resistant recorder and postaccident examination and testing did not reveal evidence of any malfunction that would have precluded normal operation."

[2] The engine-mounted FSOV is a two-position solenoid valve that must be electrically powered to the OPEN state. It is normally electrically powered CLOSED. When the engine is not operating, two electrical solenoids in the valve extend a ball valve so that the ball closes an opening that prevents the flow of fuel to the engine.

Special Federal Aviation Regulation No. 108

Pilot operation of Mitsubishi MU-2B series airplanes requires adherence to special initial and recurrent training, experience, and operating conditions as outlined in Special Federal Aviation Regulation (SFAR) No. 108, which was effective on April 7, 2008, with compliance required by February 6, 2009.[3] During flight instruction, which the accident pilot completed over a period of 3 days before the accident, pilots are evaluated on their performance in executing a set of flight profiles that are located in an appendix to the SFAR and correspond with special emphasis items covered during ground instruction; stall recognition and recovery are among the special emphasis items.[4]

For stall recognition and recovery flight training, pilots must perform approaches to stalls in takeoff, clean, and landing configurations with at least one approach-to-stall maneuver flown while in a 15º-to-30º bank turn. Accelerated stalls are performed with both 20º and 0º flap configurations. Pilots must recover the airplane at the first indication of a stall, which occurs either via airframe buffet or the stall warning system's control wheel shaker. The final phase check to confer SFAR endorsement in an MU-2B series airplane, which the accident pilot satisfactorily completed on the morning of the accident, includes three approach-to-stall maneuvers.

The NTSB's investigation found that since SFAR No. 108 became effective in 2008, the FAA has revised its general stall recovery guidance and procedures for stall and stick pusher training for pilot certification and evaluation contained in Advisory Circular (AC) 120-109, dated August 6, 2012. The AC introduces a procedure for stall recovery that conflicts with related instruction provided in the SFAR. Specifically, the SFAR "Approach to Stall" flight profile indicates that, when pilots recognize a stall, they should simultaneously apply maximum engine power and adjust the airplane's angle of attack as necessary to minimize the loss of altitude; however, AC 120-109 changed the priority of responsive actions to emphasize reducing the angle of attack at the first sign of a stall. The AC also states "recovery profiles that emphasize zero or minimal altitude loss and the immediate advancement of maximum thrust have been eliminated." The accident pilot's flight instructor reported that during training, he instructed the pilot in stall recovery methods from the SFAR, as required, as well as the AC.

The NTSB is aware that Mitsubishi and the FAA have discussed the need to update the "Approach to Stall" flight profile in SFAR No. 108 so that it aligns with changes to current FAA policies and procedures. However, revisions to the special regulation are not able to occur without going through the notice of proposed rulemaking process, which can unduly delay any needed updates to training materials. Although it is unknown whether the difference between

[3] The FAA issued SFAR No. 108 after conducting a safety evaluation of Mitsubishi MU-2B series airplanes in response to an increase in accidents involving the high-performance aircraft. For initial training, pilots are required to receive a minimum of 20 hours of ground instruction and a minimum of 12 hours of flight instruction, with a minimum of 6 hours accomplished in the airplane, a level C simulator, or a level D simulator.

[4] The SFAR special emphasis items are 1) accelerated stall awareness and recovery procedures with emphasis on configuration management, 2) minimum control speed (V_{mc}) awareness and early recognition, 3) airspeed management and recognition of airspeed deterioration below recommended speeds and recovery methods, 4) knowledge of icing conditions and encounters, and 5) airplane performance characteristics with all engines operating and with one engine inoperative.

stall recovery methods in the SFAR and AC played a role in the outcome of this accident, the NTSB concludes that the difference is inconsistent with the purpose of SFAR No. 108 to facilitate safe operation of MU-2B series airplanes through standardized training. Therefore, the NTSB recommends that the FAA revise, as soon as is practical, the "Approach to Stall" flight profile currently contained in SFAR No. 108 so that it is consistent with AC 120-109. The NTSB also recommends that the FAA separate the flight training profiles from the SFAR such that any updates to the profiles can be made without having to go through the rulemaking process.

Required Use of FAA-Accepted MU-2B Series Checklists

All training and operations conducted in MU-2B series airplanes must be completed in accordance with applicable checklists listed in the SFAR or checklists accepted by the FAA MU-2B Flight Standardization Board. In addition, the SFAR requires that all pilots operating a MU-2B series airplane have access to and use FAA-accepted checklists at the pilot station for each flight. The NTSB's investigation found that, in addition to an accepted checklist, a checklist that had not been accepted by the FAA was provided to the accident pilot as part of his SFAR No. 108 training syllabus. Identified as "For Training Purposes Only," the training checklist generally followed the SFAR No. 108 accepted checklist content except for a few items that were in a different sequence. The checklist was also labeled as applicable to other MU-2B airplane models (MU-2B-40 and MU-2B-60) and did not mention the MU-2B-25.

The accident pilot's flight instructor reported that the training checklist was used during the first training flight because it contained supplemental information that the instructor found helpful for pilots new to MU-2B series airplanes. Both checklists were used during the accident pilot's training, but the accepted checklist was used exclusively after the first flight. A fire-damaged copy of the training checklist was found in the cockpit wreckage of the accident airplane and another copy was found in the aft portion of the fuselage. Postaccident interviews with pilots who previously completed training with the flight instructor reported different experiences concerning the training checklist. One former trainee reported never using the training checklist in flight and emphasized that only the FAA-accepted checklist was used. Another former trainee used the training checklist as the sole checklist for almost every flight. The NTSB observed the presence of checklists other than those accepted by the FAA (with and without the accepted checklist) in 3 of 10 MU-2B cockpits examined during the investigation.[5]

It is unknown whether the training checklist was used during the accident flight. However, the NTSB notes that the intent of SFAR No. 108 is to improve safety through standard training and operational procedures for MU-2B series airplanes and is concerned that some pilots may be using checklists not accepted by the FAA. The NTSB concludes that to maintain the intent of SFAR No. 108, the checklist requirements set forth in the special regulation should be reinforced among flight instructors, owners, and operators of MU-2B series airplanes. Therefore, the NTSB recommends that the FAA work with Mitsubishi Heavy Industries America Inc. to develop and distribute guidance to flight instructors, owners, operators, and pilots of Mitsubishi MU-2B series airplanes about the requirement to use FAA-accepted checklists as specified in SFAR No. 108.

[5] Anecdotal information provided by Mitsubishi suggests that some MU-2B pilots continue to use checklists other than those accepted by the FAA because of familiarity with those checklists.

Flight Recorder Systems

As stated previously, because the airplane was not equipped with any type of recording device, the pilot's control inputs and cockpit movements are completely unknown, and the airplane's motions (pitch, bank, yaw attitudes) and the time that the pilot's reported engine and control problems began are not known with precision. Further, although radar data and ATC voice communications were available to the NTSB to determine the altitude and flightpath of the airplane, the exact movements and trim state of the airplane are unknown. Thus, the lack of available data significantly increased the difficulty of determining the specific causes that led to this accident, and it was not possible to determine the reasons for the left engine shutdown or evaluate the pilot's recognition of and response to an engine problem.

The NTSB has previously addressed the need for recording information on airplane types such as the one involved in this accident. On May 6, 2013, the NTSB issued Safety Recommendation A-13-13, which asked the FAA to do the following:

> Require all existing turbine-powered, nonexperimental, nonrestricted-category aircraft that are not equipped with a flight data recorder or cockpit voice recorder and are operating under 14 [CFR] Parts 91, 121, or 135 to be retrofitted with a crash-resistant flight recorder system. The crash-resistant flight recorder system should record cockpit audio and images with a view of the cockpit environment to include as much of the outside view as possible, and parametric data per aircraft and system installation, all as specified in Technical Standard Order C197, "Information Collection and Monitoring Systems."

On December 10, 2013, the NTSB classified Safety Recommendation A-13-13 "Open—Unacceptable Response" because the FAA stated that it had not found any compelling evidence to require installation of cockpit image recording systems. Accordingly, the FAA stated that it planned no further action to mandate flight deck image recording systems and considered its actions for this recommendation complete.

Despite the FAA's position, the lack of required crash-resistant flight recording systems on aircraft operating under Parts 91, 121, or 135 remains an important safety issue. If such a system had been required and installed on the accident airplane, recorded video images would possibly have shown where the pilot's attention was directed during the reported problems, his interaction with the airplane controls and systems, and the status of many cockpit switches and instruments. Recorded flight data would have provided information about the engines' operating parameters and the airplane's motions. The NTSB continues to support the required installation of flight recorder systems because they can help accident investigators identify safety issues that may not otherwise be detectable, which is critical to the prevention of future accidents. Therefore, the NTSB reiterates Safety Recommendation A-13-13.

Therefore, the National Transportation Safety Board makes the following recommendations to the Federal Aviation Administration:

> Revise, as soon as is practical, the "Approach to Stall" flight profile currently contained in Special Federal Aviation Regulation No. 108 so that it is consistent with Advisory Circular 120-109. (A-14-96)
>
> Separate the flight training profiles in Special Federal Aviation Regulation (SFAR) No. 108 from the SFAR such that any updates to the profiles can be made without having to go through the rulemaking process. (A-14-97)
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> Work with Mitsubishi Heavy Industries America Inc. to develop and distribute written guidance to flight instructors, owners, operators, and pilots of Mitsubishi MU-2B series airplanes about the requirement to use Federal Aviation Administration-accepted checklists as specified in Special Federal Aviation Regulation No. 108. (A-14-98)

The National Transportation Safety Board also reiterates Safety Recommendation A-13-13, previously issued to the Federal Aviation Administration:

> Require all existing turbine-powered, nonexperimental, nonrestricted-category aircraft that are not equipped with a flight data recorder or cockpit voice recorder and are operating under 14 *Code of Federal Regulations* Parts 91, 121, or 135 to be retrofitted with a crash-resistant flight recorder system. The crash-resistant flight recorder system should record cockpit audio and images with a view of the cockpit environment to include as much of the outside view as possible, and parametric data per aircraft and system installation, all as specified in Technical Standard Order C197, "Information Collection and Monitoring Systems."

The NTSB also issued one safety recommendation to Mitsubishi Heavy Industries America Inc.

Acting Chairman HART and Members SUMWALT, ROSEKIND, and WEENER concurred in these recommendations.

The NTSB is vitally interested in these recommendations because they are designed to prevent accidents and save lives. We would appreciate receiving a response from you within 30 days detailing the actions you have taken or intend to take to implement them. When replying, please refer to the safety recommendations by number. We encourage you to submit your response electronically to correspondence@ntsb.gov.

[Original Signed]

By: Christopher A. Hart,
Acting Chairman