Aviation Investigation Final Report

Location:	St Paul, Minnesota	**Accident Number:**	CHI02LA044
Date & Time:	November 30, 2001, 09:28 Local	**Registration:**	N9052Y
Aircraft:	Mitsubishi MU-2B-40	**Aircraft Damage:**	Substantial
Defining Event:		**Injuries:**	4 None
Flight Conducted Under:	Part 91: General aviation		

Analysis

The airplane sustained substantial damage on impact with the runway during a hard landing following a coupled autopilot approach. The pilot and three passengers were uninjured. Instrument meteorological conditions prevailed. The pilot reported, "I was using the autopilot to fly the ILS localized timed approach. I was looking for the runway and watching the time. The autopilot inadvertently disengaged, turning the airplane to the left. I righted the airplane just before touchdown. It landed on the mains with the nose slightly high. It came down, and the front wheel and strut broke." During the next flight, a ferry flight for repairs, the accident pilot reported that he engaged the autopilot at 2,500 feet. The pilot reported that when the autopilot was engaged, the airplane pitched down and turned sharply to the right. The pilot reported using opposing control inputs and differential engine power to maintain airplane control. The pilot performed a no flap landing at an en route airport with a 2,497-foot long runway. An examination of the airplane revealed that when the autopilot computer was moved in its shock mount the yoke moved "violently right in roll axis and forward in pitch axis." The MU-2 airplane flight manual's emergency procedures stated, "In case of emergency, the autopilot can be overpowered manually to correct the attitude, but the autopilot must immediately be disengaged. If the autopilot remains engaged, the autopilot will trim the airplane to oppose the pilot's actions. This could result in a severely out of trim condition." The manual stated, "The autopilot can also be disengaged by any of the following methods, "1. Operate trim switch UP or DOWN, 2. Position inverter switch to OFF momentarily and then return, to original position, 3. Turn off the ELECTRIC MASTER SWITCH." The pilot reported 11 hour hours of pilot in command time in the accident airplane make and model.

Probable Cause and Findings

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

The autopilot's computer connections arcing and reported disconnection during the localizer approach and the pilot not performing a go around prior to the hard landing. A factor was the pilots lack of total experience in the accident airplane's make and model.

Findings

Occurrence #1: AIRFRAME/COMPONENT/SYSTEM FAILURE/MALFUNCTION
Phase of Operation: APPROACH - FAF/OUTER MARKER TO THRESHOLD (IFR)

Findings
1. (C) AUTOPILOT/FLIGHT DIRECTOR,AMPLIFIER AND COMPUTER - ARCING

Occurrence #2: HARD LANDING
Phase of Operation: LANDING

Findings
2. (C) MISSED APPROACH - NOT PERFORMED - PILOT IN COMMAND
3. (F) LACK OF EXPERIENCE - PILOT IN COMMAND

Factual Information

On November 30, 2001, about 0928 central standard time, a Mitsubishi MU-2B-40, N9052Y, piloted by a private pilot, sustained substantial damage during a hard landing on runway 14 at St Paul Downtown Holman Field Airport (STP), near St Paul, Minnesota. The 14 CFR Part 91 business flight was operating on an IFR flight plan. Instrument meteorological conditions prevailed at the time of the accident. The pilot and three passengers were uninjured. The flight originated from Southwest Michigan Regional Airport, near Benton Harbor, Michigan, at time unknown, and was landing at STP at the time of the accident.

The pilot reported in a written statement:

> I departed Benton Harbor (B.E.H.) on 11/30/01 at 0800 using runway 14. It was an hour and half flight to S.T.P. It was an ILS approach. The glide slope and DME [distance measuring equipment] were in-op [inoperative]. I was using the autopilot to fly the ILS localized timed approach. I was looking for the runway and watching the time. The autopilot inadvertently disengaged, turning the airplane to the left. I righted the airplane just before touchdown. It landed on the mains with the nose slightly high. It came down, and the front wheel and strut broke. The airplane skidded on the nose down the runway. I kept it on the runway by using the brakes.

The Federal Aviation Administration (FAA) issued a ferry permit to allow the airplane to be flown to Green Bay, Wisconsin, for repairs.

The pilot reported in another statement:

> After receiving a ferry permit from the FAA, I departed St. Paul, MN the morning of December 17, 2001, to fly my MU-2, N-9052Y to Green Bay, Wisconsin for repairs of damage to the aircraft in a hard landing at St. Paul Minnesota, as stated above. This flight was to be flown VFR, day, single pilot only. About 10 miles east of St. Paul and level at 2,500 feet, I engaged the autopilot. A few minutes after the autopilot was engaged, the nose of the aircraft pitched down and turned sharply to the right. I immediately attempted to disengage the autopilot, which was futile, and told the traffic controller of my problem. He in turn reported that a small airport was to my left and behind my current position. I saw the airport) Lake Elmo (21D)) and in order to fly the airplane to the airport, I had to use extreme backpressure, left rudder, plus differential power to maintain

> enough control to reach the airport and land on a 2,497 foot runway without using flaps or reverse prop and with no damage to the airplane. ... After I got the aircraft back to Green Bay, Wisconsin, I took it to [a repair station there] where [mechanics and the FAA] each inspected the autopilot system. They were able to duplicate the runway trim on the ground where it was determined that the problem of the autopilot trim runaway was a faulty connection in the autopilot computer.

FAA inspectors, safety investigators from the airplane manufacturer, and representatives from the repair station examined the airplane. The repair station stated:

> The autopilot system was engaged and disengaged several times and all flight director modes engaged. Mode Annunciator test function, all lamps test and illuminated when mode selected and coupled to autopilot.
>
> Electric manual trim and automatic pith trim moved elevator trim tab in the correct direction and speed.
>
> The servos in pitch, roll, and yaw had adequate strength and speed to move the respective control surfaces. No mechanical binding or slack noted in rigging or capstans and servo mounts.
>
> The attitude gyro Sperry VG14A (primary attitude reference for M4D autopilot, FD112V flight director and weather radar) was removed from its mount for field troubleshooting.
>
> Voltage measurements were taken at the autopilot computer, of 200mv per degree for pitch and roll output from vertical gyro referenced on flight director. Readings corresponded with pilot's primary attitude reference with respect to pitch and roll.
>
> Autopilot system performed satisfactory until the autopilot computer model 5536F part number 400495-8501 was moved in its shock mount at which time the yoke was pulled violently right in roll axis and forward in pitch axis. This finding is consistent with [the pilot's] experience, as you reported to us, during landing on November 30, 2001 had the autopilot remained engaged. This malfunction was repeated five times ... However during closer examination of the autopilot computer connections pin 53 of jack 2 of autopilot computer was found to be oversized and discolored in a manor consistent with electrical arcing. Pin function described as servo motor power in the M4D maintenance manual.

The MU-2 airplane flight manual's emergency procedures stated:

> In case of emergency, the autopilot can be overpowered manually to correct the attitude, but the autopilot must immediately be disengaged. If the autopilot remains engaged, the autopilot will trim the airplane to oppose the pilot's actions. This could result in a severely out of trim condition.

The manual stated:

> The autopilot can also be disengaged by any of the following methods:
> 1. Operate trim switch UP or DOWN
> 2. Position inverter switch to OFF momentarily and then return to original position
> 3. Turn off the ELECTRIC MASTER SWITCH

The pilot reported he accumulated 11 hours of pilot in command time in the accident airplane make and model.

Parties to the investigation were the FAA and Mitsubishi Heavy Industries America, Inc.

Pilot Information

Certificate:	Private	**Age:**	71,Male
Airplane Rating(s):	Multi-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	Airplane multi-engine	**Toxicology Performed:**	No
Medical Certification:	Class 3 Valid Medical--w/ waivers/lim	**Last FAA Medical Exam:**	April 29, 2000
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	December 4, 2000
Flight Time:	3420 hours (Total, all aircraft), 3370 hours (Pilot In Command, all aircraft), 25 hours (Last 90 days, all aircraft), 3 hours (Last 30 days, all aircraft), 2 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Mitsubishi	**Registration:**	N9052Y
Model/Series:	MU-2B-40	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	39917
Landing Gear Type:	Retractable - Tricycle	**Seats:**	10
Date/Type of Last Inspection:	September 12, 2001 100 hour	**Certified Max Gross Wt.:**	10470 lbs
Time Since Last Inspection:		**Engines:**	2 Turbo prop
Airframe Total Time:		**Engine Manufacturer:**	Garrett
ELT:	Installed, not activated	**Engine Model/Series:**	TPE-331-10
Registered Owner:	Superior Builders	**Rated Power:**	665 Horsepower
Operator:		**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Instrument (IMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	STP,705 ft msl	**Distance from Accident Site:**	0 Nautical Miles
Observation Time:	09:53 Local	**Direction from Accident Site:**	0°
Lowest Cloud Condition:		**Visibility**	4 miles
Lowest Ceiling:	Overcast / 700 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	3 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	60°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29.77 inches Hg	**Temperature/Dew Point:**	1°C / -1°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	BENTON HARBOR, MI (BEH)	**Type of Flight Plan Filed:**	IFR
Destination:	Saint Paul, MN (STP)	**Type of Clearance:**	IFR
Departure Time:	08:00 Local	**Type of Airspace:**	Class D

Airport Information

Airport:	ST PAUL DOWNTOWN HOLMAN FLD STP	**Runway Surface Type:**	Asphalt
Airport Elevation:	705 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	14	**IFR Approach:**	ILS
Runway Length/Width:	6711 ft / 150 ft	**VFR Approach/Landing:**	Full stop

Wreckage and Impact Information

Crew Injuries:	1 None	**Aircraft Damage:**	Substantial
Passenger Injuries:	3 None	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	4 None	**Latitude, Longitude:**	44.930728,-93.07933(est)

Administrative Information

Investigator In Charge (IIC):	Malinowski, Ed
Additional Participating Persons:	Samuel B Weatherford; Federal Aviation Administration; Minneapolis, MN Ralph Sorrells; Mitsubishi Heavy Industries America; Addison, TX
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Investigation Class:	Class
Note:	
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