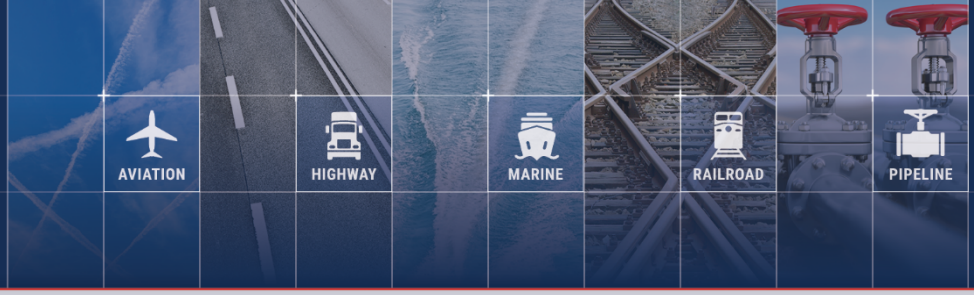

Aviation Investigation Final Report

Location:	Osteen, Florida	**Accident Number:**	ERA22FA384
Date & Time:	August 24, 2022, 16:39 Local	**Registration:**	N263MX
Aircraft:	MXR Technologies MX2	**Aircraft Damage:**	Substantial
Defining Event:	Loss of control in flight	**Injuries:**	2 Fatal
Flight Conducted Under:	Part 91: General aviation - Other work use		

Analysis

The accident flight was part of a training and demonstration flight that included a series of aerobatic maneuvers. Flight track data for the accident flight revealed that the airplane departed and maneuvered for about 7 minutes before impacting terrain almost directly under the last data point. No linear ground scar was observed at the accident site, which was indicative of the airplane having descended nearly vertically to ground impact. Additionally, the wreckage was found in an inverted orientation. Examination of the wreckage revealed no evidence of a preimpact mechanical anomaly that would have precluded normal operation of the airplane structure, the flight controls, or the engine. Estimated weight and balance calculations revealed that the airplane's weight and its aft center of gravity were likely at or near the limit for aerobatic flight.

Given the purpose of the flight, the flight track, and the orientation of the wreckage, it is likely that the pilot lost control of the airplane while performing aerobatic maneuvers and that the airplane inadvertently entered an inverted flat spin. A fracture of the elevator torque tube at the aft bulkhead opening corresponded with the elevator control surface being in the full nose-up position when the airplane impacted the ground, which would have been a position consistent with the pilot attempting to recover from an inverted flat spin. The airplane's weight and aft center of gravity likely contributed to the pilot's inability to recover from the spin. Thus, the inverted flat spin likely continued until the airplane impacted terrain.

Toxicology testing revealed subtherapeutic concentration of chlorpheniramine in the pilot's blood, which likely did not cause significant symptoms. Hydrocodone and its active metabolites (hydromorphone and dihydrocodeine) were detected in the pilot's urine but not in his blood, so they would not have had any therapeutic effect or side effect. Thus, the detected

chlorpheniramine, hydrocodone, hydromorphone, and dihydrocodeine did not contribute to this accident.

Probable Cause and Findings

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

The pilot's loss of airplane control while performing aerobatic maneuvers, which resulted in the airplane entering an inverted flat spin that continued until the airplane impacted terrain.

Findings

Personnel issues	Aircraft control - Pilot
Aircraft	(general) - Not attained/maintained

Factual Information

History of Flight

Maneuvering-aerobatics	Loss of control in flight (Defining event)
Maneuvering-aerobatics	Aerodynamic stall/spin
Maneuvering-aerobatics	Collision with terr/obj (non-CFIT)

On August 24, 2022, at 1639 eastern daylight time, an experimental amateur-built MXR Technologies MX2, N263MX, was substantially damaged when it impacted terrain in Osteen, Florida. The private pilot and pilot-rated passenger were fatally injured. The airplane was operated under the provisions of Title 14 *Code of Federal Regulations* Part 91 as an aerobatic demonstration flight.

According to individuals familiar with the purpose of the flight, the accident pilot organized training and demonstration flights for a group of pilots from a foreign air force. The planned flights included two 30-minute flights in the accident airplane for aerobatic demonstration and upset recovery and prevention training with a flight instructor in a different airplane. The accident flight was the first aerobatic demonstration flight for the pilot-rated passenger and the airplane's third demonstration flight of the day. During the two previous demonstration flights earlier in the day, pilots had performed Lomcovák, half-Cuban eight, and hammerhead aerobatic maneuvers along with loops and vertical climbs with rolls.

Review of Federal Aviation Administration (FAA) flight track data revealed that the airplane departed Spruce Creek Airport (7FL6), Daytona Beach, Florida, at 1632. The airplane flew south and began maneuvering to the east between 2,000 and 5,000 ft mean sea level (msl). The last data point, at 1639, showed the airplane at an altitude of 2,738 ft msl, on a track of 068°, and at a groundspeed of 15 knots. The airplane impacted a wooded marshy area almost directly under the last data point.

Pilot Information

Certificate:	Private; Remote	**Age:**	61,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Rear
Other Aircraft Rating(s):	Unmanned (sUAS)	**Restraint Used:**	4-point
Instrument Rating(s):	None	**Second Pilot Present:**	Yes
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 3 With waivers/limitations	**Last FAA Medical Exam:**	June 2, 2021
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	February 19, 2021
Flight Time:	1342 hours (Total, all aircraft)		

Pilot-rated passenger Information

Certificate:	Foreign	**Age:**	34,Male
Airplane Rating(s):		**Seat Occupied:**	Front
Other Aircraft Rating(s):		**Restraint Used:**	4-point
Instrument Rating(s):		**Second Pilot Present:**	Yes
Instructor Rating(s):		**Toxicology Performed:**	
Medical Certification:	Unknown	**Last FAA Medical Exam:**	
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	
Flight Time:			

Postcards promoting the accident pilot's aerobatic experience were recovered from the airplane. The postcards stated in part that the accident pilot had "an impressive competition record flying aerobatics and has finished strongly in every competition he has entered since 2010."

Aircraft and Owner/Operator Information

Aircraft Make:	MXR Technologies	**Registration:**	N263MX
Model/Series:	MX2	**Aircraft Category:**	Airplane
Year of Manufacture:	2006	**Amateur Built:**	Yes
Airworthiness Certificate:	Experimental (Special)	**Serial Number:**	3
Landing Gear Type:	Tailwheel	**Seats:**	2
Date/Type of Last Inspection:	October 4, 2021 Condition	**Certified Max Gross Wt.:**	1850 lbs
Time Since Last Inspection:		**Engines:**	1 Reciprocating
Airframe Total Time:	467 Hrs as of last inspection	**Engine Manufacturer:**	Lycoming
ELT:	C126 installed, activated, did not aid in locating accident	**Engine Model/Series:**	AEIO-540-X experimental
Registered Owner:	On file	**Rated Power:**	400 Horsepower
Operator:	On file	**Operating Certificate(s) Held:**	None

According to the manufacturer's website, the MX2 was an all-carbon-fiber two-seat high-performance aerobatic airplane constructed to sustain ± 12 Gs. The maximum aerobatic weight limit was 1,850 pounds, and the aerobatic center-of-gravity range (CG) was between 81.62 and 88.65 inches.

According to placards near the fuel tanks, each airplane wing had a capacity of 22 gallons, and the header tank had a capacity of 17 gallons. Two fuel receipts on the day of the accident showed a fuel purchase of 18.9 gallons about 0827 (before the first demonstration flight, which lasted 22 minutes) and 7.5 gallons about 0909 (before the second demonstration flight, which lasted 23 minutes). Video from the fueling area showed the pilot adding fuel to the wing and header tanks during the first fueling of the day and to only the header tank during the second fueling. The pilot did not add fuel immediately before the accident flight.

According to an interview with an aerobatic pilot of the accident airplane model, the "Typical Aerobatic Weight and Balance" information in the airplane's *Pilot's Operating Handbook*, and weight and balance forms in the accident pilot's aerobatic binder, aerobatic flights were conducted with fuel only in the header tank.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	SFB,55 ft msl	**Distance from Accident Site:**	13 Nautical Miles
Observation Time:	15:53 Local	**Direction from Accident Site:**	228°
Lowest Cloud Condition:	Scattered / 3300 ft AGL	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	10 knots /	**Turbulence Type Forecast/Actual:**	Unknown / Unknown
Wind Direction:	80°	**Turbulence Severity Forecast/Actual:**	N/A /
Altimeter Setting:	29.95 inches Hg	**Temperature/Dew Point:**	32°C / 24°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Daytona Beach, FL (7FL6)	**Type of Flight Plan Filed:**	None
Destination:	Daytona Beach, FL (7FL6)	**Type of Clearance:**	None
Departure Time:	16:32 Local	**Type of Airspace:**	Class E

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:**	28.921482,-81.064466

Accident Site Examination

The airplane came to rest inverted on a 098° heading. The debris field was limited to within 1 ft of the perimeter of the airplane, and the trees and shrubs near the wreckage were not damaged, both of which were consistent with the airplane impacting the marsh in a near-vertical, inverted, and flat attitude.

Airframe and Engine Examination

Recovery personnel stated that a total of 10 to 15 gallons of fuel was drained from the wings and that about 0.5 gallons of fuel was drained from the right wing fuel line when the wing was turned upright. The header tank was found breached. The recovered fuel was light blue in color and absent of debris.

Examination of the airframe revealed rudder and aileron control continuity that could be traced through cuts made to facilitate recovery. Elevator control continuity was confirmed from the cockpit control column to just aft of the rear pilot seat, where there was a bend fracture about 17 inches aft of the elevator torque tube end fitting, a 40-inch span of torque tube, and another fracture about 20 inches forward of the aft bellcrank. The elevator torque tube was fractured at the aft bulkhead opening, consistent with the elevator control surface in the full nose-up position at the time of impact with the ground. Examination of the fractured elevator torque tube at the National Transportation Safety Board's Materials Laboratory revealed that the tube fractured in overload due to contact with the airframe structure during impact.

Compression and suction were confirmed on all cylinders, and borescope examination of the cylinders revealed no anomalies. Examination of the engine revealed no evidence of any mechanical failures or malfunctions that would have precluded normal operation.

Medical and Pathological Information

The Office of the Medical Examiner, District 7, Daytona Beach, Florida, performed an autopsy on the pilot. The autopsy report indicated that his cause of death was multiple blunt force injuries of the head, neck, torso, and extremities.

Toxicology testing by the FAA's Forensic Sciences Laboratory detected chlorpheniramine in the pilot's blood at 17 nanograms per milliliter (ng/mL). Hydrocodone, hydromorphone, and dihydrocodeine were detected in the pilot's urine at 17 ng/mL, 37 ng/mL, and 16 ng/mL, respectively; these three substances were not detected in the pilot's blood.

Chlorpheniramine is an over-the-counter sedating antihistamine to treat allergy or common cold symptoms. The therapeutic range is 10 to 40 ng/mL, and it has a half-life of 12 to 43 hours. Chlorpheniramine undergoes postmortem redistribution, and central blood levels may be two to three times higher than peripheral blood levels. FAA provides guidance on wait times before flying after using this medication; post-dose observation time is 60 hours, and the medication is not for daily use.

Hydrocodone is an opioid that is often used in combination with acetaminophen to treat moderate-to-severe pain; one such commonly marketed combination is Vicodin. The therapeutic range is between 10 and 50 ng/mL. As an opioid, hydrocodone carries a warning for its high risk of addiction, abuse, and misuse. Adverse reactions to the central nervous system from hydrocodone include drowsiness, mental clouding, anxiety, and impairment of mental and physical performance.

Dihydrocodeine is a commonly found active metabolite of hydrocodone, with an average concentration in blood that is about 29% of the hydrocodone value. Hydromorphone is also an active metabolite of hydrocodone. Dihydrocodeine and hydromorphone have warnings and adverse reactions that are similar to those for hydrocodone.

Additional Information

Weight and Balance Calculations

Weight and balance calculations were performed using weight and balance documents recovered at the accident site, the actual weights of the occupants (as determined by the medical examiner), and the weight of the parachutes. The weight and balance calculations assumed 5 gallons of fuel in each wing tank and no fuel in the header tank. The calculations revealed that the airplane weighed about 1,850 pounds, which was the maximum allowable takeoff weight for aerobatic maneuvers, and had a CG of 88.61 inches, which was close to the aft CG limit.

Aerobatic Maneuvers

An aerobatic pilot who flew the accident airplane model and knew the accident pilot provided a written statement in which he stated, in part that “I doubt seriously that [the accident pilot] was doing an intentional inverted spin” and was not sure that the pilot was proficient in inverted normal or flat spins. The pilot indicated that he would not perform any type of inverted spin with fuel in the wing tanks or with “a passenger weighing more than 200 [pounds]” (the weight of the passenger aboard the accident airplane).

Administrative Information

Investigator In Charge (IIC):	Spencer, Lynn
Additional Participating Persons:	Michael Loehlein ; FAA/FSDO; Orlando, FL J Mike Childers; Lycoming Engines; Williamsport, PA
Original Publish Date:	January 30, 2024
Last Revision Date:	
Investigation Class:	Class 3
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=105795