Aviation Investigation Final Report

Location:	Williams, Arizona	**Accident Number:**	WPR21LA166
Date & Time:	April 15, 2021, 19:48 Local	**Registration:**	N2506N
Aircraft:	Cessna 140	**Aircraft Damage:**	Substantial
Defining Event:	Loss of control in flight	**Injuries:**	2 Fatal
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

During a night cross-country flight in visual meteorological conditions, the pilot made a precautionary landing due to a failure of the airplane's engine tachometer. The audio from an airframe-mounted camera captured the pilot's post-flight inspection comment that the tachometer cable housing appeared to be intact, and subsequent departure on the accident flight. Shortly after takeoff, the pilot deviated left of the runway heading before entering a right turn, away from an on-course heading toward the destination airport. The departure airport was located in a sparsely populated valley with rising terrain on all sides, and the airport's chart supplement indicated that a 479-ft hill existed about 1.4 nautical miles north of the departure end of the runway.

Sound spectrum analysis of the video revealed that the engine rpm decreased slightly, and the video showed an increase in the airplane's bank angle. There was no indication on the camera of any distress or malfunction. The increased bank angle of the airplane, along with the airplane's descent and impact with terrain was consistent with an incipient loss of control.

Examination of the airframe and engine revealed no evidence of additional mechanical failure or malfunction that would have precluded normal operation.

Review of the pilot's logbook indicated 10.1 hours of night experience and that his most recent night flight before the accident flight was over 90 days before the accident. The lack of cultural lighting in the vicinity of the airport would have provided few visual cues to help the pilot maintain attitude orientation. In addition, the pilot's decision to fly the airplane without a functioning tachometer may have served as an operational distraction after takeoff. Given the lack of mechanical anomalies, the departure into impoverished lighting conditions, the pilot's lack of recent night flight experience, and the descending turn into terrain, the circumstances

of the accident are consistent with a loss of control shortly after takeoff as a result of the pilot's spatial disorientation.

Probable Cause and Findings

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

The pilot's loss of control due to spatial disorientation shortly after takeoff in night visual meteorological conditions.

Findings

Personnel issues	Aircraft control - Pilot
Personnel issues	Identification/recognition - Pilot
Personnel issues	Spatial disorientation - Pilot
Environmental issues	Dark - Effect on operation

Factual Information

History of Flight

Takeoff	Loss of visual reference
Maneuvering	Loss of visual reference
Maneuvering	Loss of control in flight (Defining event)

On April 15, 2021, about 1948 mountain standard time, a Cessna 140A, N2506N, was substantially damaged when it was involved in an accident near Williams, Arizona. The commercial pilot and passenger were fatally injured. The airplane was operated as a Title 14 *Code of Federal Regulations* Part 91 personal flight.

According to social media posts made by the pilot and passenger, they departed Sedona Airport (SEZ), Sedona, Arizona, with the destination of the Grand Canyon National Park Airport (GCN), Grand Canyon, Arizona. Automatic Dependent Surveillance – Broadcast (ADS-B) data indicated that the airplane departed SEZ to the northwest about 1845. About 41 minutes into the flight, the pilot made a precautionary landing at H.A. Clark Memorial Field Airport (CMR), Williams, Arizona. A GoPro video camera mounted to the airplane captured the pilot's assertion that the airplane's engine tachometer had failed and that there was "nothing really wrong with the way the airplane is flying." After landing at CMR, the pilot visually inspected the cable, which was determined to be intact, and subsequently departed on the accident flight.

Sound spectrum analysis of the GoPro video indicated that the pilot performed an engine run-up about 1944:49. About 1947:16, engine power was applied for takeoff, and the airplane began flying about 30 seconds later. GoPro video revealed that, during the takeoff climb, the airplane drifted left of the departure runway 36 and paralleled the runway before reaching the departure end of the runway. Sound spectrum analysis confirmed that the engine was operating about 2,448 rpm during the initial climb. About 1948:24, the pilot initiated a turn to the right. A direct track from CMR to GCN would have required a near straight-out departure on a magnetic heading of 353° (about 5° left of the runway heading). About 1948:31, the engine speed decreased to 2,198 rpm. The airplane remained in a right bank and the engine power remained around 2,198 rpm when the airplane impacted terrain about 1948:43.

Pilot Information

Certificate:	Commercial	**Age:**	38,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	4-point
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 2 With waivers/limitations	**Last FAA Medical Exam:**	May 14, 2020
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	May 3, 2020
Flight Time:	(Estimated) 477 hours (Total, all aircraft), 171 hours (Total, this make and model), 391 hours (Pilot In Command, all aircraft), 20.3 hours (Last 90 days, all aircraft), 9.2 hours (Last 30 days, all aircraft), 2.3 hours (Last 24 hours, all aircraft)		

Passenger Information

Certificate:		**Age:**	40,Female
Airplane Rating(s):		**Seat Occupied:**	Right
Other Aircraft Rating(s):		**Restraint Used:**	4-point
Instrument Rating(s):		**Second Pilot Present:**	No
Instructor Rating(s):		**Toxicology Performed:**	
Medical Certification:		**Last FAA Medical Exam:**	
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:			

Review of the pilot's flight logbook indicated that the pilot had flown 7.4 hours in the accident airplane make and model within the 90 days before the accident, The pilot had 10.1 hours of night flying experience, but he had not logged night flight time within the 90 days before the accident. The pilot's logbook indicated that his most recent night flight was conducted on October 29, 2020.

Aircraft and Owner/Operator Information

Aircraft Make:	Cessna	**Registration:**	N2506N
Model/Series:	140	**Aircraft Category:**	Airplane
Year of Manufacture:	1947	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	12763
Landing Gear Type:	Tailwheel	**Seats:**	2
Date/Type of Last Inspection:	March 28, 2021 Annual	**Certified Max Gross Wt.:**	1450 lbs
Time Since Last Inspection:	8.76 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	2908.98 Hrs at time of accident	**Engine Manufacturer:**	Continental
ELT:	C91A installed	**Engine Model/Series:**	O-200-A
Registered Owner:	On file	**Rated Power:**	100 Horsepower
Operator:	On file	**Operating Certificate(s) Held:**	None

At the time of the accident, the airplane's tachometer time indicated 660.88 hours. Review of the airplane's maintenance records indicated that a 100-hr engine inspection was performed on March 07, 2021, and the airframe annual inspection was performed on March 28, 2021. Both the airframe and engine logbooks indicated that the inspections were completed at a tachometer time indicated 652.12 hours and a Hobbs meter time of 315.8 hours.

The empty weight of the airplane was 1,016 lbs and its maximum gross weight was 1,450 lbs. The combined pilot and passenger weight was 315 lbs. The airplane departed SEZ with full fuel and landed at CMR about 45 minutes later. At the time of departure from the accident airport, about 90 lbs of fuel remained onboard. Aircraft performance calculations derived using the atmospheric conditions about the time of the accident an airplane gross weight of 1,450 lbs in a retracted flap, full throttle configuration, indicated that the airplane would have required a nearly 1,400 ft ground run and could have established a best rate of climb of 378 ft per minute, and normal climb rate of 350 ft per minute at 73 mph per the manufacturer's operation manual. The GoPro video indicated that the airplane's ground run was about 1,450 ft, and the airplane remained airborne for just over 63 seconds before impacting terrain.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Night
Observation Facility, Elevation:	KCMR,6677 ft msl	**Distance from Accident Site:**	1 Nautical Miles
Observation Time:	19:35 Local	**Direction from Accident Site:**	218°
Lowest Cloud Condition:		**Visibility**	10 miles
Lowest Ceiling:		**Visibility (RVR):**	
Wind Speed/Gusts:	6 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	280°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30.01 inches Hg	**Temperature/Dew Point:**	6°C / -19°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Williams, AZ	**Type of Flight Plan Filed:**	None
Destination:	Grand Canyon, AZ (GCN)	**Type of Clearance:**	None
Departure Time:		**Type of Airspace:**	Class G

At 1935, CMR reported wind from 280° at 6 knots, 10 statute miles visibility, sky clear, temperature 43°F, dew point temperature of -2°F, and an altimeter setting of 30.01 inches of mercury. The pressure altitude was 6,548 ft and the density altitude was 7,038 ft.

Airport Information

Airport:	H. A. CLARK MEML FLD CMR	**Runway Surface Type:**	Asphalt
Airport Elevation:	6690 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	36	**IFR Approach:**	None
Runway Length/Width:	6000 ft / 100 ft	**VFR Approach/Landing:**	Unknown

A review of the airport/facility directory revealed that the airport was located in a valley surrounded by rising terrain. The departure runway was 100 ft wide by 6,000 ft in length. The CMR chart supplement indicated that a 479-ft hill was located about 1.4 nautical miles (nm) north of the departure end of runway 36. The sunset on the evening of the accident was 1902, with nautical twilight about 1959. Moon illumination was minimal, as indicated by the waxing crescent moon, with moonrise at 0802 and moonset at 2235. GoPro recordings of the accident flight revealed a faint horizon to the west, visible outside the pilot's left door, with minimal cultural lighting in the vicinity of the airport and in the direction of the pilot's right turn.

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Substantial
Passenger Injuries:	1 Fatal	**Aircraft Fire:**	None
Ground Injuries:		**Aircraft Explosion:**	None
Total Injuries:	2 Fatal	**Latitude, Longitude:**	35.312778,-112.1878

The airport elevation was 6,690 ft mean sea level (msl) and the terrain elevation at the accident site was 6,625 ft msl. The wreckage was located about 1,440 ft northeast of the departure end of the runway. Examination of the wreckage revealed that the impact damage was more pronounced on the right side of the airplane. The engine and the cockpit floorboards were displaced upward and aft. The main landing gear were bent aft, rotating the landing gear box forward about 90º. Both wings remained attached to the upper fuselage and exhibited leading edge damage that continued aft to the spar. The cabin sustained occupiable space encroachment.

Flight control cable continuity was established between the flight control surfaces and the cockpit controls. Rudder, elevator, and pitch trim cables remained complete and attached. The flap cable remained attached to the flap handle, but the handle position could not be determined due to impact damage. The elevator trim position could not be determined due to impact damage sustained to the trim wheel, but the control cable chain remained intact in the cockpit and in position on the trim actuator. The engine tachometer drive cable was found separated inside the housing at the locking sleeve. About one inch of the tachometer drive shaft cable remained attached to the tachometer drive assembly. The tachometer drive rotated freely when the propeller/crankshaft was rotated by hand. The tachometer drive shaft revealed signs of rotational overload. The engine examination revealed no additional evidence of a mechanical failure or malfunction that would have precluded normal operation.

Preventing Similar Accidents

Reduced Visual References Require Vigilance (SA-020)

The Problem

About two-thirds of general aviation accidents that occur in reduced visibility weather conditions are fatal. The accidents can involve pilot spatial disorientation or controlled flight into terrain. Even in visual weather conditions, flights at night over areas with limited ground lighting (which provides few visual ground references) can be challenging.

What can you do?

- Obtain an official preflight weather briefing, and use all appropriate sources of weather information to make timely in-flight decisions. Other weather sources and in-cockpit weather equipment can supplement official information.
- Refuse to allow external pressures, such as the desire to save time or money or the fear of disappointing passengers, to influence you to attempt or continue a flight in conditions in which you are not comfortable.
- Be honest with yourself about your skill limitations. Plan ahead with cancellation or diversion alternatives. Brief passengers about the alternatives before the flight.
- Seek training to ensure that you are proficient and fully understand the features and limitations of the equipment in your aircraft, particularly how to use all features of the avionics, autopilot systems, and weather information resources.
- Don’t allow a situation to become dangerous before deciding to act. Be honest with air traffic controllers about your situation, and explain it to them if you need help.
- Remember that, when flying at night, even visual weather conditions can be challenging. Remote areas with limited ground lighting provide limited visual references cues for pilots, which can be disorienting or render rising terrain visually imperceptible. When planning a night VFR flight, use topographic references to familiarize yourself with surrounding terrain. Consider following instrument procedures if you are instrument rated or avoiding areas with limited ground lighting (such as remote or mountainous areas) if you are not.
- Manage distractions: Many accidents result when a pilot is distracted momentarily from the primary task of flying.

See https://www.ntsb.gov/Advocacy/safety-alerts/Documents/SA-020.pdf for additional resources.

The NTSB presents this information to prevent recurrence of similar accidents. Note that this should not be considered guidance from the regulator, nor does this supersede existing FAA Regulations (FARs).

Administrative Information

Investigator In Charge (IIC):	Hicks, Michael
Additional Participating Persons:	Paul Alukonis; FAA; Las Vegas, NV Casey Love; Textron Aviation; Wichita, KS
Original Publish Date:	January 31, 2023
Last Revision Date:	
Investigation Class:	Class 3
Note:	The NTSB did not travel to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=102952