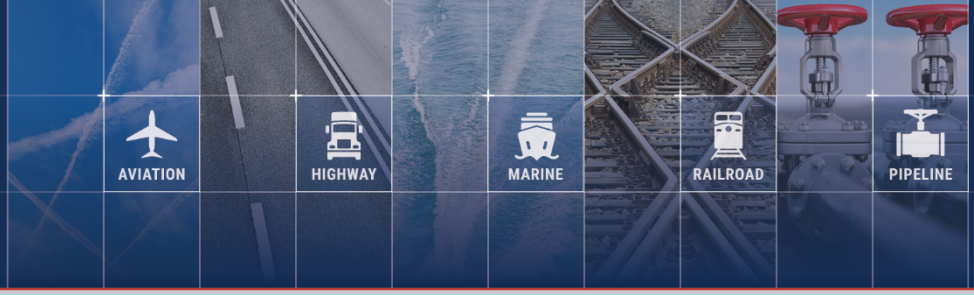

Aviation Investigation Final Report

Location:	Weston, Florida	**Accident Number:**	ERA20LA327
Date & Time:	September 9, 2020, 09:35 Local	**Registration:**	N120GX
Aircraft:	Mooney M20R	**Aircraft Damage:**	Substantial
Defining Event:	Loss of engine power (total)	**Injuries:**	2 None
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The pilot completed a multi-day cross-country trip on the day prior to the accident flight during which he noted an increase in the engine's oil consumption. The purpose of the accident flight was a planned trip for a scheduled oil change, where he also intended to ask the maintainer about the oil consumption. Prior to departing on the accident flight, he performed a preflight inspection and noted that the engine oil level was about 6.5 quarts. While in cruise flight about 20 minutes after departure, the engine lost all power. The pilot performed a successful forced landing to the right shoulder of an interstate highway, where the airplane came to a stop. As the pilot and passenger prepared to disembark, a truck struck the airplane's left wing from behind, resulting in substantial damage to the wing. The pilot reported that the oil level after the accident was between 6 and 6.5 quarts.

A review of data recorded by the airplane's avionics system revealed that during two previous legs of the cross-country trip the oil pressure began to gradually decrease and fluctuate about midway through each flight. During the last leg, the oil pressure decreased continuously throughout the entire flight. During the accident flight, the oil pressure remained in the green range until just prior to the loss of engine power.

During the most recent annual inspection, the engine oil was noted as excessively dirty and contaminants ("gunk") were found in the oil filter pleats. Contaminated oil is commonly caused by an excessive interval between oil changes and/or excessive wear of the piston rings, neither of which appear to have occurred in this case. The oil change intervals were consistently within the manufacturer's specifications and there was no significant loss of cylinder compression (a potential indicator of piston ring wear) noted during the last annual inspection. There were no anomalies noted with the oil and no debris noted in the oil filter during the following oil change, which was the last change before the accident flight.

Although the damage to the engine components was consistent with thermal damage due to a lack of lubrication, given the reported oil quantity after the accident and during the previous trip, as well as the gradual decreases in the recorded oil pressure on the previous flights, it is unlikely that the damage resulted from too little oil in the sump. The gradually decreasing oil pressure during the previous flights suggests a possible problem with the oil pump, an oil leak or restriction, or excessive oil temperature, no evidence of which was found during the examination. It is possible that the overheating and subsequent damage to the bearings began during one of the previous flights when the oil pressure decreased. The reasons for the decreased oil pressure and the increased oil consumption could not be determined.

The engine had never been overhauled, and at the time of the accident had reached just over half of the recommended operating hours between overhauls. However, it was 14 years old, which is 2 years past the recommended calendar time between overhauls. Had the engine been overhauled at the recommended calendar time, it is likely that the issue with the lubricating system could have been addressed or prevented.

Probable Cause and Findings

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

A total loss of engine power because of the overheating and failure of the connecting rod bearings due to a lack of lubrication for reasons that could not be determined.

Findings

Aircraft	Recip eng oil sys - Unknown/Not determined

Factual Information

History of Flight

Enroute	Loss of engine power (total) (Defining event)
Standing-engine(s) not oper	Ground collision

On September 9, 2020, at 0935 eastern daylight time, a Mooney M20R airplane, N120GX, was substantially damaged when it was involved in an accident near Weston, Florida. The pilot and passenger were not injured. The airplane was operated as a Title 14 *Code of Federal Regulations* Part 91 personal flight.

According to the pilot, the airplane had 6.5 quarts of oil (8 quarts total capacity) and 65 gallons of fuel onboard before departure for the 35-minute flight from Naples to Fort Lauderdale, Florida. About 20 minutes into the flight, at an altitude of 3,500 ft mean seal level, he “heard a loud pop and the prop sputtered and the engine started losing power.” He noticed that the oil pressure had decreased from 58-60 psi to 0 psi; however, all other engine gauges, including the oil temperature, were normal except for a “larger than normal draw on the battery.” About 30 seconds later, part of the engine exited through the top of the engine cowling, and the engine and propeller stopped completely. The pilot performed a successful forced landing to the right shoulder of an interstate highway where the airplane came to a stop. As the pilot and passenger prepared to disembark, a truck struck the airplane’s left wing from behind, and the airplane spun around 180°.

Examination of the airplane at the accident site by a Federal Aviation Administration inspector revealed that the airplane sustained substantial damage to the left aileron, the left wing trailing edge forward of the aileron, and the inboard trailing edges of both the left and right elevators. A hole was present on the top left side of the engine cowling and in the engine case near the base of the No. 6 cylinder. Metal debris, including a damaged connecting rod, its separated cap, a piston wristpin, a valve lifter, and crankcase fragments were found in the engine’s oil pan.

Examination of the engine revealed discoloration/thermal damage to one of the crankshaft main bearings, one of the crankshaft connecting rod journals, and two of the connecting rods (and bearings) at their crankshaft ends. The discoloration and damage were consistent with a lack of lubrication. The examination found no anomalies with the engine oil pump, and no blocked oil passages were found in the crankshaft.

The pilot/owner reported that on the previous day, he completed a long cross-country trip (four flights over four days, totaling about 16 hours). Over the course of the last two flights of that trip (which totaled about 7.25 flight hours), the engine used about 3.5 quarts of oil, or about 1

quart every 2.07 hours. When he added 2 quarts of oil after completing the trip, which brought the oil level to 6.5 quarts, he noted that the oil consumption “seemed to be on the high side.” Previously, he had added oil prior to two other legs of the trip, and the lowest oil level observed was “just below 6 quarts.” He recalled the recent oil additions from memory as he did not keep a written log of every addition. He did not report observing any oil leaks. The accident flight occurred the next day, which was a planned trip to get the oil changed. He intended to ask the maintainer to determine if the oil consumption was normal or to determine a reason for it, if not.

The airplane was equipped with electronic primary and multifunction displays, which recorded flight data to an on-board memory card. A review of the data from 34 previous flights revealed that during cruise flight, the engine oil pressure was typically between 60 and 65 psi, and consistent. Any fluctuations in cruise flight were normally concurrent with a change in engine rpm or oil temperature. Figure 1 shows the engine rpm, oil pressure and temperature for a typical flight.

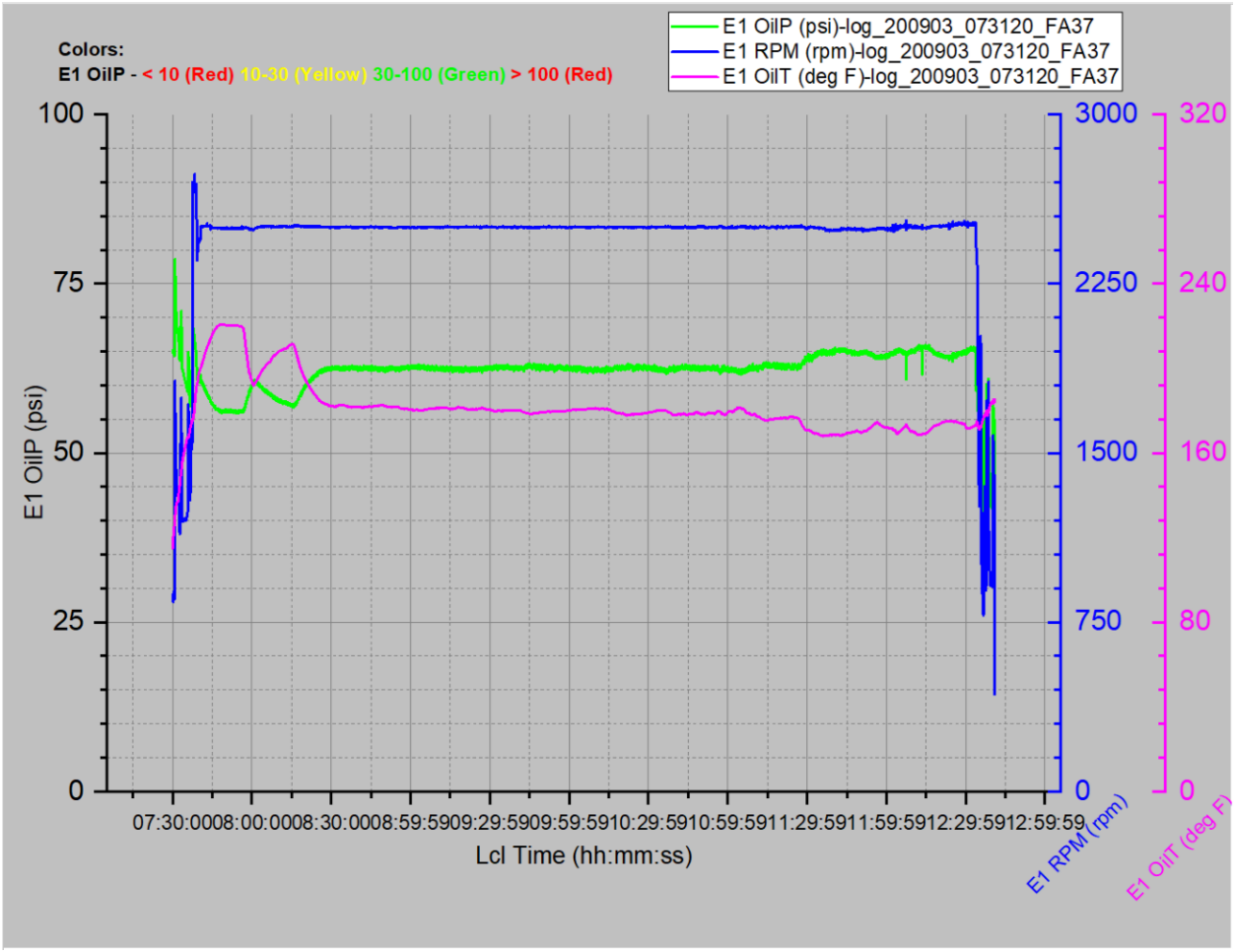

Figure 1 - Engine Oil Pressure - Typical Flight

Beginning with the 3rd previous flight (which occurred 6 days prior to the accident), the recorded data for engine oil pressure deviated from the preceding typical trends. During the 3rd and 2nd previous flights, the oil pressure began to decrease about halfway through the flight, without an accompanying change in oil temperature or engine rpm. Additionally, during the decreasing trend, the oil pressure data became "noisy", exhibited by high frequency fluctuations in the recorded pressure. These trends continued for the remainder of both these flights. The decrease in pressure was gradual, dropping 15-20 psi over about 90 minutes, reaching about 45 psi by the end of the cruise. A review of the data from 31 flights prior to this time revealed that the oil pressure was not below 60 psi during the cruise phase. Figure 2 shows the data from the 2nd previous flight.

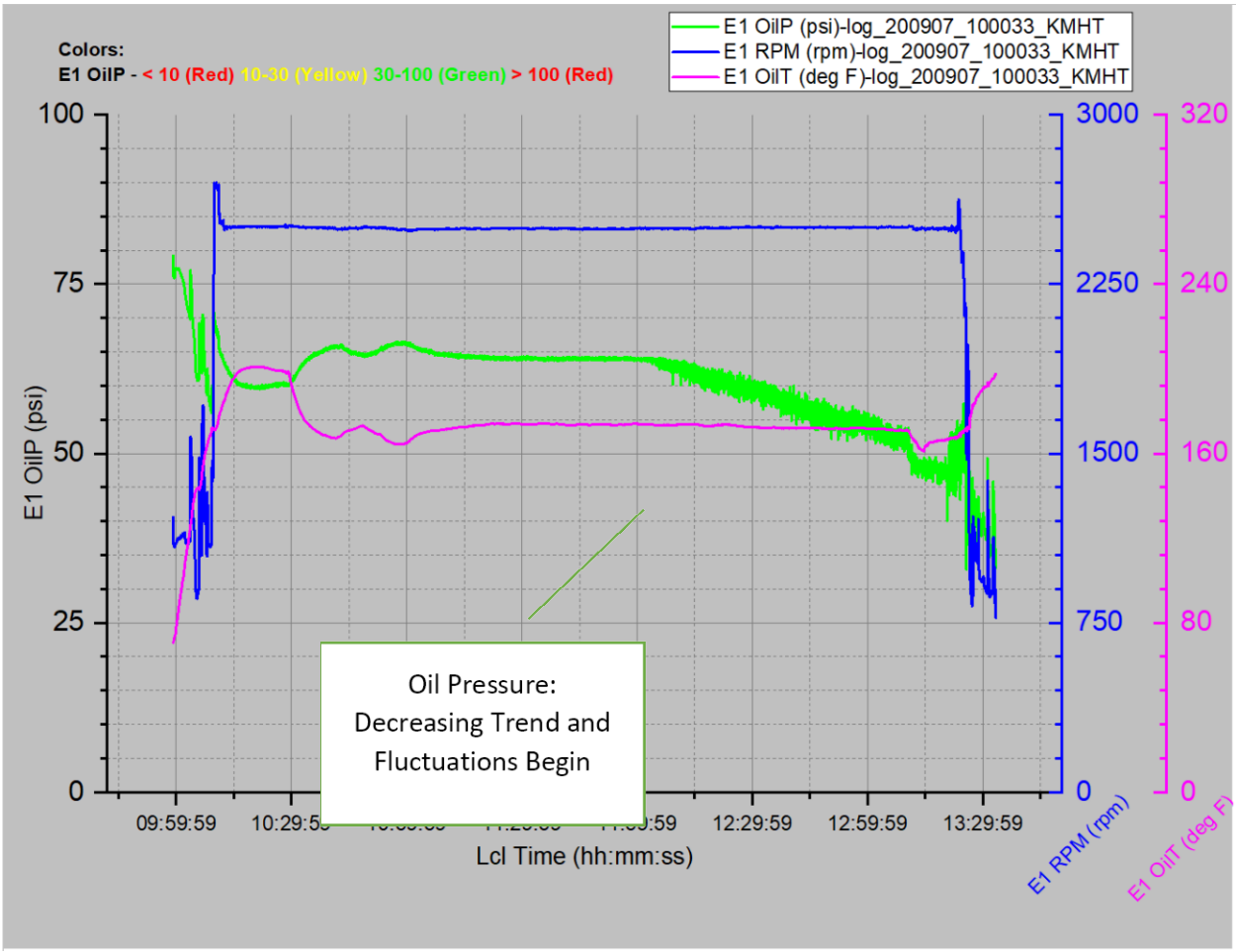

Figure 2 – Engine Oil Pressure - Data from 2nd Previous Flight Prior to Accident Flight

During the flight prior to the accident, the oil pressure did not reach the typical 60-65 psi during cruise, and it decreased throughout the entire flight. About 1/3 of the way through the flight, the pressure fell into the yellow range of the oil pressure gauge (10-30 psi). It continued to decrease until it briefly reached the lower red range (<10 psi) twice, near the end of the flight. Figure 3 shows the data from the previous flight.

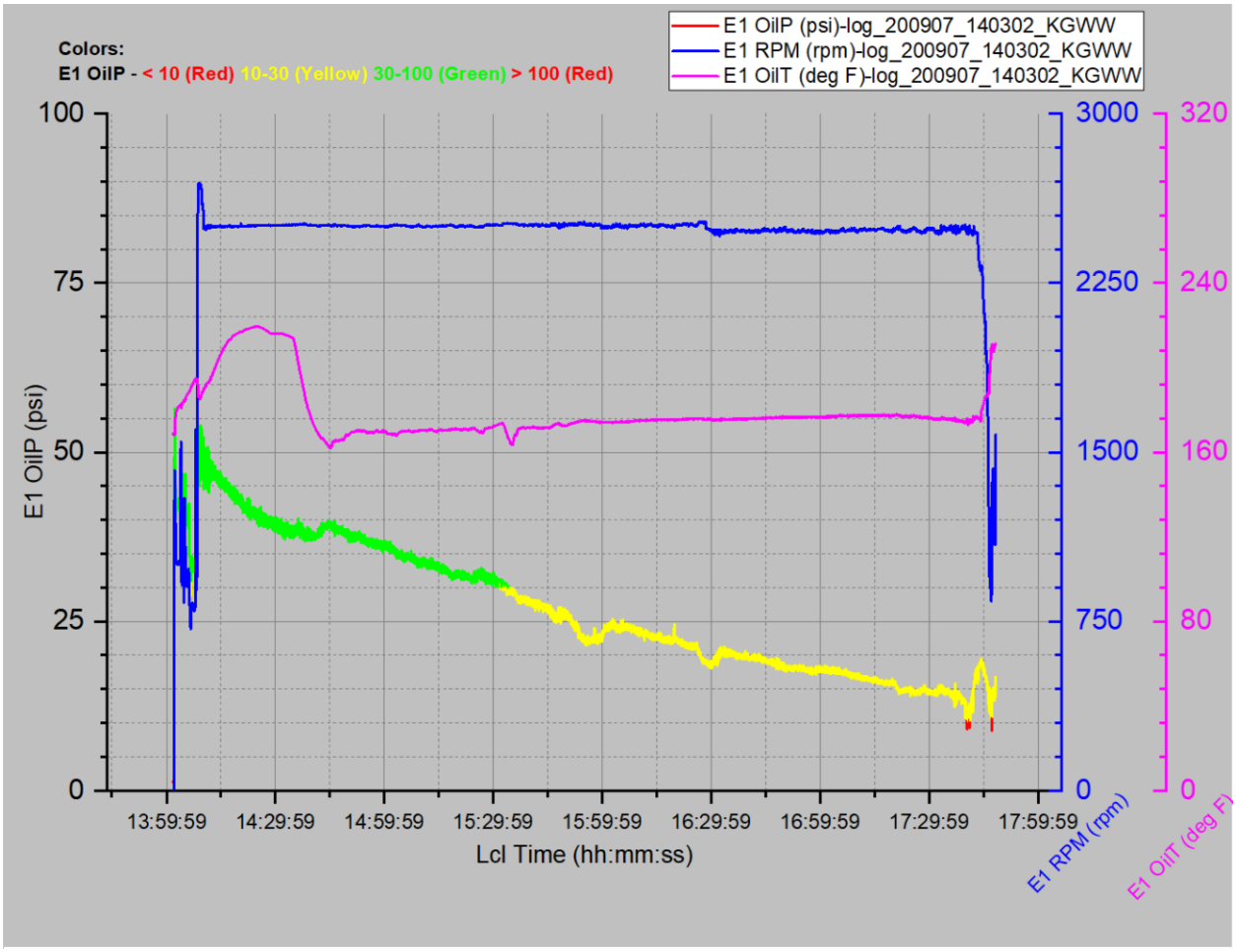

Figure 3 Engine Oil Pressure - Data from Flight Prior to Accident Flight

During the accident flight, the oil pressure was generally more consistent with a typical flight, with a decrease (about 7-8 psi) over the 3 minutes prior to the loss of engine power. Figure 4 shows the data from the accident flight.

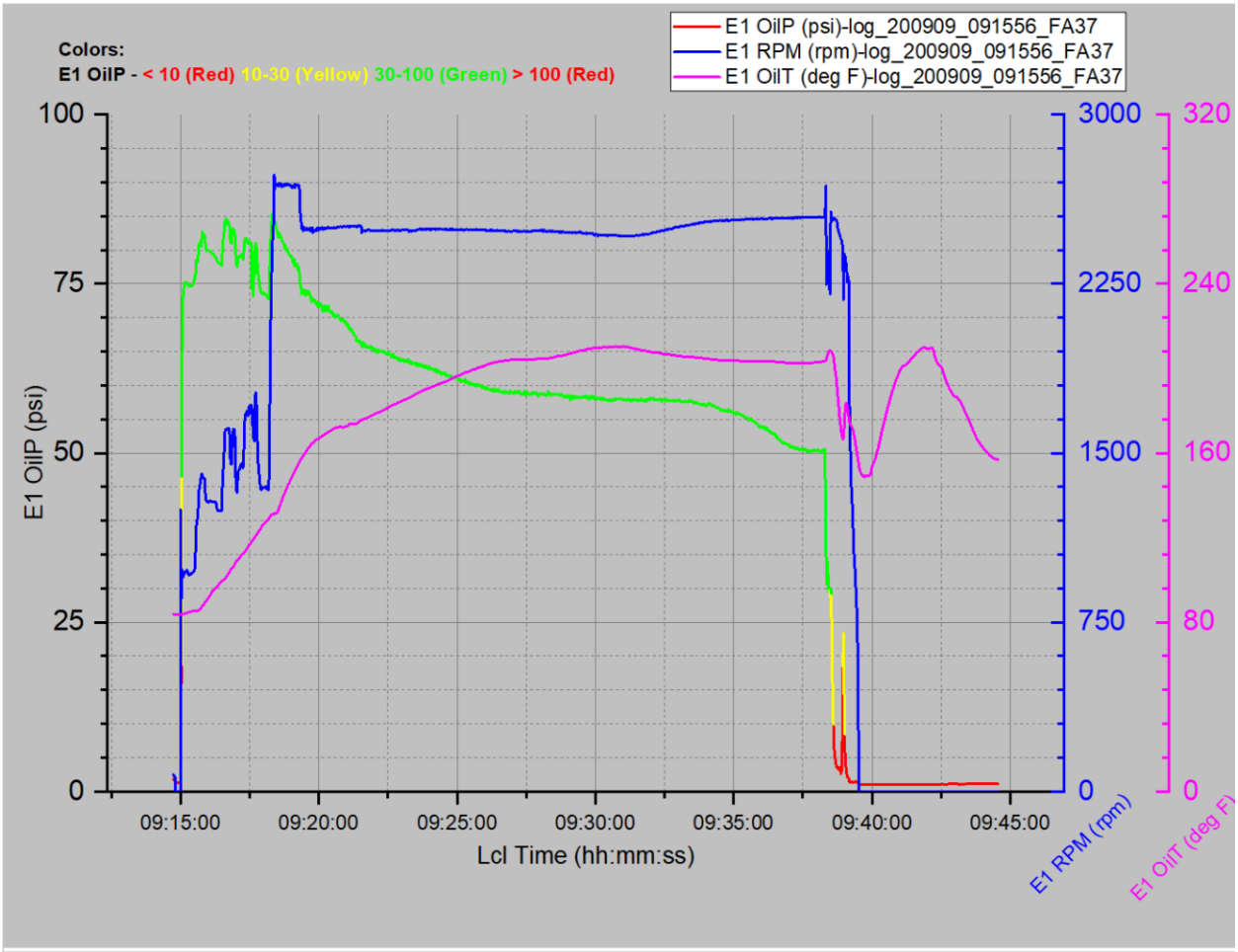

Figure 4 Engine Oil Pressure - Data from Accident Flight

Engine Instruments

Oil pressure and other engine indications are displayed on the airplane's multifunction display (MFD). While this display is used for many different functions, engine data are typically depicted on the left side of the screen as shown in an exemplar image in figure 5. In some cases, such as when using the 'lean' function, the oil pressure gauge is not depicted. According to the MFD pilot's guide:

> "When unsafe operating conditions occur, the corresponding readouts flash to indicate cautions and warnings."

The pilot's guide did not specify whether the oil pressure indicator would flash if the oil pressure value fell within the yellow range.

The airplane was not equipped with a secondary oil pressure gauge.

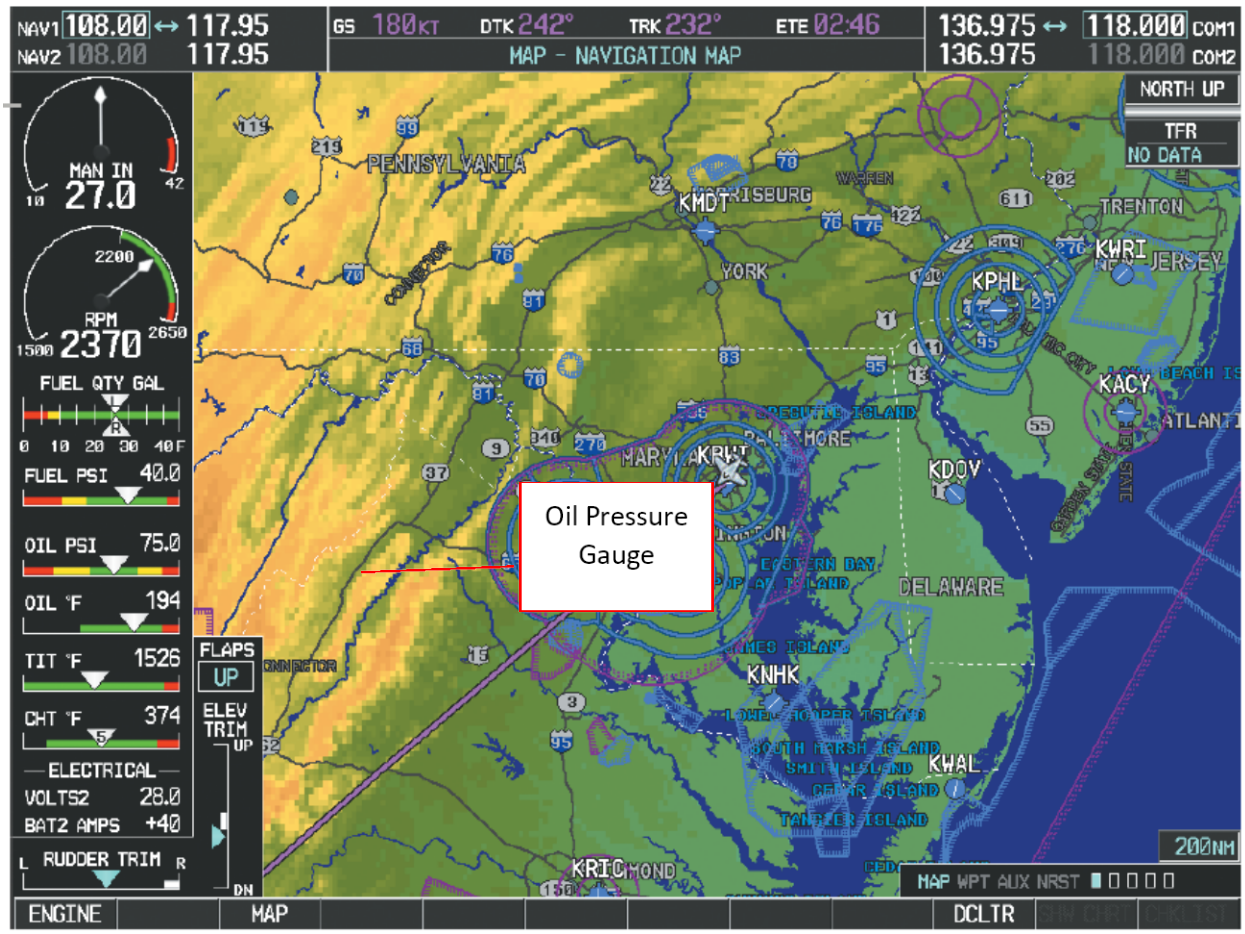

Figure 5 - Exemplar MFD Display (Mooney M20M)

A review of the engine maintenance logbook revealed that the engine was manufactured May 2006, was installed when the airplane was manufactured, and had accrued a total of 1,166 hours. It had not been overhauled. According to the engine manufacturer's overhaul manual, the recommended time between overhauls was 2,000 hours or 12 years, whichever comes first. The manual states in part:

> "Regardless if the engine has been operated regularly or has been in storage; gaskets, seals, and synthetic and natural rubber goods deteriorate over time. Replace or overhaul the engine upon accumulating the operating hours specified in Table 6-1 [2,000 hours], or twelve (12) years after being placed in service, whichever occurs first."

The most recent maintenance was an oil change, about 38 flight hours prior to the accident flight, on July 10, 2020. The oil filter was opened and examined at that time with no anomalies noted.

The most recent annual inspection was performed about 81 flight hours prior to the accident flight, on May 29, 2020, with no anomalies noted in the logbook entry. That logbook entry included a note that the oil filter was cut open and inspected, with no debris or metal detected.

However, a separate supplemental document for that same inspection entitled “Mooney International Corporation 50-Hour/100-Hour/Annual Maintenance Inspection Guide” noted in one section “Dirty Oil – gunk in filter”. The remarks section at the end of the document read “oil was awfully dirty, filter was not clean, gunk like substance in filter folds (element).” The cylinder compression test values did not vary significantly between the previous annual inspection (May 2019) and the most recent annual inspection, except for cylinder number 2, which increased by 20 psi.

A review of the last 10 oil changes prior to the accident flight (including the two noted above) revealed oil change intervals that ranged from 21 to 46 hours. Of these, there were no other anomalies noted about the oil condition or mention of any debris found in the oil filter. However, the records for 5 of these oil changes did not specifically indicate if the oil filter was opened and examined.

Pilot Information

Certificate:	Commercial	**Age:**	45,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	Unknown
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	Class 3 Without waivers/limitations	**Last FAA Medical Exam:**	November 1, 2019
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:	(Estimated) 452 hours (Total, all aircraft), 410 hours (Pilot In Command, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Mooney	**Registration:**	N120GX
Model/Series:	M20R No Series	**Aircraft Category:**	Airplane
Year of Manufacture:	2006	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	29-0459
Landing Gear Type:	Retractable - Tricycle	**Seats:**	4
Date/Type of Last Inspection:	May 29, 2020 Annual	**Certified Max Gross Wt.:**	3369 lbs
Time Since Last Inspection:	81 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	1166 Hrs at time of accident	**Engine Manufacturer:**	Continental
ELT:	Installed, not activated	**Engine Model/Series:**	IO-550-G(7)B
Registered Owner:	On file	**Rated Power:**	280 Horsepower
Operator:	On file	**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	FLL,11 ft msl	**Distance from Accident Site:**	24 Nautical Miles
Observation Time:	09:53 Local	**Direction from Accident Site:**	100°
Lowest Cloud Condition:	Scattered / 2300 ft AGL	**Visibility**	10 miles
Lowest Ceiling:	Broken / 15000 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	8 knots /	**Turbulence Type Forecast/Actual:**	None / None
Wind Direction:	160°	**Turbulence Severity Forecast/Actual:**	N/A / N/A
Altimeter Setting:	29.97 inches Hg	**Temperature/Dew Point:**	28°C / 24°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Naples, FL (FA37)	**Type of Flight Plan Filed:**	None
Destination:	Fort Lauderdale, FL (FXE)	**Type of Clearance:**	None
Departure Time:	09:15 Local	**Type of Airspace:**	Class G

Wreckage and Impact Information

Crew Injuries:	1 None	**Aircraft Damage:**	Substantial
Passenger Injuries:	1 None	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	2 None	**Latitude, Longitude:**	26.14583,-80.520841(est)

Administrative Information

Investigator In Charge (IIC):	Brazy, Douglass
Additional Participating Persons:	Daniel Sullivan; FAA/FSDO; Miramar, FL Kurt Gibson; Continental Aerospace Technologies; Mobile, AL
Original Publish Date:	January 25, 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=102013