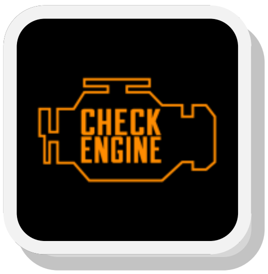
General Aviation
Joint Steering Committee
Safety Enhancement Topic

FAA
Aviation Safety

Engine Maintenance and Performance Monitoring

In order to reduce the risk of loss of control accidents due to engine failure related factors, the FAA and industry are reviewing the current technological capabilities available for engine trend monitoring, engine health analysis, fuel management, and fuel indicator systems. Between 2001-2010, 35 of 70 randomly selected accidents had engine maintenance errors identified as a contributing factor. When a pilot makes an error, the consequences sometimes manifest immediately. A maintenance error, on the other hand, can take many years to manifest into an accident. Proper engine maintenance, post maintenance advanced pre-flights, and engine performance monitoring can go a long way in eliminating this type of mishap.

Accidents Happen …



On Jan. 11, 2005, an airplane experienced a total loss of engine power and collided with wires and a power line pole while descending for a forced landing. The pilot-rated student reported that while returning, he noted a smell of something burning which triggered him to look at the engine gauges; he noted " … that we had no oil pressure." The flight continued for 5 minutes 3 seconds until the engine quit. The CFI took the controls and tried to maneuver for a forced landing but the airplane collided with power lines, then a power pole. A post-accident inspection noted oil film on the exterior surface of the fuselage bottom skin, and in the engine compartment area on the aft side of the baffling. A leak was noted from a flexible hose near the oil cooler end. Ten ounces of oil remained in the engine, which exhibited internal evidence of oil exhaustion which resulted in failure of the No. 2 cylinder connecting rod cap and bolt.

But This One Probably Didn't Have To …

- First, poor engine maintenance directly contributed to this mishap. From the report:

The engine was overhauled last in 2001. The engine manufacturer recommends replacement of oil hoses at normal engine overhaul. A note in the airplane maintenance manual indicates that rubber engine compartment hoses are to be replaced every five years or at engine overhaul, whichever occurs first. Examination of the hose by the NTSB Materials Laboratory revealed a .7 inch long crack located approximately 4.25 inches from the oil cooler adapter end.

The NTSB determined a contributing factor of this accident was:

The failure of company maintenance personnel to replace the flexible oil cooler hoses during engine installation following overhaul, as recommended by the engine manufacturer.

- Second, this mishap serves as a great example for how engine performance monitoring might have detected an issue far sooner.

Sound Maintenance Practices

⇒ Get to know your airplane, and your mechanic!

Ideally, pilots and mechanics should work together to make sure the aircraft is operated and maintained properly. As a pilot, you are encouraged to take an active role in maintenance by reviewing inspection results and discussing Airworthiness Directives and Service Bulletins with your mechanic.

⇒ Don't ignore regular maintenance!

- Be sure to comply with all manufacturer-recommended service intervals.
- Fifty-hour oil changes are recommended for most normally-aspirated piston engines.
- Turbo-charged engines should undergo oil changes more frequently.
- An oil filter inspection with each oil change will yield immediate feedback.
- Investigate further if you find metal particulate in the filter.
- Oil analysis can reveal a lot about engine health, but it works best when several samples create a trend.
- It's not a bad idea to do a compression check as well as check magneto timing, spark plugs and the exhaust system every other oil change.

Resources:

To learn more about engine data management systems read "Check Engine!" in the May/June 2015 edition of *FAA Safety Briefing*.

Engine Performance Monitoring

⇒ Basic instrumentation such as airspeed indicators, attitude indicators, angle of attack indicators, manifold pressure gauges, RPM gauges, and G-force meters all give immediate feedback as to whether design limitations have or are about to be exceeded. This information is available real-time on every flight.

⇒ Engine diagnostic equipment can come in many different forms. One version is the external, hand-held test kit that attaches to ignition plugs and determines system functionality. A good test kit can check engine compression, magnetos, ignition leads, and engine timing, to name a few.

⇒ Engine data management (EDM) systems come in a variety of forms and are offered by a host of different companies. These devices watch over your engine while you concentrate on flying the aircraft and, combined with a controller, can meter your mixture and exhaust gas temperature (EGT) to optimize lean-of-peak operations. Some brands even offer the interpretive software and/or provide professional analysis as to what your data might indicate. In most cases, you can upload your information directly to a website, and if need be, request a report when anomalies present themselves.

⇒ A digital/electronic engine control (D/EEC) regulates the functions of the injection system to ensure the engine provides the power that is required of it. An engine control unit reads a multitude of sensors and then manipulates the engine by adjusting a series of actuators. Sensors include ones for airflow, engine cooling, throttle position, and fuel flow.