

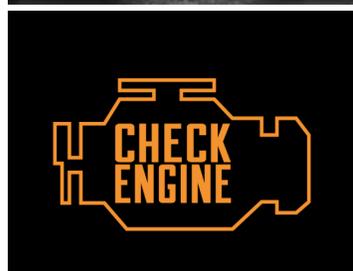


Full Authority Digital Engine Control (FADEC)

The General Aviation Joint Steering Committee (GAJSC) identifies electronic engine control (EEC), which ranges from electronic ignition through full authority digital engine control (FADEC), as a safety enhancement to GA aircraft. These systems can decrease pilot workload and provide engine monitoring capability that can alert operators of certain mechanical problems.

Electronic Ignition & Engine Control

Whether we realize it or not, most cars today benefit from electronic ignition and electronic engine control (EEC) technology. If you press a button to start and stop your car, you have an EEC on board. The EEC keeps your engine running at peak efficiency for your operational environment by evaluating input from engine and environment sensors hundreds of times per second. Those same sensors can provide valuable input as to the health of your powerplant. If problems are detected, a service light on your panel will indicate the issue.



Fewer mechanical parts means longer service intervals and reduced maintenance expense.

Electronic Ignition for Aircraft

As with automobiles, fewer mechanical parts on aircraft equals increased reliability which, in turn, increases maintenance intervals and reduces maintenance expense. You may also see an increase in fuel efficiency.

But, to get all the benefits from digital technology, you'll have to cede at least some engine control to computers. There are a couple of ways to do that.

The first way is through EEC. With EEC, we get electronic ignition and some computer control such as ignition timing and air/fuel mixture. EEC is also more reliable than magnetos.



Digital Electronic Control System

Full Authority Digital Engine Control (FADEC) means just that. There is no direct pilot control over the engine or manual control mode. If the FADEC fails, the engine fails. However, system redundancy makes it much less likely for a FADEC system to fail than a traditional magneto system. In fact, a double magneto failure is statistically more likely than a FADEC failure.

FADEC systems are:

- ◆ autonomous,
- ◆ self-monitoring,
- ◆ self-operating, and
- ◆ redundant.

FADEC Advantages

FADEC shares advantages with electronic ignition and EEC systems, but it takes power management several steps further. FADEC combines throttle, prop, and mixture controls into a single control. Every throttle setting at any altitude results in the optimum power/prop RPM/mixture combination. This enables pilots to realize fuel economy that would only have been dreamed of previously.

Automatic engine performance monitoring constantly provides over-speed and over-boost protection throughout the operational range. Pilots can command maximum power and the system will deliver just that and no more. There is no possibility of exceeding limitations. FADEC also features diagnostic processes that constantly monitor the health and well-being of the aircraft powerplant. The diagnostics are very good at defining small



problems before they become big problems. It's not surprising that FADEC delivers big returns in increased fuel efficiency and reduced maintenance expense.

FADEC Disadvantages

Pilots, accustomed to managing their engines directly, may initially view FADEC exclusive engine control with suspicion, but with experience, will learn to trust the system. The hardest fact for most to get accustomed to is that the system provides no reversion to manual control.

Occasionally, pilots have run engines beyond operational limits in order to get out of tight situations. That can't happen with FADEC. Maximum allowable power for any flight level is always available, but no more than that. Also, sufficient electrical power to start and run the engine is needed. Hand propping definitely won't work with FADEC.

Although just a few GA manufacturers are using FADEC now, we can expect to see many more in the future.

Resources

- ◆ FAA Advisory Circular 33.28-1, *Compliance Criteria for 14 CFR section 33.28, Aircraft Engines, Electrical and Electronic Engine Control Systems*: <https://go.usa.gov/xn89k>

