

Modern Engine-Monitoring Systems Offer Cost-Effective Options

BY MATT THURBER

There have been many exciting — and expensive — developments in technologically advanced all-glass instrument panels, and now most glass cockpits feature sophisticated engine instrumentation.

If you can't afford a complete glass panel with integrated engine instruments, there are a surprising number of options for sophisticated engine monitoring and display systems that will make even a panel full of old avionics look remarkably modern. These systems cost far less than you might expect and the safety benefits are huge, not to mention opportunities for gains in engine operating efficiency.

As avionics manufacturers have incorporated engine monitoring into their glass-panel systems, the way engine instrumentation information is displayed has taken on a more modern look. Instead of just raw numbers that pilots must interpret, engine displays now offer a variety of display types, from digitally rendered analog-looking sweep indicators adjacent to the raw number of the item being measured to multi-colored bar graphs.

Most systems now offer alarms to warn pilots of exceedances — including potentially damaging shock cooling — and many systems allow the user to set warning criteria for each gauge. Voice alerts also are available on some systems. An excellent feature on many engine monitors is a percent-power or horsepower indicator, which shows the actual power output of the engine in the existing air-density conditions.



Advanced Flight Systems' AF-3500

Modern engine-monitoring systems now are available from a growing number of manufacturers, some targeting only the experimental aircraft market and others aiming for factory-built airplanes. While most of these engine-monitoring systems include fuel-flow information, you still can buy separate and quite useful fuel-flow monitors, and often these include the ability to interface with GPS for accurate enroute fuel calculations.

When looking over any of these products, check with the manufacturer and your installation facility to make sure the system you are interested in is qualified for installation in your airplane.

Engine-Monitoring Systems

The state of the art for piston-engine monitoring has advanced quickly in recent years, both for the experimental market and for certified airplanes. The

following are some examples of new engine-monitoring systems:

- Advanced Flight Systems' new AF-3400 and AF-3500 can be configured as an EFIS, engine monitor or combination of both. The AF-3400 and AF-3500 systems utilize the Advanced avionics buss, allowing the pilot and copilot displays to exchange screens. The heading display is generated from a remote-mounted magnetometer. A sunlight-readable color LCD display makes the instruments easy to read. The aircraft monitoring and data acquisition system not only continuously monitors and displays all aircraft engine data, but also several other aircraft functions. The systems' display can be customized to the user's preference, and any of the standard instruments can be eliminated or added to the screen.

- Dynon's EMS-D120 engine-monitoring system looks like the EICAS



Dynon's EMS-D120

portion of an EFIS panel in a business jet and is just as capable. With up to 27 separate inputs available, the EMS-D120 monitors all parameters and annunciates any problem so the pilot can take action before the problem grows too large. Up to four fuel tanks can be monitored, and color ranges and limits can be set by the user. The EMS-D120 also includes timer functions. Like most modern systems, data can be downloaded to a PC for later analysis.

- Electronics International, which makes the tried-and-true Ultimate Bar Graph engine analyzer, introduced a new all-in-one engine instrument called the MVP-50 glass panel engine monitor and in-flight information system. The most interesting feature of the MVP-50 is its configuration, with a panel-mounted display that is fed by a small box called the engine data converter mounted under the instrument panel. The EDC converts engine read-



Electronics International's MVP-50

ings to serial data that drives the MVP-50's display. All the typical engine-monitoring functions are available, as well as a weight-and-balance function and, with the correct sensors, features such as control surface position monitoring, a G-meter, carbon monoxide detector, and angle-of-attack indicator. The user can set data-logging intervals from .33 seconds to six minutes, and data is stored on a USB flash drive for easy transfer to a PC.

- Grand Rapids Technologies is adding the new EFIS Series I dedicated display to its lineup, which includes the EIS Model 4000/6000/9000 monitoring systems. The new EFIS Series I delivers full engine data in sunlight-readable color graphics. The display is driven by the EIS system, which is available in models developed specifically for Lycoming and Continental, Rotax 912/914, Jabiru, and the radial M-14P engines. New features on the EFIS I display include a visual indication of engine efficiency and an EGT time history graph so users can review

intermittent problems. An optional fuel-flow system is available, as well as an altimeter, VSI, and landing gear reminder that is triggered by airspeed or rpm.

- I-K Technologies has developed two unique engine-monitoring systems for experimental aircraft and light sport aircraft in addition to its AIM-3000. The AIM-Lite features bright, color-coded LED bar graphs for easy pilot interpretation of instrument indications. The AIM-Sport displays information on a large-character, sunlight-readable LCD screen, with three rows of bright, color-coded LED bars. Both include options for data logging and separate audible and visual warning alert signals.

- Insight Instrument Corp., a pioneer in engine-monitoring systems, makes the popular GEM graphic engine monitor, which fits in a standard 3-inch instrument hole. The latest model for single-engine applications is the GEM Series 610, designed for both normally

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Grand Rapids Technologies' EFIS Series I



I-K Technologies AIM-3000

ENGINE MONITORING SYSTEMS

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aspirated and turbocharged engines. A key GEM feature is the lean mode, which identifies the leanest cylinder. The GEM 610 includes a built-in wireless interface for downloading recorded information directly into a palmtop computer. Insight Instrument is working on a supplemental type certificate for installation of the GEM system as a primary engine instrument replacement.

- J.P. Instruments' EDM-930 brings together all of the company's engine analysis technology into a colorful engine-monitoring system that is certified to replace primary engine instruments in production airplanes. J.P. Instruments has been making engine analyzers since 1986 and was an early adopter of recording technology so pilots could review and analyze engine operation data. The EDM-930 display shows actual engine horsepower output and makes EGT and CHT readings easy to interpret with color bar graphs above the raw temperature number. Operation of the EDM-930 is made easy with just four buttons to control all functions. The EDM-930 displays fuel quantity in airplanes equipped with capacitive probe or resistive float-type fuel quantity indicating systems, and a fuel-reserve function displays the fuel remaining for reserve for a planned waypoint or destination.

- Vision Microsystems, manufacturer of the VM1000 engine management system, is now owned by J.P. Instruments. The VM1000 also is certified for use in production airplanes and features a bright, sunlight-readable color display that is only 1.5 inches deep but is fully integrated will all engine data in one compact display. In addition to having all the expected engine-monitoring functions, the VM1000 also has an autotrack mode that is designed to monitor engine performance. In autotrack, the pilot



J.P. Instruments' EDM-930

is alerted when a measured value changes from its original reading. This is very useful when, for example, an engine problem causes oil pressure to decrease slowly, something that may be difficult for pilots to perceive. An optional module, the EC100 provides audible alerts and text messages for any exceedances.

Fuel-Flow Systems

While many pilots would enjoy the benefits of a full-blown engine-monitoring system such as those already mentioned, a fuel-flow system offers many important benefits at a much lower cost. A large percentage of engine-failure accidents actually are caused by fuel starvation. Fuel-flow instruments, especially those that interface with GPS, add greatly to flight safety and pilot comfort, ensuring adequate reserves at the destination and alerting the pilot when changing wind conditions make an interim fuel stop necessary.

Independent fuel-flow systems are much more accurate than some so-called fuel-flow gauges installed in production aircraft because some of these only measure fuel pressure and convert pressure to a relatively inaccurate fuel-flow number. Fuel-flow systems use fuel-flow transducers to measure fuel flow accurately, independent of the fuel pressure. The following manufacturers offer these fuel-flow systems:

- Electronics International: FP-5 and FP-5L. These units can dis-

play in U.S. gallons, pounds, liters or British gallons per hour. They include a pilot-programmable low-fuel warning, which can be set to alert the pilot when fuel drops to a selected level. The recurring fuel-used alarm can be set to let the pilot know when a certain amount of fuel has been burned, instead of using time to measure fuel consumption.

- Insight Instrument: True Flow 500. This system is actually a fuel-flow computer hooked up to the engine that interfaces with GPS navigators to deliver fuel-flow information, saving valuable instrument panel space.

- J.P. Instruments: FS-450. This system offers displays in U.S. gallons, liters or pounds per hour. The display includes nautical miles per gallon, endurance, reserve at next waypoint, fuel required to next waypoint, total fuel burned, fuel remaining, and an auto button to cycle automatically between all parameters. It interfaces with older Shadin and Hoskins systems.

- Shadin Avionics: Digiflo-L, Microflo-L and Miniflo-L. Shadin offers three types of fuel-management instrument systems, all of which can interface with GPS, including the Bendix/King KLN series and Garmin navigation receivers. The Microflo-L takes up very little panel space. The Shadin systems are certified for installation in more than 180 airplane types, both single- and multi-engine.

- TL elektronik: TL-2524 fuel com-



Shadin Avionics' Microflo-L

puter. This system displays in liters, U.S. gallons and British gallons per hour. Fuel consumption data can be downloaded for later analysis. It fits in a standard 2.25-inch hole, and also tracks flight time and engine hours. □

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