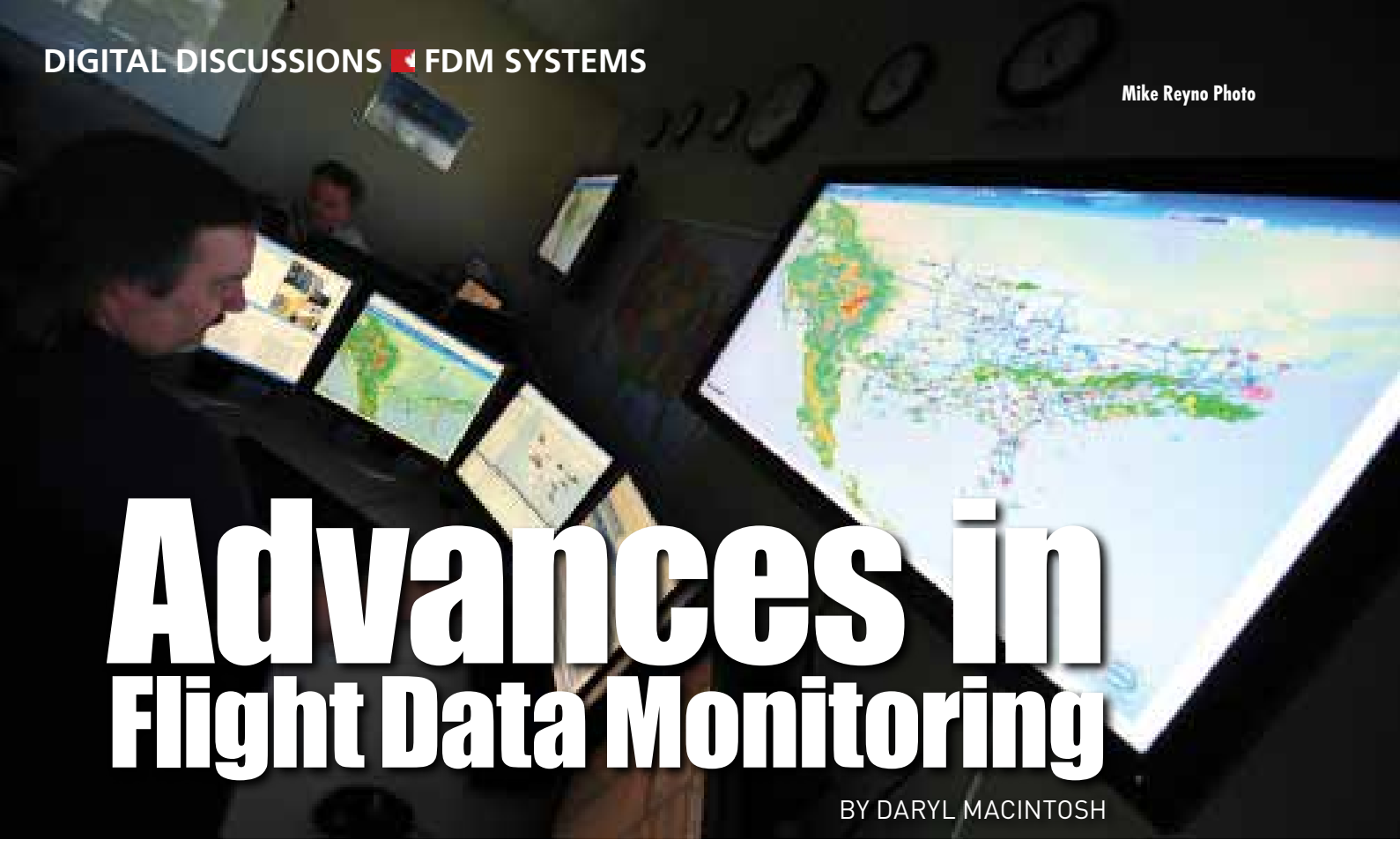

Mike Reyno Photo

Advances in Flight Data Monitoring

BY DARYL MACINTOSH

WHAT IS FLIGHT DATA MONITORING (FDM)?

Flight data monitoring (FDM) is generally considered to be a systematic method of accessing, recording, analyzing, and acting upon information obtained from flight data to identify operational and/or maintenance risks, before they can lead to incidents and accidents. The term "flight data monitoring" incorporates a variety of systems that continue to evolve to meet the unique needs of each industry sector. The most well-known of these systems include:

- Flight operations quality assurance (FOQA)
- Helicopter flight data monitoring (HFDM)
- Helicopter operations monitoring program (HOMP)
- Health and usage monitoring system (HUMS)
- Maintenance operations quality assurance (MOQA)
- Aircraft condition monitoring system (ACMS)

All FDM systems aim to improve aviation safety, but the systems do differ when it comes to their specific areas of focus.

Operations-focused FDM

The primary function for many systems (FOQA, HFDM and HOMP) is to act as a feedback loop that enables aircraft operators to compare their standard operating procedures (SOPs) with the actual results obtained from routine daily flight operations. This feedback loop is typically an integral part of an operator's safety management system (SMS). The data collected is used by analysts to investigate predefined exceedances, establish trend analysis and initiate corrective actions. These systems are intended to prevent accidents by reacting to normally unreported events, and modifying procedures and behaviours in a non-punitive manner. Operations-focused FDM systems are currently used by many of the world's major airlines, and smaller airlines and various other air operators are beginning to implement these systems as well.

Maintenance-focused FDM

Other systems (HUMS, MOQA and ACMS) are more maintenance oriented, with goals of early fault detection and overall maintenance cost reduction. As a maintenance tool, these systems enable operators to predict some mechanical failures, order the necessary parts and schedule maintenance events. Users report a significant reduction in unscheduled down time and reduced need for maintenance test flights. These types of FDM systems have become standard equipment for offshore oil and gas helicopter operations across the globe.

Converging focus FDM

The differences between the operations-focused systems and the maintenance-focused systems are becoming blurred, as some products within each group continue to evolve and add new features.

FDM SYSTEM ESSENTIALS

The five essential aspects to a functional FDM program are as follows:

1. Record the flight data (hardware): FDM equipment must be selected, purchased and installed on each aircraft in a particular fleet. This hardware should be carefully chosen to ensure that the system's capabilities match the operator's actual requirements. There is a significant variation in capabilities, size, weight and cost between the various available FDM products. The ideal hardware should be lightweight, affordable, easy to install, easy to use, reliable, and capable of recording a wide variety of data. In reality, some compromises may have to be made when selecting hardware for any particular application.

2. Extract the data: The method used to extract data from the on-aircraft hardware varies with each system manufacturer. Most require personnel to physically go to each aircraft to download the data. Older systems typically utilize a credit-card sized PCMCIA (Personal Computer Memory Card International Association) card, while newer systems typically have a USB port. Some systems automatically download their data (when the aircraft is on the ground) via a cellular telephone network, and a few other systems download via Wi-Fi.

3. Deliver the data: The data must be delivered, in a timely manner, to the facility that will analyze it. This data delivery can be a logistical headache for operators that do physical downloads and operate from remote bases.

4. Analyze the data: The capability of the system software to properly analyze an operator's flight operations data is critical to the overall success of any FDM program. Most of the hardware manufacturers also supply analyzing software specifically developed for their products. There are also independent software suppliers with products that can analyze data downloaded from

a variety of hardware platforms. Another critical decision for any operator implementing FDM is whether to analyze their data in house, or to outsource that function.

5. Utilize the results: In order to achieve meaningful results from a FDM program, each operator must also make a substantial investment in developing policies and procedures appropriate for their particular operations.

HISTORY OF FDM

1960s: Crash-survivable flight data recorders were developed to aid in accident investigation.

1970s: The first flight data monitoring (FDM) programs were developed by two European airlines – British Airways and TAP Air Portugal.

1990s: By the late 1990s, FDM technology had evolved considerably, to the point where it had become commonplace with the world's major airlines.

2000s: In the early 2000s, standards for helicopter FDM systems began to be developed.

2006: Technology advances made it possible to install FDM systems in lighter general aviation aircraft.

CURRENT FDM TECHNOLOGY

Until recently, FDM system hardware was universally large, heavy, expensive and difficult to retrofit. FDM systems utilized a quick access recorder (QAR) connected to the aircraft's flight data acquisition unit (FDAU). An FDAU is the device that interfaces all of the various aircraft systems with the crash-survivable flight data recorder (FDR). In other words, FDM hardware has typically been piggybacked onto an existing flight data recorder system. If an aircraft didn't already have an FDR system, there wasn't any easy way to add FDM capability.

Today, new lightweight FDM hardware products are available with features such as built-in GPS position sensor, inertia sensor, attitude sensor, temperature sensor and magnetometer, along with multiple digital, serial and discrete input/outputs. If interfaced to a satellite communications transceiver, the details of an exceedance can be transmitted to management immediately after the occurrence. Some FDM systems also utilize audio and video inputs to record all flight deck activity, including instrument indications.

Most legacy QARs must be manually accessed by ground crews in order to download the data. Some of the newest FDM systems have Wi-Fi capability, which enables automatic downloading of stored data when a Wi-Fi hotspot is detected in the hangar or on the ramp.

In most cases, STC-approved data is required to install these systems on a certified aircraft. Some of the manufacturers have already made substantial investments to obtain a number of STCs. FDM equipment is not designed to be crashworthy, but it often does survive crashes, thereby providing accident investigators with valuable data they wouldn't otherwise have.

THE FINAL WORD

FDM technology is hot right now, with the leading manufacturers scrambling to release new products (or busily tweaking existing products) in order to stay ahead of their competition. Almost any type of business manager would benefit from increased access to relevant operational data and flight operations managers are no different. Now that affordable technology is available to provide this valuable operational feedback data, more operators are choosing to make the investment. I expect that over the next few years, portions of this technology will migrate into all segments of commercial and business aviation.

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