

FLIGHT DATA MONITORING EXPLAINED



OUTERLINK
GLOBAL SOLUTIONS
A METRO AVIATION COMPANY

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INTRO

Flight data monitoring (FDM) is the proactive use of recorded flight data from routine operations to improve aviation safety margins and aircraft usage and availability. To truly understand the value in FDM, a company's culture must be centered around safety and compliance as the implementation of FDM is all about going above and beyond to improve safety and better manage risk in aviation operations.

The concept of flight data monitoring has been around for decades. In the past, large fleets typically adopted such systems to improve operational efficiency and flight safety. However, recent technological advancements have made it possible for smaller fleets to implement FDM as well.

In this eBook, we'll tell you everything you need to know about flight data monitoring. We'll start by explaining exactly what it is and how it works in Section 1. In Section 2, we'll explain in greater depth the benefits of FDM. Finally, in Section 3, we will give some insights into how flight data monitoring is implemented.

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CEO





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SECTION 1

What is Flight Data Monitoring?

FDM's roots start with the Heinrich Safety Triangle, a principle theorizing severe injuries often occur after many less severe injuries and near misses. It goes on to say that those events happen in a fixed ratio of 300 near misses to 29 less severe injuries to 1 major injury.

Concerning the aviation industry, if an operator can detect the 300 events that deviate from

its safety standards, it can take actions to change behavior and avoid moving up the pyramid where more severe incidents occur and eventually result in a major accident. To spot these events, operators must have the means to capture the data from aircraft systems to quantify and identify procedural deviations.

GLOSSARY

EVENTS

Trends or circumstances that are monitored by flight data monitoring.

FLIGHT DATA MONITORING (FDM)

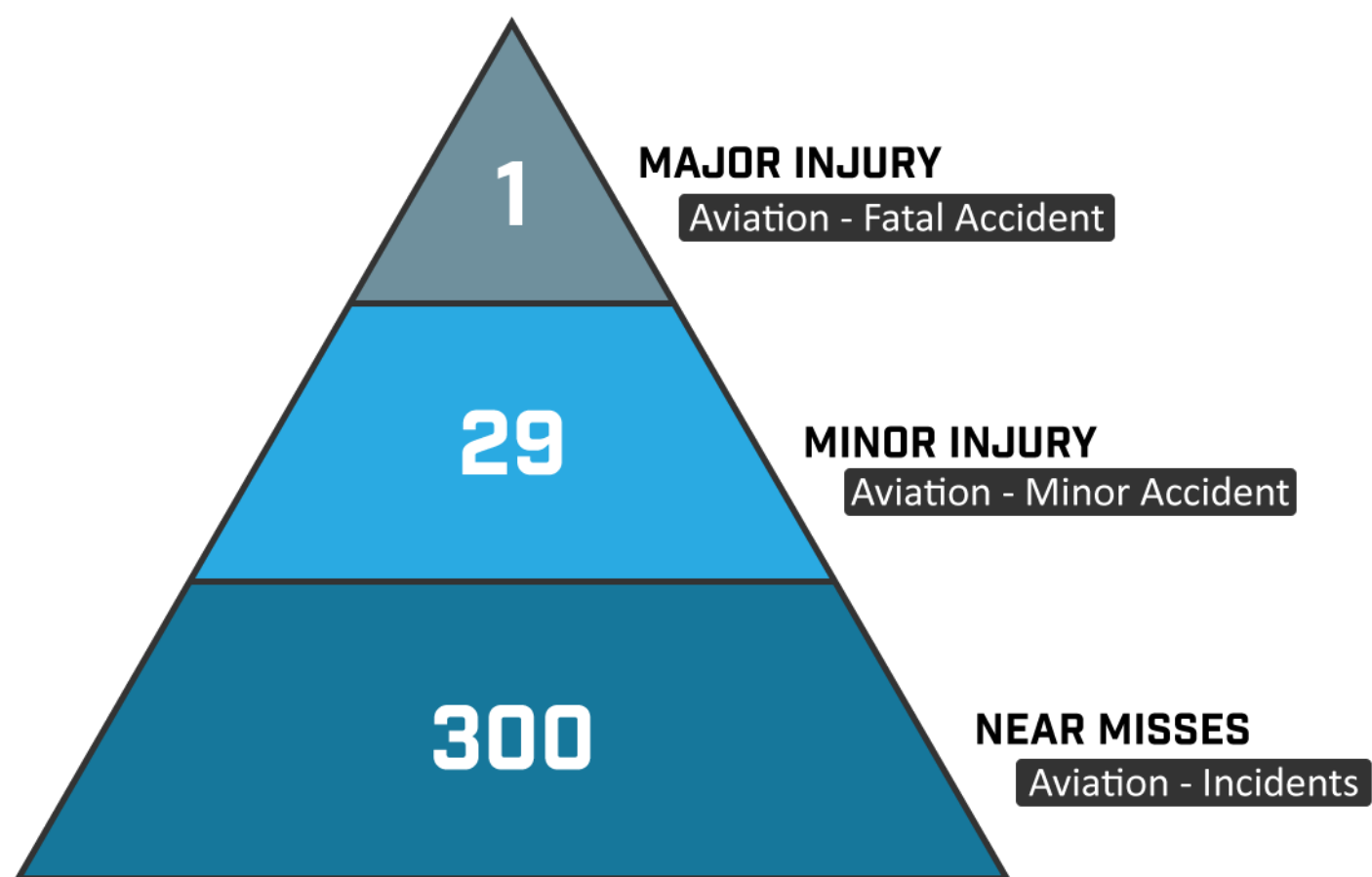
The proactive use of recorded flight data from routine operations to improve aviation safety and maintenance.

FLIGHT OPERATIONS QUALITY INSURANCE (FOQA)

A voluntary safety program designed to improve aviation safety through the proactive use of flight-recorded data as defined by the FAA.

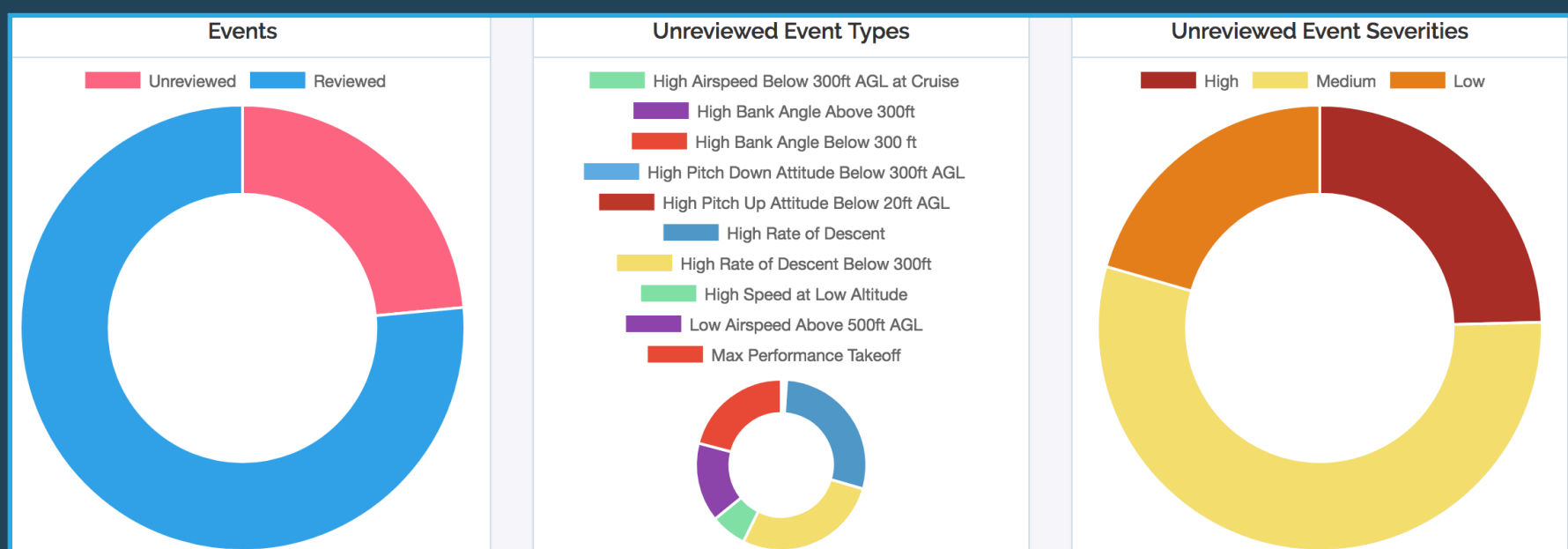
FLIGHT DATA RECORDER

An instrument used to record flight data.



This concept is not new for airlines and large fleet operators. They've invested in expensive equipment and analytic software for years; however, recent technological advancements have made it possible for smaller fleets to take advantage of this same opportunity. Recorded data from the aircraft is used to track a variety of pre-determined flight events (event sets). A team then analyzes and validates the data against these event sets to determine what/if operational changes need to be made.

Today's technology allows us to process data in smarter, more efficient ways and getting that data is easier than ever. Aviation companies can analyze every detail of their operation to generate actionable insights.





Flight Operations Quality Assurance (FOQA)

Access to aircraft data not only gives operators a chance to see their detailed flight data but it allows them to share that information with other operators, pilots and the FAA through routine gatherings known as InfoShares. These gatherings are meant to enhance the aviation industry. Collecting as much data as possible is key to that mission.

“A FOQA program requires a legal agreement between the FAA and the operator, providing enforcement protection to organizations and individuals through voluntary data collection.”

Without a few assurances, though, aviators would be wary of handing over their data to the FAA, fearing punitive action against unintentional violations that would otherwise

have gone unnoticed. Such fears conflict with the FAA’s interest in aggregating data to reduce accidents and increase safety.

In response to those fears, the FAA developed Flight Operations Quality Assurance (FOQA) – a program that incorporates FDM information into a complete system that is operator-maintained

and FAA-approved. A FOQA program requires a legal agreement between the FAA and the operator, providing enforcement protection to organizations and individuals through voluntary

data collection. So, as long as a company participating in FOQA complies with the rules, the FAA is legally prohibited by CFR 13.401 from acting on violations discovered solely through FDM-submitted data.



Then, concerns surrounding privacy surfaced. Without protection from the disclosure of information, operators would refrain

from willingly submitting information. Thus, Congress passed Public Law 104-264 on October 9, 1996, which mandated that the FAA create a regulation (CFR 193.7) to outline what privacy protections are provided by the FAA: protected information will not be given out as part of a Freedom of Information Act request, nor will it be given out in response to a subpoena. They may, however, share the data with agencies who have signed a non-disclosure agreement and whose mission matches the FAA’s goal of increasing flight safety. If the same information is obtained outside of FOQA, then the protections may not apply.

The agency uses five criteria to determine whether the submitted information is eligible for protection. Those are:

	The information is provided voluntarily
	The information is safety or security-related
	The disclosure of the information would inhibit the voluntary provision of that type of information
	The receipt of that type of information aids in fulfilling the FAA’s safety and security responsibilities
	Withholding such information from disclosure, under the circumstances provided in this part, is consistent with the FAA’s safety and security responsibilities

The circumstances under which the agency may give out information that has been marked protected are laid out in CFR 193.9. They are as follows:

1 The FAA may disclose de-identified, summarized information submitted under this part to explain the need for changes in policies and regulations. An example is the FAA publishing a notice of proposed rulemaking based on your information, including a de-identified, summarized version of your information (and the information from other persons, if applicable) to explain the need for the notice of proposed rulemaking.

2 The FAA may disclose information provided under this part to correct a condition that compromises safety or security if that condition continues uncorrected.

3 The FAA may disclose information provided under this part to carry out a criminal investigation or prosecution.

4 The FAA may disclose information provided under this part to comply with 49 U.S.C. 44905, regarding information about threats to civil aviation.

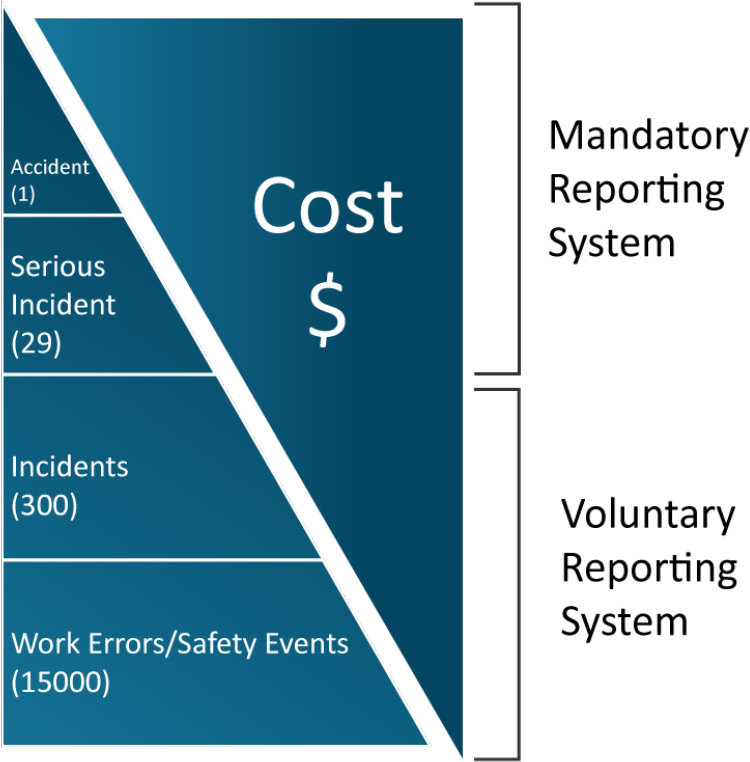
An operator could choose not to share its data with the FAA, so it is possible to have an FDM program without participating in a FOQA program. However, because FOQA by definition is the sharing of flight data, it is not possible to participate in FOQA without having an FDM program. The data collected is the same but without FOQA protections, information



obtained from that data is subject to enforcement actions by the FAA as well as public disclosure.

Though sharing FDM data with the FAA is optional for commercial aircraft, the FAA requires helicopter air ambulance operators to install flight data monitoring systems on all aircraft in its fleet. Since the capabilities and use cases of different helicopters vary widely, the FAA has not laid out any specific requirements as to which data must be collected. The vagueness of the rule means a helicopter ambulance operator would comply with even the most minimal FDM system, although the benefits of FDM go beyond mere compliance with the law.

An organization that is truly committed to risk mitigation would choose a robust system that not only fulfills legal obligations but provides as many actionable insights as possible. Safety



and efficiency should be seen as investments, not expenses. When correlating the cost of FDM with the cost of a major accident it becomes clear what's more inexpensive.

SECTION 2

Why you need FDM

Flight data monitoring sounds great but is it worth it? Just how much does it improve safety margins? Does it save more money than it costs and if not, are the increases in safety margins significant enough to justify the cost? What other benefits does FDM provide to a smaller aviation company?

The short answer is yes; it is absolutely worth it. There are many examples of the direct and indirect benefits of FDM – some operational, some maintenance-related. Regardless, FDM's necessity and efficiency cannot be overlooked.

FDM AS A SAFETY TOOL

The first reason to implement an FDM program is quite clear: it is a safety tool. If you implement

FDM, your passengers, crew, equipment, and cargo will all fly safer. Safety should be a top priority for every fleet operation and having an FDM solution installed in your aircraft will help to cultivate a culture of safety.

When paired with the right software, FDM equipment like Outerlink's IRIS platform allows operators to track data in real-time. This essentially places you in the cockpit of every flight at any given time. With instant access to your aircraft data, you will create a level of transparency in your company that gives you complete oversight of your operations.

REAL-WORLD APPLICATION

Minor mistakes cause major issues.

On a cold winter night, an air medical operator approves a 2:00 am flight for a twin-engine EC135 with a pilot and medical crew of two onboard to pick up a patient. Minutes into the flight the aircraft suddenly pitches up and begins descending rather rapidly while at cruise with the autopilot engaged.

The pilot disengages the autopilot, takes manual control, and performs a precautionary landing. With everyone onboard safe, an autopilot failure is suspected to be the issue. Not knowing the true problem, plans were made to relocate the aircraft using ground vehicles (a crane and

truck), to pull the autopilot modules and to call a backup aircraft for the customer (a hospital).

Luckily, the aircraft was equipped with a lightweight data recorder, so the operator pulls data from the data card to review. Within hours, the results show the collective was manually lowered before the aircraft changed flight altitude and the rate of descent began. Essentially, the autopilot on the aircraft did NOT control the collective and was not the cause of the incident.

Here are a few ways real-time data can benefit your operations

1

OPERATORS HAVE A SEAT IN THE COCKPIT OF EVERY FLIGHT

Operators can see, in real-time and in recorded data, how pilots are flying, and if the aircraft is functioning how the Original Equipment Manufacturer (OEM) intended. This data can provide great insight into how your company operates and the problems your pilots face.

2

COMPLIANCE ISSUES ARE EASILY CAUGHT

In the first section, we talked about how the FOQA program shields a participating operator from punitive action if compliance issues are revealed in its

submitted FDM data. Those compliance issues are, more often than not, accidental. Flight data monitoring will help you catch and correct those compliance issues, helping meet the FAA's Safety Management System (SMS) requirement of continuous improvement.

3

FUEL CAN BE MONITORED IN REAL-TIME

Fuel costs and related accidents are completely preventable. The logistics of your fueling are more efficient and safer when you can constantly keep tabs on your fuel levels. You will know how much fuel is required upon landing and have the capability of monitoring



Hearing this, the pilot recalls adjusting his position in his seat right before the incident, unknowingly moving the collective, causing the scare. An unintentional mistake.

Due to the timely access of the aircraft data, the operator is able to perform an onsite rotor head overspeed inspection to return the aircraft to service. The potential costs that would have been incurred - autopilot overhaul, crane, flatbed truck, backup aircraft - and the resulting avoidance of these costs more than pays for and certainly justifies the investment in FDM.

consumption patterns. What conditions cause fuel usage to spike? Can they be avoided? These questions are harder to answer when you only have data from the beginning and the end of a flight.

4

HIDDEN RISKS ARE UNCOVERED

Flight data monitoring can be used to analyze specific incidents, but it is also great at identifying trends. If your pilots are flying in a manner that is outside of, or contrary to your Standard Operating Procedures (SOP's) and training guidelines you will know about it and be able to proactively address the situation and revise your training plans accordingly.

5

REVEALING THE WHOLE PICTURE

Data can reveal trends and, in many cases, the cause of an incident. Unfortunately, there are many instances when data alone cannot provide the whole picture. Along with recent developments of less expensive flight data recorders, big strides have been made to incorporate synchronized voice and video into the parametric data stream. When the parametric data cannot give you all the answers, even with the addition of voice recording, video can expose the truth about what occurred.

REAL-WORLD APPLICATION

A case in point.

An operator with a light twin engine helicopter had just received its helicopter from maintenance when it required an engine run up before returning to service. During the maintenance run up, it appeared the first engine start had a failure of the digital engine control module, causing the helicopter to turn rapidly to the right and collide with the ground power unit. The result: a broken chin bubble.

The cost to repair the engine module was estimated to be thousands of dollars but the operator decided to view the recorded video before writing a check. The video revealed the pilot had the tail rotor pedals pushed full right,

his feet flat on the floor, and was in the middle of texting his wife.

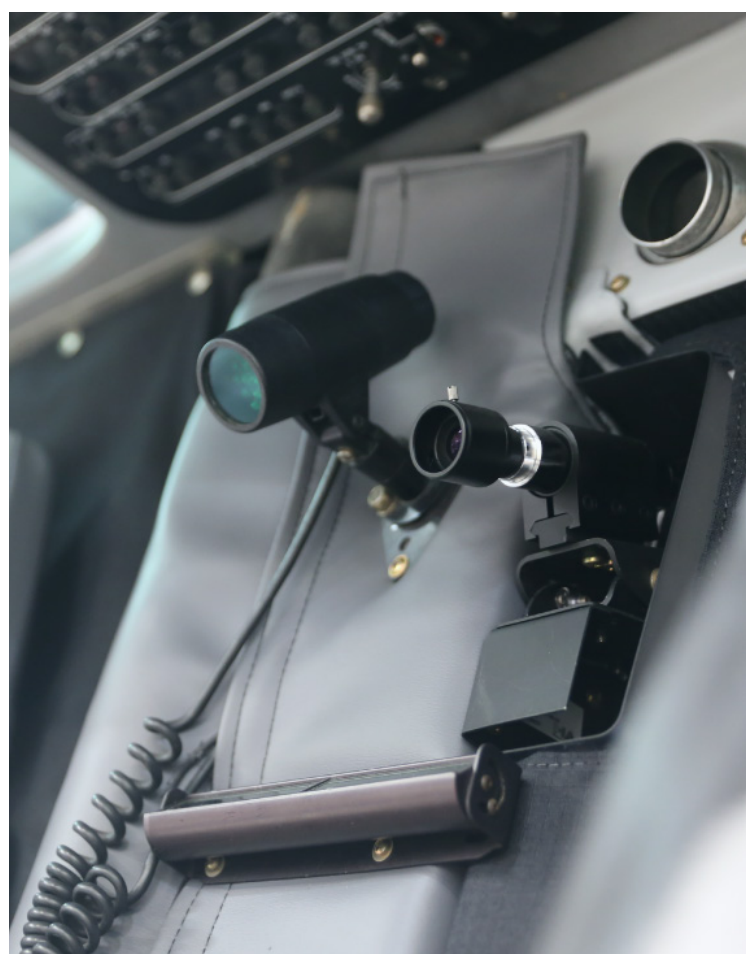
In this case, the parametric data alone, would have only shown a normal engine start and no crew audio or unusual aircraft engine sounds captured on the area mic. It was the video, though, that revealed the true sequence of events and confirmed there was no aircraft system failure. The operator could now replace the chin bubble window and safely return the aircraft to service.

The key to having useable video recording is in the integration of parametric data, voice and video. The idea is to synchronize all data sources to efficiently allow operations management to assess situations, define the causes and effects, and take quick remedial action.



So, we have seen how beneficial FDM is to any fleet operation. But is it worth it? How much do all of these benefits cost? In short, flight data monitoring pays for itself over time because the capabilities and insights it provides save money

and prevent potentially expensive costs.



REAL-WORLD APPLICATION

You don't know what you don't know!

Certain engines under certain conditions, can be susceptible to “oil coking,” which is the buildup of carbon deposits on engine components and oil lines. For one operator, it was discovered that the major contributing cause of oil coking involved pilots failing to adhere to a cooldown procedure: a minimum of 30 seconds and no longer than two minutes.

Simply by tracking this event, the operator discovered over 70% of the recorded flights were not within procedural limits. After issuing an operations notice to all pilots and emphasizing the proper cool-down procedure in initial and recurrent training, the results showed

immediate and complete compliance, saving hundreds of thousands of dollars in premature and unscheduled maintenance. Without recording the engine data as part of its FDM program, there is no way this operator could have identified and prevented compliance issues with this procedure.



Whereas the traditional cockpit audio recording was added to fill in the gaps when data did not reveal the possible cause of an incident or accident, full use of FDM takes it a step further by:



HELPING PREVENT FATAL ACCIDENTS

The loss of life is always the greatest tragedy. When an accident occurs that includes the loss of life, the cost is always magnified. Imagine an operator being able to identify risk trends and issue a change to an operations or crew training manual. Those operational and training enhancements could save lives in the future. Plus, the addition of a camera in the cockpit gives operators the last piece of information missing from audio and data.



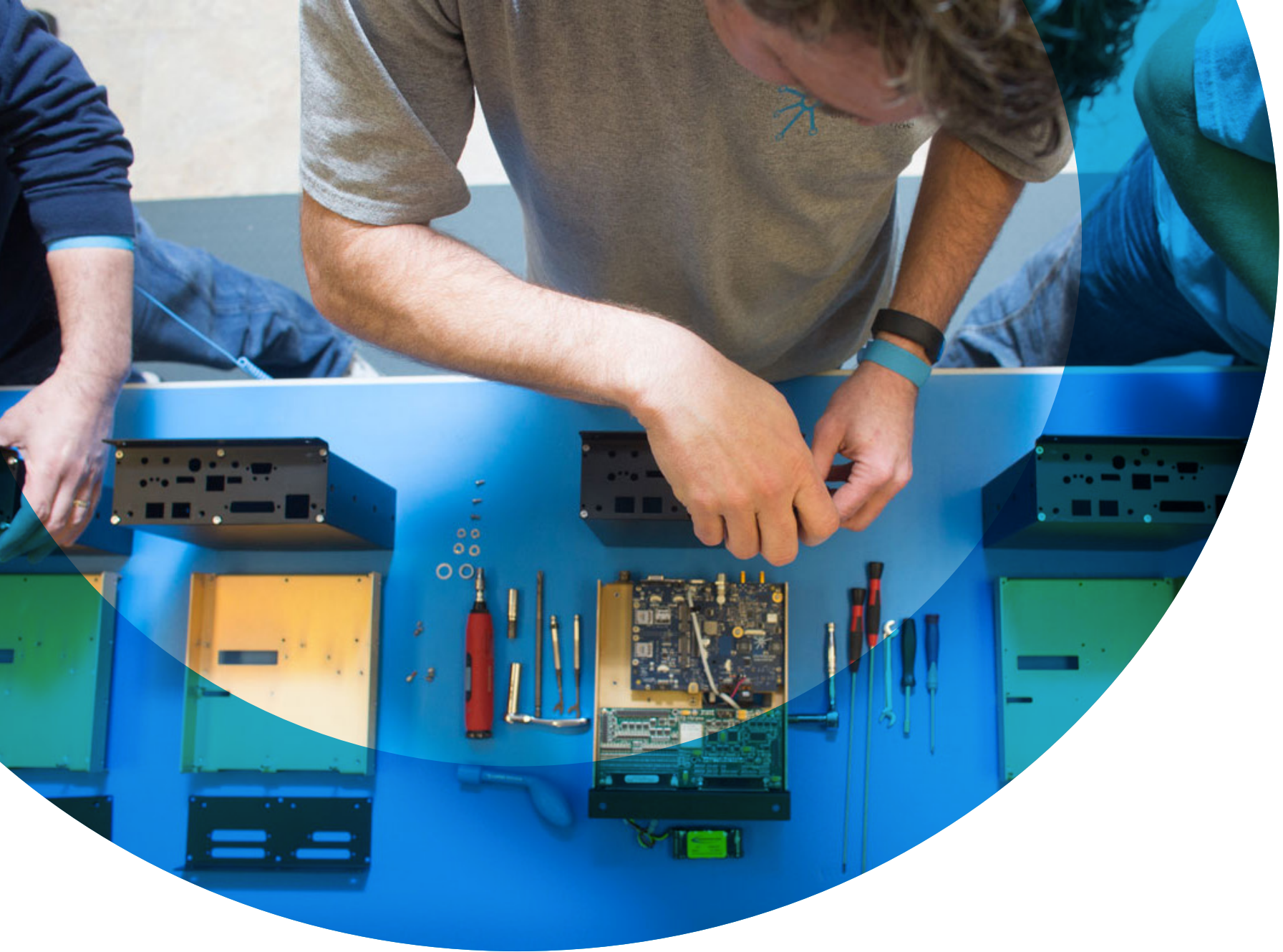
REDUCING MAINTENANCE COSTS

An FDM program has the additional benefit of a Maintenance Operation Quality Assurance (MOQA) program to identify the mechanical health of an aircraft and those actions that directly affect component health and longevity. Flight data monitoring reduces unscheduled maintenance and saves money not only on the cost of the repairs but on the costs associated with having an aircraft out of service.



IDENTIFYING PILOT PERFORMANCE DEFICIENCIES

Your pilots are great at what they do but FDM can find areas that can be improved. Opportunities for improvement in training and procedural non-compliance can be easily identified and acted upon. The data generated and the algorithms utilized to analyze that data help improve oversight.



SECTION 3

How FDM is Implemented?

So, now you see how flight data monitoring can be beneficial to your business. You have decided the next step to increased safety margins, risk reduction and efficiency is to implement a flight data monitoring solution.

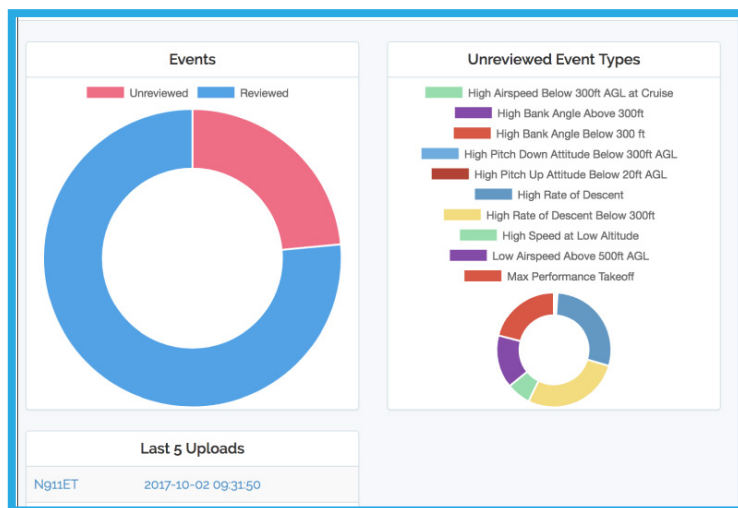
In this final section, we will go over what is needed to get up and running with FDM, including the equipment and processes needed to get the most out of the technology.

EQUIPMENT

The equipment, flight data recorders, are installed on the aircraft. There are several FDM

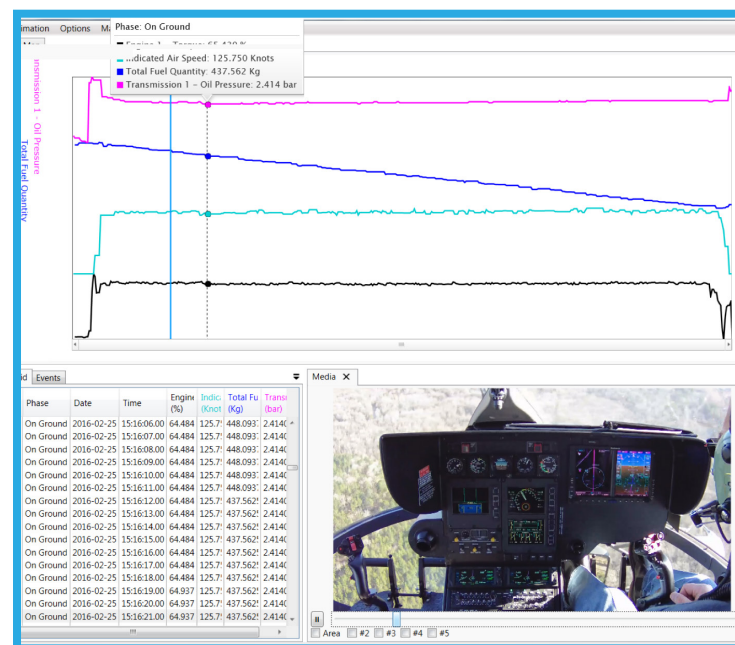
systems you can buy. Some are minimal, others are full-featured. At one time, flight data recorders were too bulky and too heavy to fit on light helicopters. Modern technology has made recorders practical for aircraft of any size. Critical milestones have been achieved by systems that integrate and synchronize voice and video with flight data.





FLAGGED EVENTS

Operators define events (trends or circumstances) they would like to track in their flight program. As an example, you may want to track fuel consumption to optimize situations within a pilot's control. Perhaps, as in our example from the section below, you want to track the number of bird strikes and the circumstances under which they occur. You will no doubt have a mixture of routine trends to look out for and specific data that is unique to your business model or current goals.



SOFTWARE

System software stores the data collected by the equipment onto an SD card. With the right software, some FDM systems can also stream the desired data for monitoring in real-time. Highly capable software can now display synchronized voice, video and flight data along with an animated flight path overlaid on satellite maps in a user-friendly platform.

REAL-WORLD APPLICATION

FDM can help reduce bird strikes? Really?

Let's take a look at an example of how FDM can illustrate positive changes that can be used to drive strategic operational decisions. Based on USDA and USDOT findings, it was discovered an aircraft is significantly more likely to be struck by a bird while flying under 2000 feet. In addition to the higher-risk altitude for bird strikes, time of day/night, aircraft speed, and time of year were all analyzed using FDM data. All FDM data was cross-referenced and correlated with company incident reports to arrive at factual conclusions. Additionally, the data showed that an aircraft

not equipped with a Pulselite system was 3-5 times more likely to be struck by a bird than one that was equipped with the system. This data has enabled Precise Flight (the manufacturer of the Pulselite system) to help make the industry safer.

There are countless ways you can use FDM to identify a problem and then evaluate solutions before spending a great deal of money to outfit your entire fleet. It is easy to see how FDM helps to drive the aviation industry toward greater safety.

DATA RETRIEVAL

Once the aircraft has reached its destination or returned to its base, the SD card info gets transferred into a server, allowing the software to analyze the data. Robust systems will be able to record hundreds of different variables onto the SD card for later viewing. The model of aircraft will play a role in what data can and cannot be collected by flight data monitoring systems.

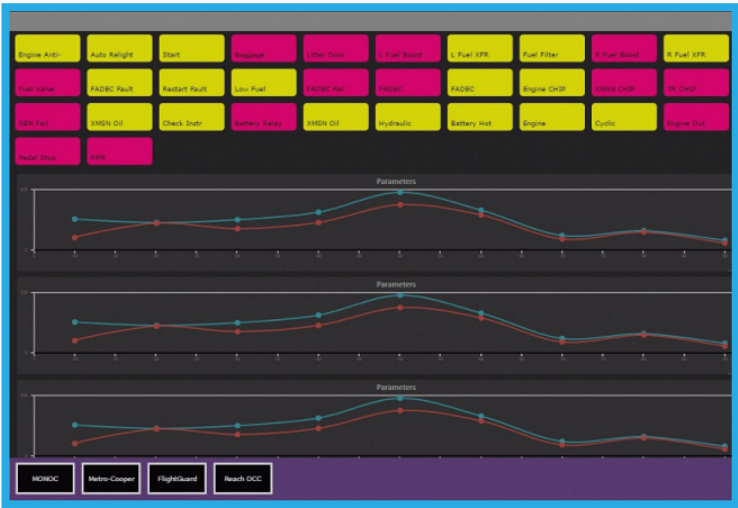


DATA MINING

The software compares the recorded data parameters to the operator’s defined events, flagging any events that occurred. Of course, you are not limited to just events that you have asked it to track. If an aircraft behaves oddly during a flight, the data will be there for you to examine. It could be that the crew was not operating within the procedure, or it could be that there are gaps in the procedure that will need to be addressed. It is often the trend lines that you did not know you were looking for that provide the greatest insights into the hidden risks and costs of your operation.

- The more events that are tracked, the better the reliability. This will require careful planning on the part of the operator to ensure the collection of every variable that will be useful in evaluating the desired

events. It will also require a quality flight data recorder that will be able to record any data point you require.



ANALYZE

Human analysts review the flagged events to identify or confirm potential issues. This can mean confirming that a tracked event did occur or discarding an event that can skew the data, such as a training flight.



DEFINE OPERATIONAL CHANGES

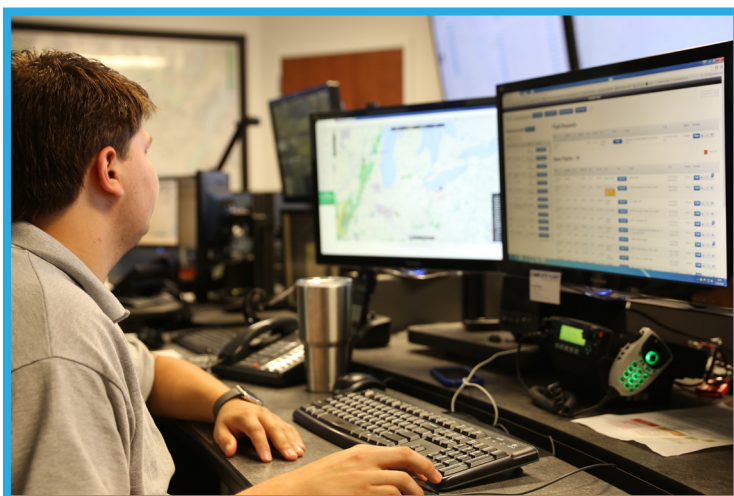
Operators then take action according to their policies. This is where all of the benefits of FDM are realized. Changes may include altering a training program, adjusting maintenance schedules, changing routes for a more efficient flight path, or any other alterations to the way that the business operates. Constant monitoring of the flight data combined with a willingness to adapt to what the data shows will give a marked increase in safety and efficiency.

EQUIPMENT OPTIONS

Choosing the right flight data monitoring system is key to getting the best results. Whether you operate a helicopter air ambulance or have only implemented FDM to comply with regulations, you will still find that a robust system pays for itself. The Outerlink IRIS system brings together a combined voice, video, flight data monitoring and flight tracking system that is fully integrated into a satellite communications platform, designed to adapt to industry changes. The solution provides worldwide coverage, allowing immediate communication air-to-ground, ground-to-air or air-to-air with push-to-talk VoIP (Voice over IP) radio with real-time position reporting.

Choosing the right FDM platform for your operation will require researching the parameters you want to record, the capabilities of the specific system with your specific aircraft and, of course, budget. Today's options allow operators to invest in integrated platforms and avoid the investment in partial capabilities from different vendors.

No matter which system you choose, it will be a step in the right direction for your organization's safety.



IRIS

THE WHOLE SOLUTION

CONSTANT COMMS

IRIS is the first commercial rotorcraft use of situational awareness technology similar to that employed by the military. Delivering an uninterrupted connection with constant communication and push-to-talk VOIP radio, operators can communicate with one aircraft or an entire fleet across the globe in an instant.

REAL-TIME DATA

By monitoring and transmitting key data in real-time to ground support staff, IRIS turns an FDM system into an accident prevention tool.

Immediate Alerts and Warnings

To benefit from most FDM systems, operators traditionally wait until the aircraft lands to collect flight data from a storage device on the recorder. That data may improve future flights, but does little to protect the aircraft and its occupants while they are flying a mission. By monitoring and transmitting key data in real-time to ground support staff, IRIS turns an FDM system into an accident prevention tool.

FDM

The onboard FDM contains an SD card that records more than 300 parameters of data. Any data collected from the FDM can be transmitted electronically, and operators are free to select which labels to receive, from traditional FDM data points such as GPS coordinates, airspeed, altitude and direction; or mechanical data such as engine temperature and rotor RPM.

VOICE AND VIDEO

The IRIS system provides a continuous minimum 30+ hour recording loop of up to 3 high definition IP cameras and 5 audio sources.



ABOUT US

Outerlink Global Solutions is a first-responder communications provider for M2M applications including voice, text, satellite tracking and efficiency diagnostics for fixed and rotor wing aircraft, ground, marine, and utility mobile fleet operators.

Founded in 1992 as a satellite tracking provider for aviation service organizations, Outerlink has incorporated its long-standing public safety history and technological knowledge into a mobile communications platform of integrated next-generation devices.

The future is here, and her name is IRIS.

Our U.S.-patented IRIS platform is not just flight tracking, nor is it just flight data monitoring. IRIS is all-encompassing, giving users the capability to record large amounts of aircraft data, process it through an onboard computer and filter it directly to communication centers or Operational Control Centers. The solution provides worldwide coverage, allowing immediate communication air-to-ground, ground-to-air or air-to-air within the entire system, from anywhere in the world.

We service hundreds of air and ground customers in various industries including:





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