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ADVANCED FOD DETECTION

Technology is changing the game and making rapid response possible

On July 25, 2000, a DC-10 shed a metal strip from its thrust reverser while taking off from Paris. Four minutes later, an Air France Concorde was lifting off from the same runway when the unimaginable happened.The plane ran into the discarded metal strip, busting a tire, hurling debris at the plane's fuel tank and engine, which caused a raging fire. Two minutes later the plane crashed into a hotel, killing 113 people. Each year, foreign object debris (FOD) such as this metal strip causes the air transport industry (ATI) billions of dollars in losses. Here's an analysis of advances making inroads on FOD detection.

Airlines and airports have investigated numerous ways to reduce FOD-related losses, from initiating personnel awareness and training programs to implementing expensive redesign of aircraft engines and airframes. With up to 70,000 annual incidents, FOD costs each airport as much as US$20 million a year, which adds up to an estimated US$12 billion annually in direct and indirect costs.

Direct costs include such activities as repairing damage to the aircraft, replacing mechanical parts, and paying for human injury. The most frequent FOD-related maintenance repairs are to an aircraft's engines, tires, skin, hull, and airframe.

Indirect expenses include loss of money from FOD-related flight delays and added fuel expenditures. Delays happen when runways are temporarily forced to close, when unexpected maintenance repairs must be made, or when an aircraft damaged by FOD must be exchanged with one that is flight-worthy. Fuel inefficiencies related to blended engine blades and employee overtime are other examples of indirect costs. In fact, indirect costs are said to be ten times as much as direct costs.

AVOIDING FOREIGN OBJECT DAMAGE

Besides expensive aircraft redesigns, there are many approaches in preventing FOD damage. Airports train personnel on the importance of identifying and properly eliminating debris, while industry and federal groups institute policies and inspections to prevent FOD. Organizations may also utilize innovative technologies to find and remove debris from runways.

Traditional FOD detection programs consist of maintenance crews periodically walking or driving down the runway to manually find and remove debris. However, this antiquated method is not fool-proof, especially when studies show that 70-80 percent of all aviation accidents are from human error. Additionally, having personnel walk the runway takes a great deal of time and can stall operations. And in busy airports such as Charles de Gaulle Airport where Air France's fatal flight left only four minutes after the DC-10 shed its metal strip, traditional methods fail miserably.

When seconds count, air transport organizations must implement a more reliable means to find and remove runway debris before it becomes a problem. One alternative that is gaining popularity is the use of surveillance and detection technologies to monitor runways.

BENEFITS OF SURVEILLANCE, FOD DETECTION SYSTEMS

Disastrous accidents stemming from foreign object debris can be thwarted with the right technology. There are in fact a few FOD prevention systems on the market today.

These detection systems use sensors, cameras, radar, and similar technologies to find pieces of discarded metal, nuts and bolts, garbage, rocks, broken pieces of concrete, birds, and other objects that could potentially cause runway accidents.

The biggest single benefit in using surveillance and FOD detection systems is the ability to spot FOD the moment it is deposited on the runway — before it becomes a problem. This is extremely valuable when aircraft takeoffs are only minutes apart.

Other benefits include the reliability that comes with a computerized system. It reduces the possibility of human error and offers the ability to continuously monitor the runway 24/7, without having to delay airport operations to perform routine FOD runway checks.

A properly installed FOD detection system can save an airport US$1 million a year in runway closures. Consider, for example, the indirect costs of two European airports that each experienced approximately 667 minutes of delays from FOD for every 10,000 movements. This delay translates into US$26,740 per 10,000 movements. For large airports that see upwards of 400,000 annual movements, the cost reaches over US$1 million a year.

DESIRABLE CHARACTERISTICS

Quality systems work automatically and are able to scan the runway, analyze the scene, detect and classify potential problems, and promptly send real-time alerts to responsible parties.

A FOD detection system must be able to work unimpeded in severe weather. This includes operating and spotting debris in extreme heat and cold, rain, or snow, day or night. It must withstand high-wind conditions and operate continuously year-round.

Another desirable quality is the ability to equally recognize and clearly display both small and large objects. This is done through high-resolution camera sensors that have the capacity to zoom in to view small objects and zoom out to focus on larger objects.

Pinpointing the exact location of FOD can be difficult. Yet, with a properly installed, automated surveillance and detection system, this is done easily and accurately. Self-calibrating electro-optic sensors detect and locate impediments in real time as they occur. Ideally, the system should be able to be programmed to "learn" what is FOD and what is not — the sensors see the scanned area as it should be, including all stationary objects, like runway lights — and alert accordingly, eliminating false alerts as much as possible.

When determining legal liability, a FOD detection and surveillance system that is able to perform post-event analysis is invaluable. Look for systems that can accurately record events and categorize debris, which is helpful in ruling out or uncovering the cause of issues involving the runway, apron, hangar, flight deck, and taxiway.

There are both active and passive FOD surveillance systems on the market today. Many active systems include radar and active light sources. While these systems may work well, they can pose certain safety concerns. For instance, radar detection systems emit a level of radiation that may be dangerous to humans. Furthermore, systems employing active light sources may cause operational interference with airport systems and equipment. Where these issues are a concern, there are passive surveillance and FOD detection systems available that are specifically designed not to interfere with existing airport and airline technology or produce unhealthy emissions.

Testing is crucial in determining whether a FOD detection system can perform as specified. Many systems such as Trex Enterprises' FOD Finder, QinetiQ's Tarsier, and Xsight's FODetect are undergoing or have completed testing. In 2007, Stratech's iFerret passed two rounds of evaluation conducted by the University of Illinois Center of Excellence for Airport Technology (CEAT), which supports the Federal Aviation Administration in a FOD technology performance assessment program. Following these evaluations at Singapore Changi Airport, iFerret was subsequently recommended for a full evaluation at Chicago O'Hare by FAA. It has been tested successfully at O'Hare, and the system has also satisfied operations under winter/snow conditions. [SITA is in a partnership with Stratech to promote iFerret.]

By incorporating the help of today's advanced technologies in finding and removing FOD, airports can prevent many potential disasters while reducing delays and minimizing outmoded labor-intensive processes with innovative FOD detection systems to achieve optimal operational efficiencies and safety.

About the Author

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