

# Far sighted

A major US test of automatic runway debris detectors could pave the way for them becoming the norm at the world's airports, writes Oliver Clark.

**K**eeping runways clear of hazards is one of the prime responsibilities of an airport authority and the dangers to airfield safety don't get much bigger than debris in the path of aircraft.

A widespread and often hidden threat, foreign object debris or FODs, are defined as any object strewn across a runway, whether it's fallen branches, nuts and bolts or luggage, which could strike and damage a moving aircraft.

While much FOD is relatively harmless, such as grass cuttings or litter, others, if not discovered and dealt with, can do serious damage to an aircraft, whether it is moving at speed or taxiing, by hitting the fuselage, bursting tyres or being sucked into the engines.

According to the US's National FOD Prevention Inc (NAFPI), FOD strikes or 'invisible' runway incursions cost the aviation industry \$4 billion a year, while an international airport the size of New York JFK typically experiences losses of \$18 million per year.

While most incidents are minor, on rare occasions they can be catastrophic, such as the crash of the Air France Concorde as it took off from Paris CDG in July 2000. French investigators claimed that a piece of titanium strip left on the runway by a Continental Airlines DC-10 was to blame for the incident that claimed 113 lives and effectively led to the retirement of the world's only supersonic commercial aircraft after nearly 30 years in service.

To combat the serious threat of FOD, ICAO has set down industry guidelines for airports to carry out at least two inspections of the runway every 24 hours – typically airports conduct four a day with ground staff carrying out manual inspections.

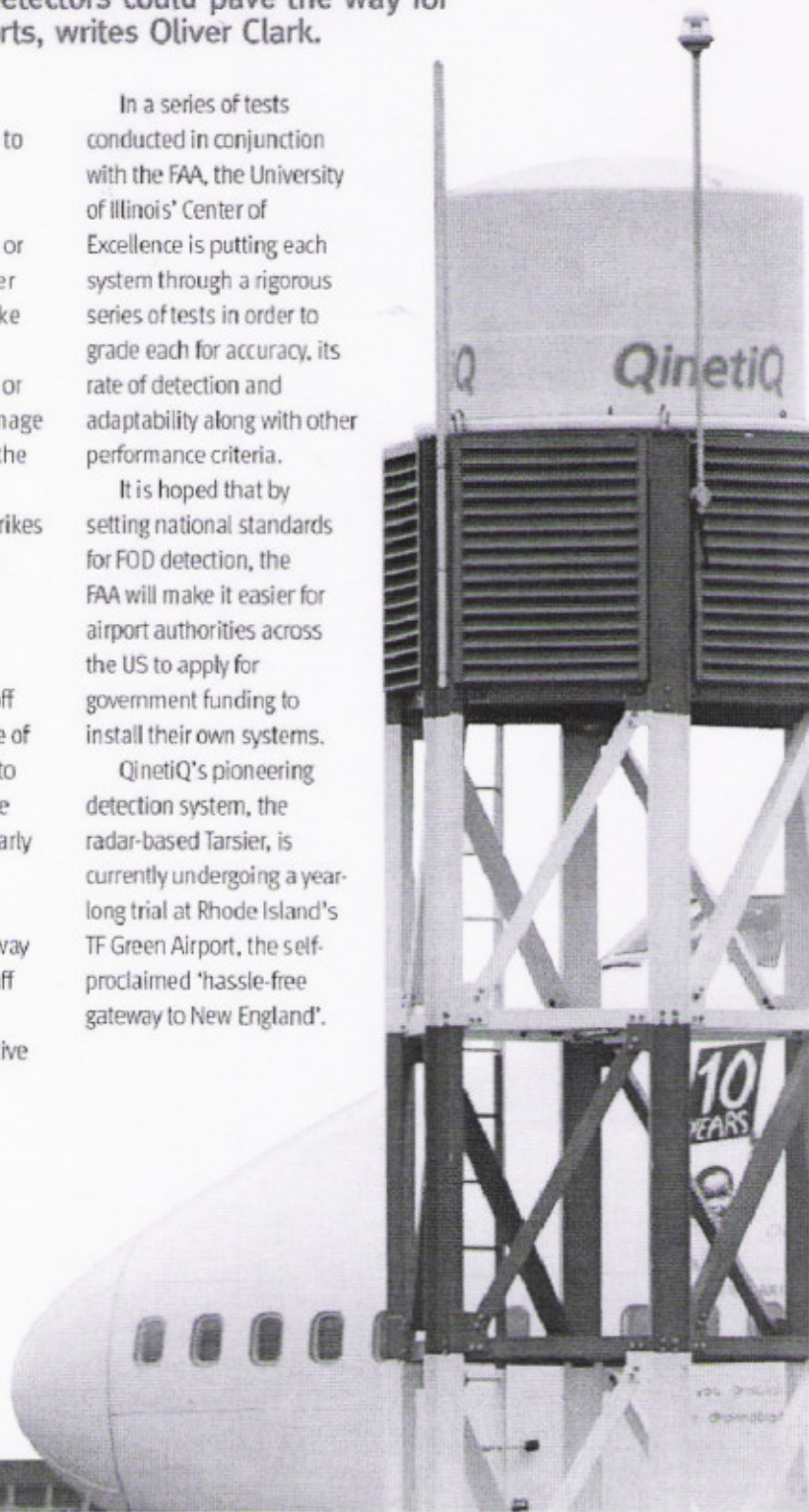
However, not only is this physical reconnoitering slow and disruptive to operations, it is surprisingly ineffective, with runway staff only estimated to be capable of monitoring 0.6% of the runway surface at any one time.

With this in mind the Federal Aviation Authority (FAA) has embarked on an ambitious trial of the four principal FOD systems now on the market and is putting them through their paces at several major US airports in the hope of establishing some common performance standards.

In a series of tests conducted in conjunction with the FAA, the University of Illinois' Center of Excellence is putting each system through a rigorous series of tests in order to grade each for accuracy, its rate of detection and adaptability along with other performance criteria.

It is hoped that by setting national standards for FOD detection, the FAA will make it easier for airport authorities across the US to apply for government funding to install their own systems.

QinetiQ's pioneering detection system, the radar-based Tarsier, is currently undergoing a year-long trial at Rhode Island's TF Green Airport, the self-proclaimed 'hassle-free gateway to New England'.



Using a network of high-resolution millimetre wave radars mounted on towers at varying distances from the runway, the Tarsier system sweeps the entire surface approximately once a minute, 24 hours a day.

If debris is detected, the display unit alerts ground staff and provides co-ordinates that can be entered into a vehicle's GPS system allowing for quick and accurate retrieval.

And its UK manufacturers believe that Tarsier has already proved its worth to the industry, as within months of its 2006 installation at Vancouver International Airport, the gateway experienced a dramatic drop in the number of runway incursions made by airport staff to check out FOD sightings. The technology also slashed retrieval times.

"Before we installed Tarsier it took eight or nine minutes between the report of a FOD and its removal, now we can find its exact location in five minutes or less. This is a significant time gain over the long-term," says Brett Patterson, director of airside safety at Vancouver.

Patterson says that the gateway chose to try automatic detection after two serious FOD incidents in 2000, the most serious of which included the outer engine casing from an A330 laying on the runway for several hours before being detected and removed.

"The biggest win for Tarsier was in March 2008 when it alerted us to a 30-foot piece of grounding wire which had fallen off a refuelling truck and had been dragged onto the runway," adds Patterson. "In that one incident the system has already paid for itself."

Earlier this year the Tarsier system was permanently installed at London Heathrow and, under the terms of the contract, Qinetiq has agreed to further enhance the system through the use of high specification day/night cameras that will allow the remote visual confirmation of detected debris. The Tarsier system has also been snapped up by Doha and Dubai airports.

Meanwhile SITA in partnership with Singapore-based Stratech Systems have taken a radically different approach in creating a device that relies on intelligent, real-time detection, called the iFerret.

Using a network of sensors which combine real time imaging cameras with an artificial intelligence component known as iVision, the iFerret literally not only sees foreign objects but can recognise and then identify them.

"The iFerret is equipped with an intelligent self-learning technology which means over time the system can differentiate foreign objects and recognise when it is an aircraft, a metal strip or a human being," enthuses Umar Khan, vice president indirect channels for SITA.

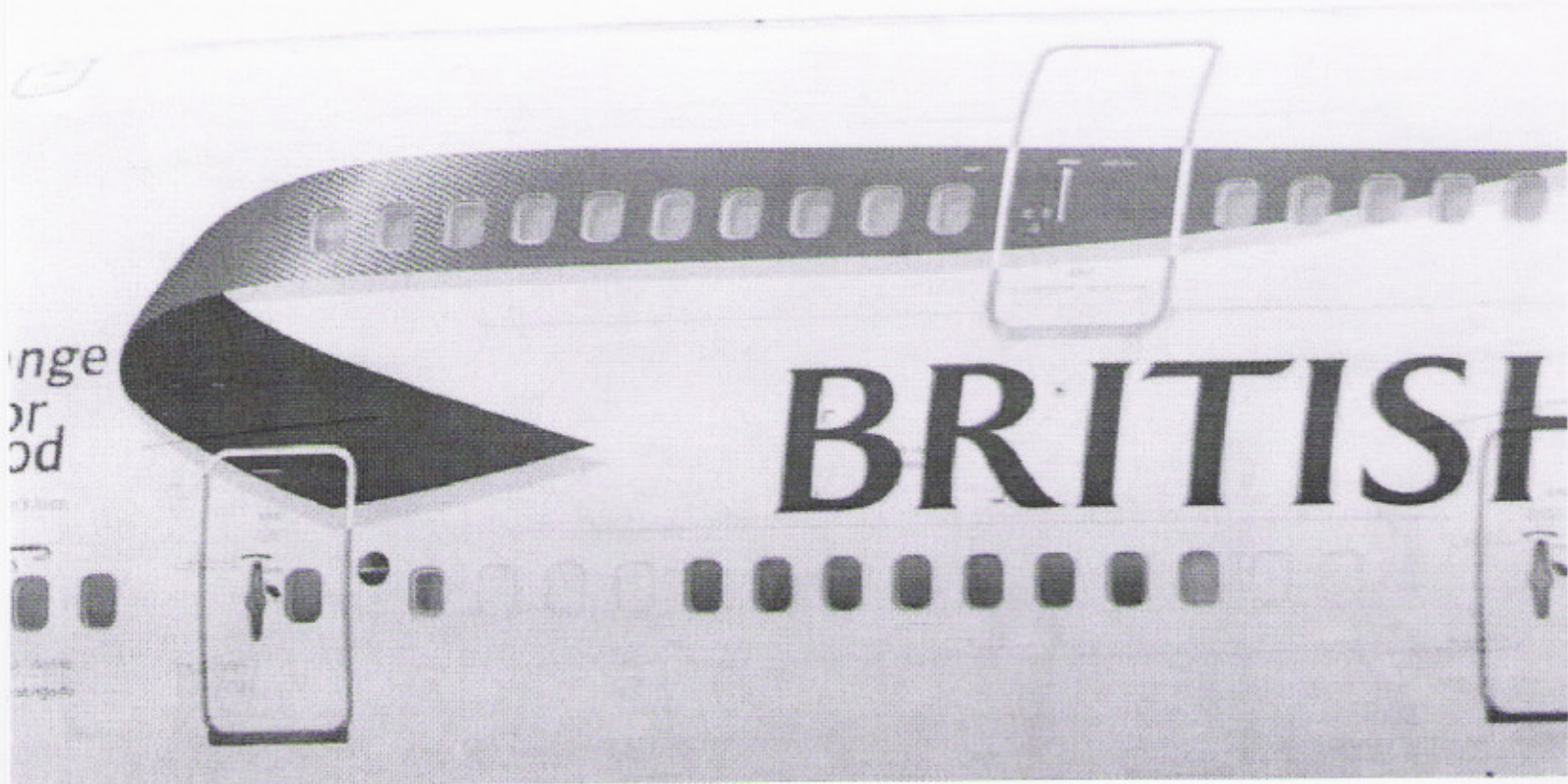
According to Khan the iFerret's image processing software also means that it is highly adaptable to changes in lighting and surface conditions. "This is a major advantage for any vision-based system when faced with the hazardous weather conditions ranging from heavy rain to snow and sand storms experienced at the world's airports," he notes.

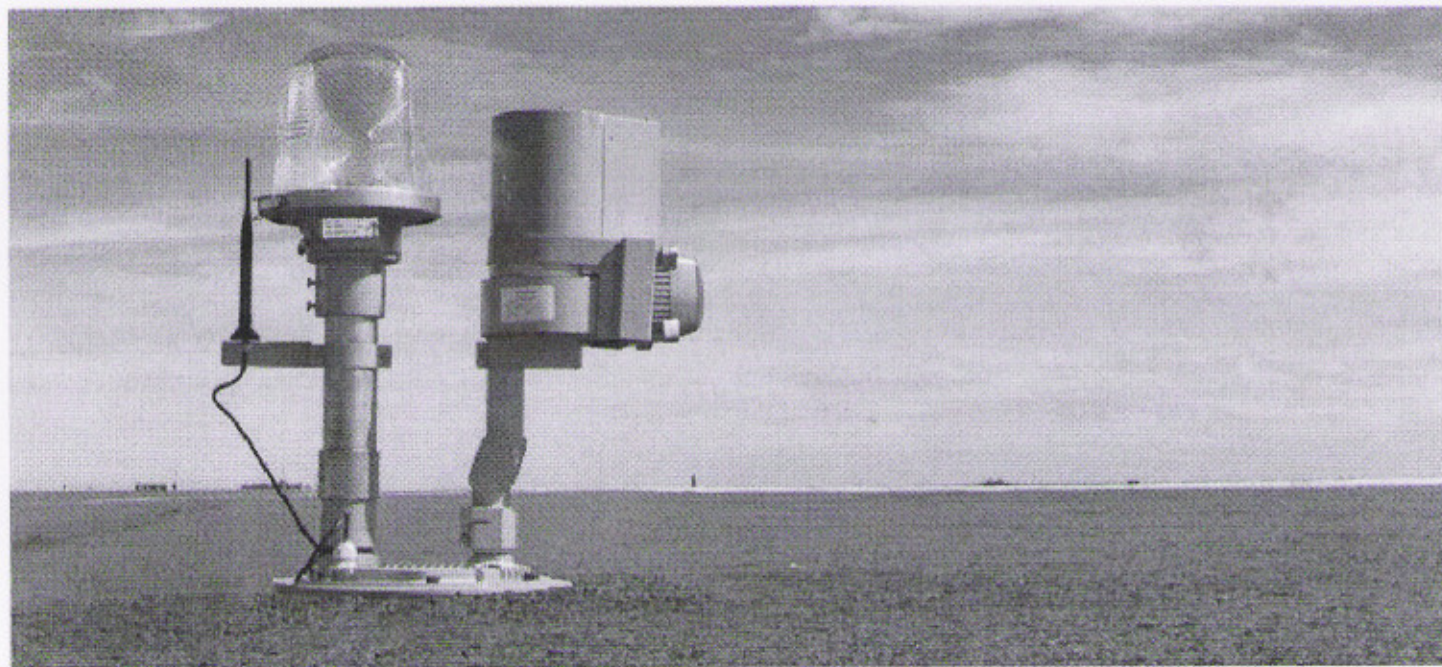
Indeed the system has already proved its versatility in successful tests at Singapore Changi, where the country's monsoon rains actually improved the iFerret's detection rate, according to Khan.

It has now been permanently installed at Runways 1 and 2 at Changi and is being deployed by the FAA for runway and taxiway trials at Chicago O'Hare International Airport.

While both the iFerret and Tarsier require separate installation, a unique selling point of Xsight's FODetect system is that it has been designed for integration with existing airport infrastructure.

It utilises a network of surface detection units (SDUs) – which combine electro-optical cameras with high frequency radar – installed in a runway's landing lights. The company says that its system can then sweep every section of the runway in under a minute and ensures that there is no need to build towers or dig up the runway.





Once an alert is received, FODetect can provide staff with a package of important data including visual images, object size, location and even a risk factor analysis of the object in question.

Each SDU is also equipped with a laser pointer so that once an alien object has been spotted it can project a red beam onto the target, making it easier for ground crew to pinpoint and retrieve it during night hours.

FODetect's key advantage is that it is an effective, low-cost, easy to install alternative to the other systems on the market, admits Xsight's vice president for marketing and business development, Dr Meny Benady.

"Ours is the only system capable of detecting debris between runway movements. In most busy airports the time between movements is one minute, so a four to five minute detection rate means that four to five aircraft are in risk of hitting a FOD prior to take off," he claims.

Xsight's system has been installed at Tel Aviv's Sde Dov Airport after a successful test period and is now taking part in the FAA trials at Boston Logan International Airport (BOS).

The most recent system to come on the market is Trex Enterprise's FOD Finder, a unique solution based on a mobile radar system, which can literally reach around every corner of an airport.

Utilising a high powered radar mounted on the roof of a retrieval vehicle, the FOD Finder scans an area ahead as it moves at a rate of 30 scans per minute, while an inbuilt camera captures real images and on-board computer processes the data to be sent back to a central control room.

The addition of a state-of-the-art GPS system allows FOD Finder to achieve pinpoint accuracy while also providing the user with an aerial photograph of the area of operation allowing them to track their vehicle's progress, the radar scan line and labels indicating FOD items.

A key advantage of this system lies in its versatility; while fixed detectors may have a wide range of a fixed surface, FOD Finder can be used to cover taxiways and areas disguised by buildings and parked aircraft. The vehicle can also pick up FOD as it finds it.

Having gone into full operation in March 2008, the device is now

#### FOD systems taking part in the FAA trials

**Name:** FOD Finder

**Developer:** Trex Enterprises Corporation

**Primary detector:** Mobile low-power MMW 3D imaging radar

**Unique elements:** Combined mounted radar and GPS guidance system

**Installed at:** Chicago Midway

**Name:** iFerret

**Developer:** Stratech Systems/SITA

**Primary detector:** Real time camera imaging

**Unique elements:** Artificial Intelligence recognition

**Installed at:** Chicago O'Hare

**Name:** Tarsier

**Developer:** QinetiQ

**Primary detector:** High frequency radar

**Unique elements:** Combined fixed radar, GPS and camera addition

**Installed at:** TF Green Airport, Rhode Island

**Name:** FODetect

**Developer:** Xsight

**Primary detector:** Combined radar and high-resolution camera

**Unique elements:** Integrated to allow individual light control (ILC)

**Installed at:** Boston Logan

forward in transforming automatic FOD detection from a quirky airport innovation into an industry norm.

With other research being carried out by Eurocontrol and NAFFI, and ICAO understood to be interested in an international standard for FOD devices, the era of manual inspections could be numbered.

Perhaps Dr Dominic Walker, product development director for QinetiQ Airport Technologies, best sums up the benefits of the FAA trials. "We welcome the fact that there are now other systems out there as it can only