

FOD Detection System

Evaluation, Performance Assessment and Regulatory Guidance

Wildlife and Foreign Object Debris (FOD)
Workshop, Cairo, Egypt

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Administration



Automated FOD Detection

Why is the FAA Interested?

Air France Flight 4590 was a Concorde flight operated by Air France which was scheduled to fly from Charles de Gaulle International Airport near Paris, to John F. Kennedy International Airport in New York City. On 25 July 2000, it crashed into a hotel in Gonesse, France. All one hundred passengers and nine crew members on board the flight died. On the ground, four people were killed and one seriously injured.

Five minutes before the Concorde, a Continental Airlines DC-10 departing for Newark, New Jersey, had lost a titanium alloy strip, 435 millimeters (17.1 in) long and about 29 to 34 millimeters (1.1 to 1.3 in) wide, during takeoff from the same runway. French authorities acknowledged that a required runway inspection was not completed after the Continental takeoff, as was protocol for Concorde-takeoff preparation.^[8]

During the Concorde's subsequent take-off run this piece of debris, still lying on the runway, cut a tire, rupturing it. A large chunk of tire debris (4.5 kilograms or 9.9 pounds) struck the underside of the aircraft's wing at an estimated speed of 140 meters per second (310 mph)



Aug 20, 2007 China Air 737-800 – Fuel tank punctured by bolt from slat.



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Evaluation of FOD Detection Systems

Project Description:

Evaluate and develop operational performance standards for ground based FOD Detection systems designed to detect foreign object debris (FOD) that is on the surface of a runway or taxiway.



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Automated FOD Detection

FAA Goals

Develop performance standards for Automated FOD Detection Systems.

1. Conduct research & publish technical notes
2. Develop FAA Advisory Circulars specifically for FOD detection systems and FOD management
3. Enable civil airports opportunity to apply for federal funding to procure systems



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Automated FOD Detection

Approach

- Install systems at US airport.
- Work with vendor during installation.
- Utilize Center of Excellence for Airport Technology (CEAT) – Univ of Illinois - for manpower and expertise.
- Conduct 12 month evaluation of system, though comprehensive test protocol.



Automated FOD Detection

Technologies Assessed:

- **QinetiQ – Tarsier Radar – Providence, RI (PVD)**
 - Millimeter Wave Radar
 - Mounted on Rigid Towers
- **Stratech – iFerret – Chicago O’Hare (ORD)**
 - High Resolution Camera
 - Mounted on Rigid Towers
- **X-Sight – FODetect – Boston Logan (BOS)**
 - High Resolution Camera and Millimeter Wave Radar
 - Mounted on Airport Lighting Fixtures
- **Trex Enterprises – FOD Finder – Chicago O’Hare (ORD)**
 - Millimeter Wave Radar and Infrared Cameras
 - Mounted on roof of Airport Vehicle



Background

- In 2007 the FAA began conducting performance assessments of automated systems designed to detect FOD on runways.
- Boston Logan International Airport was selected as one of the sites to conduct the assessments.
- Between June 2008 and May 2009, the FAA conducted tests on the XSight FODetect system at BOS to determine the performance capabilities of the system.
- The FODetect system was able to detect objects of various sizes, shapes and materials on runway surfaces and perform satisfactorily in nighttime, daytime sun, rain, mist, fog and snow.



Automated FOD Detection

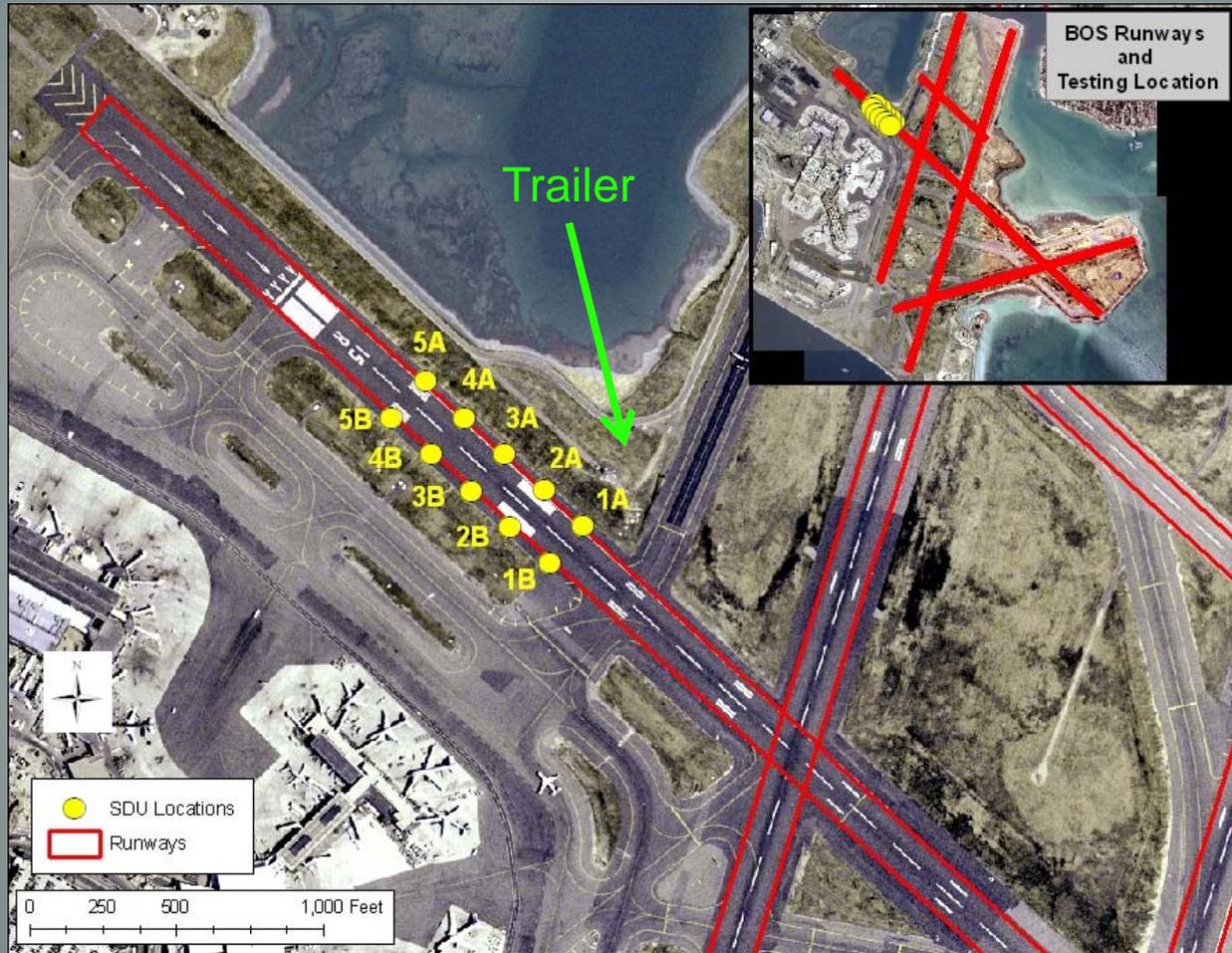
X Sight – FODetect, Boston Logan (BOS)

- High Resolution Camera and Millimeter Wave Radar
- Mounted on Airport Lighting Fixtures



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Location of Sensors



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XSight – FODetect BOS Testing



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QinetiQ Tarsier Camera Installations

Millimeter Wave Radar mounted on rigid towers



London Heathrow
UK



Vancouver International
Canada



RAF Boscombe Down
UK



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QinetiQ Tarsier camera in operation

- Providence, RI (PVD)



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QinetiQ Tarsier camera in operation



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Stratech iFerret – Chicago O’Hare (ORD)

High Resolution Camera

Mounted on Rigid Towers



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Stratech iFerret

Chicago O'Hare (ORD)



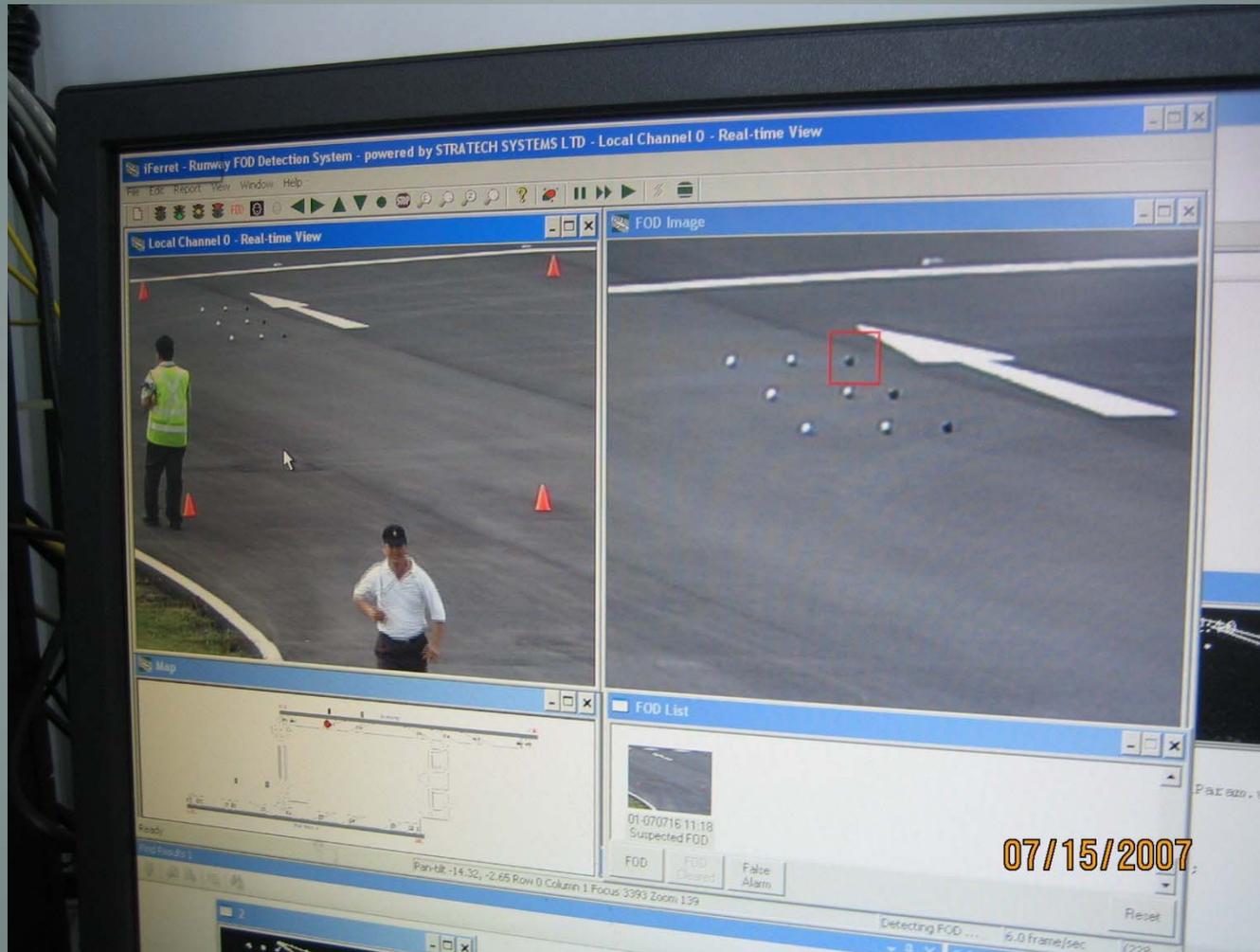
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Stratech iFerret



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Stratech iFerret



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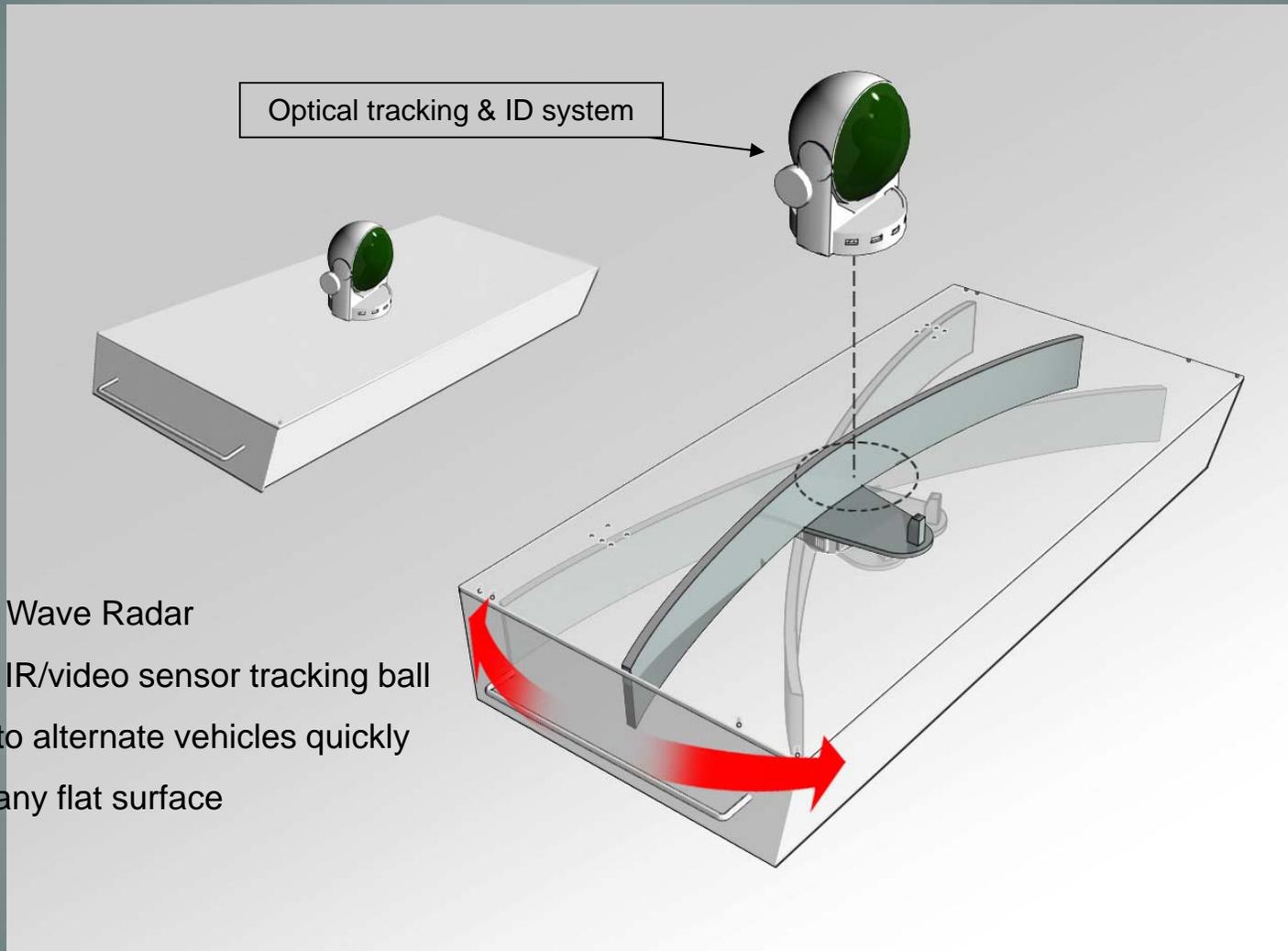
Trex Enterprises **FOD Finder** Chicago O'Hare (ORD)

Millimeter Wave Radar and Infrared Cameras
Mounted on roof of Airport Vehicle



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Trex Enterprises **FOD Finder** Radar/Optics Configuration



Features

- Millimeter Wave Radar
- Multi-axis IR/video sensor tracking ball
- Relocate to alternate vehicles quickly
- Mount to any flat surface



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FOD Finder CONOPS



Radar sweep

- 600 Feet wide
- Single Pass
- Cover full width of runway
- Cover approaching taxiways/high speed turnoffs

Low-cost, High efficiency Solution!



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Trex FOD Finder



User view showing detected FOD items and sweep line.

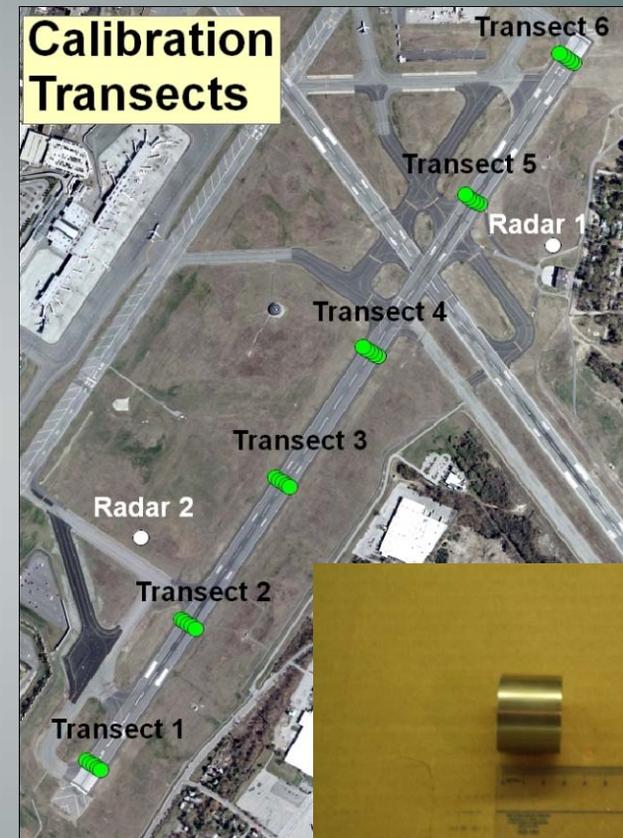


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Calibration Testing

Known Position – Known Items

- Determine detection performance using known, repeatable targets at measured distances from the sensor (known object of known size at known position and distance)
- 6 lines of 5 cylinders with a specific reflectivity
- 6 lines approximately equally spaced along the runway.



Detection Capability Testing

Known Location- Unknown Items

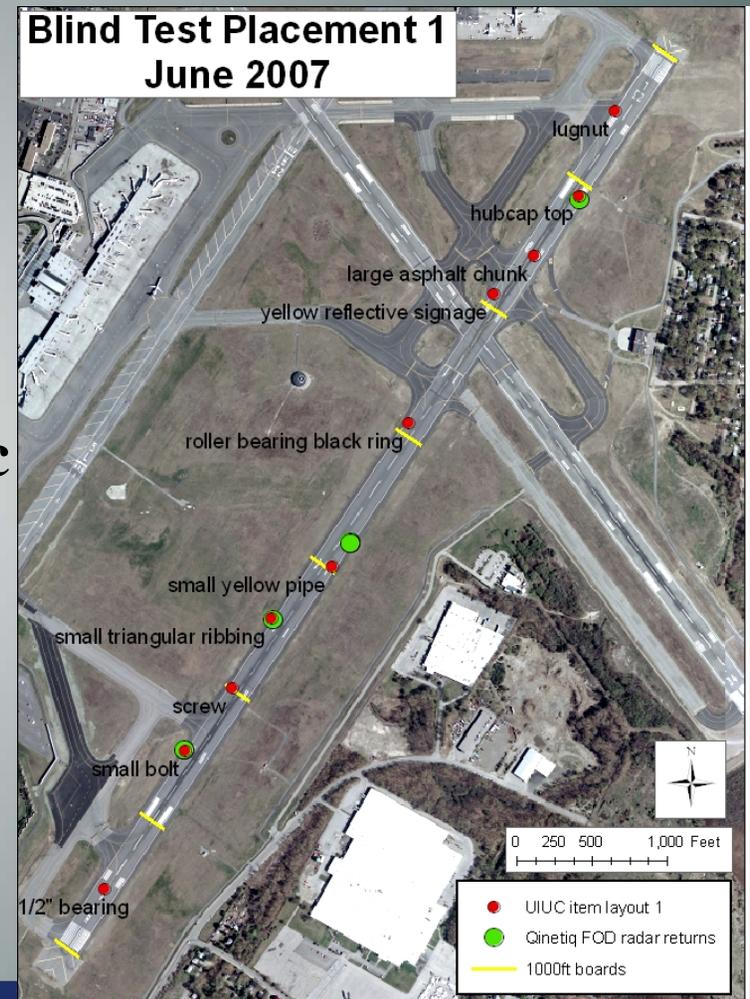
- Standard objects used in standard grids of approximately equal spacing down the runway
- Each object in grid was placed randomly
- Repetition of this experiment will build a statistical basis for what the radar will detect



Blind Testing

Unknown position – Unknown Items

- Determine detection performance using known, repeatable targets at measured distances from the sensor and randomly placed unknown items.
- 6 lines of 5 cylinders with a specific reflectivity, equally spaced along the runway.
- Randomly placed FOD Items



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Status of Research

- **AC150/5220-24 –Airport FOD Detection Equipment– September 2009**
- **AC 150/5210-24 – Airport FOD Management – September 2010 (Cancels 5380-5B, Debris Hazards at Civil Airports (7/96))**
- **Technical Notes have been published for each technology**



FOD Detection – Future Plans

- Two AC's are out and published
- Continue development of national FOD database (FOD.FAA.GOV)
- Continue Characterization Study of FOD being found at airports – ORD and others
- Evaluation/assessment of FOD Removal tools
- New Technologies

