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**Airports**



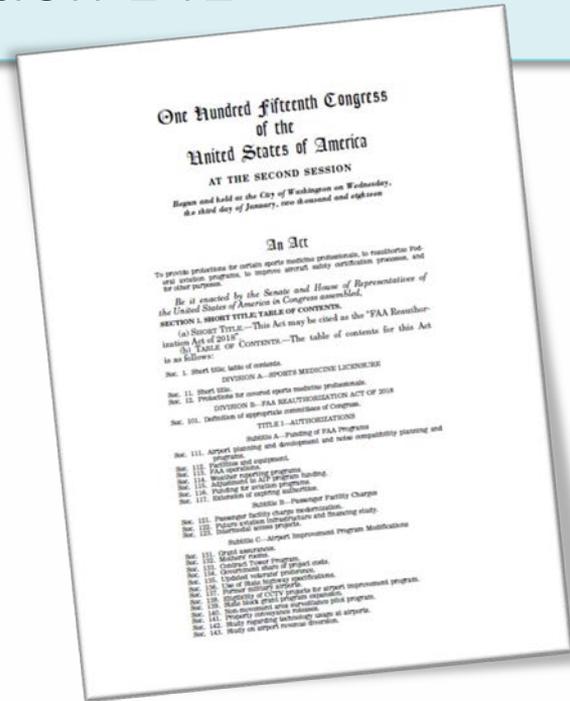
# **FAA Reauthorization Bill 2018 Foreign Object Debris (FOD) Detection Technology**



**FAA**  
Office of Airports

# Overview

This briefing is in response to House Bill H.R. 302 FAA Reauthorization Act of 2018, Section 142



# H.R. 302 FAA Reauthorization Act of 2018

**“SEC. 142. STUDY REGARDING TECHNOLOGY USAGE AT AIRPORTS.**

(a) IN GENERAL.—Not later than 6 months after the date of enactment of this Act, the Administrator of the Federal Aviation Administration shall initiate a study on—

(1) technology developed by international entities (including foreign nations and companies) that have been installed in American airports and aviation systems over the past decade, including the nation where the technology was developed and any airports utilizing the technology; and

(2) aviation safety-related technology developed and implemented by international entities with proven track records of success that may assist in establishing best practices to improve American aviation operations and safety.

(b) REPORT.—Not later than 18 months after the date of enactment of this Act, the Administrator shall submit to the appropriate committees of Congress a report on the results of the study.”

# Foreign Object Debris (FOD)

## Overview

- FAA defines foreign object debris (FOD) as, “any object, live or not, located in an inappropriate location in the airport environment that has the capacity to injure airport or air carrier personnel and damage aircraft.”
- Airports use a variety of tools to find and remove FOD, including visual inspections and the use of sweepers, vacuums and magnet bars to collect debris.
- FAA provides guidance to airports regarding FOD through two advisory circulars (AC)s
  - AC 150/5210-24, “**Airport Foreign Object Debris (FOD) Management**,” provides strategies and practices in four different FOD-related areas: prevention, detection, removal, and evaluation
  - AC 150/5220-24, “**Foreign Object Debris Detection Equipment**,” states the minimum performance standards for FOD detection systems and identifies four types of FOD detection systems.

# Section 142 (a) (1)

- The following slides present FAA's extensive study of FOD detection systems to address the language of Section 142 (a) (1).

*“(1) technology developed by international entities (including foreign nations and companies) that have been installed in American airports and aviation systems over the past decade, including the nation where the technology was developed and any airports utilizing the technology;”*

# Types of FOD Detection Systems

System	Detection Principles	Capability
<b>Human / Visual</b>	Fundamental baseline for the performance of FOD detection systems. Human observation provides detection and human judgment provides the hazard assessment capability to assure safety.	Supports regularly scheduled, periodic condition, and special inspections.
<b>Radar</b>	Uses radio transmission data as the primary means to detect FOD on runways and AOA surfaces.	Fixed systems support continuous surveillance. Mobile systems supplement human/visual inspections.
<b>Electro-Optical</b>	Uses video technology and image processing data as the primary means to detect FOD on runways and AOA surfaces.	Supports continuous surveillance.
<b>Hybrid</b>	Uses a combination of radar and electro-optical data as the primary means to detect FOD on runways and AOA surfaces.	Supports continuous surveillance.

# Current FOD Detection Systems

FOD Detection System Name	Company	Country
FODetect®	Xsight Systems Ltd.	Israel
iFerret	Stratech*	Singapore
Tarsier	QinetiQ/Moog	United Kingdom
FODDS	Hitachi Kokusai Electric Inc.	Japan
DEB-RA	Rheinmetall AG	Germany
A-FOD	ArgosAI	Turkey

Systems Assessed by FAA

\* Stratech is no longer in business

# Airport Installations

FOD Detection System	Airport	Airport Code	Location/Country
Xsight FODetect®	Suvarnanhumi International Airport	BKK	Thailand
	Ben Gurion International Airport	TLV	Israel
	Charles de Gaulle Airport	CDG	France
	Hamad International Airport	DOH	Qatar
	Beijing Daxing International Airport	PKX	China
	Beijing Capital International Airport	PEK	China
	Seattle-Tacoma International Airport	SEA	United State of America
	Boston Logan International Airport	BOS	United States of America
Stratech iFerret*	Singapore Changi International Airport	SIN	Singapore
	Dubai International Airport	DXB	United Arab Emirates
	Düsseldorf International Airport	DUS	Germany
	Hong Kong International Airport	HKG	China
QinetiQ Tarsier	Vancouver International Airport	YVR	Canada
	London Heathrow Airport	LHR	United Kingdom
	Yuma International Airport	YUM	United State of America
ArgosAI A-FOD	Ankara Esenboğa Airport	ESB	Turkey
Rheinmetall DEB-RA	Pratica di Mare Air Base	LIRE	Italy
Hitachi Kokusai Electric FODDS	Narita International Airport	NRT	Japan
	<i>Kuala Lumpur International Airport (Field Trial)</i>	KUL	Malaysia

Systems Assessed by FAA

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# FAA Research on FOD Systems

## Airport Technology R&D (ATRD) Branch

- 2005: Short-term evaluation of radar based FOD detection system at JFK International Airport
  - Demonstrated successful detection of FOD
  - Provided justification for further research
- 2008 – 2010: ATRD and University of Illinois' Center of Excellence for Airport Technology (CEAT) conduct performance assessments of four FOD detection systems to establish minimum performance requirements
  - Four published Technical Reports
  - Published AC 150/5220-24 "Foreign Object Debris (FOD) Detection Equipment" in 2009."



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# FAA Performance Assessments

- Assessments of four type of automated FOD detection systems were conducted to establish baseline performance standards.
- Performance was assessed based on a collection of controlled FOD items that represent the typical types, sizes, colors, and material composition of actual FOD found at airports.



# FAA Research on FOD Systems

- 2012: FAA floats the prospect of a Pilot Program to fund a limited number of FOD systems i.e. three, installations at U.S. civil airports
  - Initial installation was at BOS on the full length of runway 9/27
  - Subsequent installations were delayed due to competitive bidding issues among vendors
- FY 2015, U.S. Senate drafted Senate Report 113-183
  - The Committee recommends that the FAA study whether it is appropriate to expand the installation of foreign object debris detection technology at hub airports in order to increase safety.
  - Study conducted at BOS from July 2014-December 2015.
  - FAA expanded the study to include SEA in 2017.

# BOS Study

Completed

- Study objective: Compare how much FOD is detected on a runway by an automated FOD detection system to a runway monitored only by traditional human-based FOD inspection methods.
- April 2013 – FAA and Massport execute an OTA to install Xsight FODetect® on 7000 ft. of runway 9/27.
  - FAA funded 3000 ft. (~\$850K)
  - Massport funded 4000 ft. (~850K)
- Installation Costs = ~\$1.7M
- Data collected on two runways (9/27 and 4L/22R) for 18 months (July 2014- December 2015).
  - Human-based detections = 21 objects
  - FODetect® detections = 139 objects (including 95 wildlife carcasses)

# SEA Study

## Ongoing

- Study objective: Compare how much FOD is detected on a runway by an automated FOD detection system to a runway monitored only by traditional human-based FOD inspection methods.
- October 2018– FAA and SEA collaborate via an MOA to collect data from Xsight’s FODetect® system installed on full length (9500 ft.) of runway 16C/34C.
- System became functionally operational on January 2016.
- Data collected for two runways (16C/34C and 16L/34R) for 12 months (January 2019- January 2020).
  - Human-based detections = 30 objects
  - FODetect® detections = 102 objects (including 37 wildlife carcasses)
- Final report in progress.

# Section 142 (a) (2)

*“(2) aviation safety-related technology developed and implemented by international entities with proven track records of success that may assist in establishing best practices to improve American aviation operations and safety.”*

- FAA is aware of advertised system enhancements i.e. “add-ons” offered by vendors designed to expand the benefit of their FOD detection systems.
- FAA is currently engaged with U.S. and international airports to quantify performance and assess compatibility with safe U.S. civil airport operations.

# Additional Functionality

- The following are additional “add-ons” that are available on some existing FOD detection systems:
  - Wildlife Detection and Mitigation
  - Pavement Inspection and Management
  - Runway Contaminant Presence and Measurement
  - Airfield Surveillance (Runway Incursion Reduction and Unauthorized Access)
  - Post-Airbus A380 Operations Inspections



# Status of FOD systems globally

- There are six (6) distinct stationary FOD detection systems worldwide.
- Three of the six systems have been assessed by FAA, resulting in published performance standards.
- Three U.S. civil airports and 16 international airports have FOD detection systems.
- 15 of the 19 installations worldwide consist of one of the three FOD detection systems assessed by the FAA i.e. FODetect<sup>®</sup> (8), iFerret<sup>™</sup> (4) or Tarsier<sup>®</sup> (3).

# Summary

- The Automated FOD detection technologies that FAA has assessed have demonstrated successful performance in detecting FOD on runways.
- There is still concern regarding the amount of “false positives” that these systems generate.
- FAA study continues on FOD detection performance and safety benefits at SEA.
- FAA remains in communication with Airside Operations at BOS, London Heathrow (LHR), and Vancouver (YVR) who utilize automated FOD systems.

# Summary

## Continued

- Current guidance from the Office of Airports is that FOD detections systems are not designed nor certified as safety critical systems and therefore cannot be utilized by airports in place of required inspections.
- Airports that have automated FOD systems can utilize the full functionality offerings of the system, however only in a supplemental advisory manner.

# Summary

Continued

With only a small sample size of operational FOD detection systems worldwide consisting of 15 civil airport installations, comprising only 3 vendors, it is worthwhile to continue data collection on the performance, safety benefits, costs and lessons learned over extended period of time.

# Next Steps

- Complete FOD study at SEA on runway 16C/34C on the operation of Xsight automated system.
- Continue information gathering from international Airside Operations departments utilizing automated FOD detection systems e.g. LHR, YVR etc.
  - FOD detection performance
  - Use of expanded capabilities such as wildlife mitigation, pavement inspections, winter contaminants etc.
  - Costs and Safety Benefits
- Complete a Cost Benefit Analysis of FOD detection systems by Winter 2020.

# Long-term plan

- Based on information gathered from the airport user community, FAA will consider the extent and manner in which these systems can continue to be implemented at U.S. civil airports to enhance safety and improve operational efficiencies.

# Questions...



# FAA Research on FOD Systems

- Type: Radar Based System
- Manufacturer: QinetiQ Tarsier
- Airport: Providence T. F. Green International Airport (PVD)
- Duration: June 2007 to March 2008



**DOT/FAA/AR-10/33, “Performance Assessment of a Radar-Based Foreign Object Detection System”**

# FAA Research on FOD Systems

- Type: Electro-Optical-Based System
- Manufacturer: Stratech iFerret™
- Airport: Chicago O'Hare International Airport (ORD)
- Duration: June 2009 to July 2010



**DOT/FAA/AR-11/13, "Performance Assessment of an Electro-Optical-Based Foreign Object Debris Detection System"**

# FAA Research on FOD Systems

- Type: Hybrid Radar and Electro Optical
- Manufacturer: Xsight FODetect<sup>®</sup>
- Airport: Boston Logan International Airport (BOS)
- Duration: June 2008 to May 2009



**DOT/FAA/TC-12/22, “Performance Assessment of a Hybrid Radar and Electro-Optical Foreign Object Debris Detection System”**

# FAA Research on FOD Systems

- Type: Mobile, Radar-Based
- Manufacturer: Trex Enterprise FOD Finder™
- Airport:
  - Chicago O'Hare International Airport (ORD)
  - Honolulu International Airport (HNL)
  - McClellan-Palomar Airport (CLD)
- Duration: June 2007 to March 2008



**DOT/FAA/AR-11/12, “Performance Assessment of a Mobile, Radar-Based Foreign Object Debris Detection System”**