iFerret™

*intelligent* Airfield/Runway Surveillance & Foreign Object & Debris (FOD) Detection System

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Agenda

- iFerret™ Overview
- Distinctive Advantages of iFerret™
- Key Milestones of iFerret™
- iFerret™ Pilot Evaluation at Changi Airport – Results
- Benefits of iFerret™
- iFerret™ Full-Scale Implementation at Changi Airport
What is iFerret™

World’s first *intelligent* vision-based system capable of:

- Real-time, automated FOD detection
- Identification & pin-point FOD location
- Recording & post-event analysis
- Full visual assessment from ATC/Ground Ops Control
iFerret System Overview

Runway
Operational Workflow

intelligent Runway
FOD (Foreign Object & Debris) Detection System

1. Dedicated Inspection
2. FOD Detected
3. Real-time Alert
4. Visual Verification
5. Remote Alert
6. Runway Recovery Team Dispatched

Control Tower
Apron area
Taxiway
Runway
powered by stratech
powered by CAAS
Civil Aviation Authority of Singapore
Distinctive Advantages

System Scalability
System Redundancy
Operational Simplicity
Operational Effectiveness
*Allows flexible deployment including apron, taxiway, aircraft carrier
ICAO Annex 14: “the surface of pavements (runways, taxiways, aprons and adjacent areas) shall be kept free of loose stones or other objects that might cause damage to aircraft structures or engines, or impair the operation of aircraft systems.”

Scalable & Modular
System Redundancy
Operational Simplicity - WYSIWYG

1. Real time View
2. FOD Image View
3. Digital Map
4. FOD Alarm List
Operational Effectiveness
Special Features

Passive System
- No Health Hazard
- No EMI/EMC issues

All Weather, Day and Night
- Without Assisted lighting

Night Scene without Image Enhancement
iFerret™ Image Enhancement
Runway Light
Special Features

Precise Location of FOD within 1 meter Accuracy

Post FOD Retrieval Analysis
Allows video playback of FOD Retrieval Process
Key Milestones of iFerret™

- The iFerret solution was awarded “The Enterprise Challenge (TEC)” by Prime Minister Office of Singapore in Feb 2006.

- Won Asia Pacific ICT Award (APICTA) in Research & Development category in Nov 2006.

- Passed 1st round of FAA Evaluation at Changi Airport in Apr 2007, able to detect below 4cm target object size.


- Successful completion of 15 months pilot at Changi Airport in Jul 2007 and proven highly reliable under day and night conditions.

- Passed preliminary trial at Chicago O’Hare Airport in Sep 2007 and recommended for full FAA Evaluation in the U.S.
Synergy Between CAAS & Stratech

- iFerret™ is a collaboration project between CAAS and Stratech
- Under this collaboration, Stratech provided the vision-based technology whilst CAAS provided the domain knowledge to customise the technology for use on the runway
Objective: To establish the technical limits/capabilities of iFerret™

1) Temporary Rooftop Installation (300m)
   Determined important parameters that helped finalize system and tower design

2) Housed in Cabin Upper Deck (250m)
   Tests conducted under different weather conditions

3) Operational Tower Installation (250m)
   Full functional node
Exhaustive testing was conducted on the runway especially after midnight when the runway was closed for maintenance.

At other times, when the runway was not closed, testing was conducted on the perimeter road and taxiway.

Key system/operational parameters determined:

- FOD size
- Detection range
- Detection time
- Installation height
- Performance in rain condition etc.
Evaluation Results

**Day Condition (4cm FOD):**
- Clear weather (distance up to 1,100m)
- 16 mm/hr rainfall (distance up to 890m)

**Night Condition (4cm FOD):**
- Clear weather (distance up to 600m)
- 22 mm/hr rainfall (distance up to 520m)
**Evaluation Results**

**Day Condition (2cm FOD):**
- Clear weather (distance up to 780m)
- 16 mm/hr rainfall (distance up to 590m)

**Night Condition (2cm FOD):**
- Clear weather (distance up to 390m)
- 4 mm/hr rainfall (distance up to 364m)
Evaluation Results

**Day Condition (1cm FOD):**
- Clear weather (distance up to 780m)
- 4 mm/hr rainfall (distance up to 460m)

**Night Condition (1cm FOD):**
- Clear weather (distance up to 310 m)
- 4 mm/hr rainfall (distance up to 364 m)
**Evaluation Results**

**Operational Node Evaluation:**
Distance 250m from runway centerline  
Coverage area 340m by 60m

Detect 4cm FOD consistently up to 302m

Average FOD detection time ranged from 2 minutes in the day to 4 minutes at night
# Benefits of iFerret™

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<tr>
<th>Current Situation</th>
<th>iFerret™ Benefits</th>
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<tbody>
<tr>
<td>• Tedious manual inspection</td>
<td>• Fully automated FOD detection</td>
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<td>• Scheduled infrequent inspection</td>
<td>• 24x7 continuous operation</td>
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<td>• Prone to human error, fatigue or complacency</td>
<td>• Objective, AI learning system with minimal false alarm</td>
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<td>• Difficult to inspect and/or search for FOD after dark</td>
<td>• Night operation capable without assisted illumination</td>
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<td>• Limited visibility from ATC/Ground Operations Control Centre</td>
<td>• Increased awareness through visual verification/confirmation</td>
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<td>• Rough estimation of FOD location</td>
<td>• Pin-point location for rapid recovery</td>
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<td>• No clue of FOD occurrence and no means of identifying cause/source</td>
<td>• Record playback for post-event analysis/investigation</td>
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<td>• Inefficient compliance with ICAO standards or FAA regulations</td>
<td>• Full compliance without compromising airfield/runway operation</td>
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<td>• FOD incidents endanger airport/airbase users</td>
<td>• Safety for pilots, flight crews, ground staff and passengers</td>
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Eyes on the runway could prevent disaster

This Ferret can sniff out foreign objects on airport runways

The Ferret system is a groundbreaking technology that uses artificial intelligence to detect and identify foreign objects on airport runways. It is designed to prevent accidents and enhance safety at airports.

Read more about the Ferret system in the following articles:

- [Ferreting out FOD on Changi runway](#)
- [CAAS inks deal to use Stratech iFerret system](#)

CAAS inks deal to use Stratech iFerret system

CAAS has signed a contract with Stratech Systems Limited to deploy the iFerret system at Changi Airport. This is a significant development in enhancing safety and efficiency at the airport.

Feb 2008 – CAAS awarded contract to Stratech Systems Limited

CAAS in Singapore has awarded a contract to Stratech Systems Limited for the implementation of the iFerret system at Changi Airport. This contract is a major step forward in improving safety and efficiency at the airport.

Local company develops system to counter FOD

A local company has developed a system to counter foreign objects on runways. The system uses advanced technology to detect and identify foreign objects, ensuring the safety of aircraft operations.

Full Scale Implementation of iFerret™ at Changi
Thank You