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Aerovision Technology Limited
航景科技有限公司

Twenty Ninth Meeting of the Communications, Navigation and Surveillance Sub-group (CNS SG/29) of APANPIRG

Presentation on

Intelligent Air Cargo / Baggage Thermal Detection System

and

GNSS Interference Monitoring System

Speaker:

Ir. Dr. Angus Cheung
Chief Executive Officer
Aerovision Technology Limited

Speaker Introduction

CEO of Aerovision Technology Limited

Ir. Dr. Angus Cheung

Professional Experience

(2020 – present)	**Chief Executive Officer** Aerovision Technology Limited
(1997 – 2020)	**Chief Executive Officer** China Aircraft Services Limited
(1982 – 1997)	**General Manager** Associated Engineers Limited (Jardine Matheson – Cathay Pacific JV)

Education

(Postdoc)	**Post-Doctorate Study in Artificial Intelligence** Oxford University
(EngD)	**Doctor of Engineering in Artificial Intelligence** University of Warwick
(MSc)	**Master of Science in Engineering** University of Hong Kong
(APHK)	**Associateship in Mechanical Engineering** Hong Kong Polytechnic University

AeroVision Aerovision Technology Limited 航景科技有限公司

Speaker Introduction

CEO of Aerovision Technology Limited

Ir. Dr. Angus Cheung

Professional Qualifications

Chartered Engineer
Engineering Council, UK

Chartered Professional Engineer
Institution of Engineers, Australia

Professor-level Senior Engineer
People's Republic of China

Fellow
Institution of Engineering & Technology, UK

Fellow
Institution of Mechanical Engineers, UK

Fellow
Hong Kong Institution of Engineers, HK (Mechanical, Electrical, Control, Automation & Instrumentation, Aircraft, Manufacturing, & Industrial Engineering)

Fellow
Institution of Engineers, Australia

Chartered Fellow
Chartered Institute of Logistics and Transport, UK

Fellow
Hong Kong Institute of Directors

Member
Hong Kong Computer Society

Member
Building Services Operation and Maintenance Executives Society

Speaker Introduction

CEO of Aerovision Technology Limited

Ir. Dr. Angus Cheung

Academic Affiliations

Adjunct Professor
Hong Kong Polytechnic University

Distinguished Professor
City University of Macau

Visiting Professor
Civil Aviation University of China

Honorary Industrial Fellow
University of Warwick, UK

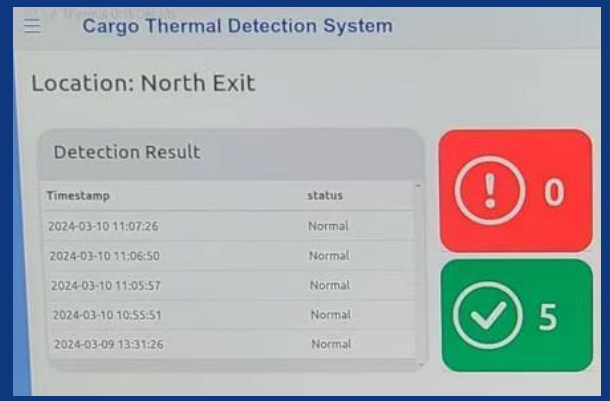
Advisory Committee Chairman
Department of Mechanical Engineering,
Hong Kong Polytechnic University

Advisory Committee Member
Department of Industrial Manufacturing and System Engineering,
University of Hong Kong

Advisory Committee Member
Department of Mechanical Engineering,
City University of Hong Kong

Advisory Committee Member
School of STEM,
RMIT University of Australia

Intelligent Air Cargo/Baggage Thermal Detection System



Intelligent Thermal Detection System

Background

- **Flammable materials are commonly included in air cargo** because air freight is the quickest method to deliver internationally. These include **lithium batteries**, **alcohols**, **chemicals**, etc.
- Shipment of flammable materials are highly regulated with multiple required safety checks.
- **Despite these safety measures, fire accidents caused by these flammable items can still occur.**

22 Jul 2020
(Chlorine Dioxide Tablets)

19 Feb 2024
(Power Bank Failure)

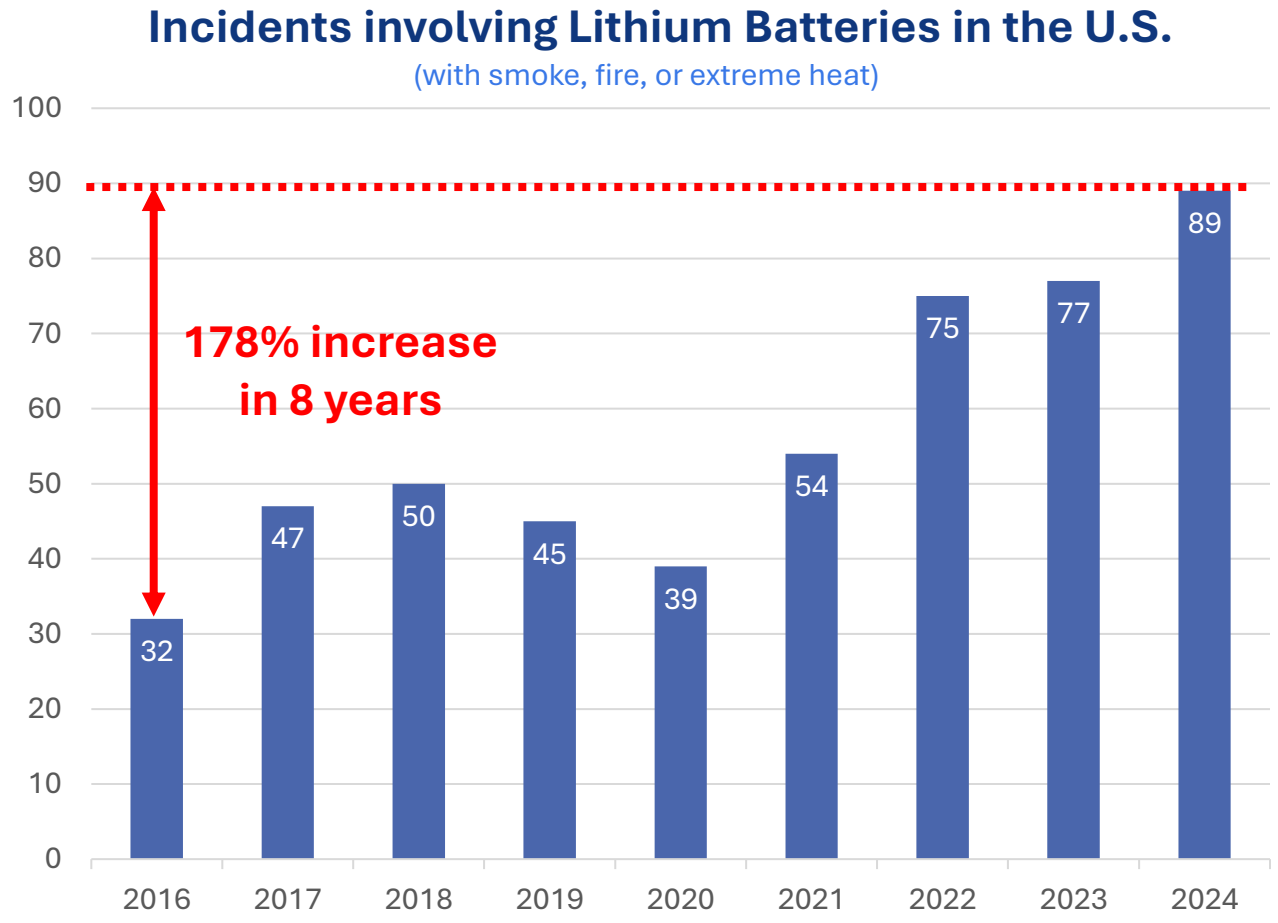
11 Apr 2021
(Bulk Smartphone Shipment)

28 Jan 2025
(Power Bank Failure)

Intelligent Thermal Detection System

Background

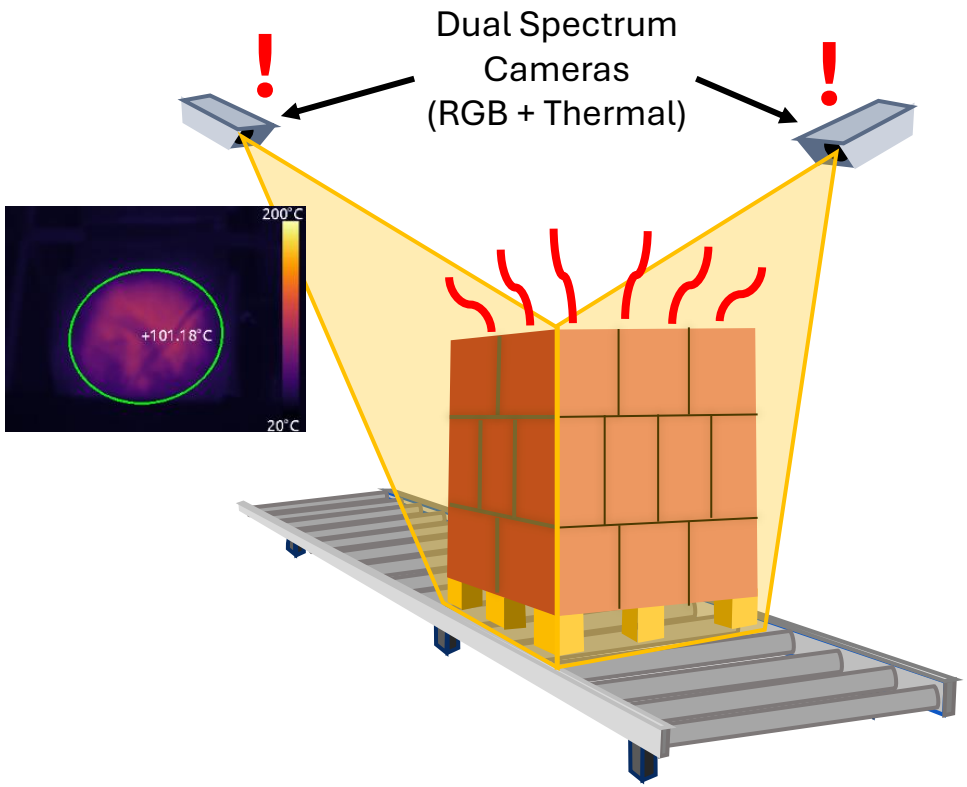
- **Number of incidents involving lithium batteries have been steadily increasing.**
- This trend will continue to grow with the increasing adoption of modern devices and lithium battery shipments.
- There needs to be an **effective** and **scalable** solution to **mitigate the risks** from lithium batteries and other flammable items.



Source: Federal Aviation Administration, Security and Hazardous Materials Safety

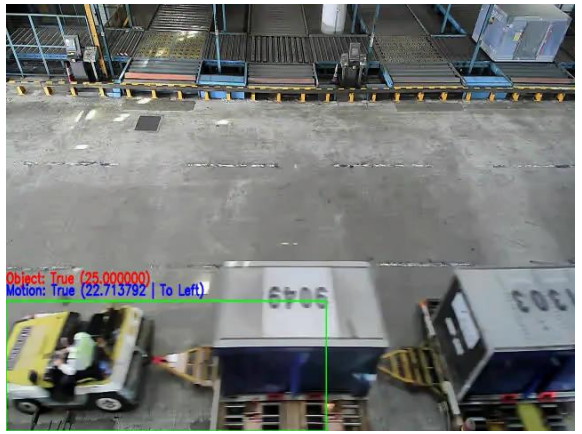
Intelligent Thermal Detection System

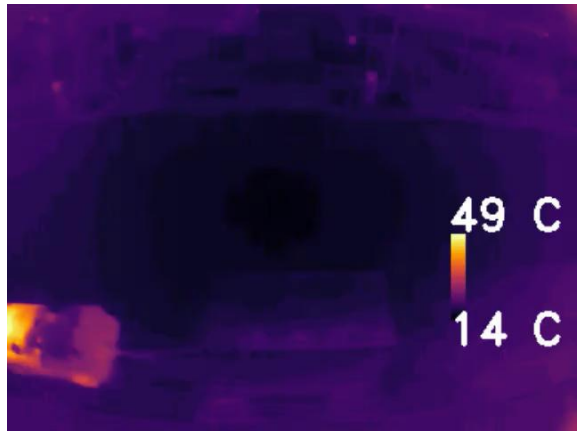
Introduction



The **Intelligent Thermal Detection System** automatically monitors air cargo or baggage for any **suspicious heat signatures** before they develop into a fire.

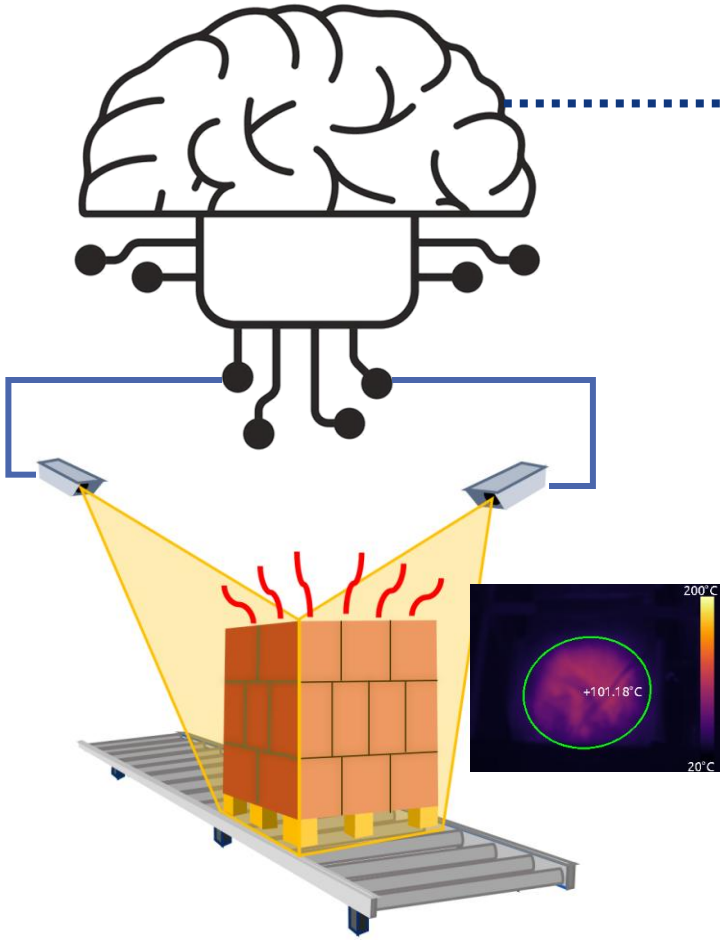
Equipped with our **proprietary dual spectrum cameras** and powered by our **dynamic thermal detection AI** for **ease of use** and **reliability**.





Intelligent Thermal Detection System

Features



Dynamic Thermal Detection AI

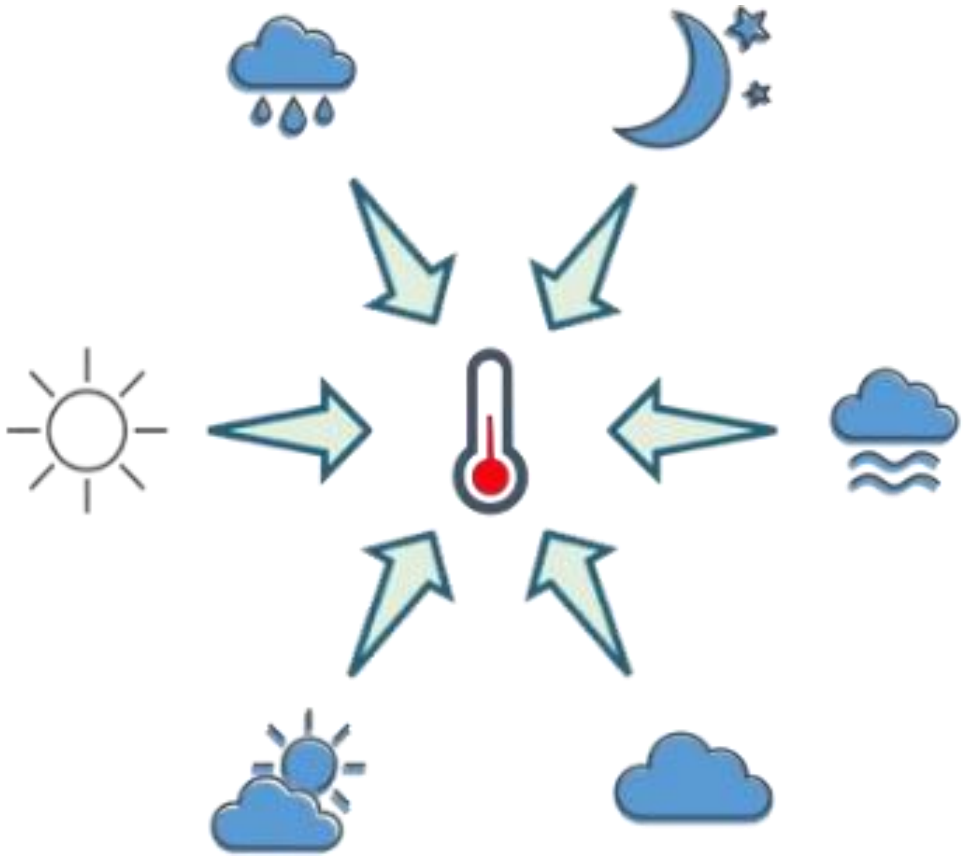
- Ambient Environment Analyzer
- Surface Material Classifier
- Thermal Pattern Recognition
- Custom Interface w/ Existing Systems

Our patented AI **factors in a variety of external factors** that can affect the thermal signature, ensuring an **accurate and reliable thermal detection capability**.

>95% Detection Accuracy

Intelligent Thermal Detection System

Features



Ambient Environment Analyzer

- Evaluates the **ambient temperature**, **humidity**, **wind speed**, **weather**, and other environmental factors.
- **Calibrates** the detection temperature threshold accordingly.
- **Ensures consistent accuracy throughout different conditions and locations.**

Intelligent Thermal Detection System

Features

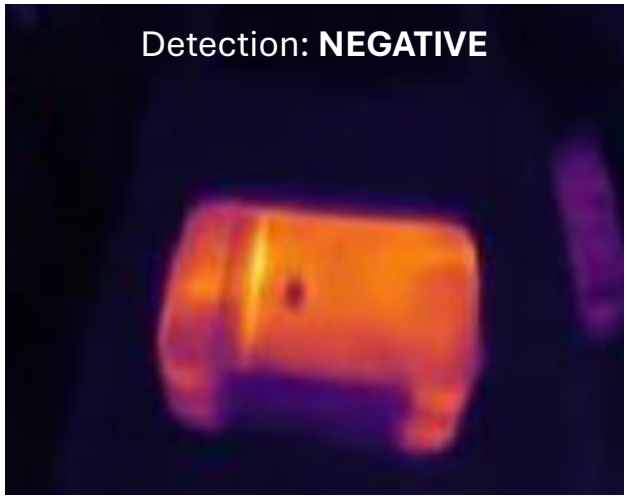
Surface Material Classifier

- Packaging materials affects the appearance of the thermal signature.
- The module **identifies the surface material** of the cargo or baggage and **applies a correction** to the data **based on the thermal properties of the material**.

Intelligent Thermal Detection System

Features

External Heating



(i.e. Sunlight, radiators, machines, etc.)

Internal Heating

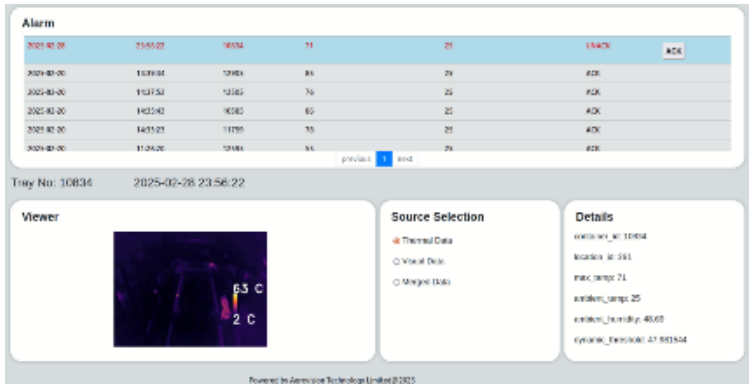
(i.e. Batteries, chemicals, flammables, etc.)

Thermal Pattern Recognition

- Capable of **differentiating thermal patterns caused by external and internal sources.**
- **Prevents false positive detections** caused by external heat sources.
- Ensures the system maintains a high level of accuracy and reliability.

Intelligent Thermal Detection System

Features

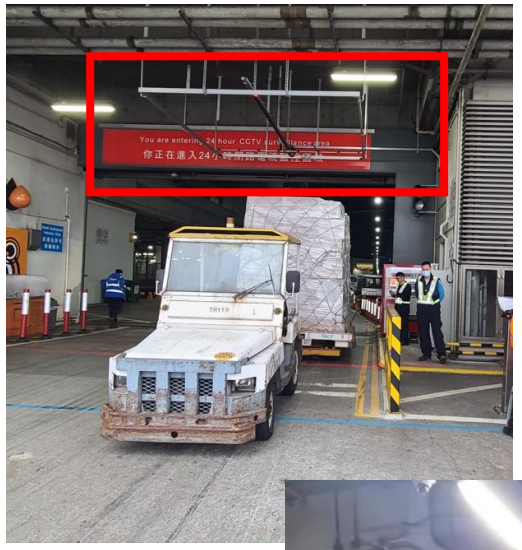


Custom Interface w/ Existing Systems

- Custom interface and APIs to **ensure ease of adoption, ease of use, and data traceability.**
- Designed according to need and scalability.
- Dashboards, historical database, automatic data entry, visible alarms, mobile apps, etc.

Intelligent Thermal Detection System

Locations for Deployment (Cargo)

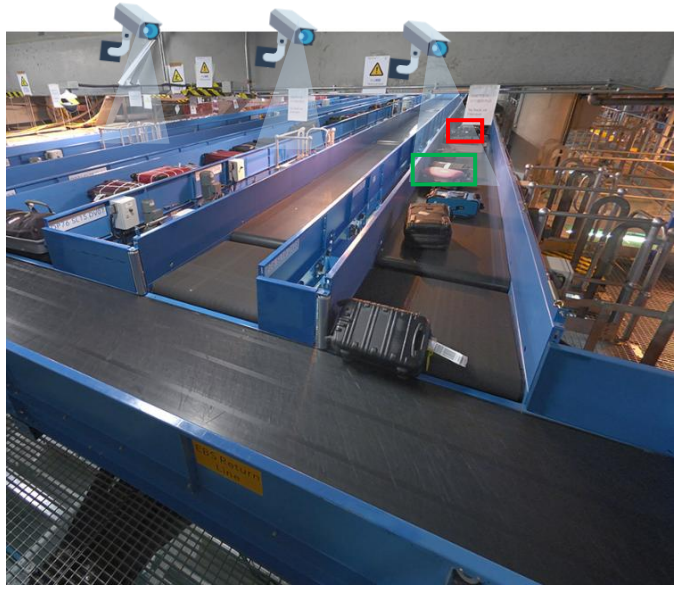


- Fully **automated** system with minimal manual interaction
- Provides **early detection of abnormal heat sources** before they develop into a full fire.
- **Mitigates the risks of flammable cargo or baggage**
- Designed to be **easy to use and integrate** into existing systems
- Takes into consideration a wide variety of factors
  - Environmental Condition
  - Thermal Properties of Materials
  - Internal or external heat source
- Excellent detection **accuracy** and **reliability**
- Thermal signature database that can be retrieved for future investigation if needed
- **System can be stand-alone or integrated with other material handling systems**

Intelligent Thermal Detection System

Locations for Deployment (Early Baggage Handling Area)

Monitoring of Detection Zones



❑ Benefits

Deploying a Thermal Detection System in the Early Baggage Handling Area can **automate monitoring** and allow for **unmanned operation**.

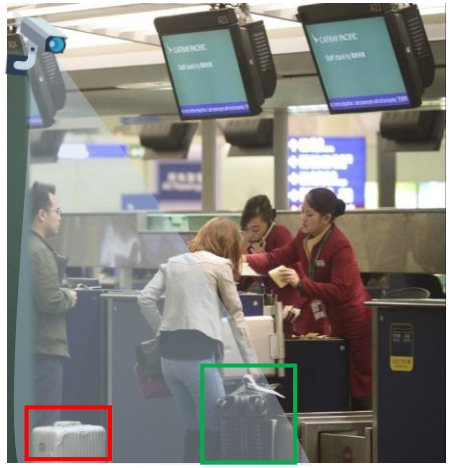
The system can detect **internal heat sources** in passenger luggage early, reducing fire risks **while maintaining smooth baggage flow**.

Intelligent Thermal Detection System

Locations for Deployment (Passenger Entry Areas)

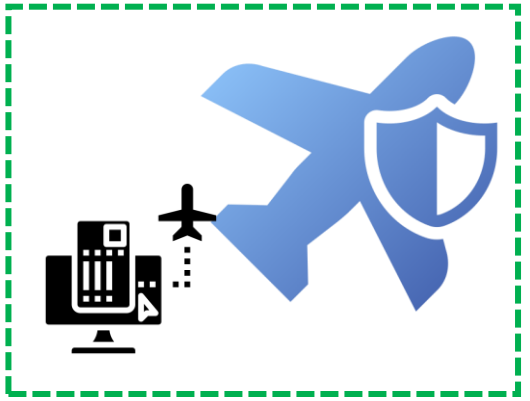
Monitoring of Detection Zones

Check-in *Or* Boarding



Various Possible Locations for Deployment

Normal:
Not storing any personal information



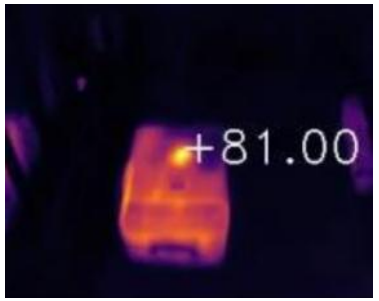
Abnormal:
Thermal Image Capturing & Alarming

Intelligent Thermal Detection System

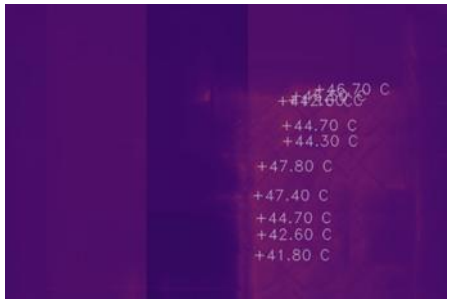
Project Reference

- **2025** **Airport Authority Hong Kong** – HKIA Baggage Thermal Detection System





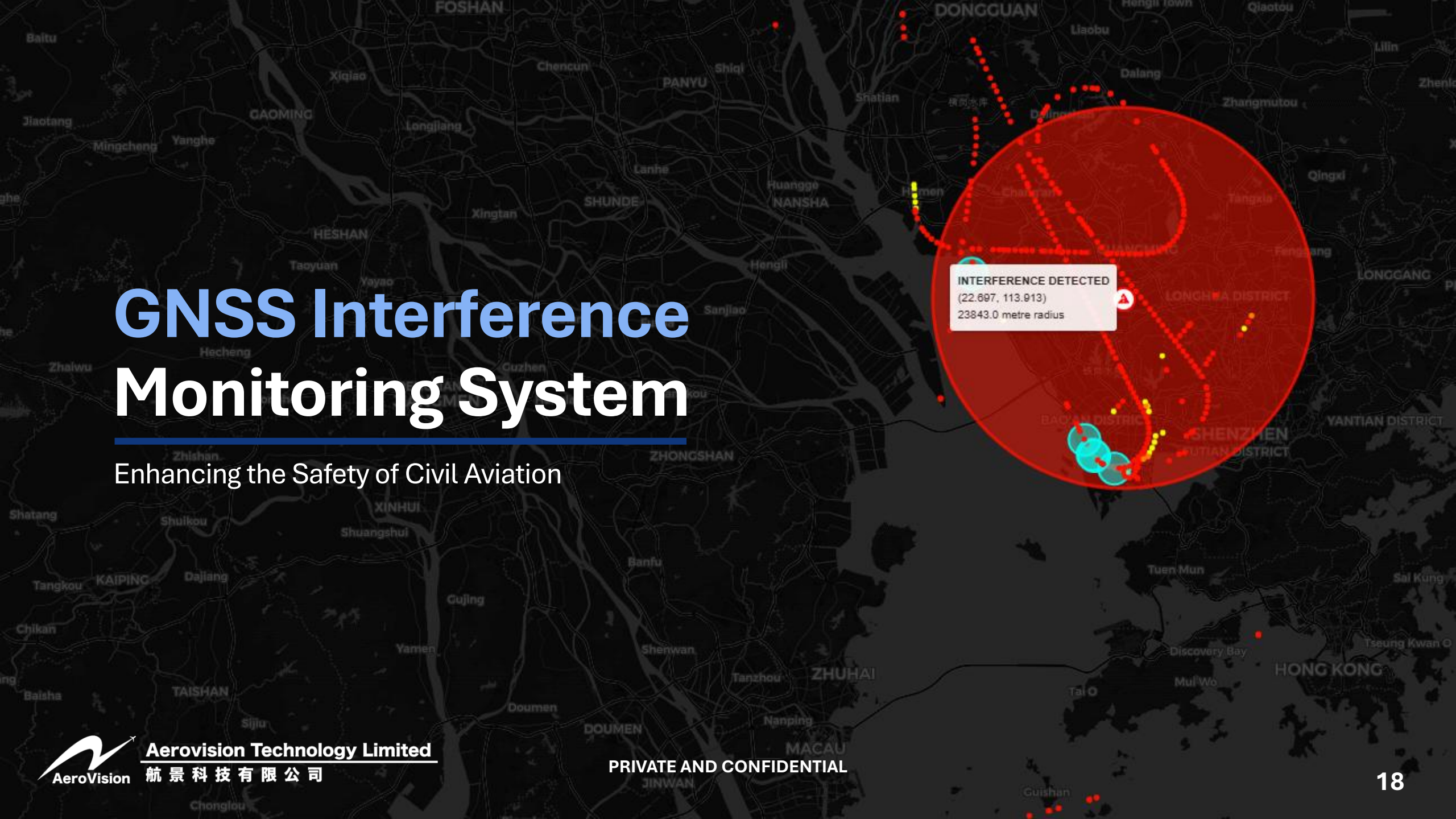
- **2023** **HACTL** – Air Cargo Thermal Detection System

Several more projects currently under development.

GNSS Interference Monitoring System

Enhancing the Safety of Civil Aviation



GNSS Interference Monitoring System

Background

- **Global Navigational Satellite System (GNSS)** is the backbone for modern positioning, navigation, and timing services.
- GNSS signals are **very weak** by the time they reach Earth's surface (about -130 dB) and can be easily **overpowered by jamming devices or space weather.**
- Highly automated navigational systems **lose their sense of position and time** during GNSS interference.

Impacts of GNSS Interference

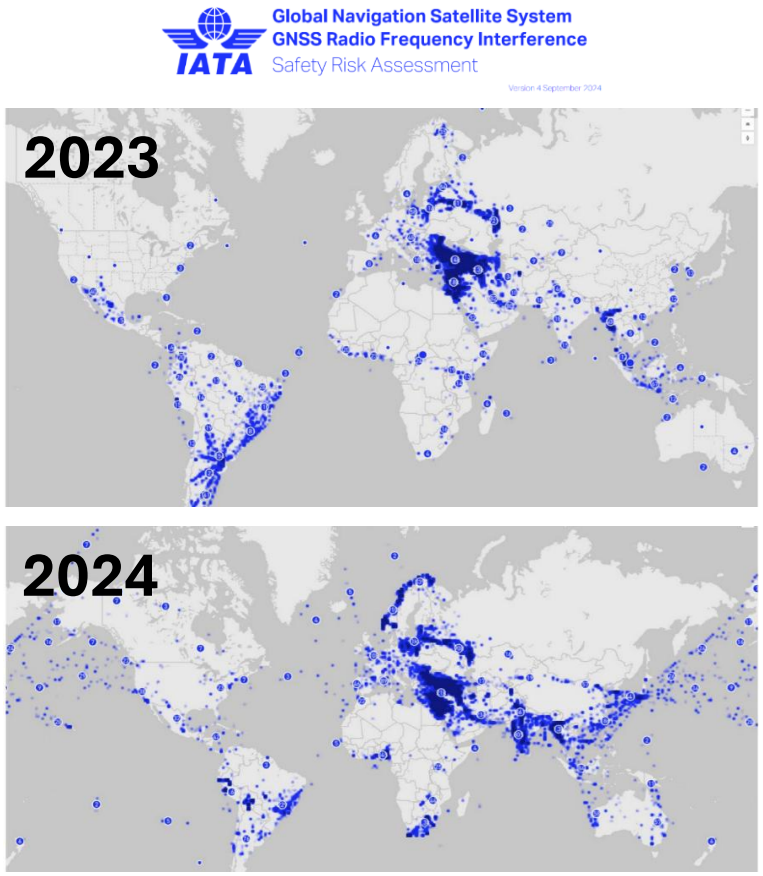
Inaccuracies in Daily Navigation Software

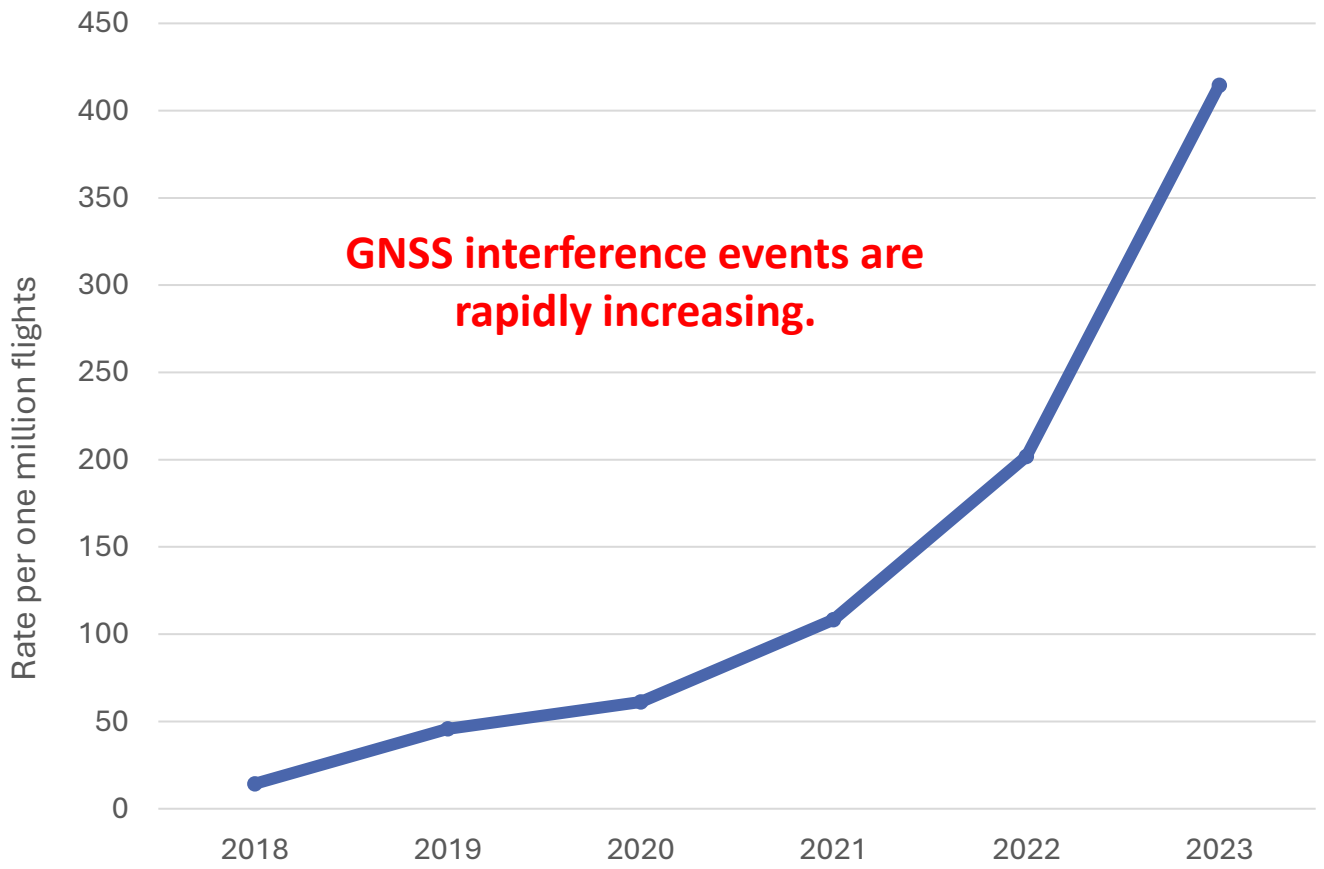
Accidents during Drone Art Shows

Failure of On-board Navigation Systems

GNSS Interference Monitoring System

Flights affected by GNSS Interference





Source: EASA, European Central Repository

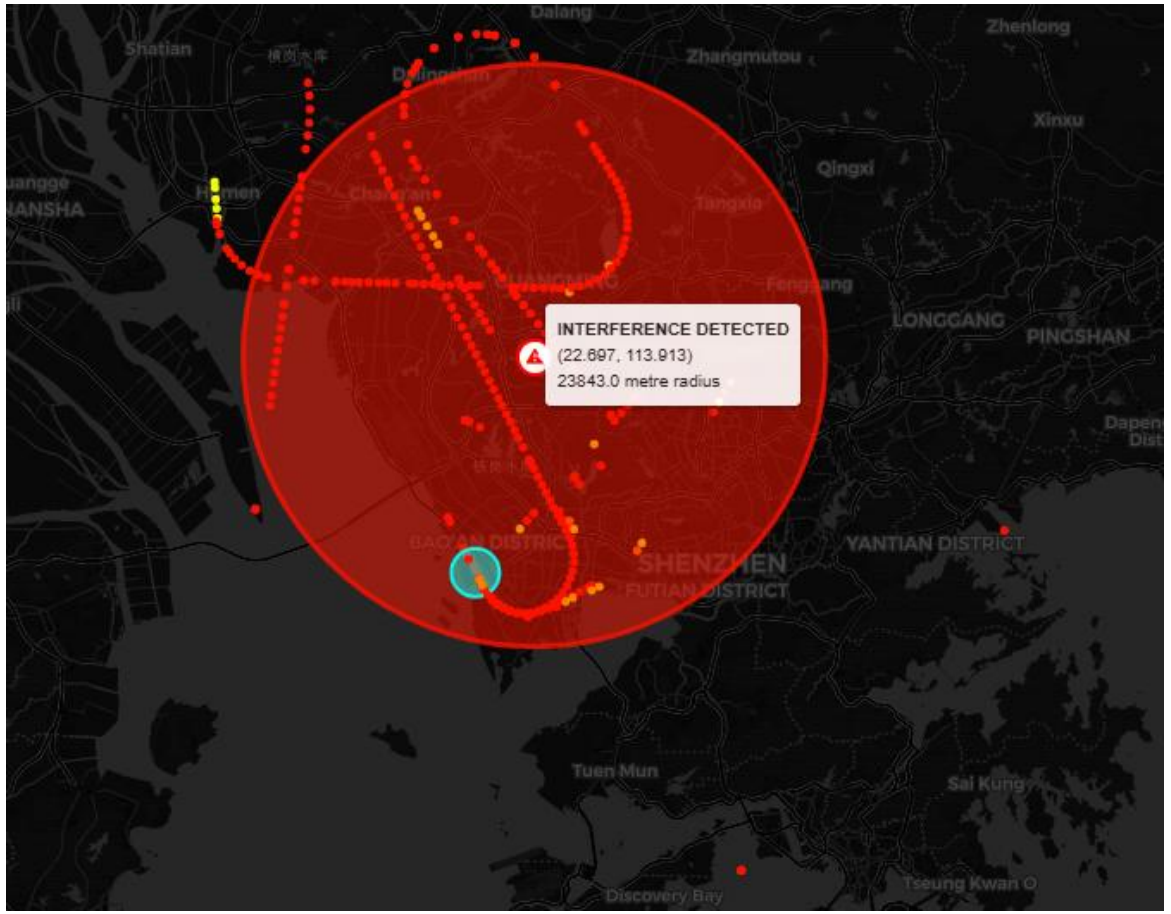
GNSS Interference Monitoring System

Introduction

The GNSS Interference Monitoring System **tracks all flights** within a certain region and **monitors for any signs of GNSS interference**.

Features:

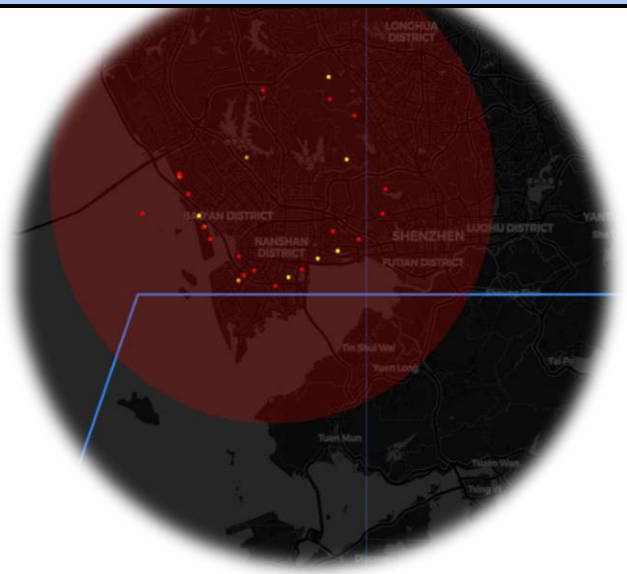
- Detection capability for wide-scale GNSS interference events (>10Km)
- **Early GNSS interference alert** for flight traffic controllers, pilots, low altitude vehicle operators, etc.
- **Estimates the position of jamming device(s)**.



GNSS Interference Monitoring System

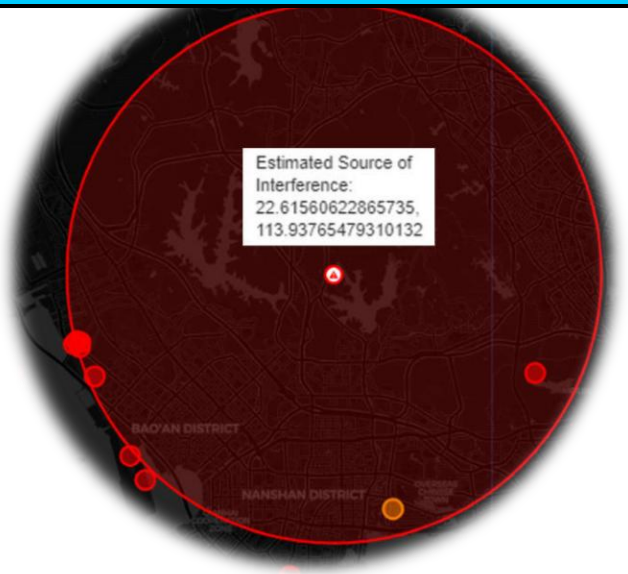
System Features

Interference Detection



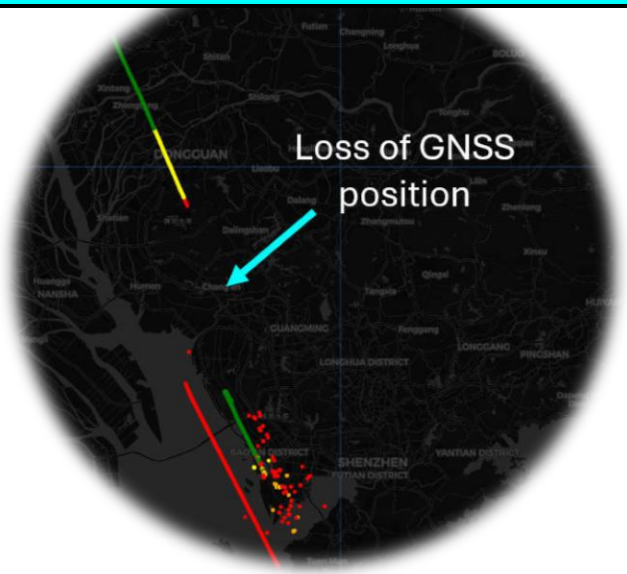
Automatic monitoring of all flights and **notifies local authorities** when interference is detected, caused either by jamming or space weather.

Interference Localization



Once an interference event is detected, localization AI can **estimate the affected area and source location**.

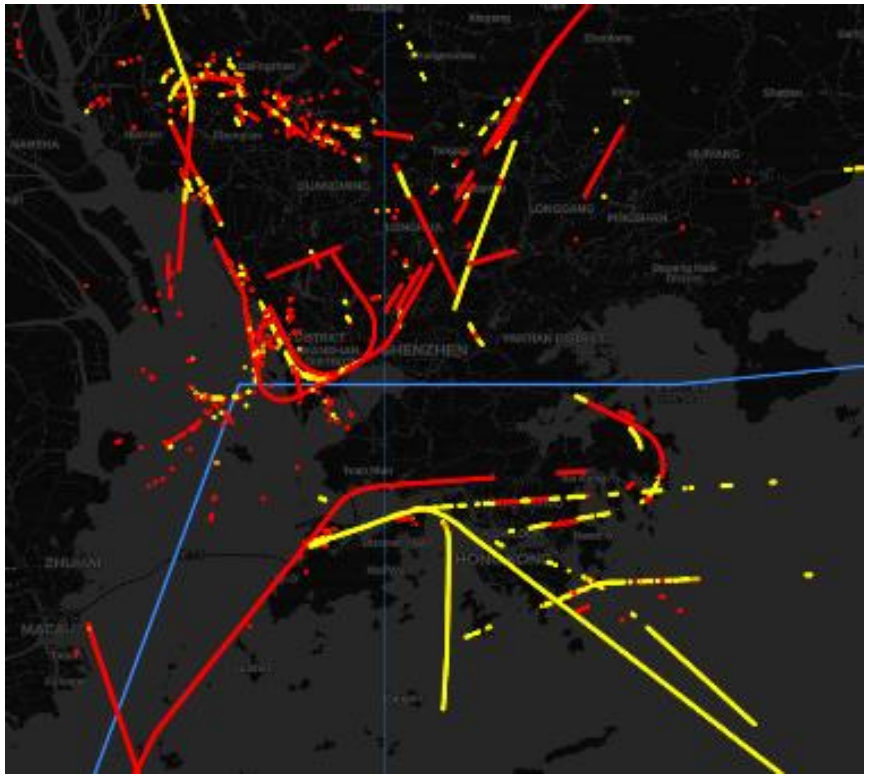
Interference Visualization



Visualize loss of GNSS position and broken flight paths caused by GNSS interference events.

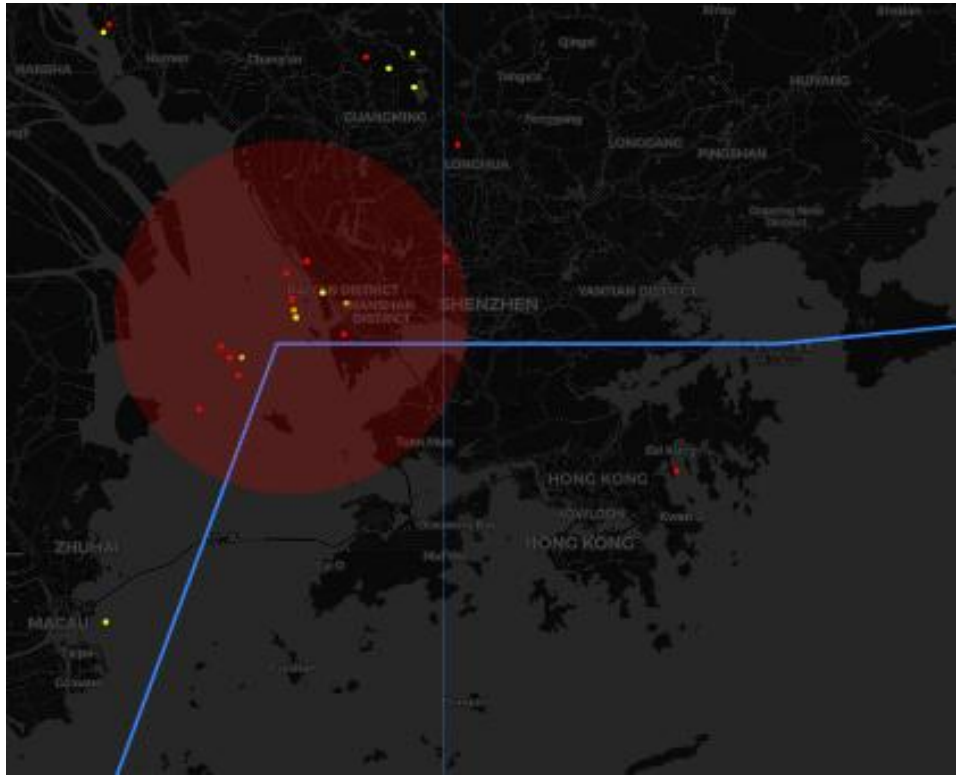
GNSS Interference Monitoring System

Interference Data Analysis



Utilizing **Artificial Intelligence**

Big data analysis &
machine learning methods

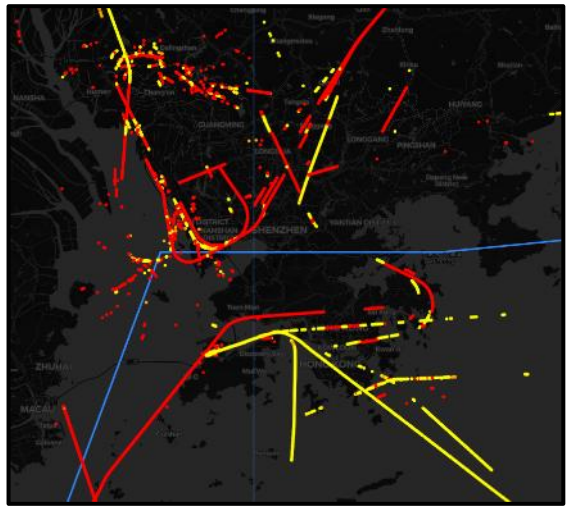


Source Data

Data analyzed by **Aerovision**

GNSS Interference Monitoring System

Benefits



GNSS interference detection and localization is "**crowdsourced**" from the hundreds of flights passing through.

Extracts information from existing air traffic control systems with **minimal added equipment.** Essentially, only a processing server.

- **Automatic and early detection of GNSS interference** within the deployed region.
- Provides **estimated location of the interference source** for deploying radio search teams.
- **Automated alerts** for air traffic controllers, civil aviation authorities, and related parties.
- **Identifies faulty radio broadcasting devices** onboard aircrafts.
- **Cost effective deployment** with minimal added equipment.

GNSS Interference Monitoring System

System Development

Preliminary test

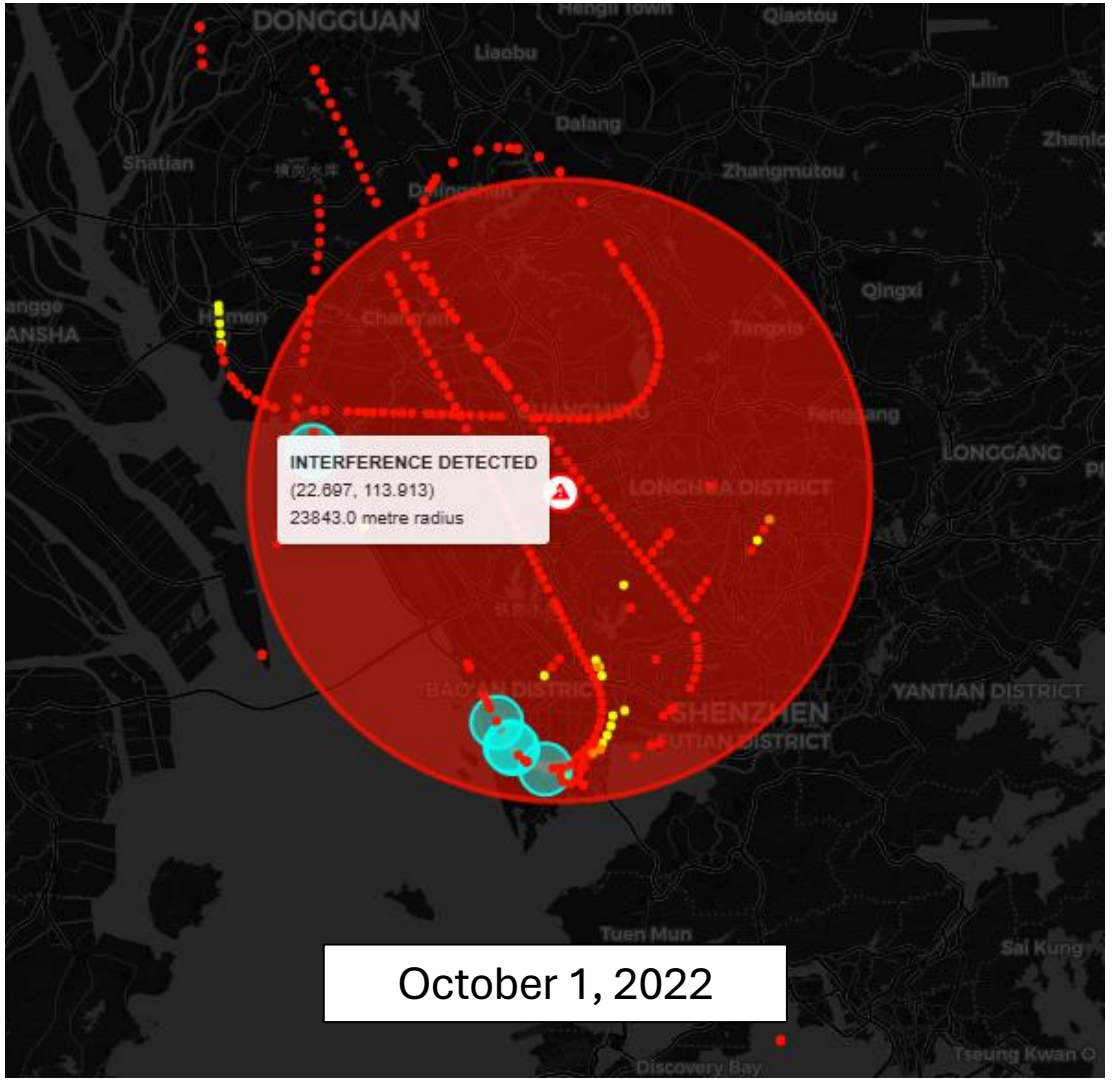
With support from Hong Kong Civil Aviation Department, the system was provided with aviation data over a long period and conducted simulated real-time monitoring and identification of interference events.

Achievement

The system successfully detected the interference event that occurred around Hong Kong and located the position of the jammer.

Case

As shown in the right figure, on October 1, 2022, the system monitored a disturbance event in the airspace of Hong Kong and located the jammer in Shenzhen.



GNSS Interference Monitoring System

Deployment

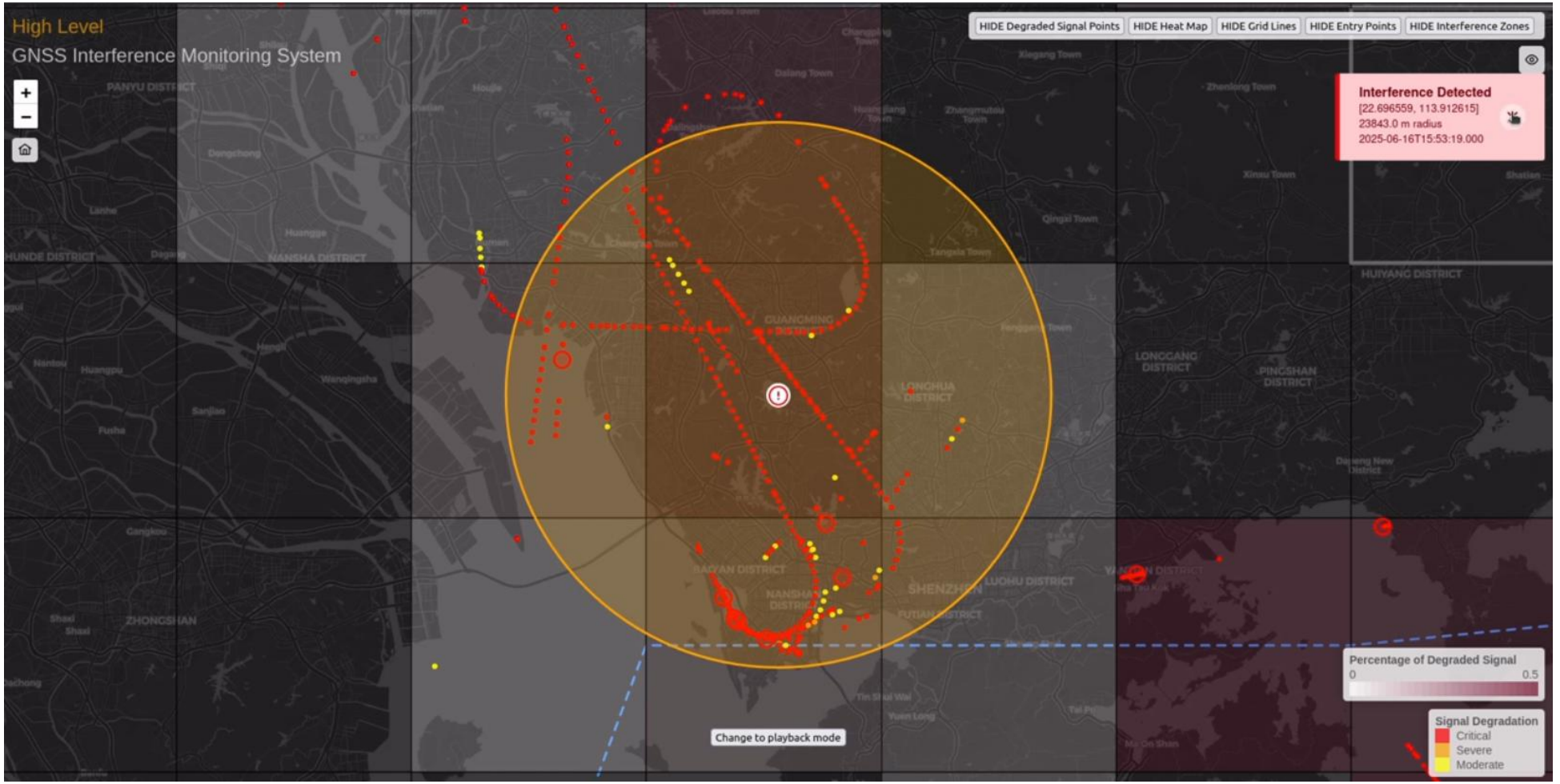
The GNSS Interference Monitoring System is currently being deployed in the headquarters of the **Hong Kong Civil Aviation Department**.

The system will constantly monitor all commercial flights within and around the **Hong Kong FIR** for any signs of interference, spoofing, or faulty aircraft radio transmitters.

Once fully operation, the system will feed information to data engineers and air traffic controllers in the department, **protecting the safety of civil aviation in Hong Kong against the threats of GNSS interferences.**

GNSS Interference Monitoring System

Showcase



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