



Case Study

Introducing Next-Generation Airfield Inspection with Autonomous System

AUTONOMOUS RUNWAY INSPECTION OFFERS A TRANSFORMATIVE SOLUTION TO THE LIMITATIONS OF TRADITIONAL METHODS, ENHANCING SAFETY, ACCURACY, AND OPERATIONAL EFFICIENCY THROUGH ADVANCED TECHNOLOGIES

sequetrics

Surface Scanning for Safe & Efficient Operations

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Summary

As air traffic continues to grow globally, ensuring airport runways' safety, efficiency, and reliability has become a top priority. Traditional runway inspection methods, typically conducted manually, are time-consuming, labour-intensive, and prone to human error. These limitations can lead to delayed detection of surface damage, foreign object debris (FOD), and other potential safety hazards.

A project was carried out in collaboration with Scotland’s Innovation Centre for Sensor and Imaging Systems and Internet of Things (IoT) technologies, i.e., CENSIS and funding provided by Innovate UK Edge in partnership with Fife Airport, Scotland.

The aim was to develop a minimum viable solution for automated runway inspection using high-resolution drone-based optical imaging and a data analytics platform.

Challenges

- Manual Inspections:** Traditional inspection methods were time-consuming and prone to human error.
- Regulatory Compliance:** Meeting the International Civil Aviation Organization (ICAO) and Civil Aviation Authority (CAA) standards required more frequent and detailed inspections.
- Resource Constraints:** Limited staff and budget made it challenging to implement comprehensive inspection programs.

Solution by Sequetrics Limited

- Digital Inspection Platform:** Implemented a web-based application enabling high-resolution data collection and analysis.
- Predictive Analytics:** Utilised AI-driven algorithms to predict potential runway deterioration, allowing for proactive maintenance.

Results

A well-executed system was developed, which led to reduced inspection duration. Findings are presented through visual maps, representing varying spreads of cracks.

Metric	Manual Baseline	Sequetrics	Improvement
Inspection cycle	45 min ¹	7-12 min	73-84 %
Surface coverage	< 100% (spot-check)	100 %	Improved coverage
Crack detection recall	n/a	93 %	New capability
Personnel required	2	1	50 %
CO ₂ per inspection*	6.5 kg	1.2 kg	82 %

*CO₂ figures calculated from UK BEIS 2024 factors

Conclusion

The collaboration exemplifies how technology can revolutionise airport operations. By embracing digital solutions, the airports can achieve high safety standards, operational efficiency, and cost-effectiveness.

Collaboration



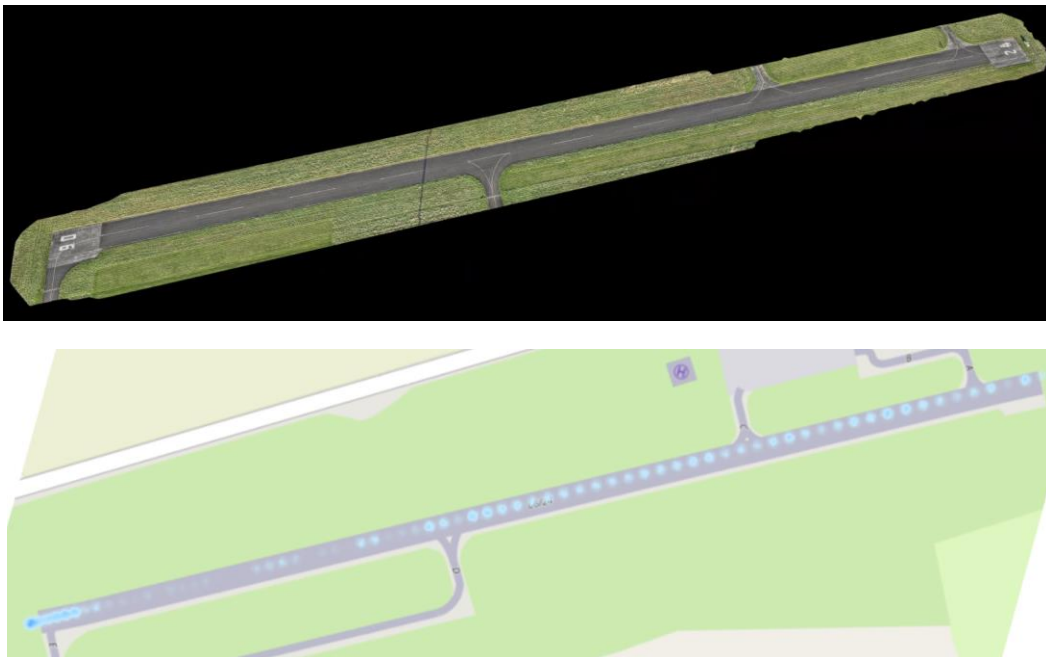
Emerging Opportunities

Automated Runway Inspections: The research enables comprehensive and repeatable inspection of runway surfaces by deploying an autonomous aerial system equipped with high-resolution cameras and geo-referencing capabilities.

Predictive Maintenance: Crack density, i.e., a ratio of crack length or area to total surface area, was used as a key metric to assess the pavement's structural integrity. The findings are presented through visual maps, representing varying spreads of cracks. These visualisations help maintenance quickly identify critical zones, prioritise repairs, and monitor deterioration trends over time. The results indicate that cracks are typically more concentrated in areas subjected to higher stress loads, such as touchdown zones and taxiway intersections. Factors contributing to these patterns include aircraft braking, thermal expansion, and ageing of materials. Maintenance activities can be prioritised and bundled, minimising downtime and resources. Early detection prevents severe damage, reducing the frequency of high-impact repairs.

Enhanced Safety & Regulatory Compliance: This approach enhances situational awareness and supports data-driven maintenance planning, reducing costs and improving runway availability and safety. The integration of autonomous aerial imaging with crack density analysis marks a significant advancement in predictive infrastructure management within the aviation sector, and it meets the aviation authority standards.

Environmental Sustainability: Reduced emissions from maintenance vehicles and personnel. Predictive scheduling helps reduce over-maintenance and material waste. By combining autonomous drones and AI, predictive maintenance improves safety and cost-efficiency and becomes a powerful tool in an airport's sustainability strategy.



Visualisation of Fife Airport runway using autonomous aerial imaging and crack density analysis

About Sequetrics Limited

Sequetrics Limited specialises in providing innovative solutions for runway infrastructure inspection and maintenance. Focusing on integrating technology and data analytics, Sequetrics empowers clients to enhance safety, efficiency, and compliance across various sectors.

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