Monitor Optics Systems

Optical Sensing Solutions for Structural Monitoring

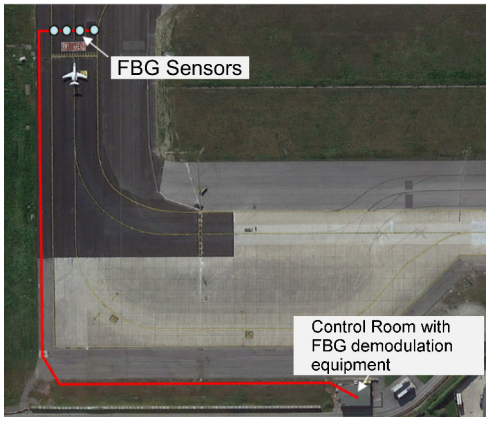
www.monitoroptics.com

117 Fortfield Rd.
Terenure, Dublin 6
Ireland
Info@monitoroptics.com

CASE STUDY

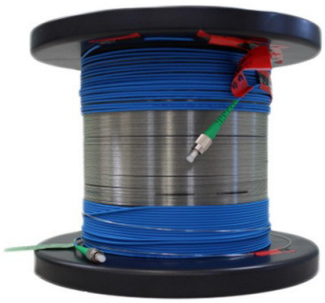
Monitoring Aircraft Passages on Taxiways in Airports Using Fibre Bragg Grating Sensors

Airport authorities are continuously working to improve the infrastructures for which they are responsible in order to guarantee increasing durability and reliability and to constantly increase the safety of aircrafts on the ground. Among the main European airport authorities, SEA in Milan is constantly testing the most innovative technologies to provide the Milan airport users with the highest levels of safety.



One of the most dangerous threat to the safety airport ground traffic is the unauthorised presence of more than one aircraft on the same runway. In order to prevent such a situation, a number of sensing devices are used to verify if an aircraft is trespassing the assigned hold areas and entering a runway. These devices are mainly based on microwave barriers that while generally reliable, can be sensitive to the passage of birds and other animals that thrive in airports.

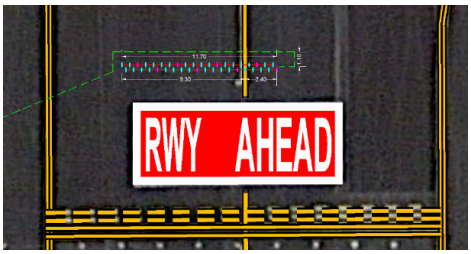
As a potential solution to the need for a sensing system capable of detecting the passage of aircrafts without false alarms, a Fibre Bragg Grating (FBG) based system has been installed on the Tango taxiway hold area by a consortium of Companies including Monitor Optics Systems (MOS), Impresa Bacchi SPA, GHT and MCI Engineering.



Sensors Selection

Impresa Bacchi, a leading Company in the field of road and airport pavements, has in past experimented with a number of different sensors for the monitoring of pavements. All these sensors have however led to mixed results, particularly regarding the capability of surviving the installation within the pavements.

Among the products available on the market, the sensors of choice for this project have been the MOS strain and temperature sensing cables. MOS sensing cables were chosen because of their proven high performance and robustness that make them ideal for similar applications. MOS sensing cables have been successfully employed in similar applications and their long term reliability is well proven- The robust construction allows these sensing cables to survive the in the harshest environments and the most demanding installation techniques.



Sensors Network

The strain sensors were embedded into the taxiway along a line perpendicular to the taxiway direction. Two sensing cables, each with 20 FBGs spaced 600 mm, were installed in two parallel lines in order to achieve a spacing of 300 mm between FBGs. The location of the sensors was designed to allow the system to detect the passages of every type of aircraft normally operating from the airport. The sensors were embedded by placing them in a narrow slot cut into the taxiway pavement and filling the slot with an appropriate epoxy resin while a hot bitumen kayer was used to completely seal the sensor location.

In addition to the strain sensors, a single-FBG temperature sensing cable was embedded to measure temperature within the taxiway pavement.

Demodulation of the signal from the FBG was performed using a Micron Optics Sm130 4-channel unit. The acquisition of data was automatically triggered by the detection of strain gradients related to the passage of vehicles or aircrafts above the sensors. The interrogation unit was hosted in a cabin containing electrical equipment at a distance of 600 m from the sensors.

Results

The sensing system has been tested in a number of trials of different duration. The longest trial saw the system automatically acquiring data for six weeks.

The system has consistently and reliably detected the passage of aircrafts through the whole duration of all trials. Data acquired using the system was compared with data supplied by the airport control tower and with data acquired by the microwave trespass detection system currently used on the airport. All passages detected by the system were confirmed by the microwave detection system and fitted with the list of flights supplied by the control tower.

During the trials aircrafts were easily classified according to their weight by the strain variations induced by their passage. Again such information was verified by comparison with the airport flights log supplied by the airport authority.

The system also managed to detect the passage of light vehicles operating on the taxiway during the airport closure times. This opens the possibility for the system to be also used to verify intrusion of vehicles on taxiways and runways.