Micro Pulse LiDAR Enhances Global Aviation Safety

Monitoring Volcanic Ash Provides Early Warnings of Hazardous Atmospheric Conditions

Volcanic ash is a recurring impediment to normal air-traffic operations in Europe, Asia and South America due to potential jet engine damage caused by the razor-sharp particles in dense ash plumes. A notable example is the 2010 eruption of the Eyjafjallajökull volcano in Iceland that shut-down air traffic throughout Western Europe for seven days, with intermittent closings necessary as new ash plumes continued to enter the European airspace. More than 300 airports were closed, 100,000 flights were canceled, and 10 million passengers were impacted. This economic disaster prompted research organizations to place more emphasis on developing effective volcanic ash monitoring systems.

Evaluation of Aerosols Detection Networks for Aviation

To address the need for better information about volcanic ash events, the Toulouse Volcanic Ash Advisory Center (VAAC) asked Météo-France (MF), the French national meteorological service, to focus on the ash issue. MF set out to determine the best method of providing accurate information about the size and concentration of volcanic particles from the ground up to a minimum of 12 km altitude.

The subsequent research efforts included the following activities:

- Tracking plumes of volcanic ash or dust through the atmosphere
- Understanding local air quality
- Providing warnings to air traffic controllers, meteorologists, and industrial sites related to aerosol events

During the summer of 2012, using desert dust as a proxy, MF collected data provided by several LiDAR sensors and ceilometers and in-situ measurements (balloon-borne particle counters and aircraft sensors) to assess their effectiveness in tracking aerosols.

Numerical weather predictions (NWP) for different synoptic weather regimes were used to determine the efficiency of networks using various sensors and the associated location of the instruments, considering the following factors:

- Vicinity of main air routes
- Coverage of the Atlantic coast for ash coming from Iceland and the Mediterranean Sea for ash emitted by the Italian volcanoes
- Impact on MOCAGE (Modéle de Chimie Atmosphérique de Grande Echelle), the French model for chemical species transport

Results of Network Study Point to MiniMPL

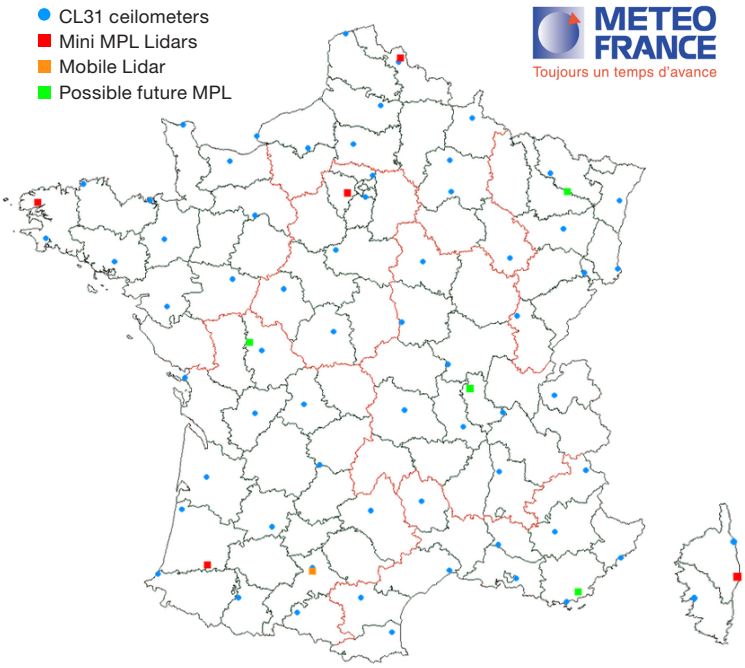
After MF's initial evaluation, several network designs were studied to determine which one provides the best cost/benefit ratio. Based on criteria of cost and robustness, MF bought six MiniMPL LiDAR sensors.

"We decided to place five of the MiniMPL in fixed locations at Lille, Trappes, Brest, Momuy and Aleria," said Jean-Luc Lampin, Studies and Development Engineer Météo-France. "The sixth MiniMPL is being kept as a mobile lidar. In case of an ash event, the Volcanic Ash Advisory Center will decide the best place to deploy in terms of the atmospheric circulation and the location of the plume to obtain the best coverage."

“By continuously monitoring the atmosphere with a network of depolarization LiDAR sensors, possible air-traffic interruptions can be prevented or mitigated.”

– Justin Fisher, Director of Atmopsheric LiDAR Products, Hexagon

In the future, additional MPL’s will be added to the inventory to expand coverage and develop a comprehensive nation-wide network.



Preliminary Map of the Network

MiniMPL Provides New Atmospheric Details Critical to Aviation Safety

Atmospheric studies are critical for safe airport operations. MF operates a hybrid network of aerosol LiDAR sensors with a re-deployable mobile component for volcanic ash early warning and detection. MF’s 3,100 employees are focused on developing the infrastructure and leading-edge technologies necessary to collect meteorological observations for a better understanding of the current state, which in turn are used to improve global and regional weather modeling and forecasting.

The MiniMPL’s ability to measure depolarization makes automatically characterizing aerosol types feasible for researchers.

“The MiniMPL network is performing very well for Météo-France,” said Justin Fisher, director of atmospheric LiDAR products, Hexagon. “By continuously monitoring the atmosphere with a network of depolarization LiDAR sensors, possible air-traffic interruptions due to volcanic ash or major dust events can be prevented or mitigated.”

The MiniMPL uses a laser with a range up to 15 km, as well as dual polarization. The dual polarization backscatter measurements allow for very high accuracy — better than 0.7%. This data enables authorities to discriminate between the occurrence of pure water clouds and the presence of volcanic ash plumes and ash/water cloud mixtures, as well as determine ash concentration profiles, with measurements and analyses completed and reported in seconds.

About Micro Pulse LiDAR

Elevating Atmospheric Monitoring

Micro Pulse LiDAR (MPL) instruments help scientists, meteorologists and air quality professionals monitor aerosols to better understand the structure of our atmosphere. MPL’s long-range capabilities and high-quality signal increase efficiency and accuracy of the data capture process for improved atmospheric monitoring. Originally designed by Sigma Space for NASA, MPL uses eye-safe lasers, precision photon counting, and built-in data analysis to deliver the best signal-to-noise ratio and thus the most reliable information in this category.

Micro Pulse LiDAR is part of Hexagon (Nasdaq Stockholm: HEXA B; hexagon.com), a leading global provider of information technologies that drive quality and productivity improvements across geospatial and industrial enterprise applications.

For more information, visit www.micropulselidar.com or call +1(301) 552-6000.