by Nicholas Demetriades

STRIKE ACTION

Advanced lightning warning systems are now available worldwide

Built on the success of the USA's National Lightning Detection Network, the Global Lightning Dataset provides high-quality lightning warnings across the world – invaluable for aviation authorities, airports, and pilots

In lightning-prone regions of the world, airlines, airport authorities, and owners of small airports need to ensure the safety of their ground crew employees while maximizing their operational efficiency. Thunderstorms produce dangerous cloud-to-ground (CG) lightning that can kill or injure a person through one direct or indirect strike, with baggage and cargo handlers, refueling personnel, and catering service personnel most at risk. When lightning threatens, high-risk activities like baggage handling and refueling have to be suspended until the threat has passed. Being able to accurately detect thunderstorms and issue timely lightning warnings helps to improve airport safety and increase the time that airports can be fully operational.

Saving lives

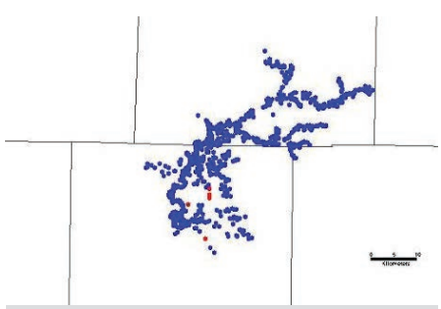
According to lightning safety expert Ron Holle, approximately 24,000 lightning casualties occur worldwide each year. Although accurate airport-related statistics are virtually non-existent, there have been at least 92 reported injuries and one death between 1991 and 2011. To address these safety concerns, Vaisala created a range of airport lightning warning systems (LWS), which combine lightning data with decision support software that alerts staff when dangerous CG lightning is imminent.

Airports in the Continental USA have been benefiting from the protection provided by the National Lightning Detection Network (NLDN) for more than 25 years. Used with advanced lightning warning software and comprised of more than 100 remote, ground-based sensing stations located across the country, the system detects the electromagnetic signals given off when lightning strikes the Earth's surface. Information on the location, time, polarity, and amplitude of each strike is processed and then communicated to users, with more than 95% of all CG lightning flashes detected and a median CG stroke location accuracy of 250m or better.

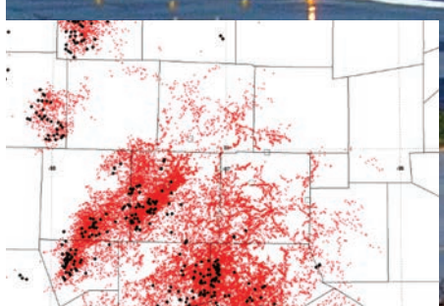
Worldwide protection

Airports outside the USA can have the same protection with the Global Lightning Dataset GLD360. GLD360 was built on the success of the NLDN and, when combined with the company's lightning warning software, provides uniform, high-quality lightning warnings around the globe. It additionally provides civil aviation authorities and pilots with the information they need to avoid turbulence caused by strong thunderstorm updrafts and improves the detection of explosive volcanic ash clouds.

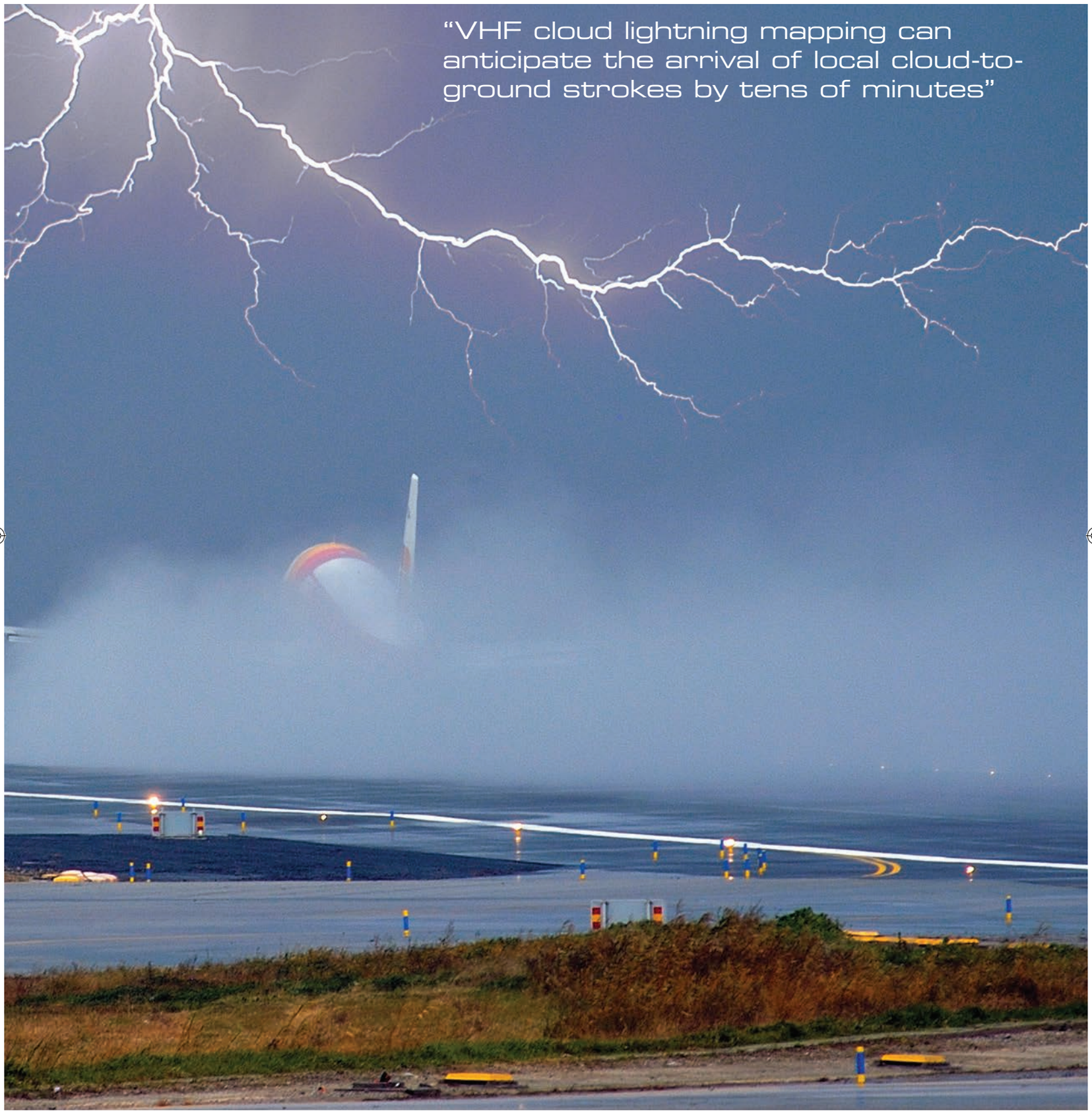
The sensors detect lightning up to 9,000km from their location due to their sensitivity and breakthroughs in sensor software algorithms developed by Stanford University. Each GLD360 sensor provides both direction and time-of-arrival information. Scientific studies have shown that lightning networks using a combination

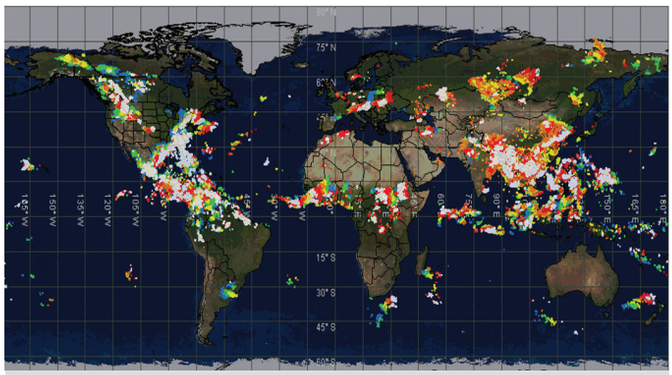


Cloud lightning flash detected in the Dallas-Fort Worth area of Texas, USA. The blue dots show VHF cloud lightning mapping and the red dots show VLF/LF cloud lightning detection. The total length of this cloud flash as shown by VHF cloud lightning mapping is 50km

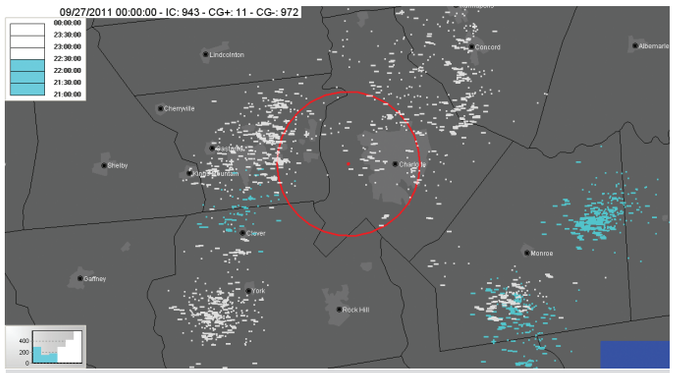


Map of VHF total lightning mapping in red and VLF/LF cloud pulses in black in north Texas for a 15-minute period. Note the large area of anvil lightning reaching northward from the center of the storm on the south side of the map


"VHF cloud lightning mapping can anticipate the arrival of local cloud-to-ground strokes by tens of minutes"



TWX300 image showing more than two million lightning events reported by GLD360 across the globe on June 23, 2011. Colors show age of lightning events on June 23rd in four-hour intervals with shades of blue representing data from 00:00-04:00 UTC and shades of white representing data from 20:00 UTC June 23rd to 00:00 UTC June 24th



TWX300 map showing a lightning warning for Charlotte Douglas Airport, North Carolina, on September 27, 2011. Lightning color-coded by time, with white shades representing data from 22:30 UTC September 27th to 00:00 September 28th and light blue shades representing data from 21:00 to 22:30 September 27th. The red circle shows a warning issued when lightning was observed within 16km of the airport

of direction and time-of-arrival sensor information provide significant detection efficiency and redundancy improvements over lightning networks using time-of-arrival sensor information alone.

Long-range severe weather detection has traditionally been limited by data gaps, leading to situations where people have late or no warnings. GLD360 is the only severe weather data set that has no data gaps and provides uniform, global coverage. Data delivered includes CG stroke and cloud lightning information – and it can be delivered to the customer in real time.

Consistent standard checks

The company continuously evaluates how well GLD360 performs as an airport LWS against the NLDN in the Continental USA. The results are consistently close to the high quality standard set by the NLDN, meaning accurate, real-time airport lightning warnings can now be issued for any airport anywhere in the world, improving safety for airport ground-crew personnel.

To ensure GLD360 provides the high level of network performance necessary to enable accurate airport lightning warnings, validation studies have been performed in North America and Europe, and are now ongoing in South America. The results of these studies show that GLD360 has a CG flash detection efficiency of 70% or greater and a median CG stroke location accuracy of 2-5km in all three regions.

To make a full airport LWS, GLD360 data is paired with Vaisala's thunderstorm warning system software – TWX300. TWX300 displays a real-time GLD360 datastream and supports customers in configuring and issuing CG lightning warnings for improved decision making.

Improving cloud lightning detection

More than a decade of lightning research conducted at universities, meteorological organizations, and Vaisala, has shown that anywhere with cloud lightning overhead is at risk for CG lightning.

The research found that very high frequency (VHF) cloud lightning mapping information would further improve CG lightning warnings at airports. The latest VHF/LF (low frequency) precision network sensor is the TLS200, which focuses on providing this high-performance cloud and CG lightning detection.

VHF cloud lightning mapping is the only way to truly identify all areas at risk for CG lightning because it shows the actual spatial extent – or branching – of cloud lightning within thunderstorm cores, as well as anvils (typically seen ahead of an approaching thunderstorm), and stratiform rain regions (typically seen behind a thunderstorm that has just moved overhead). Cloud lightning detected at very low frequency (VLF), LF, and high frequency (HF) are typically within the same area as most CG lightning strokes – for example, in thunderstorm cores – and therefore provide little to no additional improvements to lightning warnings issued using traditional CG lightning detection.

As a thunderstorm approaches, 70% to 90% of the time, VHF cloud lightning mapping provides tens of minutes of lead time before the first CG strokes reach the airport. In an informal study of 29 thunderstorms at Tucson International Airport between 2007 and 2008, cloud lightning events provided approximately 20 minutes (mean 25; median 19) of lead time before the first CG lightning affected the airport. Comparatively, the same study showed that VLF/LF cloud lightning data from the NLDN gave no lead time (mean two minutes late; median zero minutes).

A small number of thunderstorms (10% to 30%) develop above the airport being protected. Cloud lightning typically precedes CG lightning in about 70% of all thunderstorms, and the time difference between the first cloud stroke and the first CG stroke is usually just a few minutes.

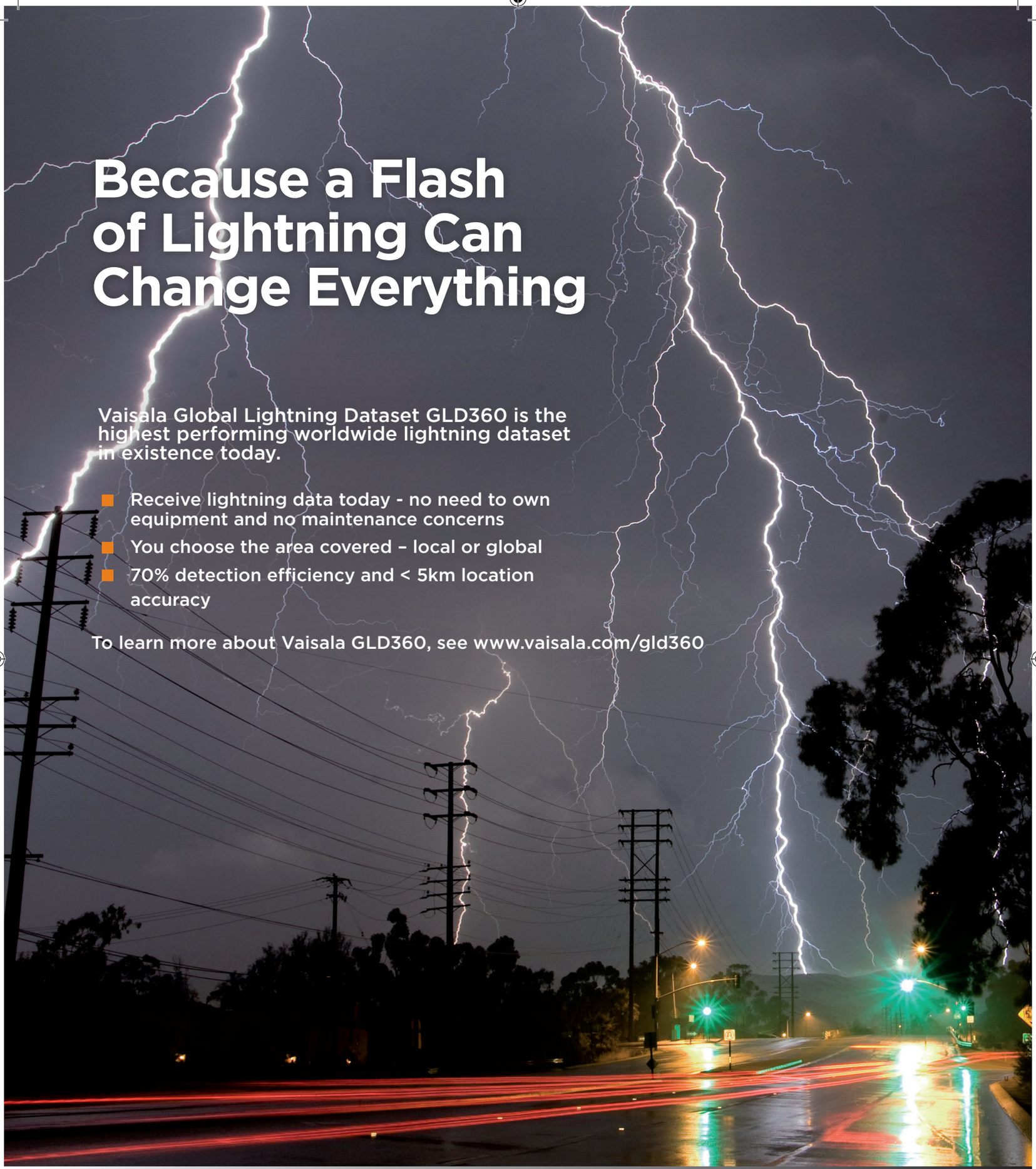
This is a much shorter lead time than for a moving thunderstorm approaching an airport, where VHF cloud lightning mapping can anticipate the arrival of local CG strokes by tens of minutes. When a thunderstorm develops directly over a fixed asset, the cloud flash detection efficiency of 90% or above maximizes lead time during thunderstorm growth. In contrast, traditional VLF/LF/HF cloud lightning detection networks detect approximately 50% of all cloud lightning flashes, and therefore miss cloud flashes that could maximize lead time before the first CG strokes in overhead developing storms.

Reduced monitoring area

The improved CG warning provided by TLS200 has improved safety for airport ground personnel, beyond using NLDN or GLD360 alone. In addition, since VHF cloud lightning mapping information will arrive at an airport before CG lightning information, the customer can accurately reduce the radius of the warning monitoring area around the airport. This reduced monitoring area provides improved operational efficiency through lower false alarm rates.

These significant advances in lightning detection will help airports to provide more accurate warnings and improve their situational awareness. Most important of all, improved ground crew safety and airport operational efficiency is now possible worldwide. ▮

Nicholas Demetriades is offering portfolio manager within the airports market segment at Vaisala



Because a Flash of Lightning Can Change Everything

Vaisala Global Lightning Dataset GLD360 is the highest performing worldwide lightning dataset in existence today.

- Receive lightning data today - no need to own equipment and no maintenance concerns
- You choose the area covered – local or global
- 70% detection efficiency and < 5km location accuracy

To learn more about Vaisala GLD360, see www.vaisala.com/gld360

www.vaisala.com

Tel. +358 9 89491 sales@vaisala.com

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