The new Vaisala LLWAS, MIDAS IV LLWAS, is a ground-based low level wind shear alert system that provides visual and audio alerts on wind shear and microburst conditions for air traffic controllers and other airport personnel. To generate wind shear alerts and warnings the LLWAS constantly retrieves wind data from an array of wind sensors along the runway. As well as wind speed and wind direction sensors along the airport’s approach and departure paths, the Vaisala LLWAS comprises one or two central data unit computers, and one or several workstations. The system typically includes different work-

New MIDAS IV LLWAS System for the Early Detection of Hazardous Conditions

The new Midas IV LLWAS Low Level Wind shear Alert System offers early detection of wind shear hazards and enhances the safety of airport operations. It represents a new approach by utilizing the same system architecture as the Automated Weather Observing System (AWOS). This ground-based system incorporates the latest version of the phase III wind shear algorithm developed for the U.S. Federal Aviation Administration (FAA) by NCAR.
The MIDAS LLWAS provides information to aviation authorities that improves aviation safety, allowing for the improvement of landing minima and all-weather traffic density.

stations for air traffic controllers, observers, forecasters and maintenance personnel.

The wind sensors of the LLWAS are carefully positioned and aligned in accordance with the system design guidelines of MIT, Lincoln Laboratories, and the NCAR (National Center for Atmospheric Research). Wind sensor suites include a Vaisala 500 series Wind Transmitter and, typically, a Vaisala Ultra-sonic Wind Sensor. The wind sensors and wind transmitter are installed on a tower the height of which is selected according to local topography constraints. At a one-runway airport the system typically has 8 wind sensors; a two-runway airport is usually equipped with 12 sensors, depending on the runway configuration.

Wind data from the sensors is retrieved via a direct wire connection or radio link. The central data unit (CDU) processes the wind speed and direction data using the LLWAS III algorithm. The CDU then transmits the wind shear data to the workstation displays. Wind shear and microburst alerts are provided when the data generated by the system exceeds the airport-specific threshold values for possible wind shear conditions.

Airport-specific configuration

In order to meet local requirements, the MIDAS IV LLWAS is always configured separately for each airport. A site survey is recommended for optimal wind sensor placement. During system configuration Vaisala personnel define the system parameters and the layout of some application windows.

Integrated or stand-alone system

As well as being offered as an integrated part of the MIDAS IV AWOS, the MIDAS IV LLWAS is also available as a stand-alone wind shear detection system for airfields. A stand-alone MIDAS IV LLWAS can be upgraded to a full-scale AWOS System. Moreover, the LLWAS can be integrated with TDWR (Terminal Doppler Weather Radar) systems to offer the best wind shear detection capability. The MIDAS IV LLWAS can output data to a radar system.

Proven system architecture

The MIDAS IV LLWAS utilizes the same application platform as the Vaisala MIDAS IV AWOS, which has been on the market for five years and been proven in operational use at airports all over the world. Moreover, it represents the third generation of Vaisala LLWAS. The MIDAS IV LLWAS uses the same graphical user interface, data acquisition and inter-process communication subsystems as the MIDAS IV AWOS. The MIDAS IV LLWAS can be integrated into a MIDAS IV AWOS, and, like the AWOS, it can run as a duplicat-ed system with hot stand-by redundancy.

Principle of LLWAS algorithm operation

Low level wind shear and microburst conditions are assessed by processing wind data collected from an array or network of wind sensors. Wind data is analyzed in accordance with a wind shear algorithm, licensed from NCAR, to determine whether there is wind divergence in the network. Wind divergence decreases aircraft headwind, the converse situation, wind convergence, increases aircraft headwind. The intensity, location, and type of shear are calculated. The output is specific to every aircraft operation and runway heading.

Wind shear and microburst conditions exist when the headwind change estimated by the system exceeds the airport-specific threshold values for wind shear.
possible wind shear conditions. The data is based on horizontal wind speed and wind direction measurements. Wind shear and microburst alerts are generated when wind shear conditions exist.

**High-quality information processing, storage and playback**

Both visual and audible wind shear alerts are produced during a wind shear event so that they can be easily identified by operators. Any combination and number of displays can be used to present the wind shear data in the air traffic control environment.

When wind shifts occur, transient aircraft can be already positioned in flight and on the ground to avoid unnecessary movement. Controllers can change approach patterns and taxi routes in advance to prevent or shorten delays in arrivals or departures.

The LLWAS provides the following information to help manage flight operations during wind shear conditions:

- timely detection of wind shear at the airport and in runway corridors
- timely identification of microburst wind shear
- head wind loss or gain associated with wind shear
- estimation of the location where wind shear will be first encountered

The processed wind shear information is archived as raw data and calculated alerts and warnings. Data is stored on the main computer’s hard disk from where it can be transferred to other media for permanent storage or analysis. The system has a playback function which allows for the feeding of wind sensor data back to the LLWAS. This way the system output and response can be reviewed.

The MIDAS IV LLWAS offers the probability of detection (POD) of microburst in excess of .90 (90 %) and the probability of false alert (PFA) of less than .10 (10 %).