M-LLWAS

Low Level Windshear Alert System

The robust and reliable LLWAS solution.

MTECH Systems

© MTECH Systems Pty Ltd 2014
Product: MLLWAS R.2.4

M-LLWAS Features

- Range of communications options
- Ultrasonic or conventional Sensors
- Dual server redundancy
- Graphical Map displays
- Solar power option for sensor Sites
- Frangible, Fixed and Tilt Mast options
- Proven reliability in lightning prone areas

MTECH Systems MLLWAS sensor station.

Available Algorithms

- FAA Phase III Algorithm
- MTECH Algorithm

Description

Wind shear and microburst can be a severe hazard to aircraft operations in the terminal area. MTECH Systems is one of the pioneers of Digital Wind Sensor networks for Wind Shear detection at Airports. From the first MTECH installation of a network of 6 Digital Wind sensors at Sydney Airport in 1987, research has been carried out by the University of NSW and that network of sensors is still in operation 24/7/365 after 21 years at one of the world's busiest airports. Multiple wind sensor networks were subsequently installed in all other major Australian airports utilising the MTECH Wind shear detection and alarm software. Total operation of MTECH Digital wind sensors is now in excess of 2.5 million hours. The service interval of the MTECH sensors offered for most LLWAS systems is 6-7 years.

FAA and NCAR have developed a version of LLWAS software for a network of wind sensor stations around an airport, to give wind shear warnings for ATC and pilots and today the Phase III LLWAS has become the standard in wind shear warning systems worldwide.

System Configuration

The MLLWAS system comprises the following elements:

- Wind Sensors and Masts
- Wind Data Telemetry Units with Data Communications device
- Central Data communications devices,
- Dual Servers with MTECH front end software
- Wind Data processing modules
- Display Systems

© MTECH Systems Pty Ltd 2014

Wind Shear Description

There are 2 main types of wind shear effecting operations at low level in the terminal area:

1. Horizontal Wind Shear

Horizontal Wind shear refers to the variation of wind over either horizontal or vertical distances. Pilots generally regard significant windshear to be a horizontal change in airspeed of 30 knots for light aircraft, and near 45 knots for airliners. Horizontal wind shear can be associated with passage of fronts, low level jet streams or caused by rotors on the leeward side of mountains.

2. Microburst

A Microburst is defined as a downburst affecting an area 4 km in diameter or less. Microbursts are recognized as capable of generating wind speeds higher than 75 m/s (168 mph; 270 km/h). Microbursts create surface winds radiating from a central point, superimposed on the general wind field.

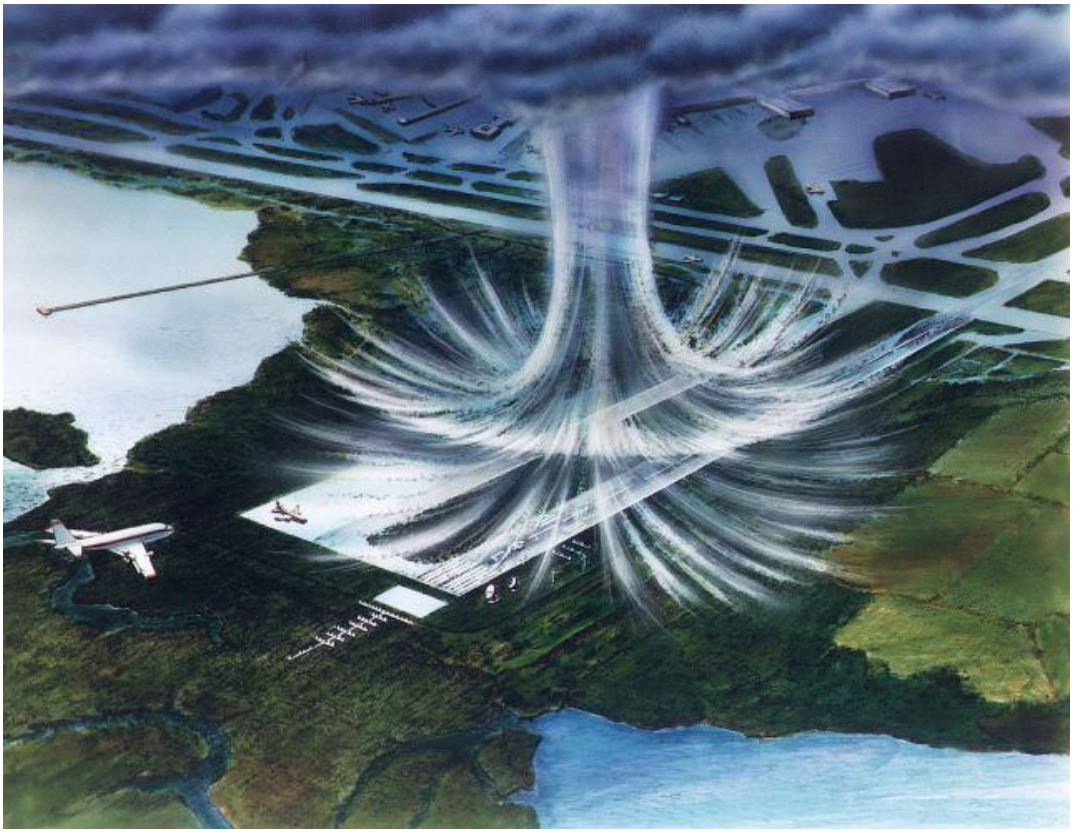


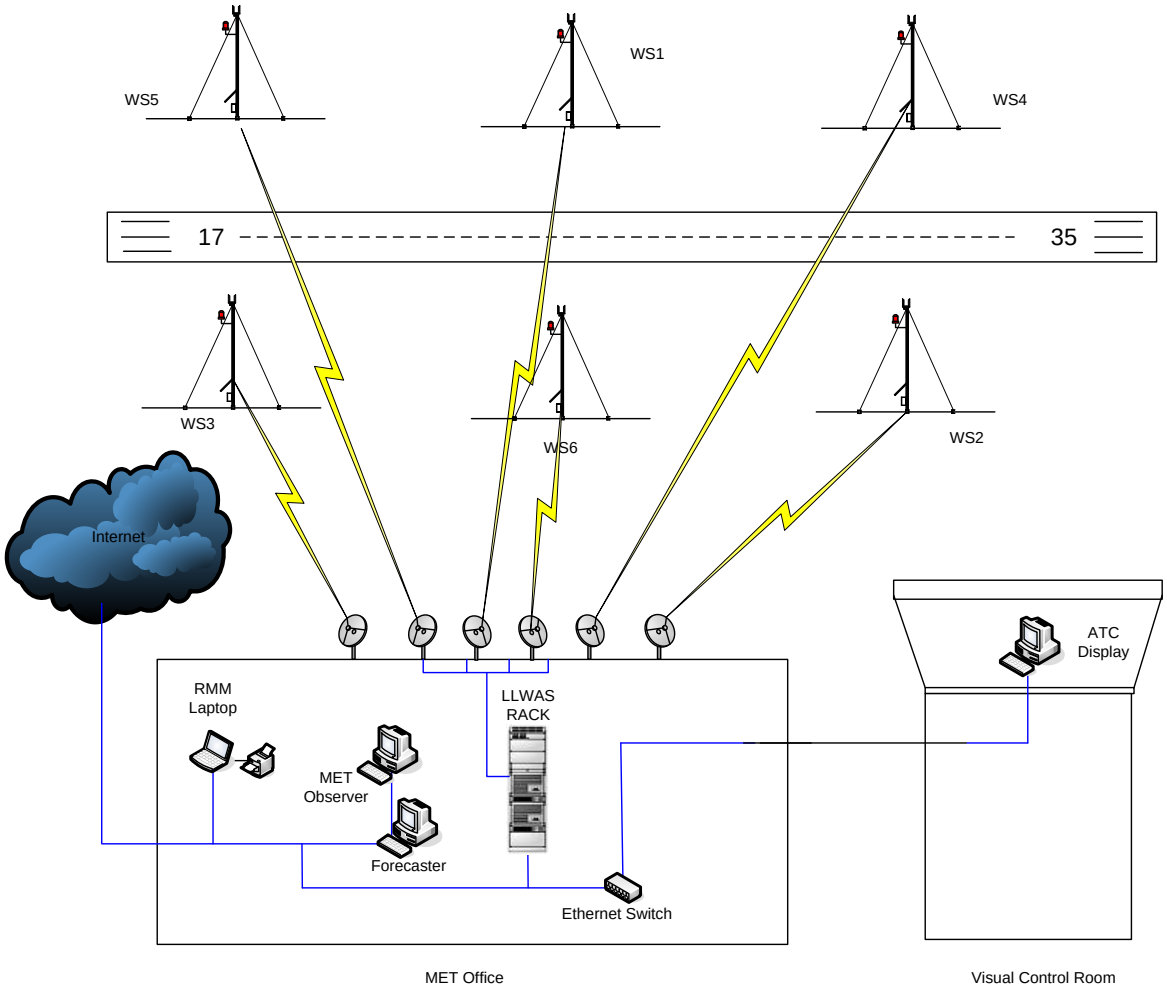
Illustration of Microburst Courtesy: NASA

A microburst is a particular threat to aircraft, as it occurs suddenly and can be so intense as to cause loss of lift when the aircraft has no margin of altitude to recover from a stall. This is the WSA alarm case which is most important. To pick up the wind shear close to the ground, in an LLWAS system a network of sensors is set up around the airport with fibre, wired or microwave communications links and processing equipment at a central site

© MTECH Systems Pty Ltd 2014

Sensor Network

The sensor network comprises from 6 to 36 sensors located around the airport, in a grid spaced 600-1000 metres, but not more than 1500 metres from the runway centre-line. The towers may be up to 50 metres high, with antennas, sensors and lights fitted as required. It is preferred that the sensors cover the approach and departure zones, which may necessitate more than the minimum of 6 sensors



Typical Sensor Network, Communications and Processing System Block Diagram:

The MTECH Wind Shear Algorithm

The MTECH sensor stations report wind speed and direction at 10 second intervals.

The Surface Weather Server software [SWS Software] implements ICAO SARPS which recommend computation of the following time averages:

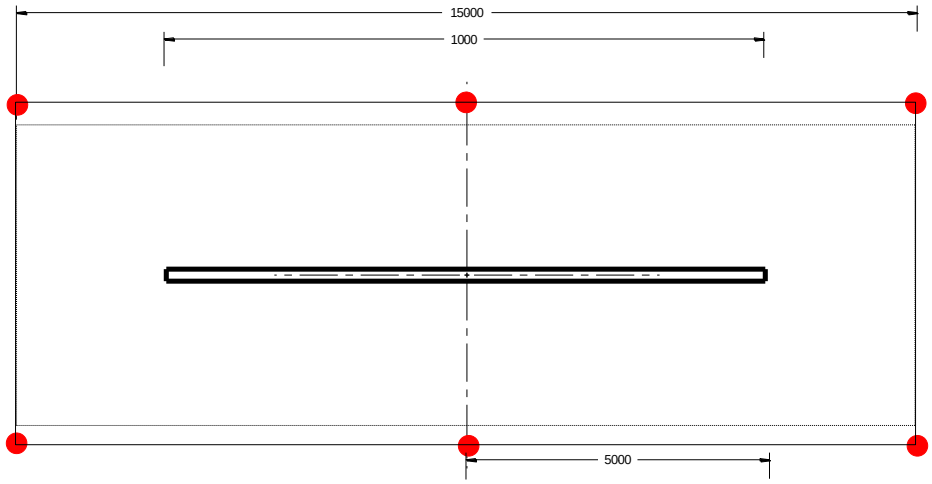
- A 3 second average of wind samples for each sensor site. [INSTANTANEOUS]
- A 2 minute average of wind samples for each sensor site [MEAN]
- A Gust reading determined from a ten minute array of wind samples. [PEAK]

© MTECH Systems Pty Ltd 2014

Wind Shear Alarms

A range of alarm conditions can be detected by the SWS Software and the user can set the thresholds for the alarms. These alarms include comparisons between MEAN and PEAK wind speed and directions and between the MEAN and INSTANTANEOUS speed and directions.

This provides a limited indication of wind shear conditions. All alarms can be disabled below a user set level, this is normally set at 10 Knots. Below this winds are usually reported as Light and variable.



Example site layout in accordance with FAA siting Guidelines.

Phase III Algorithm

The FAA algorithm is the Phase III software which processes LLWAS wind measurements to detect wind shear and prepares information for runway specific alphanumeric messages for microburst and wind shear alerts. The algorithm is controlled by parameters in the configuration file.

The steps in the algorithm are:

1. Data Collection and normalising
2. Statistical Analysis
3. Analysis of divergence
4. Alert processing

The result is the detection of a loss or gain of wind speed along the runway alignment within the protected zones

© MTECH Systems Pty Ltd 2014

Data Base Interaction

Data is gathered into an SQL database for analysis by the MITAS Surface Weather Server, before this algorithm is called. The results are stored in the SQL database and MITAS Wind Shear Display software displays the Wind Shear alerts graphically on the airport map or text only display.

Sensor Stations

The network of digital anemometers installed by MTECH Systems at Sydney international uses cup and vane sensors. Today MTECH recommends use of ultrasonic sensors for high reliability. The sensor stations will require ICAO compliant obstruction lights and connection to mains power or MTECH can provide solar arrays of adequate capacity to supply LED based obstruction lights.

Displays & Alarms

The Text based alarms are shown on the graphics display, with circular icons showing the Sensor Stations super-imposed on the airport map. The text alarms are shown in the panel on the right of the screen. The WINDSHEAR indicator turns red and an alarm sounds if a wind shear is detected. The MICROBURST indicator turns red and an alarm sounds if a microburst is detected. An example map display is shown below.

This display also shows the operational status of the sensor stations, the servers and databases.
A BITE test can be done at any time, a full BITE test is done when the program is first started.

© MTECH Systems Pty Ltd 2014

AWOS Interaction

When M-LLWAS is integrated with the opti-Met, AWOS Wind Shear alarms can easily be added into the METAR/SPECI generation and ATIS application, giving a high degree of integrity to the reporting of wind shear to pilots**.**

Project Management

The key to successful deployment of an LLWAS system is the correct layout design, which requires a site survey and well considered positioning of sensors. Fortunately, the FAA has deployed many such systems and has published comprehensive guidelines for design of the sensor network. MTECH Systems follows the siting guidelines in FAA Ref 6560.21A very closely. Accordingly a site survey is always done after contract award to finalise positions and numbers of sensors and heights of towers.

For best reliability and performance under all conditions, maximum flexibility MTECH recommends a fibre network for communications, and while fibre is absolutely the preferred medium for new airports, of course a mixture of microwave and fibre links is possible.

Support

System software factory support can be arranged by an internet connection using a secure link. This is in addition to MTECH's high quality online email and telephone support. Site visits and maintenance contracts are also available should you require them.

Specifications

Specifications	Description
Wind Sensors	911-UWS Ultrasonic Wind Sensor High Precision
	911-UWSP Ultrasonic Wind Sensor , Standard Precision
Telemetry Unit	MITAS RTU
Communications Packages	100-CP
	150-CP
	200-CP
	300-CP
Server Computers	IBM or HP servers with MITAS SWS front end and wind shear module
Display Devices	PPC153T Touchscreen Display
Display Software	MITAS LLWAS module

MTECH Systems Pty Ltd
15 Kevlar Close, Braeside, Victoria, Australia, 3195
Ph: +61 3 9551 5053
Email: sales@mtechsystems.com
http://www.mtechsystems.com

© MTECH Systems Pty Ltd 2014