

IMS4 LLWAS

Low Level Windshear Alert System

Low level windshear poses a significant threat to airport operations. It disrupts traffic patterns and air traffic control processes. The danger of a sudden loss of altitude during landing and take-off can cause a serious accident. It is important to avoid situations that endanger the safety of the aircraft and its passengers.

Using the technology to increase the safety

MULTI-TECH SOLUTION FOR AIRCRAFT SAFETY

Turnkey solution

MicroStep-MIS offers a turnkey solution delivery designed to customers' needs from technology consultation, site survey, and engineering to lifetime support.

Combination of technologies

The system overcomes individual technological limitations and combines measurements from anemometers with radar and lidar warnings, resulting in a single alarm system.

Integration

IMS4 LLWAS can be integrated with 3rd party stations and systems at any level, which benefits the ATC personnel with more comprehensive, relevant, and highly useful data.

Long-term development

The system benefits from the long-term development of Integrated Monitoring System, a software application platform installed and operated in more than 80 countries worldwide.



LLWAS SCHEME WITH 16 WIND STATIONS INSTALLED ALONG THE RUNWAY



FEATURES



UCAR Phase-3 LLWAS algorithm compliance



Anemometers, lidar, Doppler radar or combination of technologies



Turn-key delivery from site survey and engineering to lifetime support



Standalone system or integrated within AWOS / AWDSS



Low Level Windshear Alert System is a considerably approaching technology mightily decreasing the riskiness of crucial flight phases of take-off and landing. The low level windshears with a gain or a loss and microbursts have become a highly considered threat for CAT III international airport hubs as well as non-CAT local airfields. All of these factors are targeted by the automatic, durable, and reliable MicroStep-MIS LLWAS system.



Microburst scenario - effects of low level windshear on aircraft performance.

Field measurement system

Depending on the airport location and local conditions, the low level windshear alert system is built using one or more of the following technologies:

- Network of anemometers (8 as a minimum, 12 to 16 in most cases)
- Doppler lidar
- Doppler weather radar

As the windshear phenomenon requires unique sensor configuration across different airports, the selection of proper anemometer sites is a crucial issue for the site surveying teams. Therefore, MicroStep-MIS performs the probability of detection (POD) calculations to provide turnkey solution proposals designed to fit customers' needs, requirements, and expectations.

Combination of technologies

The combination of anemometers with remote sensing lidar/ radar makes it possible to detect the windshear situation in wet (radar) as well as dry (lidar) conditions, at all levels (radar/ lidar), depending on the combination used it benefits from:

- the high temporal resolution of the anemometer based LLWAS
- storm cells identification and tracking/nowcasting by Doppler radar
- and helps to overcome the limits of the single sensor systems:
- · inability to monitor the high altitudes by anemometers
- · attenuation of the lidar ray of light in wet conditions
- · impossibility to detect dry windshears by Doppler radar



One of the wind stations installed along the runway of Soekarno-Hatta International Airport, Indonesia (ICAO: WIII, IATA: CGK)





Doppler lidar

IMS4 application software platform

IMS4 LLWAS benefits from the long term development of the IMS4 application software:

- Built-in web and application server an authorized user has access to all data, statistics, and full functionality from any computer on the LAN/WAN/internet/VPN
- Situational awareness display zoomable map-based display with real-time or historical sensor data and products
- Configuration wizards web-based interface to the configuration data stored as XML files or database records. Station/sensor/variable metadata, communication settings, maintenance activities – all is easily configurable using menus, drop-down lists or standard textboxes



Doppler weather radar

• Security - the built-in security mechanisms provide userconfigurable tools for limiting user access to particular system modules, stations, or channels according to the permissions related to user names, user roles, or IP addresses of remote users.

IMS4 LLWAS server

Standard COTS server or a dual hot failover cluster, the IMS4 LLWAS server collects measurements, performs the validations and recalculations, runs the algorithm to detect the windshear, generates the alerts, and distributes data and alerts to displays and 3rd party systems.



IMS4 LLWAS Total Screen - airport visualization (map, actual warnings, wind data





IMS4 LLWAS ATC Display generating FAA alerts and ICAO WS warnings

LLWAS displays

The displays of MicroStep-MIS LLWAS are optimized to provide an optimal ergonomic view of all relevant alerts and data and to provide all necessary functionality in a convenient way.

Integration with other systems

The aeronautical ground facilities (LLWAS, AWOS, ATIS, etc.) interact together to provide crucial information to pilots. MicroStep-MIS can provide a turnkey solution consisting of all necessary subsystems.

Being a system integrator, MicroStep-MIS subsystems can also interact with the 3rd party stations or systems at various levels. System integration brings benefits to the service personnel with more comprehensive, relevant, and highly useful data. It reduces the data complexity and human workload in the ATC environment allowing the airport team to significantly decrease the risk of a sudden disaster.

	ARRIVAL	LZIB	R	WY 13	15:50 (лтс												
S	ARRIVAL ALERT	13A WSA -23KT 3MF																
<u>a</u>	LiDAR Head / Tail Wind [kt]		 ◄ H12 			< H13		-	H15			0		► T8			► T5	
	LiDAR Windshear Headwind Gain/Loss [kt]																	
ii	LIDAR Microburst Headwind Gain/Loss [kt]																	
			5NM 1600 R	>>> 5N	IF >>>	4NM 1280 R	>>> 4MF	>>>	3NM 960 ft	>>> 3MF	>>> 2	NM >>	> 2MF >	>> 1NM 320 ft	>>>	1MF >>>	RWY TOZ	RW
-1	DWR Head / Tail Wind [kt]		< H11						H16			0		► T7			► T5	
511	DWR Windshear Headwind Gain/Loss [kt]																	
2775	DWR Microburst Headwind Gain/Loss [kt]																	
opo	Anemometer LLWAS Gain/Loss [kt]																	
	DEPARTURE	LZIB	R	WY 13														
2	DEPARTURE ALERT	NO WS DEPARTURE ALERT																
QD	LiDAR Head / Tail Wind [kt]		► T5			► T6		Þ	т5			15	1	► T7			► T5	
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<u>la di seconda di seco</u>	LiDAR Microburst Headwind Gain/Loss [kt]																	
		RWY	RWY END	>>> 1N		1NM 320 m	>>> 2MD	>>>	29JM 640 ft	>>> 3MD	>>> 3	NM ≻>	> 4MD >	> 4NM 1280 T		5MD >>>	600M 1600 π	
-1	DWR Head / Tail Wind [kt]																	
511-	DWR Windshear Headwind Gain/Loss [kt]	0																
TTT	DWR Microburst Headwind Gain/Loss [kt]	1																
010	Anemometer LLWAS Gain/Loss [kt]			+	2		-4			+1			+2			-1		
	WIND PROFILER	R TEMPERATURE INVERSION ALERT																
l	TEMPERATURE INVERSION ALERT	+3.8 DEGREES BETWEEN 700 AND 1100 FT																
NB7	Wind profiler [ft]	0	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600
1	Temperature [°C]	14,3	14,2	14,1	14	13,9	13,9	13,7	13,5	14,2	14,8	16,8	17,3	17,2	17,2	16,9	16,8	16,7
-	Head/Tail Wind [kt]	► T5	► T6	► T6	► T5	► T5	► T5	► T6	► T5	► T5	► T6	► T5	► T5	► T5	► T5	► T6	► T5	► T6
	WIND PROFILER WINDSHEAR ALERT	NO V	NS AL	ERT														

Lidar / radar / RWP / LLWAS integration - single alarm system as a result of combination approach



Type approval

 Civil Aviation Authority of the Slovak Republic certified IMS4 LLWAS and Radar Studio software products to be used in civil aviation as an air traffic management equipment

Compliance with standards

- NCAR LLWAS Phase-3 algorithm (U. S. Patent 5,221,924, etc.)
- ICAO Annex 3 and 10 for Data Processing and Reporting Practices
- ICAO Annex 14 Aerodrome Design and Operations

- ICAO Doc 8896 for Aeronautical Meteorological Practices
- ICAO Doc 9817 Manual on Low Level Wind Shear
- ISO 9001: 2015 for quality assurance

System requirements

- Standard server or a dual hot-failover cluster
- Linux or Microsoft Windows 10 / Server 2016 operating system
- Mozilla Firefox / Google Chrome compatible browser supported



Installation of lidar at Yogyakarta International Airport, Indonesia (IATA: YIA, ICAO: WAHI)



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