



# VAISALA

## AviMet<sup>®</sup> Windshear Alert System

Increase situational awareness  
and decrease risk

# Windshear

## An invisible threat at any airport

Windshear is a persistent risk because it takes place at a height, and under flying conditions, when aircraft are most vulnerable. In landing or takeoff configurations, these aircraft — especially large commercial airliners — might be unable to recover from the drastic disruptions to their flight paths caused by windshear.

As a result, windshear puts lives at risk and can lead to crippling financial damages. It remains one of the most dangerous — and difficult to assess — weather phenomena in aviation.

Fortunately, recent advances in detection and alert systems have allowed airports to reliably perceive windshear dangers, alert the appropriate personnel, and take action before accidents happen.

### A problem of physics

Windshear is a powerful change in wind speed and/or direction that can drastically affect aircraft in flight. The most dangerous windshear is referred to as a microburst (the vertical element is known as a downburst). A microburst is an

intense, localized downdraft that spreads radially on the ground.

Both the strength and spreading pattern of these winds can create unseen dangers. As shown in Figure 1, downdrafts create aerodynamic and piloting problems that have resulted in serious accidents.

The performance limitations of commercial aircraft mean that windshear usually cannot be mitigated by pilots, regardless of their skill or experience. The only solution, as recommended by International Civil Aviation Organization (ICAO), is the anticipation and avoidance of windshear events.

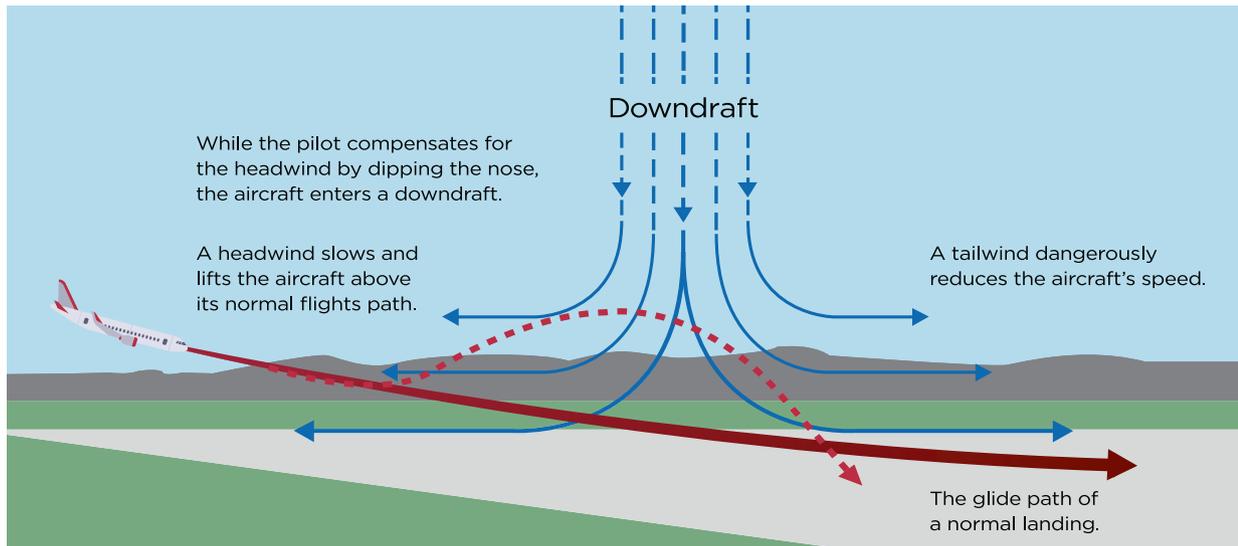


FIGURE 1: Effects of downbursts on flight path

### Regulatory context: ICAO provisions, Annex 3

The ICAO stipulates that windshear warnings at airports “shall give concise information on the observed or expected existence of windshear,” but airports have struggled to develop comprehensive warning systems using available weather technologies. There is still a need for weather information that is more complete, accounts for airport-specific factors and needs, and offers insights and alerts to users more effectively.

### Operational problems associated with windshear

- Increased risk of incidents and loss of life
- Loss of safety and efficiency due to increased workloads, rerouting, and pattern adjustments
- Financial risk and impact

# What's needed

## A single, reliable windshear alert system

Although powerful windshear detection technologies for safe take-offs and landings have been developed and maturing since the early 2000s, the challenge is that every airport is unique in both topography and weather conditions.

An ideal windshear detection system leverages several different detection methods, which work across a range of local weather conditions, altitudes, and windshear types. It should also be designed in close cooperation with the

customer, taking into account the airport's unique conditions and needs.

Importantly, the best solutions must consolidate the detection methods used in a coherent and easy-to-use way, merging them into a dependable system that achieves the best possible Probability Of Detection (POD) and False Alarm Rate (FAR) by accounting for an airport's specific geographies, risks, weather patterns, and needs.



# AviMet®

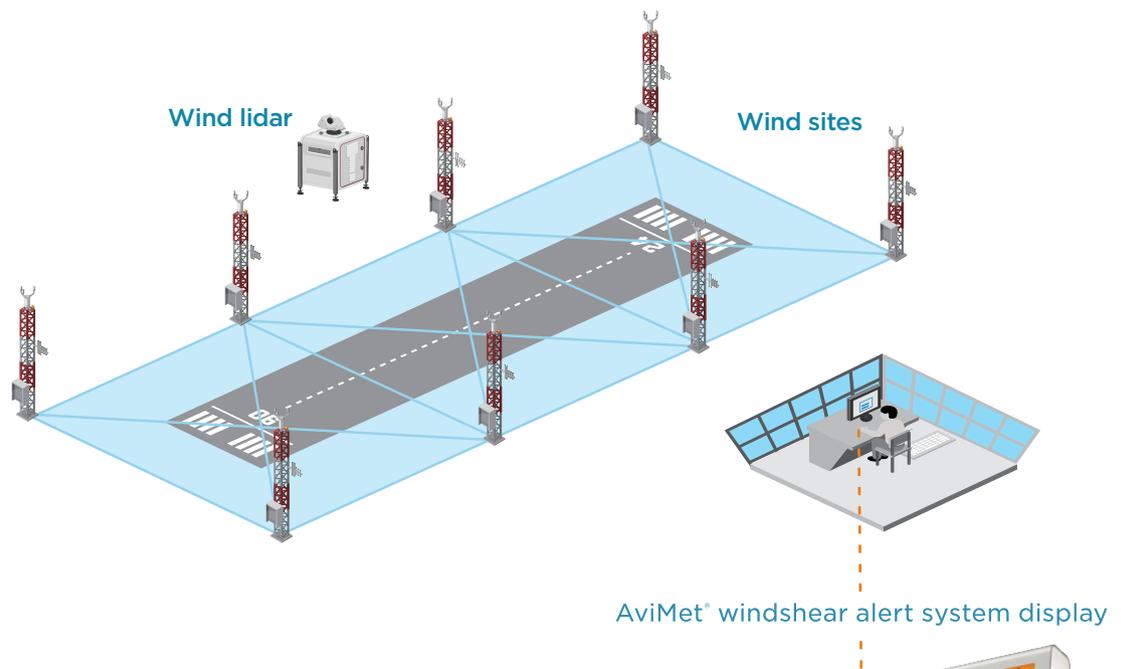
## A complete, integrated solution

The Vaisala AviMet® Windshear Alert System is a scalable, end-to-end solution suitable for any airport in the world, whatever its traffic or unique conditions. Vaisala experts determine the optimal combination of the three best detection technologies, resulting in a solution that provides users with the fullest and most dependable windshear awareness available:

- Anemometer-based Low Level Windshear Alert System (LLWAS)
- X-band Weather Radar
- Wind Lidar

### Key benefits

- Integrates the three primary windshear detection methods, or any combination thereof, into one system
- Offers excellent reliability and flexibility for different regions, making it the ideal solution for high-risk environments
- Can be scaled and customized for any airport or site, supported by expert pre-analysis
- Driven by Vaisala's philosophy of building the right solutions for each end user
- Combines the best qualities of the different technologies into a unified, cost-efficient solution with predictable life-cycle costs



Through intuitive dashboards and a variety of alert types, Vaisala AviMet® Windshear Alert System enables pilots, air traffic controllers, meteorological observers and forecasters, and other airport personnel to make better decisions based on real-time data, not guesses.

The tool also provides situational awareness well beyond the immediate airport area. Vaisala's powerful remote sensing systems can be used concurrently for other types of severe weather detection, wind studies, and safeguarding of runway and ramp operations.



## The importance of site analysis

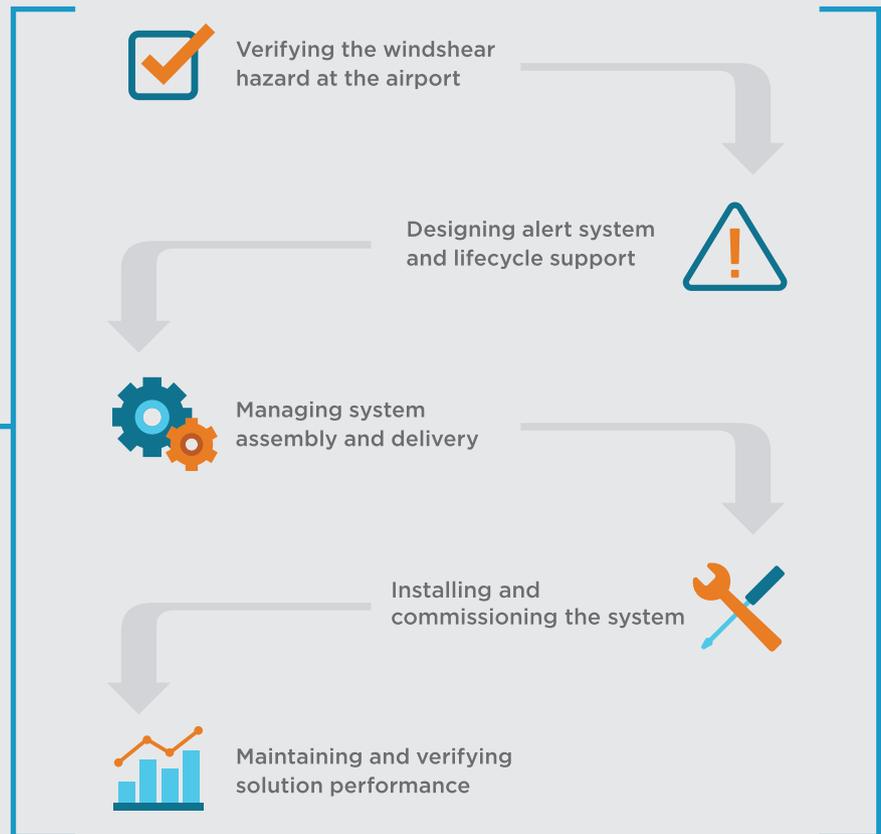
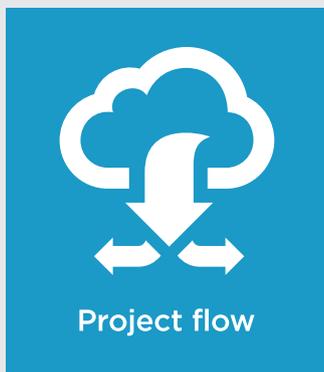
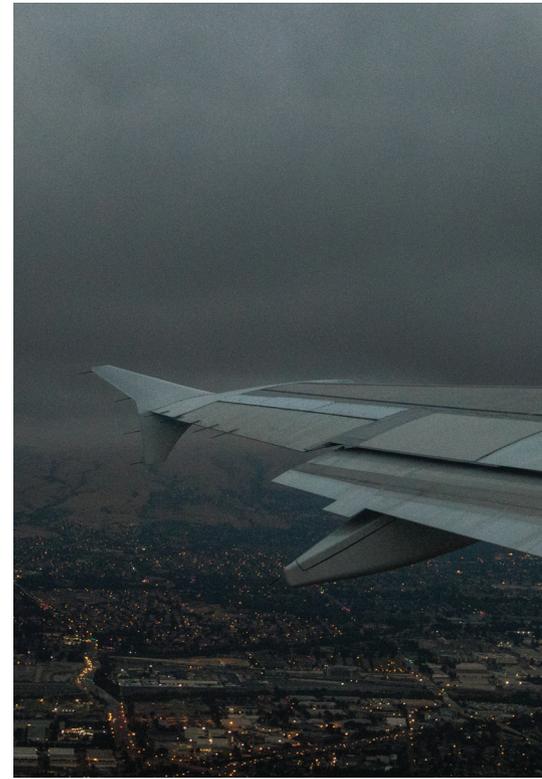
Any windshear warning system's deployment must begin with an expert pre-analysis, since airports and their associated weather risks vary. No two situations are alike, and "one size fits all" solutions are often inadequate.

Vaisala uses industry experts to conduct rigorous site visits and analyses before any equipment is installed. These visits ensure that any solution is built right the first time, and that its capabilities match an airport's situation, with the right technologies deployed for proper windshear alerting.

## The value of consolidation

Because Vaisala AviMet® Windshear Alert System consolidates available windshear detection methods into one unique integrated tool — designed, manufactured, and supported by one company — it provides peace of mind for years to come.

Vaisala's long track record and full project and lifecycle management ensure excellent uptime, fast problem resolutions, and added safety for aircrews, passengers, airports, and surrounding communities.



# The technology

The Vaisala AviMet® Windshear Alert System merges any combination of the best detection technologies into one versatile, reliable system. With it, windshear information can be displayed either as text or graphically, and alerts are presented visually and audibly as one integrated, user-friendly alarm to the end user.

Here's a look at its key components.



## Anemometer-based Low Level Windshear Alert System (LLWAS)

The Vaisala LLWAS is the most widely used ground-based system, incorporating the latest version of the windshear algorithm developed for the U.S. Federal Aviation Administration (FAA) and patented by the University Corporation for Atmospheric Research Foundation (UCAR). It consists of an array of ultrasonic wind sensors installed around an airport's runway(s) and approach corridors.

### Benefits

- A cost-effective solution with real-time windshear detection capability in all kinds of weather conditions
- The most proven and reliable windshear algorithm to estimate the effects of the windshear on aircraft



# The technology (cont.)

## X-band weather radar



Small in size and lower in cost, Vaisala X-band weather radar is the ideal instrument to enhance weather detection both in and around an airport. With multiple scanning pattern choices, it can be configured to the exact needs of any airport and provides a better understanding of storm movement and wind field to enable earlier and more accurate warnings.

### Benefits

- Excellent accuracy, sensitivity, data quality, and availability enabled by solid-state radar transmitters
- Low lifecycle costs: no use of consumables, simple site selection, automatic and continuous calibration, easy installation and integration into existing networks
- Advanced warnings of a broad range of approaching weather phenomena, including windshear, hail, freezing rain, and thunderstorms.

## Wind Lidar

The WindCube® Lidar operates on principles similar to weather radars but uses infrared light for its measurements. This technology offers wide remote measurement and multiple scanning pattern choices configurable to meet specific airport needs.

The WindCube® Lidar measures wind speed through the backscatter signal received from small particles in the atmosphere. Therefore, performance is best under clear air conditions and light rain conditions.

### Benefits

- A cost-effective solution with high-resolution windshear detection capability
- A compact, robust, and unattended system ideally suited for airport environments
- 3D wind awareness at the airport and its surroundings, and increased understanding of the wind and turbulence conditions posing a threat to aviation operations



The Vaisala AviMet® Windshear Alert System and all of its key components offer a turnkey, automated solution that pushes unified alerts and notifications to air traffic controllers, observers, and forecasters when they need them most.



# VAISALA

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## **Vaisala's record of success and dependability**

- More than 1,000 Vaisala AviMet® systems delivered
- 45 years of aviation weather experience
- More than 30 windshear solutions developed
- More than 500 weather radars using Vaisala weather radar technology
- More than 1,000 deployments of Windcube® lidars worldwide

## **Vaisala AviMet® Windshear Alert System: Scalable, consolidated, end-to-end windshear detection**

The best technologies for windshear detection are now available to any airport. The Vaisala AviMet® Windshear Alert System provides the capability, affordability, and efficiency that today's airports need to stay safe and efficient — under even the most drastic weather conditions.

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