Michigan Aerospace | AeroForecast


KNOW BEFORE YOU GO.

Wind shear, clear air turbulence, and wind veer events may not sound threatening, unless your launch vehicle or aircraft is flying through them.

# Introducing the AeroForecast™ LIDAR Product Line

The world's most advanced Light Detection and Ranging (LIDAR) system that measures wind speed, direction, temperature, density, water vapor, and other properties simultaneously to give you the most accurate picture of the atmosphere – before you fly into it.

## Airborne

Our optical air data system technology provides a full air data solution for any aircraft platform. Based on our patented Ultraviolet (UV) LIDAR technology, we can make measurements in clear air without dropouts.

Ask about our integrated, single-aperture solutions for air data, clear air turbulence, ice prediction and detection, volcanic ash detection, water vapor, and molecular mass fractions.


## Ground

Our AeroForecast ground-based LIDAR provides real-time, range-resolved continuous measurements of wind speed, direction, density, temperature, water vapor, and mass fractions, day and night, upwards of 50km in altitude. As with our airborne systems, measurements can be made in completely clear air. Competing LIDAR technologies can only guarantee measurements where there are aerosols, often not much higher than the boundary layer.

Atmospheric Intelligence™: where safety, performance, and mission capability converge.


Courtesy of NASA Armstrong Photography

# AeroForecast Airborne
# Technical Specifications

# Michigan Aerospace airborne LIDAR technology

## Features that make our technology unique in the world of air data systems:

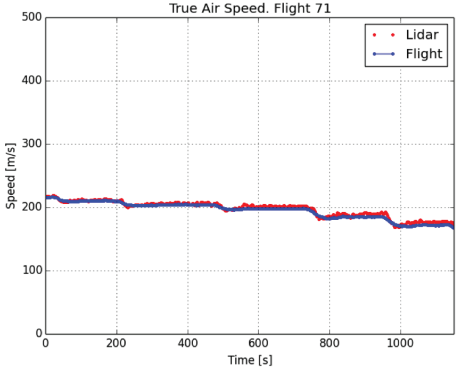
- ability to measure wind speed, direction, temperature, and density simultaneously
- operation in truly clear air through measurement of molecular scattering (60,000ft+)
- no moving parts
- a flush mounted design
- no calibration to the airframe (self calibrating with every measurement)
- definable measurement volume to avoid downwash or turbulent flow regions
- range determination via geometric and time-of-flight methods
- high-speed update rates (80Hz capable) with no scanning
- built-in redundancy with multiple lines of sight
- suitable for high-dynamic and high-altitude aircraft environments
- no sensitivity to steep angles of attack
- no limitation on minimum or maximum speed
- rotorcraft capable (able to measure at zero speed; no limitations on forward/backward motion, can avoid downwash)
- compact packaging with fiber optically coupled components (flexibility in mounting)

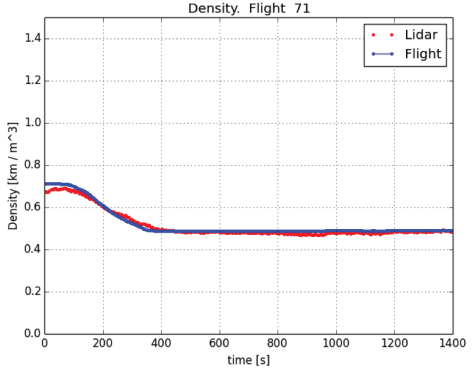
# AeroForecast Airborne Optical Air Data System Capability

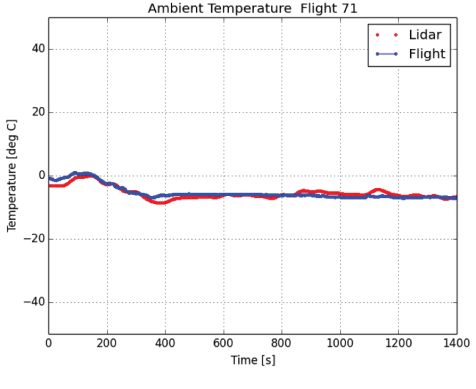
Our Molecular Optical Air Data technology has recently been flight tested on commercial aircraft (Boeing 757), light aircraft (Beechcraft King Air), various NASA test aircraft (ER-2, P-3 Orion), and NASA's Global Hawk UAV. A long-range profiling version of our system will soon be flight tested on a C-130.

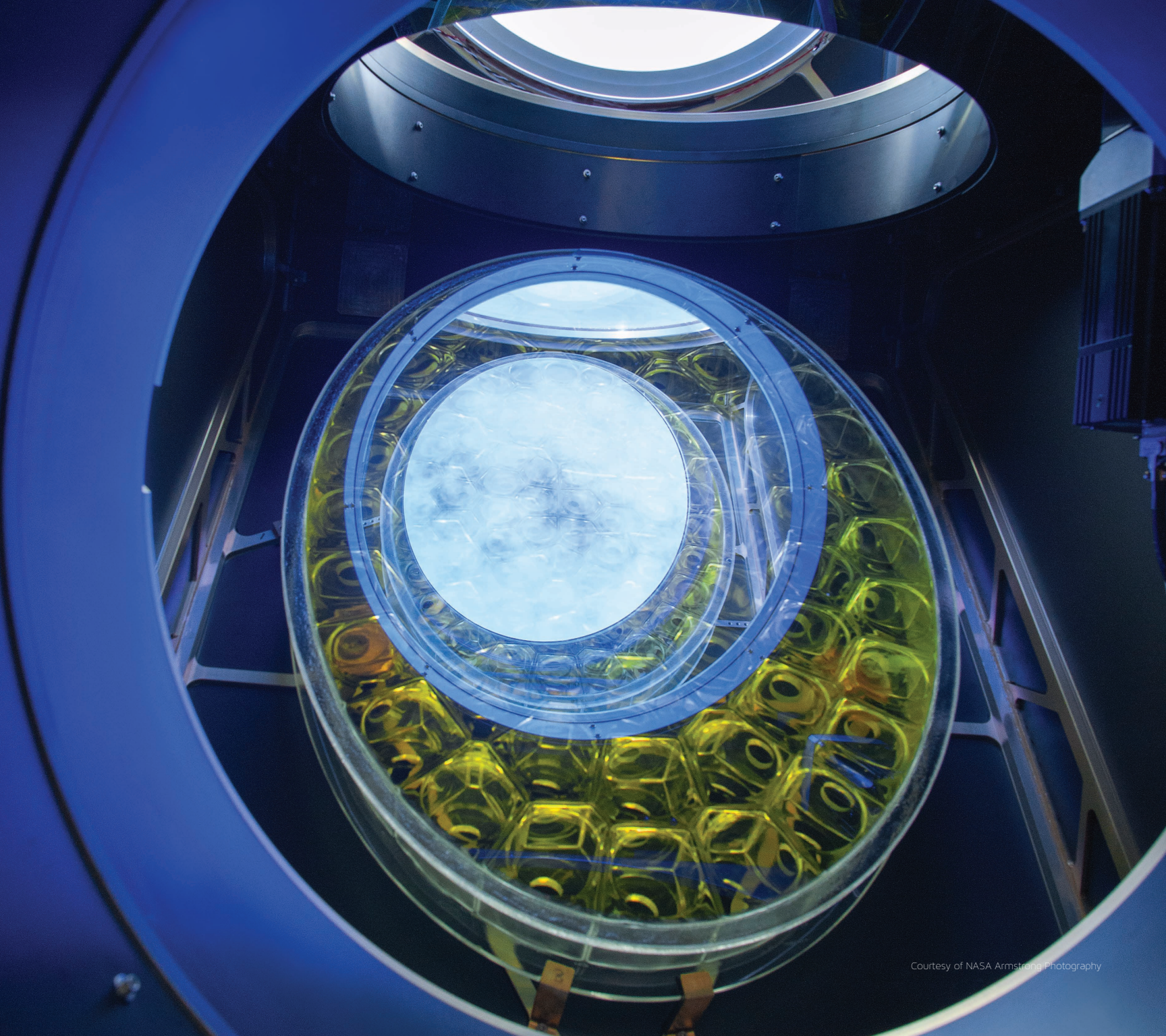
We directly measure velocity, true airspeed, vertical airspeed, angle of attack, angle of sideslip, static density, static temperature, and aerosol to total scattering ratio.

From these data products, we calculate: calibrated airspeed, Mach number, static pressure, total pressure, dynamic pressure, pressure altitude, air density ratio, total temperature, pressure differential, and angle of sideslip pressure differential.



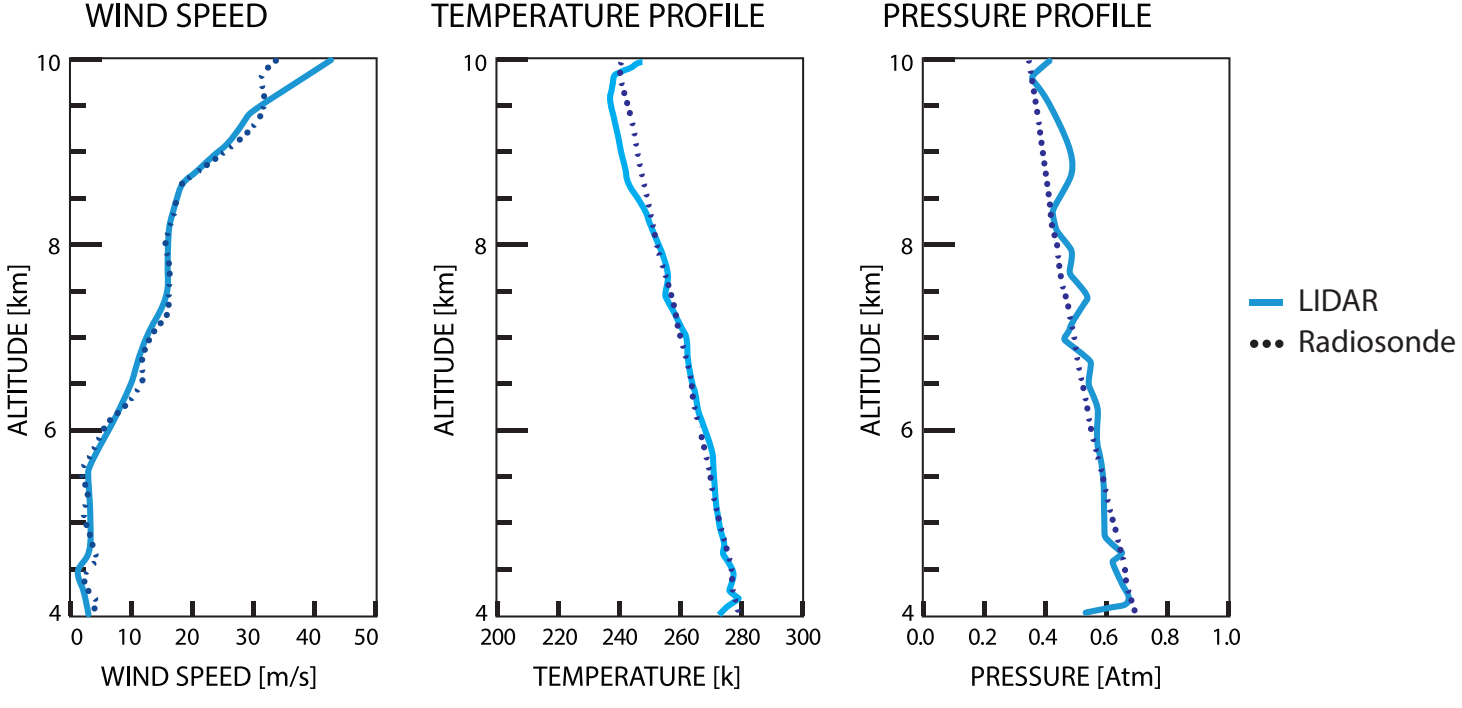


Courtesy of NASA Armstrong Photography

# AeroForecast Ground LIDAR
# Technical Specifications

# Michigan Aerospace ground based, transportable LIDAR technology

Our AeroForecast technology allows for the recording of wind measurements at the highest altitude (50 km+), of any ground-based LIDAR. Beginning with ground stations in New Hampshire and on Mauna Loa, Hawaii, we are now delivering fully autonomous, transportable solutions that have operated in tropical and desert extremes. Simultaneous measurement of wind speed, direction, density, temperature, water vapor and mass fractions provide unprecedented data availability for critical atmospheric measurements. We are the only company on the planet to provide these measurements from space, airborne and ground assets. AeroForecast technology is customizable and scalable to meet your exact data collection needs, whether for short range or long.



# AeroForecast Ground LIDAR Baseline Specifications

| Atmospheric LIDAR System Parameter | Specification |
|---|---|
| Wavelength (outgoing laser) | 355nm |
| Optical output power | 10W |
| Receive aperture | 16” |
| Range | 0 - 20km (0 - 65,000ft) – higher altitudes possible |
| Range resolution | 500m – 1km |
| Integration time/measurement update | 10 seconds to 10 min |
| Scanning (line of sight measurement) | 0 - 360° azimuth / 0 - 90° elevation |
| Data products (Baseline) | Wind speed and wind direction |
| Data products (Option) | Wind speed and wind direction, density, temperature, $O_2$ mass fraction & humidity |
| Wind speed accuracy * | 0.5 – 2.0 m/s |
| Density * | 0.1 – 0.2% |
| Temperature * | 0.5-2.5K |

* Adjustable based on aperture, integration time, range bin size and laser power

# AeroForecast Ground LIDAR Environmental Specifications

| External environment | Parameter | Specification |
|---|---|---|
| | Continuous operating temperature | -30°C to 50°C |
| | Survival/storage temperature | -40°C to 85°C |
| | Humidity | 0-100% RH |
| | Vibration | Designed to survive shipping/transport |
| | Pressure Environment | Sea level to 12,000ft |
| | Solid & Liquid Penetration | The outer enclosure and/or any external features shall comply with IP66 |

| Internal environment | Parameter | Specification |
|---|---|---|
| | Continuous operating temperature | 10°C to 30°C |
| | Survival/storage temperature | -40°C to 85°C |
| | Humidity | 0-93% RH (@30°C) |
| | Vibration | Designed to survive shipping/transport |
| | Pressure Environment | Sea level to 12,000ft |
| | Solid & Liquid Penetration | The outer enclosure and/or any external features shall comply with IP51 |

# AeroForecast Ground LIDAR Interface Specifications

| | Parameter | Specification |
|---|---|---|
| External interface | Weight | ~13,000lbs (mostly driven by ISO container) |
| | Size | 20’ x 8’ x 8’ standard ISO shipping container<br>(Other sizes available) |
| | Mechanical interface | Container will be placed on level ground (additional supports may be used for strong wind loading support) |
| | Power | 150A (max) @ 220V (Diesel generator is an option) |
| | Communication | Ethernet<br>(Other methods available) |

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