Air Data Boom

Measuring all relevant parameters during flight or other mobile applications.

- Flexible head geometry with integrated TAT probe
- One-piece, robust design
- Compatible with the VectoDAQ Air Data computer

Multi-hole Probe	
Geometry	Straight
Number of holes	5 plus static ring
Max. length	< 280 mm (one part) >280 mm multipart designs
Min. tip diameter	>=3 mm (>6mm with heater)
Tip geometry	Conical or spherical
Material	Stainless steel, Titanium, Inconel
Connections	Standard 1mm or 1,6mm pressure tubes
Fastening	Square, hexagonal, one-sided flattened cylinder, or custom
Reference	Reference surface normal to Z axis
Temperature range	Max. 800°C
Angular range	±60°
Angular accuracy	< ±1°
Velocity range	3 m/s to supersonic speeds (depends on calibration)
Velocity accuracy	< ±1 m/s
Optional	Heater 40W for anti-icing

Figure 1 Air Data Boom Head

The Air Data Boom from Vectoflow has a 5-hole probe head capable of measuring e.g. the flow velocity, angle of attack and angle of sideslip in a range of up to ±60°. It is typically used on aircrafts and drones but also on cars and wind turbines.

Like all probes from Vectoflow, they are made by additive manufacturing, giving a high geometrical flexibility and a very high robustness at the same time. The probes are generally built out of one piece, with no internal tubing or welding, avoiding any internal leakage and assuring a long lifetime.

Figure 2 Example for an extended 5-hole Air Data Boom

An extension can be added to the probe head in order to move the point of measurement as far away as possible from the vehicle, see Figure 2.

The probe head comprises further a total temperature head (TAT) equipped with a PT100 or a thermocouple as well as an optional heater for anti-icing.

In combination with the VectoDAQ Air Data Computer the Air Data Boom forms a highly capable measurement system for mobile applications, see Figure 3.

Figure 3 VectoDAQ Flight Pro

Measurement error

The measurement error of an Air Data Boom depends on the pressure scanner used for the calibration and data acquisition.

We recommend the use of the VectoDAQ Air Data Computer, designed to work with the Air Data Boom.

The lower the velocity, the higher becomes the impact of the pressure measurement error onto the determination of the flow velocity, as shown in Figure 4 (for a scanner accuracy of ± 0.05 % FS).

Generally, an error of 1 m/s or 1% of the measured velocity - whichever is higher - is expected at higher speeds. For lower speeds, the error depends on the pressure scanner and increases towards lower speeds.

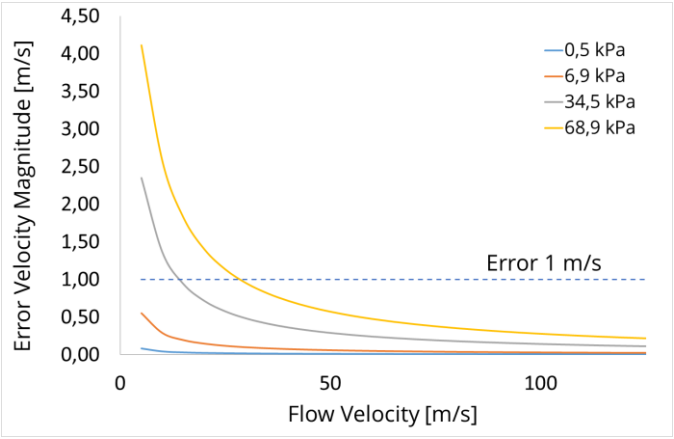

Figure 4 Dependency of velocity measurement error on pressure scanner range (0.05% FS accuracy)

Hence, it is recommended to use the lowest pressure measurement range possible or to use a VectoDAQ with a dual pressure range for each channel, assuring a good measurement uncertainty over a larger flow speed range.

Calibration process

The calibration process is always necessary for each manufactured Air Data Boom. Vectoflow has its own calibration wind tunnel, delivering flow speeds from 1 m/s up to Mach 1 (higher Mach numbers upon request). Vectoflow has a very rigid quality assurance, which ultimately leads to the highest possible measurement accuracy of the flow probes.

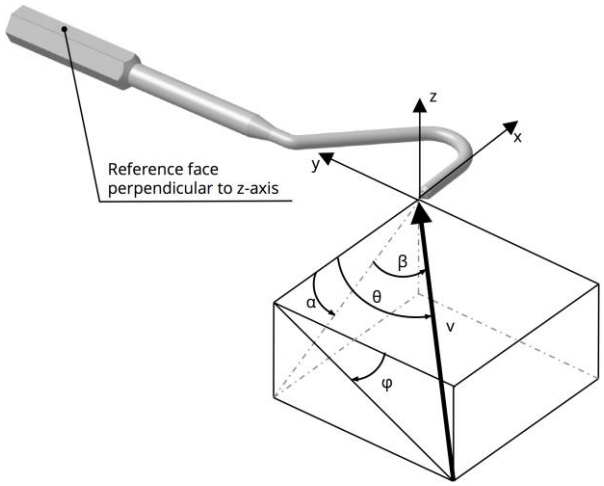

Figure 5 Flow angle definitions

During the calibration process, the probe is exposed to a steady flow with known conditions, while pitch and yaw angles change through thousands of positions. The definition of the flow angles is shown in Figure 5.

The following table shows the main characteristics of the Vectoflow calibration wind tunnel.

Calibration wind tunnel	
Angular range	±165° (yaw axis), 180° (roll axis)
Max. Power	90 kW
Velocity range	From 1 m/s to Mach 1
Control parameters	Mach number, velocity (m/s)
Long-term velocity stability	±0.25 % (at M 0.1)