First AIMMS-20AG AT-802F Installation on Forest Protection Limited Aircraft (Photograph courtesy FPL)

Local meteorological conditions (temperature, humidity, wind, and turbulence) that exist during an aerial application govern how spray will deposit and drift. Knowledge of these conditions allow an applicator to optimize spray deposition, minimize off-target drift, and document existing conditions to prove due-diligence was performed during the application. The AIMMS-20AG provides the advanced technology required to accurately measure and deliver these conditions in either real-time via on-board GPS navigation system integration or post-flight via data-log download. In addition, the AIMMS-20AG LVM (**L**oad and **V**ibration **M**onitor) functionality allows an operator to monitor airframe loading and vibration to help prevent onset of airframe service problems due to fatigue.

Advanced Technology for Airborne Wind Measurement

Accurate wind measurement on an airborne platform poses a challenging problem given the fact that the aircraft is moving many times faster than the wind being measured. As a result, the wind signal of interest is only a small portion of the measured air-motion data and it is dominated by the dynamic motion of the aircraft itself. To be confident of compliance with label wind speed regulations, precision wind measurement to an accuracy better than 1 knot is needed. This requires acquisition of true airspeed to better than 0.7 knots accuracy, flow direction (sideslip) to better than 0.1 degree accuracy, and true heading to better than 0.2 degree accuracy. The AIMMS-20AG is the only system currently on the market delivering this level of performance .

Modular by Design

The AIMMS-20AG system consists of three modules, each responsible for acquiring a particular set of airborne measurements. These modules are linked together via a high-speed, digital serial bus (**C**ontroller **A**rea **N**etwork) to a fourth central processing module responsible for evaluating the wind solution.

Air Data Probe (ADP): The ADP accurately measures the three-dimensional, aircraft-relative flow vector (true airspeed, angle-of-attack and sideslip), temperature, and relative humidity. The temperature and RH sensors are housed in a proprietary, reverse-flow chamber located in the aft section of the probe which protects them from particulate contamination thereby extending their service life. In addition, a three-axis accelerometer pack is incorporated into the module to facilitate direct turbulence measurement.

Inertial Measurement Unit (IMU): The AIMMS-20AG inertial module is a full six-degree of freedom IMU containing three rate gyros and three accelerometers. Angular rates and accelerations are broadcast 40 times a second in order to precisely track the dynamics of the aircraft attitude over the complete flight envelope.

GPS Module (GPS): The AIMMS-20AG utilizes a two antenna, dual GPS processor subsystem to determine aircraft attitude, specifically heading. A differential carrier-phase technique is applied to the signals originating from two wing-tip mounted GPS antennas that, when coupled with inertial information from the IMU, provides 0.1 degree heading accuracy (10 m antenna baseline). The GPS module also provides 3-D position and inertial velocity.

Central Processing Module (CPM): Utilizing a sophisticated Kalman Filter Digital Signal Processing Technique, the CPM module optimally combines the differential GPS carrier-phase data with the inertial data to determine accurate aircraft attitude. This in turn is combined with the raw air-motion data to precisely determine the wind solution to better than 0.5 m/s (1 knot) accuracy. The resulting meteorological data can be logged in the internal FLASH memory or transmitted in real-time to an on-board GPS navigation system. GPS navigation systems currently supporting the AIMMS-20AG include the ADAPCO Wingman, AgNav, Del Norte, and SATLOC M3 systems.

Monitor How Your Aircraft is Being Flown

The AIMMS-20AG **L**oad and **V**ibration **M**onitor provides a continuous log of airframe loading and vibration during flight using the accelerometers embedded within the IMU. This allows an operator to monitor g-loads to determine whether the airframe is being stressed beyond recommended limits. This provides an opportunity to alter flight procedures to minimize the degree of airframe loading thereby extending aircraft service life. In addition, increased vibration is a good indicator of a distinct change in the health of either the engine or airframe allowing for early detection of potential mechanical problems. IMU and LVM can be purchased separately.

Can You Afford to Fly Without It?

The AIMMS-20AG gives you the confidence of knowing you have applied your pesticide product properly by taking local meteorological conditions fully into account. Better applications mean less risk and better service to clients. Can you afford to afford to fly without it?

AIMMS-20AG Aircraft Integrated Meteorological Measurement System

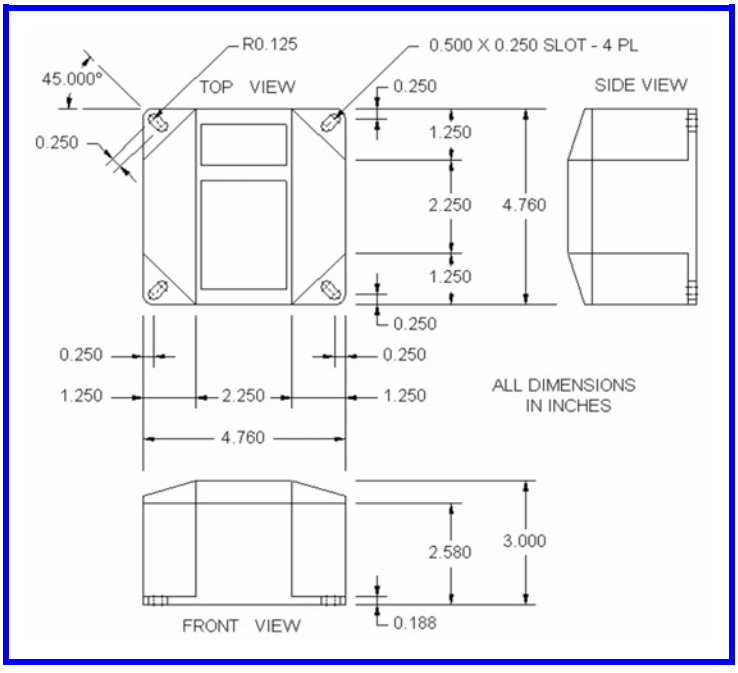
Features

- Wing-mounted Air Data Probe (ADP) for true airspeed, flow angle, temperature and humidity measurements (Other mounting options available)
- GPS measurement module for differential carrier-phase (aircraft attitude), 3-D position and velocity (WAAS DGPS and 5 Hz PVT solution options available)
- Inertial measurement module (IMU) provides precise heading data throughout the full flight envelope
- Real-time three-dimensional wind evaluated using advanced Kalman Filter Digital Signal Processing (DSP) technique
- Central Processing Module (CPM) for data logging and interfacing to on-board GPS navigation system. Supported by:

  ADAPCO Wingman
  AgNav
  Del Norte
  SATLOC M3

- Rugged construction with hermetically sealed sensor electronics for in-service reliability
- AIMMS-20AG system includes all sensor hardware, configuration software, power supply and cables

First AIMMS-20AG Installation on Forest Protection Limited Cessna 188



IMU, GPS and CPM Enclosure Physical Dimensions

Technical Specifications

Performance

AIMMS-20AG

Wind Speed Accuracy:

Horizontal North and East Components:	0.50 m/s (1.0 knot) @ 150 knot TAS
Vertical:	0.75 m/s (1.5 knot) @ 150 knot TAS

Temperature

Accuracy:	0.30 C
Resolution:	0.01 C

Relative Humidity

Accuracy:	2.0%RH
Resolution:	0.1%RH

Broadcast / Log Update Rate:	1 - 10 Hz
Log Capacity:	45000 Records (12.5 hours @ 1 Hz)

Load and Vibration Monitor (LVM):

Three-Axis (X,Y,Z) Acceleration:

Range:	+/- 7 g
Accuracy:	0.005 g

Internal Sampling Rate:	200 Hz
Digital Low Pass Frequency Range:	1 Hz - 40 Hz
Maximum Data Output Rate:	40 Hz

Electrical

Operating Voltage:	12.5 - 37 VDC Input
Max. Operating Current:	900 mA @ 12.5 VDC
Digital Interfaces:	Controller Area Network (CAN2A), 500 kbps RS-232 Serial Ports (default 19.2 kbps)

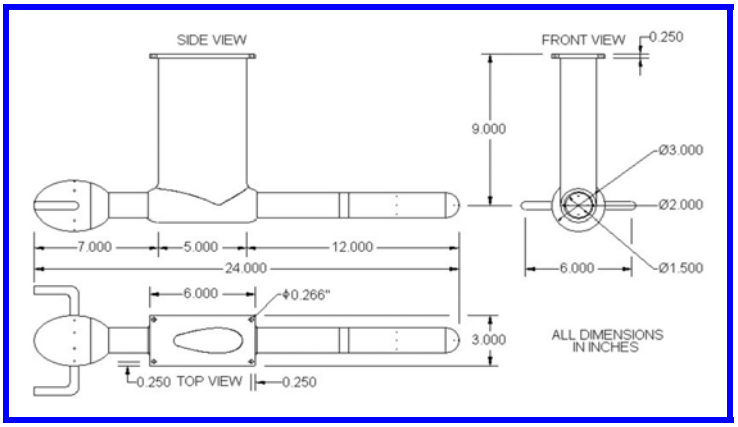
Environmental

Operating Temperature:	-20 C to 50 C -40 C to 50 C (available under special order)
Storage Temperature:	-40 C to 90 C

Physical

Weights:

Air Data Probe (ADP):	3.36 kg (7.38 lb)
Inertial Measurement Unit (IMU):	0.74 kg (1.63 lb)
GPS Module (GPS):	0.80 kg (1.76 lb)
Central Processing Module:	0.60 kg (1.32 lb)



Air Data Probe Physical Dimensions

Aventech Research Inc.

110 Anne Street South, Unit 23
Barrie, Ontario, Canada, L4N 2E3
Tel: (705) 722-4288
Toll: (800) 235-7766
Fax: (705) 722-9077
Web: http://www.aventech.com
Email: info@aventech.com