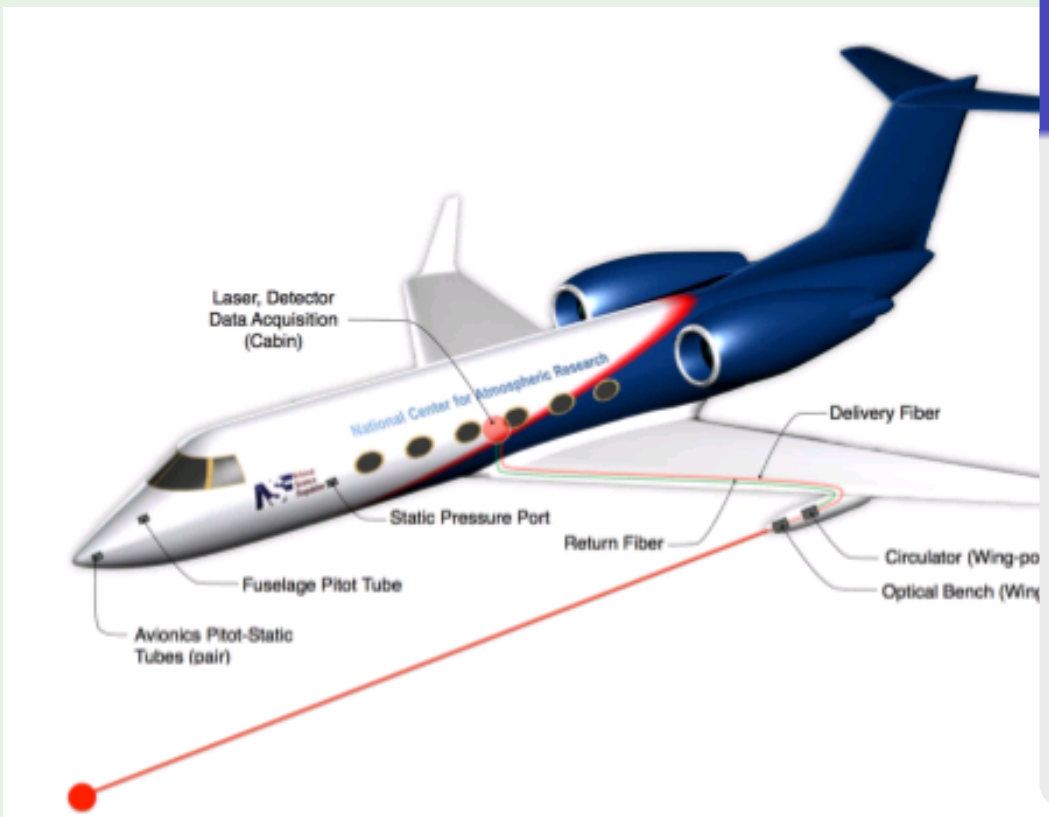
Calibrations Based On A Laser Air Motion Sensing System

Al Cooper

January 17 2012

THE LASER AIR MOTION SENSING SYSTEM



Current Single Beam System (being modified to three beams):

- Coherent Doppler measurement
- Remote sensing in undisturbed air
- An absolute measurement (accuracy$\lesssim$0.1 m/s)
- $V_{LAMS} \Rightarrow q$, dynamic pressure

Spuler, S. M., D. Richter, M. P. Spowart, and K. Rieken, 2011: Optical fiber-based laser remote sensor for airborne measurement of wind velocity and turbulence. Applied Optics, 50, 842-851.

CALIBRATIONS POSSIBLE WITH LAMS

Because LAMS Provides an Accurate Measurement of Airspeed:

1. Airspeed uncertainty: reduced from ≈ 0.5m/s to $\lesssim 0.1$ m/s
2. Pressure uncertainty: reduced from ≈ 1 mb to $\lesssim 0.15$ mb:
   (a) Uncertainty arises from effects of airflow at static ports;
   (b) Total pressure (dynamic + static) is measured accurately;
   (c) The dynamic pressure arising from airspeed is predicted accurately by LAMS; so
   (d) Pressure = (total-dynamic) pressure has reduced uncertainty
3. Temperature uncertainty: reduced from $> 1^{\circ}$C to about 0.3°C.
   (a) Accurate altitude from GPS is available;
   (b) With improved measurement of pressure, integration of the hydrostatic equation during climbs and descents produces a usable independent measurement of temperature;
   (c) Combining many such climbs and descents yields a new calibration of the temperature sensors.