



Large Amplitude Multi-Purpose (LAMP) Wind Tunnel Facility



Corporate Research Facility



The facility is used for research projects, preliminary configuration studies, measuring the data required for spin predictions, and for obtaining all the subsonic data required for full-envelope modeling of flight vehicle aerodynamics for use in high-fidelity engineering or training simulations.

Introduction

Bihrlle has developed a wholly-owned research center located in Germany incorporating a unique vertical wind tunnel and associated testing apparatus which became operational in 1991. The Large-Amplitude-Multi-Purpose (LAMP) Wind Tunnel was designed specifically to eliminate the undesirable cost and time constraints associated with assembling large aerodynamic data bases, in addition to providing experimental capabilities not available in other facilities. The testing apparatus was updated in 2007 with a completely new rotary balance rig (shown above) and forced-oscillation stings. Enhanced data acquisition and reduction software was also installed as part of this comprehensive update.

Using a single model, one can quickly acquire the aerodynamic data necessary for calculating all the full-scale subsonic vehicle motions realized in all flight regimes, including stall and post-stall flight. Force and moment as well as pressure data can be measured in static, body-axis oscillatory, and wind-axis rotational motions at all angles of attack, sideslip, oscillatory and rotational rates theoretically attainable by a vehicle.

Wind Tunnel Design

The LAMP facility consists of an open circuit, 78' high, low-speed vertical wind tunnel having a circular cross section. The tunnel is located within a building that also contains offices and test support facilities. It is powered by a six-bladed, 14-ft (4,3m) diameter fan, driven by a 350-hp electric motor, providing for a max speed of approximately 120 ft/s (36,6m/s). The wind tunnel has a 10-ft (3m) constant diameter, 12-ft (3,7m) long test section that utilizes a rotary balance apparatus to measure steady-state (both static and rotational) aerodynamic force and moment and/or pressure data.

Model installation and configuration modifications are conveniently performed in the area outside the tunnel section, since the entire rig, including the model, can be quickly moved in and out of the tunnel on a motorized traveling beam.

Testing Capabilities

A C-sector sting support system provides the capability for continuous angle-of-attack sweeps of 0 degrees to 90 degrees and the entire C-sector can be tilted for continuous sideslip angle sweeps to ± 30 degrees. By using alternate mountings, a full ± 180 degrees angle-of-attack and ± 90 degree sideslip range is possible. Oscillatory stings, capable of sinusoidal motions at selected amplitudes and frequencies, also attach to the test rig to measure pitch, roll, and yaw forced oscillation dynamic characteristics. The same angle-of-attack and sideslip ranges are available during steady rotation rates of up to 100 revolutions per minute in either direction. The range of $\Omega b/2V$ values are again obtained by adjusting rotational speed and/or tunnel air flow velocity. (Static aerodynamic forces and moments are obtained when $\Omega=0$.) In addition, forced oscillation tests can be performed with the rig rotating, for unique combined motion testing.



The LAMP facility is situated in Neuburg a.d. Donau, a medieval town on the Danube river, located in the State of Bavaria, Germany. The facility is within a 30-minute drive of the Munich International Airport.

LAMP Features

- Bihrlle-designed vertical wind tunnel facility
- Bihrlle-designed multi-axis rig
- Open circuit
- 10-ft (3m) closed test section
- Dynamic pressure 1 to 5 psf (48-240 pascal)
- Diverse test capability:
 - Static
 - Wind and body axis dynamic
 - Multi-axis dynamic
 - Simultaneous force, moment, and pressure data acquisition