Comprehensive Capabilities

Nowhere in the world are there as many aerospace ground testing facilities in one location as exist at the NASA Langley Research Center. We have the most complete suite of facilities; all specifically built to collect, analyze and interpret test data.

At Langley, we have conducted projects for NASA, industry, the Department of Defense, and academic partners within the research and development communities.

A One-Stop Setting

All types of vehicles, from subsonic through hypersonic, have been evaluated at Langley.

Our unique infrastructure is complemented by unmatched computational capabilities, including state-of-the art tools, access to world-renowned specialists and extensive code validation.

In addition, test article fabrication capabilities, advanced instrumentation, cutting-edge test techniques, a diverse, highly skilled and experienced workforce, and excellent data support are all available at Langley in a one-stop, ISO9001/AS9100C-certified setting … and we continually invest to maintain, upgrade, and modernize our facilities to keep pace with customer requirements.

Delivering Solutions to Complex Challenges

At Langley, we have a critical mass of subject-matter experts with internationally recognized core competencies in aero-sciences, acoustics, structures, and materials to identify and deliver solutions to your complex aerospace systems challenges.

At Langley, you can

Accomplish your design objectives · Realize your vision · Test in one location · Collect more data to support your decision making · Take the time to make sound design adjustments

Doing Business with Us

Our extensive aerospace expertise and unique ground testing capabilities will prove invaluable to your enterprise.

We offer what others can't. Infrastructure. Know-how. Experience. And most importantly: Success.

We're the most complete ground testing facility in the world. And we want to share with you the benefits of our decades of accomplishment. But don't just take our word for it. Work with us, and your results will speak for themselves. You won't be disappointed.

We're just a call (757-864-6885) or email (larc-dl-gftd@mail.nasa.gov) away.

Visit us on line at: http://gftd.larc.nasa.gov/ or come see us in person at the NASA Langley Research Center in Hampton, Virginia.

The solution to your aerospace challenges starts by contacting:

Chief Engineer for Test Operations Excellence
Ground Facilities and Testing Directorate (GFTD)
GFTD Main Office, Mail Stop 225
NASA Langley Research Center
Hampton, VA 23681

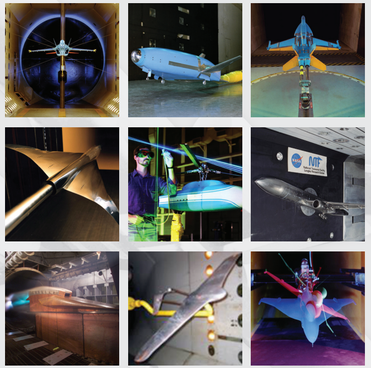
National Aeronautics and Space Administration
Langley Research Center
Hampton, VA 23681

NP-2011-03-345-LaRC

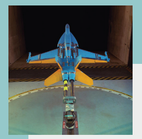
National Aeronautics and Space Administration

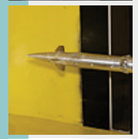
Wind Tunnel Testing Guide

at NASA Langley Research Center



www.nasa.gov





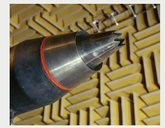
Facility Capabilities at a Glance

Facility		Speed	Reynolds Number	Test Section Size	Total Pressure	Total Temperature	Test Gas	Type	Sample Test Capabilities
SUBSONIC SPEED REGIME									
14- by 22-Foot Subsonic Tunnel (14 x 22)		Mach 0 to 0.3 (348 ft/s)	0 to 2.2 x 10^6 per ft	14.5'H x 21.75'W x 50'L	Atmospheric	Ambient	Air	Closed Circuit, open or closed test section	AC FF FO GE S&C HA P JET R SS
Low Speed Aeroacoustic Wind Tunnel (LSAWT)		Mach 0.10 to 0.32 (365 ft/s)	—	17' H X 17' X 34' L	Dual streams rated at 175 psi	Dual streams up to 2000°F	Air	Open Circuit, anechoic	AC PAAI
20-Foot Vertical Spin Tunnel (VST) (1)		0 to 90 ft/s	0 to 0.55 x 10^6 per ft	25'H x 20'W	Atmospheric	Ambient	Air	Closed-throat, annular return	FF FO S&C HA
TRANSONIC SPEED REGIME									
Transonic Dynamics Tunnel (TDT)	Air Mode: Heavy Gas Mode:	Mach 0 to 1.2 Mach 0 to 1.2	0.01 to 3.0 x 10^6 per ft 0.1 to 9.6 x 10^6 per ft	16'H x 16'W	0.5 psia to atmos	70° to 130°	Air R-134a	Closed Circuit	AWS AE FO S&C R SS
National Transonic Facility (NTF)	Air Mode: Cryogenic:	Mach 0.1 to 1.05 Mach 0.1 to 1.20	1.0 to 20 x 10^6 per ft 4.0 to 145 x 10^6 per ft	8.2' H x 8.2'W x 25'L	15 to 133 psia	90° to 130°F -250° to 0°F	Air Nitrogen	Closed Circuit	AWS S&C HA JET PT SS
0.3-Meter Transonic Cryogenic Tunnel (0.3-M TCT)	Air Mode: Cryogenic:	Mach 0.1 to 0.8 Mach 0.1 to 0.9	1 to 13 x 10^6 per ft 1 to 100x 10^6 per ft	13"H x 13"W Adaptive wall	14.7 to 65 psia 14.7 to 88 psia	120°F -280°F to 80°	Air Nitrogen	Closed Circuit	AF SS
SUPERSONIC SPEED REGIME									
20-Inch Supersonic Wind Tunnel (SWT)		Mach 1.6 to 5.0 (0.35 to 0.75 for airfoils)	0.05 to 20 x 10^6 per ft	20" H x 18" W	0.2 to 130 psia	75° to 200°F	Dry Air	Blow Down	AF AT SS
4-Foot Supersonic Unitary Plan Wind Tunnel (UPWT)	Test Section 1: Test Section 2:	Mach 1.5 to 2.9 Mach 2.3 to 4.6	0.5 to 11.4x 10^6 per ft 0.5 to 8.4x 10^6 per ft	4'H x 4'W x 7'L	0 to 10 atm	100° to 300°F	Dry Air	Closed Circuit	AT FO S&C HA JET PT SS
HYPERSONIC SPEED REGIME									
Langley Aerothermodynamics Laboratory (LAL)									
20-Inch Mach 6 CF4 Tunnel		Mach 6 (13-18 simulation)	0.05 to 0.75 x 10^6 per ft	20" diameter open jet	100 to 2000 psia	1100° to 1480°R	CF_4 (2)	Blow Down	AT JET RG
20-Inch Mach 6 Air Tunnel		Mach 6	0.5 to 8.0 x 10^6 per ft	20"H x 20.5"W	30 to 475 psia	760° to 940°R	Dry Air	Blow Down	AT JET
15-Inch Mach 6 High Temperature Air Tunnel		Mach 6	0.5 to 6.0 x 10^6 per ft	14.6" diameter open jet	50 to 450 psia	940° to 1260°R	Dry Air	Blow Down	AT JET
31-Inch Mach 10 Air Tunnel		Mach 10	0.5 to 2.2 x 10^6 per ft	31"H x 31"W	150 to 1450 psia	1850°R	Dry Air	Blow Down	AT JET
8-Foot High Temperature Tunnel (8-ft HTT)		Mach 3,5 Mach 4,5, and 7	—	54.5" dia. Mach 3,5 96" dia. Mach 4,5 & 7	50 to 4000 psia (3)	850° to 4000°R	Air (4)	Blow Down	AT P
SUPERSONIC COMBUSTION RAMJET TEST COMPLEX									
Combustion-Heated Scramjet Test Facility		Mach 3.5 to 6 *	1.0 to 6.8 x 10^6 per ft	13.26'H x 13.26'W	50 to 500 psia	1300° to 3000°R	Hydrogen/Air (5)	Blow Down	AT P
Arc-Heated Scramjet Test Facility		Mach 4.7 to 8 *	0.035 to 2.2 x 10^6 per ft	10.89"H x 10.89"W	675 psia	2000° to 5200°R	Dry Air	Blow Down	AT P
Direct-Connect Supersonic Combustion Test Facility		Mach 4 to 7.5 *	2 to 8 x 10^6 per ft	(6)	115 to 500 psia	1600°w to 3800°R	Hydrogen/Air (5)	Blow Down	AT P
Mach 4 Blow-Down Facility		Mach 4 * Simulated	~20 x 10^6 per ft	9.0"H x 9.0" W	200 psia	540°R	Dry Air	Blow Down	AT P

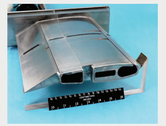
(1) Facility located in Research Directorate (2) Tetrafluoromethane (3) Customer specifies altitude (4) Vitiated Heater (air, methane, lox) (5) Hydrogen-air combustion products with oxygen replenishment (6) Four two-dimensional nozzles; two with exit of 1.52" x 3.46" and two with exit of 2.88" x 5.2"

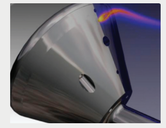
Sample Test Capabilities*


AWS Abrupt Wing Stall Testing


AC Acoustic Testing


AE Aeroelastic Testing


AF Airfoil Testing


AT Aerothermal Testing


FF Free-Flight Testing


FO Forced Oscillation Testing

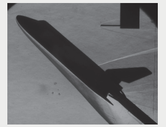

GE Ground Effects Testing

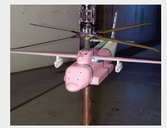

S&C Stability and Control
HA High Angle-of-Attack Testing


PAAI Propulsion Airframe Aeroacoustic Integration


P Propulsion System Testing
JET Jet Effects Testing


PT Performance Testing


RG Real Gas Effects Simulation


R Rotorcraft Testing


SS Semi-Span Testing

* Please contact the **Ground Facilities and Testing Directorate** for a full list of test capabilities and specialized test techniques.

Specialized Test Techniques*

Doppler Global Velocimetry

A nonintrusive measurement technology that can provide global flow field measurements.

IR Thermography

A real-time, nonintrusive surface temperature measurement technique used for measuring global surface temperature, heat flux, emissivity, flow separation and transition.

Oil-Film Interferometry

A method for determining shear stress magnitude in surface flows of aerodynamic test articles.

Particle Image Velocimetry

A method for measuring two-dimensional velocity in a particle laden flow. A double pulsed laser sheet illuminates a two-dimensional particle field.

Planer Laser Induced Fluorescence

An optical diagnostic technique used for flow visualization and quantitative measurement of local flowfield velocity, pressure, temperature, and species concentrations.

Pressure/Temperature Sensitive Paint

A technique that permits measurement of global pressure and temperature distributions on aerodynamic test articles.

Thin-Film Gauges

A discrete technique used to measure convective heating on model surfaces.

Virtual Diagnostics Interface

A suite of techniques utilizing image processing, data handling and 3-D computer graphics to aid in the design, implementation, and analysis of complex aerospace experiments.