

9 m x 9 m Low Speed Wind Tunnel

The 9 m x 9 m Low Speed Wind Tunnel facility is located on the National Research Council (NRC) campus adjacent to the Ottawa International Airport. The facility has been in operation since 1970, serving the aerodynamic testing requirements of government agencies, research institutes and private companies, in addition to supporting ongoing internal R&D activities at the NRC Institute for Aerospace Research (NRC Aerospace). It recently underwent a major renovation of the fan drive, balance weigh-beam controls and data acquisition systems, and important mechanical components such as the cooling system and main drive shaft components.

General specifications

The wind tunnel is a horizontal closed circuit atmospheric facility with a large test section (9.1 m wide x 9.1 m high x 22.9 m long (30 ft x 30 ft x 75 ft)). It is powered by an air-cooled 6.7 MW (9000 hp) DC motor whose speed may be varied and set at any value from 0 to 230 rpm and can be maintained within ± 0.1 rpm. The maximum wind speed is about 55 m/s (180 ft/s). Other major components are listed on page 2 under Technical Specifications.

Floor mounted models are supported directly by extensions to the balance turntable and in the case of surface vehicles rectangular pads with instrumented pressure taps are used. Strut-mounted models may use two or three support struts and wind fairings are available for all struts.

Automation with LabView allows five main subsystems to be fully operated from the control-room operator's user-friendly screens: yaw drive, balance weigh-beam control



system, tunnel speed control, boundary layer control system, LabView-based data acquisition and MatLab-based data reduction system.

A large-scale atmospheric boundary layer simulation exists and is frequently used by the wind engineering community.

Test program support

The staff at NRC Aerospace provide skilled and experienced professional and technical support in all aspects of wind tunnel testing. This includes wind tunnel testing techniques, fully-equipped electronics and instrumentation, model design and manufacture, customized data processing, and computational fluid dynamics capability. Adjoining shops support fabrication of most wood, sheet metal and fiberglass models, as well as model modification services to custom test hardware.

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Technical specifications

Type of wind tunnel:	• Continuous flow, closed throat, atmospheric pressure test section																																			
Test section size:	• 9.1 m x 9.1 m x 22.9 m (30' x 30' x 75')																																			
Special configuration:	• Floor boundary layer suction system, several wake rake scanning rigs																																			
Maximum velocity:	• 55 m/s (180 ft/s)																																			
Drive motor:	• 6.7 MW DC electric (9000 hp) with 8 MW thyristor-based speed control system																																			
Force balance:	• 6 component, pyramidal, external mechanical																																			
Model support:	• Strut, sting, floor mounting with self-aligning fairings, floor pad mounting equipped with pressure taps																																			
Balance capabilities:	<p>FOUR RANGES ARE AVAILABLE:</p> <table border="1"> <thead> <tr> <th>Component</th> <th>Normal</th> <th>VSTOL</th> <th>Special Moment</th> <th>Omega</th> </tr> </thead> <tbody> <tr> <td>Lift</td> <td>± 22,250 N (± 5,000 lb)</td> <td>± 5,550 N (± 1,250 lb)</td> <td></td> <td>± 2,220 N (± 500 lb)</td> </tr> <tr> <td>Drag</td> <td>± 8,900 N (± 2,000 lb)</td> <td>± 2,225 N (± 500 lb)</td> <td></td> <td>± 1,090 N (± 245 lb)</td> </tr> <tr> <td>Side Force</td> <td>± 22,250 N (± 5,000 lb)</td> <td>± 5,550 N (± 1,250 lb)</td> <td></td> <td>± 2,719 N (± 612 lb)</td> </tr> <tr> <td>Pitching Moment</td> <td>± 8,100 Nm (± 6,000 ft-lb)</td> <td>± 2,000 Nm (± 1,500 ft-lb)</td> <td>± 27,100 Nm (± 20,000 ft-lb)</td> <td></td> </tr> <tr> <td>Yawing Moment</td> <td>± 8,100 Nm (± 6,000 ft-lb)</td> <td>± 2,000 Nm (± 1,500 ft-lb)</td> <td>± 27,100 Nm (± 20,000 ft-lb)</td> <td></td> </tr> <tr> <td>Rolling Moment</td> <td>± 4,050 Nm (± 3,000 ft-lb)</td> <td>± 1,000 Nm (± 750 ft-lb)</td> <td>± 67,800 Nm (± 50,000 ft-lb)</td> <td></td> </tr> </tbody> </table> <ul style="list-style-type: none"> • Balance incidence arm range is ± 50° • Balance turntable can be rotated from -115° to + 215° 	Component	Normal	VSTOL	Special Moment	Omega	Lift	± 22,250 N (± 5,000 lb)	± 5,550 N (± 1,250 lb)		± 2,220 N (± 500 lb)	Drag	± 8,900 N (± 2,000 lb)	± 2,225 N (± 500 lb)		± 1,090 N (± 245 lb)	Side Force	± 22,250 N (± 5,000 lb)	± 5,550 N (± 1,250 lb)		± 2,719 N (± 612 lb)	Pitching Moment	± 8,100 Nm (± 6,000 ft-lb)	± 2,000 Nm (± 1,500 ft-lb)	± 27,100 Nm (± 20,000 ft-lb)		Yawing Moment	± 8,100 Nm (± 6,000 ft-lb)	± 2,000 Nm (± 1,500 ft-lb)	± 27,100 Nm (± 20,000 ft-lb)		Rolling Moment	± 4,050 Nm (± 3,000 ft-lb)	± 1,000 Nm (± 750 ft-lb)	± 67,800 Nm (± 50,000 ft-lb)	
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Auxiliary electric power:	<ul style="list-style-type: none"> • Four 150 kW (200 hp) variable frequency power supplies • Two Danfoss (200 hp) variable frequency drives 																																			
Compressed air:	• 13.2 cm (6") diameter supply line of 1700 kPa (250 psi) at 4.5 kg/s (10 lb/s)																																			
Data system:	<ul style="list-style-type: none"> • PXI-based control data system with 64 channel A/D and 128 digital input/outputs, remote field point with 16 temperature RTD inputs and 8 channel A/D, twelve axis motion control system with programmable PID. Additional data system: PXI-based with 96 digital input/outputs, 64 channel A/D with programmable signal conditioning system • Data processing using LabView and MatLab 																																			
Pressure measurement:	• Electronically Scanned Pressure (ESP) modules with electronic pressure scanners																																			

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