

# STRUCTURES AND MATERIALS PERFORMANCE

## ***Aeroacoustics and Structural Dynamics***

The NRC Institute for Aerospace Research (NRC Aerospace) has a solid track record in aeroacoustics and structural dynamics for a broad range of aerospace applications. Facilities are available to clients through cooperative or collaborative research agreements or fee-for-service testing.



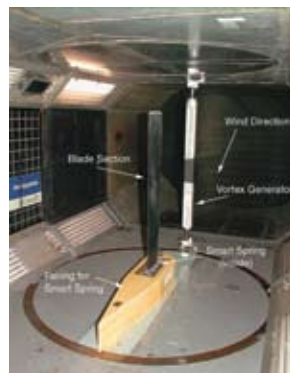
*The SMPL management system has been registered to ISO 9001:2000*

### **Adaptive control of flexible structures**

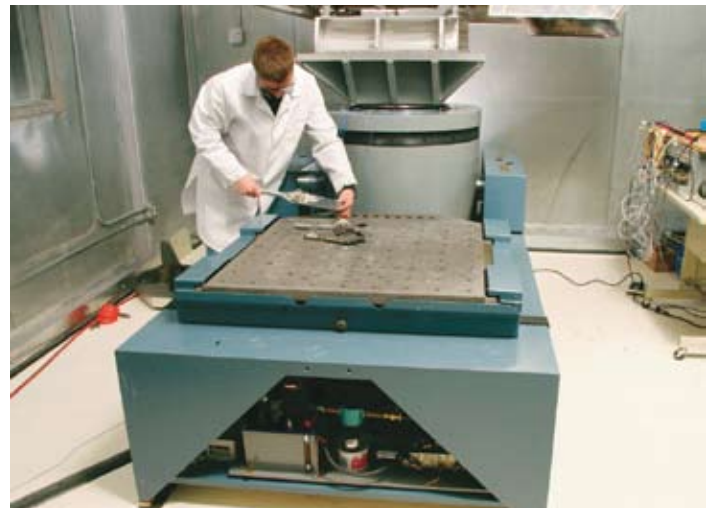
NRC Aerospace conducts analytical and experimental research in the active control of flexible structures to reduce vibration and noise. Theoretical expertise and experimental facilities are available to investigate:

- active and passive damping of structural vibration
- shape and vibration control of aerospace structures
- active control of aeroelastic flutter
- attenuation of interior noise in aircraft fuselages, and
- active control of vibration and noise generated by helicopter rotors.

It has also invested in the research and development of active control systems involving adaptive or “smart” materials to control tail buffet vibration of a military aircraft, rotorcraft blade vibration and other applications. Its facilities enable unique test configurations including mechanical or aerodynamic loading.



*Test of active vibration control of rotorcraft blade under aerodynamic loading*



*Electrodynamic shaker*

### **Active noise control**

NRC Aerospace is involved in research with Canadian industry to reduce noise in aircraft. Its activities focus on direct measurement of sound transmission through structures, vibro-acoustic modelling of structures, and active noise control. Computer models developed for predicting both open and closed loop sound pressure levels in aircraft have been verified on a full-scale aircraft fuselage.

### **Acoustic testing**

Airborne noise measurement to help clients meet noise level standards (MIL STD and proprietary) is another specialty. Measurements can be made on-site in the NRC Aerospace operation bay or at remote locations as required.

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### **Structural vibration testing**

NRC Aerospace has extensive experience in structural vibration testing of a diverse range of hardware, from spacecraft, antennae, aircraft and gas turbine engine components to shipborne electronic equipment. Tests can be adapted to established standards or to client requirements. A large test bay features a 45 kN (10,000-lbf) electrodynamic shaker with a 1 m (3 ft) slip table for three-axis testing and the capability of various controlled input spectra including sine sweep, random, sine on random, sine dwell and shock. Portable measuring equipment is also available for in-situ tests outside the laboratory.

### **Unique reverberant acoustic chambers**

The high-intensity noise reverberant facility at NRC Aerospace, unique in Canada, has two reverberant chambers and a progressive wave tube for testing full-size aerospace components at high levels of sound pressure. The chambers offer maximum flexibility for investigating the specifications of space shuttle and rocket launches or military equipment, and for testing spacecraft and spacecraft components, aircraft structural excitation, engine nacelle noise, and unsteady turbulent airflows. The noise environment is accurately controlled with an automatic spectrum control system capable of maintaining tight tolerances on noise levels over the frequency range of 25 to 20,000 Hz.

The reverberant chamber and high-bay preparation area have a Class 100,000 clean-room capability, with required humidity and temperature control. Other aeroacoustic research related to the reverberant chambers includes:

- acoustic fatigue studies on aircraft components
- measurement of propeller noise transmission, and
- noise generation concepts and associated consulting.

### **The latest tools**

Leading-edge research requires leading-edge analysis and simulation tools. NRC Aerospace experts in aeroacoustics and structural dynamics make sure clients can count on the most up-to-date testing, evaluation and data acquisition equipment, whether purchased or developed in-house.

NRC Aerospace expertise in computational structural analysis on aircraft and engine structures covers:

- finite element analysis (FEA)
- transient dynamic FEA
- modal analysis
- stress analysis on metallic and composite materials and structures
- dynamics and aeroacoustic analysis, and
- design optimization.

All research and testing services in the NRC Aerospace aeroacoustics and structural dynamics laboratory are supported by advanced data acquisition systems and strong expertise in data interpretation. Among the systems now in place are:

- NASTRAN/PATRAN FEA software
- LS DYNA FEA software
- LMS modal analysis software, and
- Matlab software.

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