

GAS TURBINE RESEARCH

Propulsion and Tribology – General

The Gas Turbine Laboratory (GTL) of the NRC Institute for Aerospace Research (NRC Aerospace) offers integrated performance evaluation and R&D for aero and land-based propulsion or power systems. Highly qualified and experienced staff within its propulsion and tribology program use comprehensive analysis and diagnostic tools to study, develop and evaluate the aerothermodynamic performance, control systems, emissions and mechanical durability of gas turbine engines and their components.

Both transient and steady-state performance applications are investigated using international standards and an ISO-based quality management system. State-of-the-art conventional and non-intrusive measurement techniques, complemented by computational fluid dynamics, are applied to research involving steady-state or time-dependent internal flows in turbomachinery components. Particular expertise is offered in lubrication tribology for mechanical components like seals, gears and bearings, including oil free bearings. Non-intrusive techniques such as thermal imaging are used to assess the operational environments of rotating and stationary aerothermodynamic and mechanical components.

Expertise in analysis and test extends to the operation of propulsion systems in adverse environments. NRC Aerospace is the only institution in Canada with the expertise and facilities to carry out icing certification trials for turboprop and turbofan engines. Novel test techniques and



The GTL management system has been registered to ISO 9001:2000



Test cell #4 used for development and certification

analysis procedures are often developed for both internal and external client requirements.

These core capabilities and facilities in aeropropulsion are supported and complemented by associated expertise and facilities in structural design and analysis, and in materials selection and evaluation. Specialists from across NRC Aerospace can be assembled to meet design or development challenges in combustion, internal flows, materials, structures, and calibration. For example, the Institute has been active in materials performance evaluations for service use, life assessment, and durability. NRC Aerospace also offers a turnkey R&D and test and evaluation capability with proven capabilities for onsite hardware modification and fabrication.

Benefits

NRC Aerospace partners and clients benefit from a high return on R&D investment from:

- specialist research, instrumentation and operations staff during planning, execution and analysis phases of projects: tasks through to turn-key projects

"We've been amazed at the number of testing hours we've been able to get in a day. Everyone here multi-tasks ferociously. We got the engine out of the box and running in one week – which is unheard of – and it meant that we didn't miss the icing window."

Ron Goodwin, Engineer, Honeywell

...cont'd



- availability of specialized national facilities with recognized quality systems
- access to novel research tools, e.g. non-intrusive spectroscopy, and thermal imaging
- access to international research and knowledge through its extensive science and technology network.

Program areas

Within the propulsion and tribology program, work is grouped in three research, development, and test and evaluation domains with the following objectives:

Performance analysis

- To develop and validate methods for predicting and measuring component performance, condition and operability, particularly contributing to diagnostics and prognostics systems.
- To improve flows in turbomachinery components for better efficiency and cost effectiveness.

Environmental and icing simulation

- To develop new certification methods and models for engine and engine-inlet systems.
- To contribute to the design of engine components by understanding the effects and means of mitigation for ice, rain, hail and other environmental threats.

Tribology

- To develop and validate analytical and experimental means to predict and measure the performance and condition of mechanical components in propulsion systems, including gears, bearing and seals.

Proven capabilities

NRC Aerospace expertise has attracted clients ranging from engine manufacturers and overhaul contractors to small and medium-size enterprises, universities and Canadian government departments. Substantial savings in time and money also have resulted from novel approaches to engine operability, diagnostics, calibration/correlation, flow measuring techniques, and the application of high-speed data acquisition systems.

Recent work includes:

- improvements in engine power assurance and fault detection in near real time
- integrated certification methods for engine and inlet systems for a new helicopter
- new methods of analyzing bearing dynamics with uncertainty assessments.

Facilities

The program and test and evaluation work for clients are integrated with extensive facilities and supported by comprehensive design, fabrication and operational capabilities. Projects and facilities are developed and operated following formal project management and quality management processes under ISO 9001:2000.

Details of these capabilities are provided in associated fact sheets, but an overview comprises:

- a calibrated gas turbine test cell referenced to internationally accepted standards
- three turboshaft test stands with low-speed dynamometers and a high-speed gearbox
- a seasonally operated engine/inlet facility for icing and snow ingestion tests
- a large-capacity liquid fuel facility and a high-pressure natural gas source
- tribology test rigs with static, dynamic and high-speed shaft applications
- abradable seal rig for composite, honeycomb and metal seal systems
- oil-free bearing test rig (in commissioning)
- traceable volumetric liquid flow calibrator, and
- access to a spin pit, large exhaust plants, and compressor plants.

Staff pride themselves on their ability to conceive, develop, fabricate and deliver complex test equipment and systems for turnkey projects that meet real-world problems on real-world time schedules.

CONTACT:

Mr. Martin Trerice, Gas Turbine Laboratory
Tel: (613) 993-0142 Fax: (613) 990-7444
E mail: martin.trerice@nrc.gc.ca

Dr. Waldemar Dmochowski, Gas Turbine Laboratory
Tel: (613) 990-0457 Fax: (613) 957-3281
E mail: waldemar.dmochowski@nrc.gc.ca

Mr. Jeff Mackwood, Marketing and Contracts Office
NRC Institute for Aerospace Research
Ottawa, Ontario, Canada K1A 0R6
Tel: (613) 990-0765 Fax: (613) 952-7214
E mail: jeff.mackwood@nrc.gc.ca

Or visit our Web site at: www.nrc.aerospace.com

January 2006
Aussi offert en français
IAR-GT02e