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INFORMATION

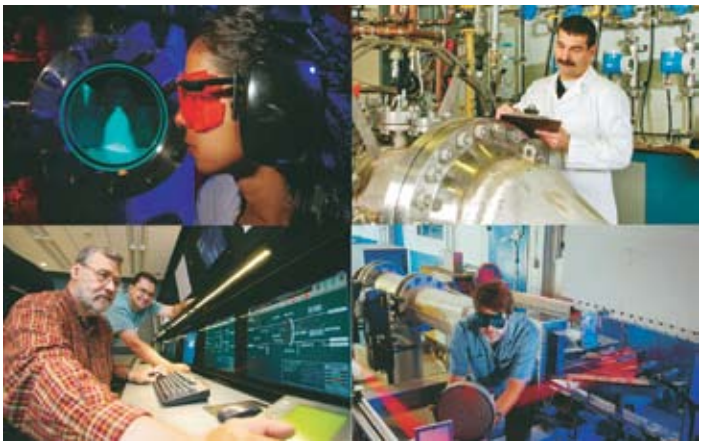
GAS TURBINE RESEARCH

Gas Turbine Aerodynamics & Combustion – General

Gas turbine aerodynamics and combustion is one of three programs within the Gas Turbine Laboratory (GTL) at the NRC Institute for Aerospace Research (NRC Aerospace). With approximately 40 highly qualified and innovative research and technical support personnel, the program undertakes a comprehensive range of research, development, test, and evaluation activities in support of the Canadian aerospace and industrial technology base. It provides extensive test and evaluation services to industry, as well as engages in collaborative research programs with industry, universities and other government departments. Work is carried out along five distinct thrusts:

- internal aerodynamics
- applied combustion & emissions
- numerical simu lations
- support capabilities and facilities
- quality standards.

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



Internal aerodynamics – turbomachinery fluid dynamics
Years of research experience and client service stand behind the internal aerodynamics program at NRC Aerospace. Work is predominantly focused on the experimental investigation of steady and unsteady flows and heat transfer in gas turbine engines. Our expert team serves gas turbine industry needs for testing turbine and compressor designs in our large-scale test and development facilities.

NRC Aerospace offers a large-scale transonic planar cascade and a large-scale subsonic linear cascade capable of handling most aircraft and land-based gas turbines. Flow quality in the transonic planar cascade is so good that it has been used as the basis for the design of other industrial test cascades. Our support facilities include a high-subsonic and a low-subsonic probe calibration rigs. Designed for quick and easy operation, our test facilities can accommodate a wide range of test assignments in a timely fashion and at reasonable rates.

There is much more to our service than reliable testing and data acquisition. We design experiments from beginning to end, always with your needs in mind. We design and build models to the most critical tolerances. We also provide fast and accurate computational solutions for analysis and design problems.

Applied combustion – emissions reduction
NRC Aerospace expertise is used extensively by clients and collaborators to help develop the next generation of combustion technologies. Such expertise is prerequisite for more efficient, environmentally clean industrial combustion processes for gas turbine engines. The strong research capabilities of our highly trained staff, combined with our state-of-the-art facilities, are dedicated to helping clients advance their knowledge of combustion processes, emissions, and gaseous and liquid spray systems that are required for the successful pursuit of the next generation of low emission combustors.

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Applied combustion – mixing & spray characterizations
We are ready to work with you to address your specific needs in the areas of spray and mixing characterization as well as in the development of new and innovative mixers and injectors. NRC Aerospace specializes in characterizing combustor components such as fuel injectors and pre-mixers using state-of-the-art, non-intrusive optical diagnostics with most of the major gas turbine manufacturers. Fuel injectors from small aero-engines as well as larger, dual-fuelled industrial combustors have been tested under steady and unsteady conditions at atmospheric and high-pressure conditions. Sufficiently detailed data can be provided for use in conjunction with CFD simulations as well as design selections. Studies of combustor aerodynamics and direct pre-mixer characterization have also been under-taken with a view to advancing low-NO_x combustor design.

Spray characterization expertise in analysis and testing has in the past been extended to non-aerospace applications such as agricultural sprays, pyrophoric sprays, spray cooling, and sprays in chemical reactors. Current research and development efforts are directed towards developing fuel-injectors and mixers for low-NOx gas turbine combustors and enhancing the existing capabilities of the optical instrumentations.

Numerical simulations
Numerical simulation has become an essential tool in the R&D of advanced reacting and non-reacting systems. It enables researchers to complement and sometimes substitute expensive experimental tests with equivalent numerical simulations.

NRC Aerospace has expertise and comprehensive modeling capabilities to allow researchers to investigate a broad spectrum of reacting and non-reacting flows or product design options. These advanced techniques have been successfully applied to various R&D programs, such as NO_x emission in a diffusion flame combustor, noise reduction of a modern burner unit, lobed fuel/air mixers, failure analysis of gas-sampling probes, vortex shedding behind turbine cascade trailing edges, and flow characteristics in the exhaust section of a combustor test rig. Substantial contributions have been made to the Canadian industrial technology base and to internal R&D projects.

We are ready to serve you in the areas of premixed or diffusion combustion modeling, alternative fuel combustion, combustion instability studies, large eddy simulation, fuel/air mixing, as well as other industrial flow problems. Our numerical and experimental expertise with the solid background in propulsion & combustion science and technology will adequately address your specific needs. In addition, the development of physical sub-models, such as fuel atomization models, is also among our research interests.

Support capabilities & facilities
Available experimental techniques include temperature and multi-hole pressure probe measurements; multi-wire, hot-wire, and surface-mounted hot-film measurements; laser velocimetry; schlieren flow visualization; 2-D & 3-D particle image velocimetry; PDPA; PLIF; surface temperature measurement with liquid crystals; and surface pressure measurement with pressure sensitive paint. Data acquisition and control systems are developed in-house.

NRC Aerospace possesses a broad spectrum of air moving facilities that are capable of supplying either heated or cooled air to a number of test rigs and combustion test cells via common piping manifolds.

Quality standards
Projects and facilities are developed and operated following formal project management and quality management processes under ISO 9001:2000.

NRC Aerospace is continuously developing and advancing testing techniques for the benefit of clients looking for imaginative and economical design solutions. Our researchers deliver responsive and high-quality services that meet many research challenges. We would be pleased to discuss your turbine and compressor testing and analysis needs at any time.

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