NRC·CNRC

1916 ✦ 2016

100 years of innovative solutions

National Research Council Canada

Conseil national de recherches Canada

Canada

The past 100 years of aerospace innovation in Canada have been marked by a plurality of successes and revolutionary technologies created and developed by NRC.

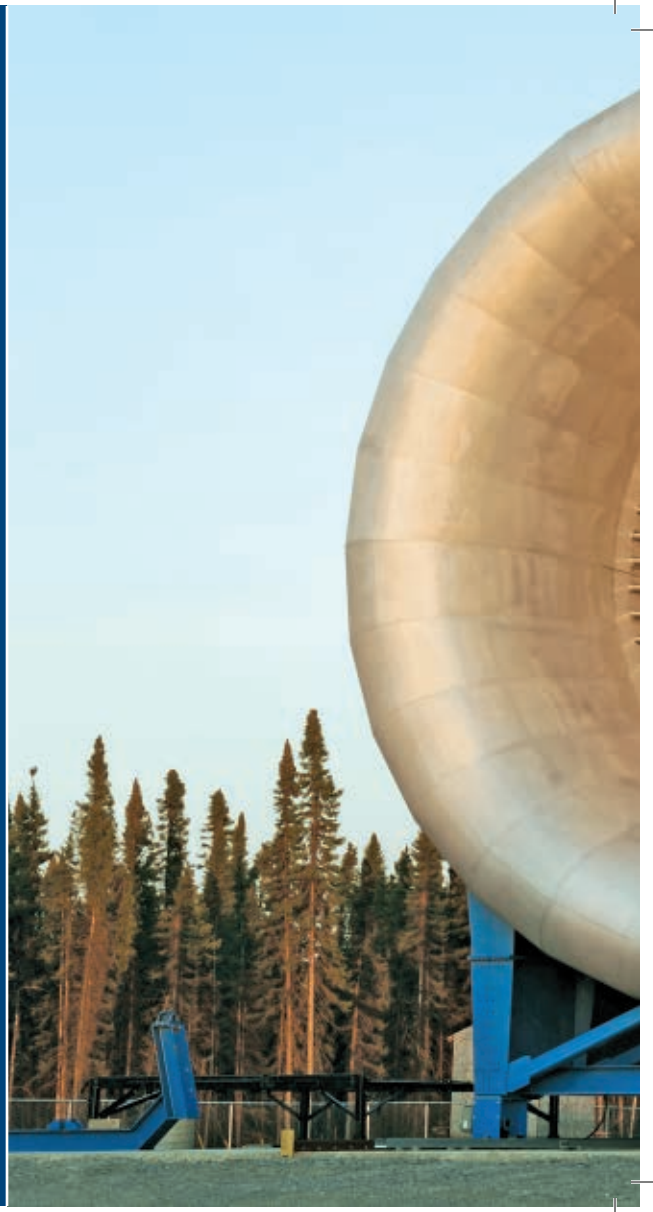
Canada's aerospace industry is vibrant, innovative and complex, with a rich history and elite reputation on the global stage. As Canada's premier research and technology organization (RTO), the National Research Council (NRC) aims to innovate, develop solutions and stimulate growth for the industry.

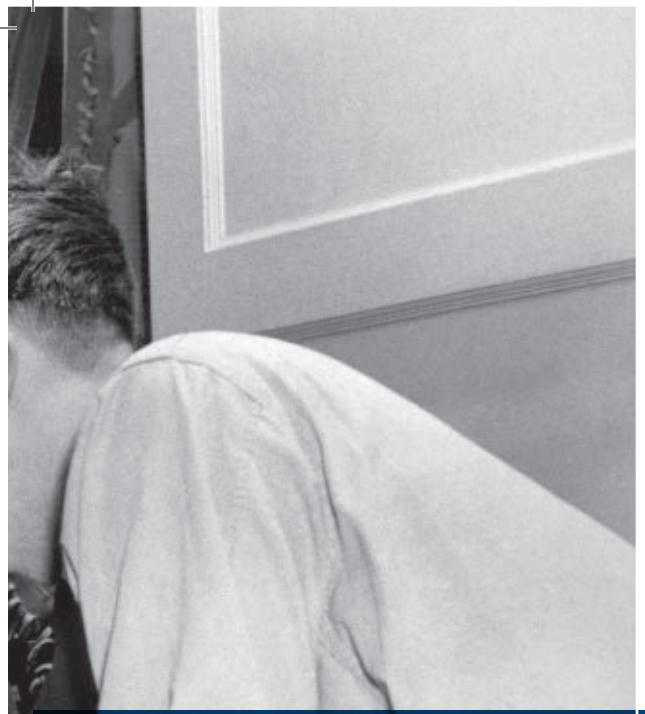
Innovation in icing

The work at NRC to keep planes ice-free began in 1939. By the 1940s, NRC's responsibilities expanded to include icing detection, mitigation and engine-icing certification.

Flash forward to modern-day aircraft: NRC has become a world leader and innovator in combating and detecting aviation icing.

NRC is a fundamental partner in Rolls-Royce Canada and Pratt & Whitney Canada's Global Aerospace Centre for Icing and Environmental Research (GLACIER) in Manitoba, Canada. GLACIER is at the forefront of engine icing innovation and certification.

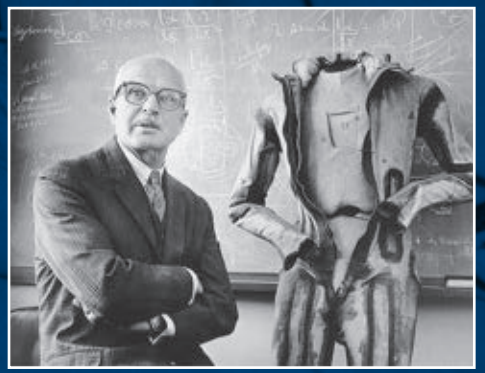


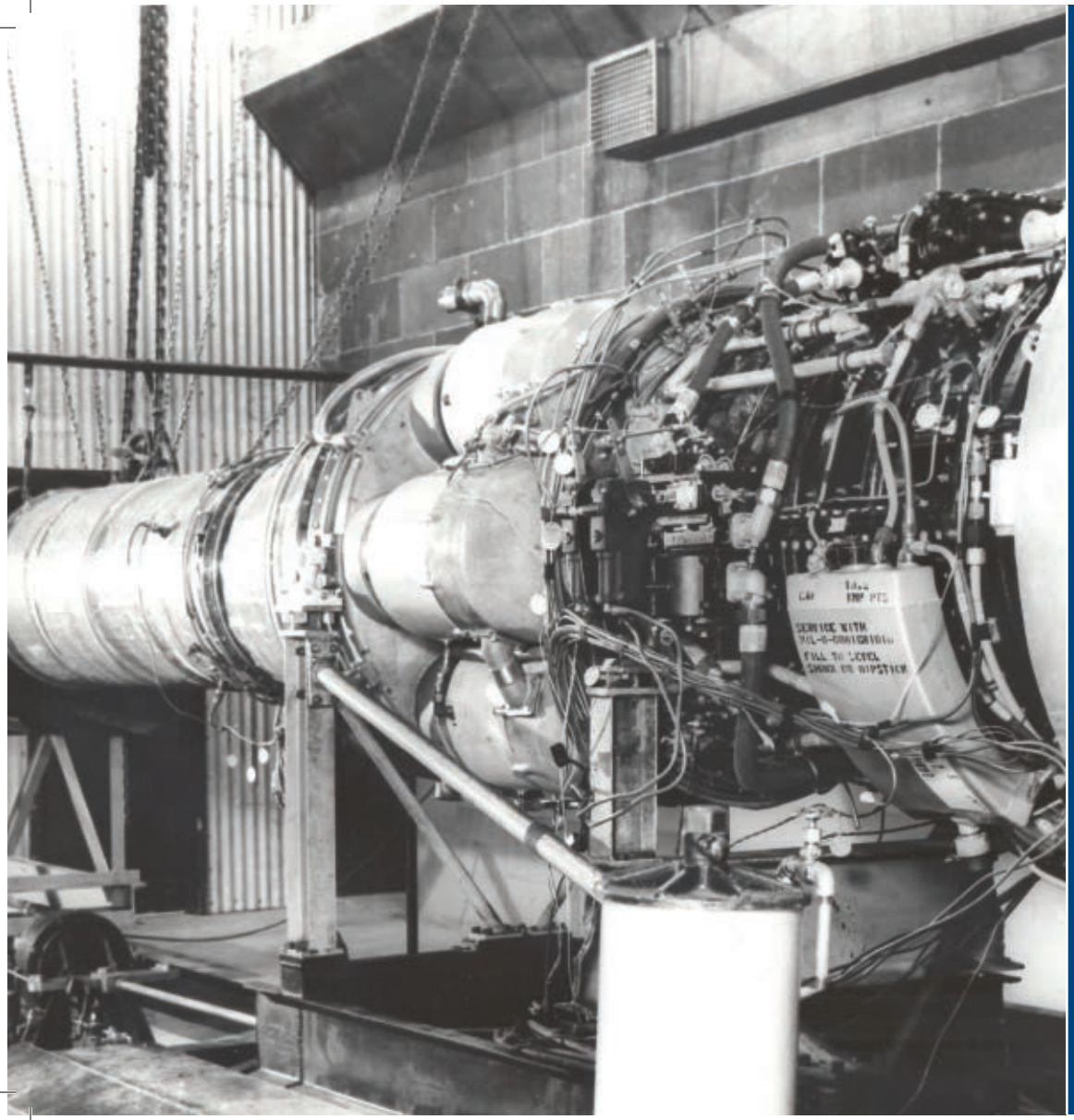


G-suit genesis

In the 1940s, Dr. Wilbur Franks developed the anti-gravity flight suit, still worn today by modern fighter pilots, in collaboration with Nobel Laureate and NRC Council member Sir Dr. Frederick Banting. Designed, refined and tested in an NRC-funded research facility, the "Franks Flying Suit" prevented blackouts at high altitude and was one of many projects initiated by NRC to protect aircrew in Europe during World War II.

NRC continues to build G-force expertise by tackling the problems of motion sickness, by devising oxygen masks and ejection seats, and by creating altitude chamber tests and human-rated centrifuges to help other innovative groups study this strong force.

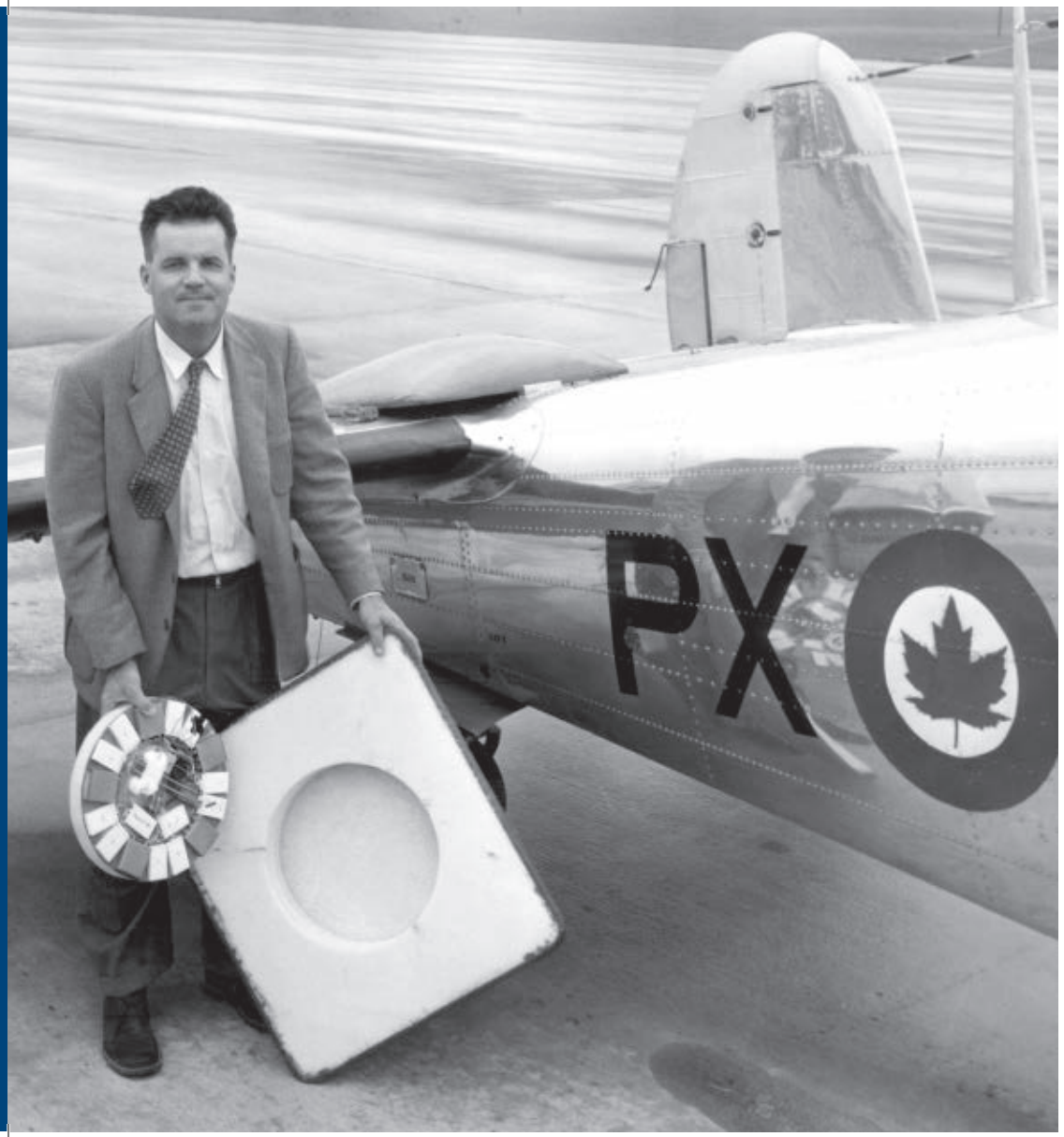




Powering Canadian take-off

NRC began developing innovative jet engine technologies during the last part of World War II. One of these successful jet engines, the Orenda, became the powerhouse behind the CF-100, known as the Canuck. Avro Canada designed and built the Orenda engine using the expertise of the NRC-Turbo Research Foundation in 1946.

The Orenda was the most powerful jet engine in the world from 1949 to 1952. Many jet engine successes followed the development of the Orenda engine and the CF-100 continued to fly until 1981.



Crash position indicator

In the 1940s, NRC's Harry Stevinson designed a crash-resistant radio beacon, the precursor of the modern "black box." The beacon was designed to fall away from a downed aircraft, turn on and then beam out a homing signal to call attention to its vault of data.

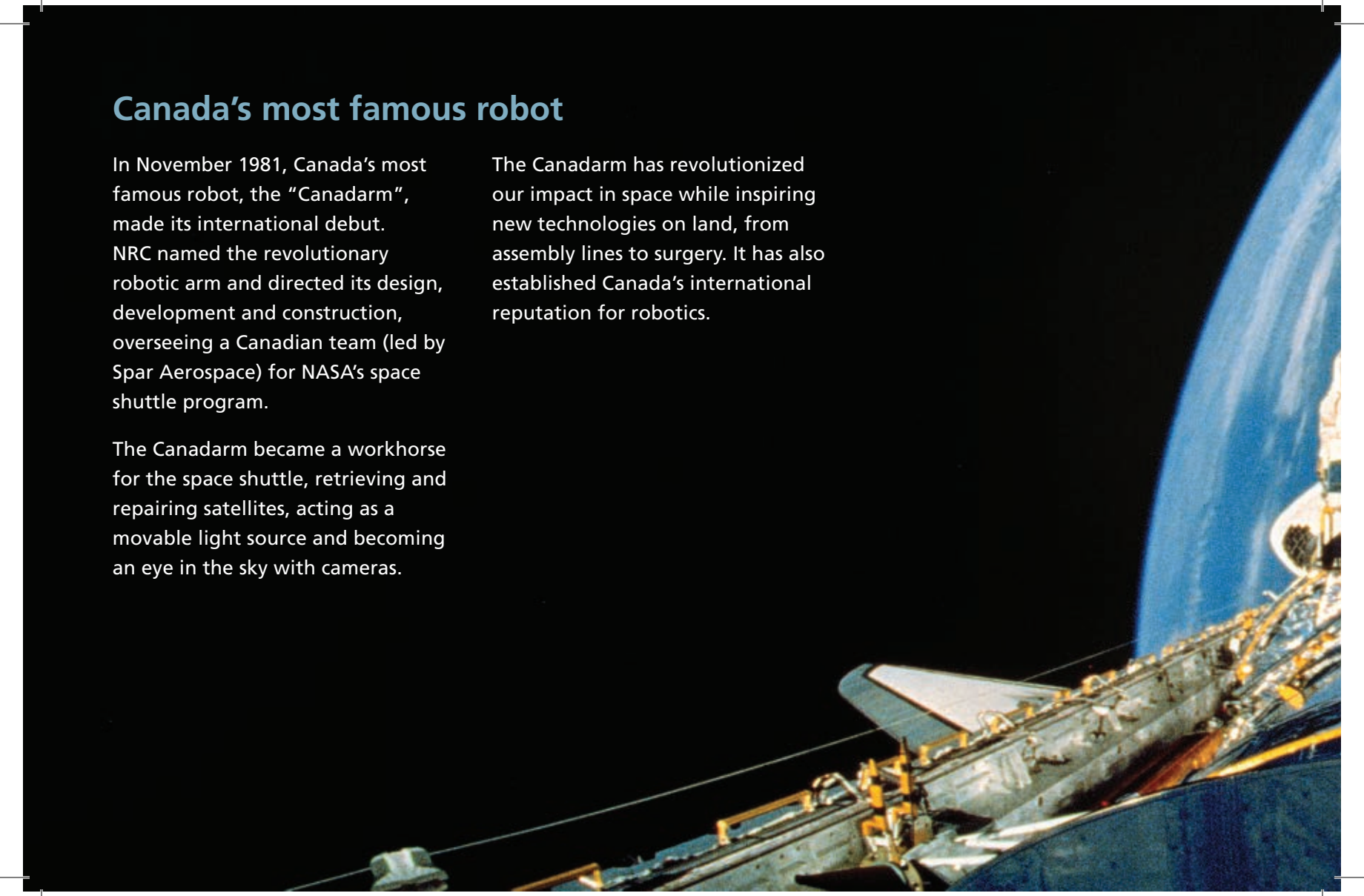
NRC licensed this technology to a Canadian company, where it was combined with innovations from other countries to further monitor an aircraft's systems. The "black box" has been a permanent fixture on modern aircraft since the 1970s. As a contributing pioneer, NRC not only gained recognition for its technologies, but also acquired vast expertise in retrieving data from flight recorders.

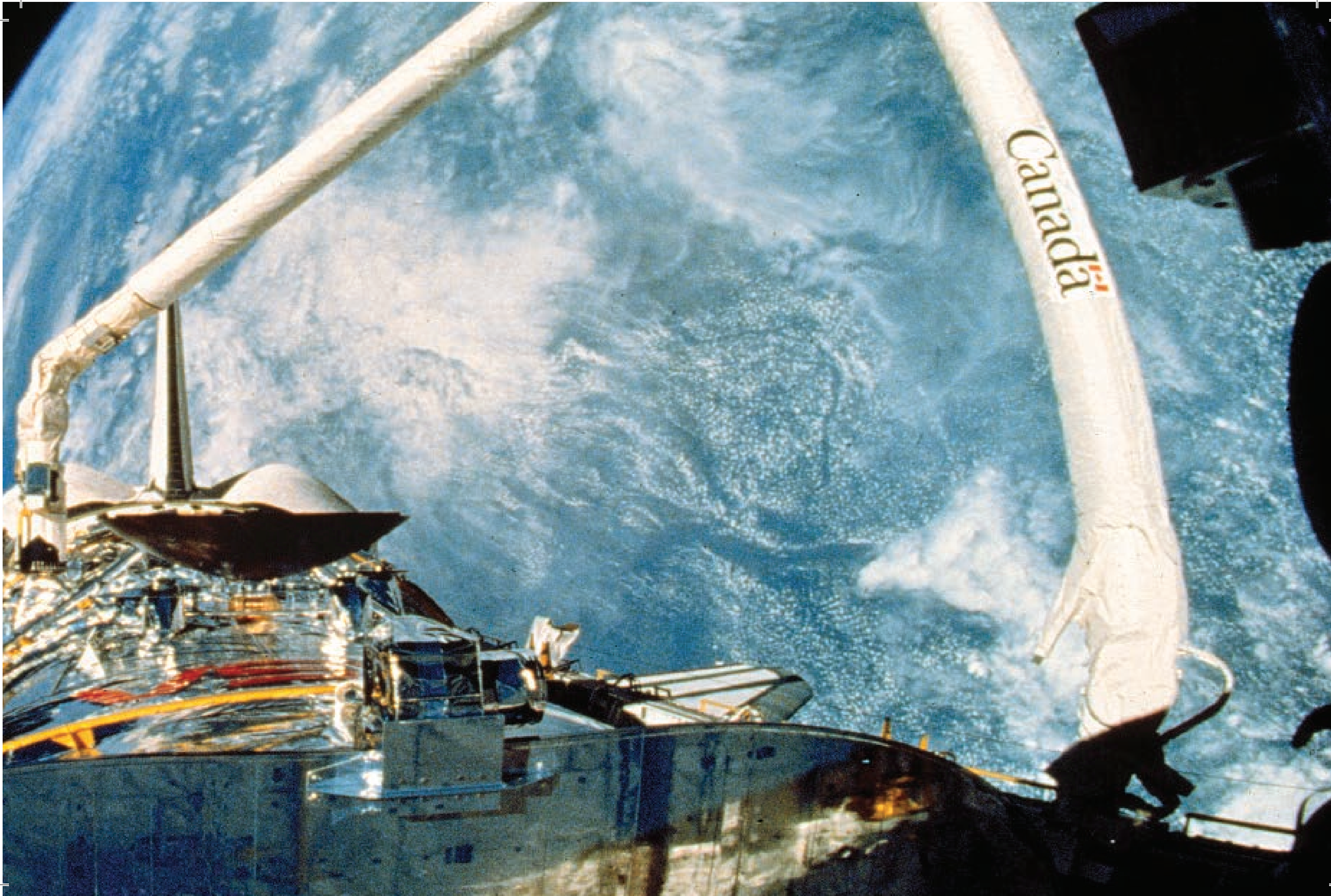
Canada's most famous robot

In November 1981, Canada's most famous robot, the "Canadarm", made its international debut. NRC named the revolutionary robotic arm and directed its design, development and construction, overseeing a Canadian team (led by Spar Aerospace) for NASA's space shuttle program.

The Canadarm became a workhorse for the space shuttle, retrieving and repairing satellites, acting as a movable light source and becoming an eye in the sky with cameras.

The Canadarm has revolutionized our impact in space while inspiring new technologies on land, from assembly lines to surgery. It has also established Canada's international reputation for robotics.




Canada

Flying by wire

In 2003, NRC was recognized for its innovative work in the development of fly-by-wire (FBW) helicopters, which were initially created in 1960 in their FBW laboratory. The technology enables pilots to focus on other mission-related tasks while guidance is safely controlled through electronic signals and computer systems.

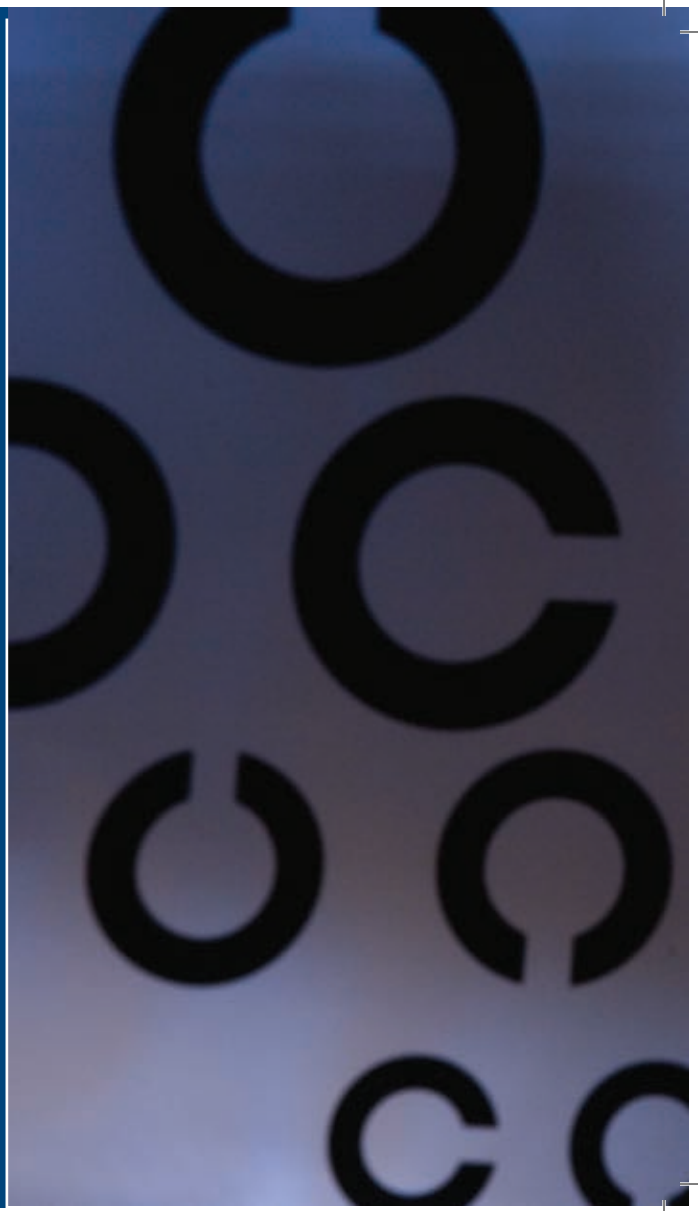
Scientists tested this technology using a modified NRC Bell helicopter as the airborne flight simulator. NRC has since developed successive generations of FBWs and now operates one of the world's most advanced flight training centres.


C-FPG

Improving the eyes in the sky

Bush plane exploration pushed north in the 1930s as the map of Canada began to require more detail. In response, NRC played a major role in developing efficient and effective aerial survey equipment that allowed detailed mapping and a rich inventory of natural resources.

After many tests, including the use of advanced wind tunnel facilities, NRC research dramatically increased the stability and aeronautics of aerial camera attachments. NRC's designs gave bush pilots better tools to identify objects from the air and fill in the map of Canada.



Evaluating pilots' night sight

For a pilot on a remote search and rescue mission, the ability to "see" in the dark is critical. Night vision technology has long been used by the military in night flight rescue missions, but NRC scientists are continuously engineering unique improvements, allowing the Canadian Armed Forces and their rescue pilots to fly safely.

In the near future, aerospace experts expect to see night vision technologies become standard equipment.

Photo courtesy of Bombardier

Shedding light on hidden flaws

Before taking off, all factors potentially detrimental to flight safety must be identified, including wear-and-tear issues. Operators must anticipate and assess these risks, yet avoid unnecessary replacements and labour costs.

NRC aimed to address this inspection problem by adapting a technology originally developed by Diffracto Ltd. to inspect automobiles using reflected light to sweep an aircraft's vast surface.

This technique identified minute imperfections and flagged them for closer inspection for potential corrosion, impact strikes or aging defects. The identification of minor surface anomalies and their later associated underlying problems has helped in getting planes up in the air safely.

A front seat to innovation

Flying long hours in an environment of relentless jolting and shaking could leave helicopter aircrews with negative effects on their comfort, safety and health. The Department of National Defence enlisted NRC's assistance to help minimize effects of these vibrations. Alongside defence engineers, NRC researchers developed an innovative solution: a seat cushion integrating traditional foam with a novel energy-absorbing, hexagonal material.

NRC's Bell-412 helicopter provided a controlled environment for in-flight tests that confirmed the cushion's ability to successfully dissipate vibrational energy, which led to the seat's implementation in a fleet Canadian Armed Forces helicopters and its licensing for use in commercial helicopters.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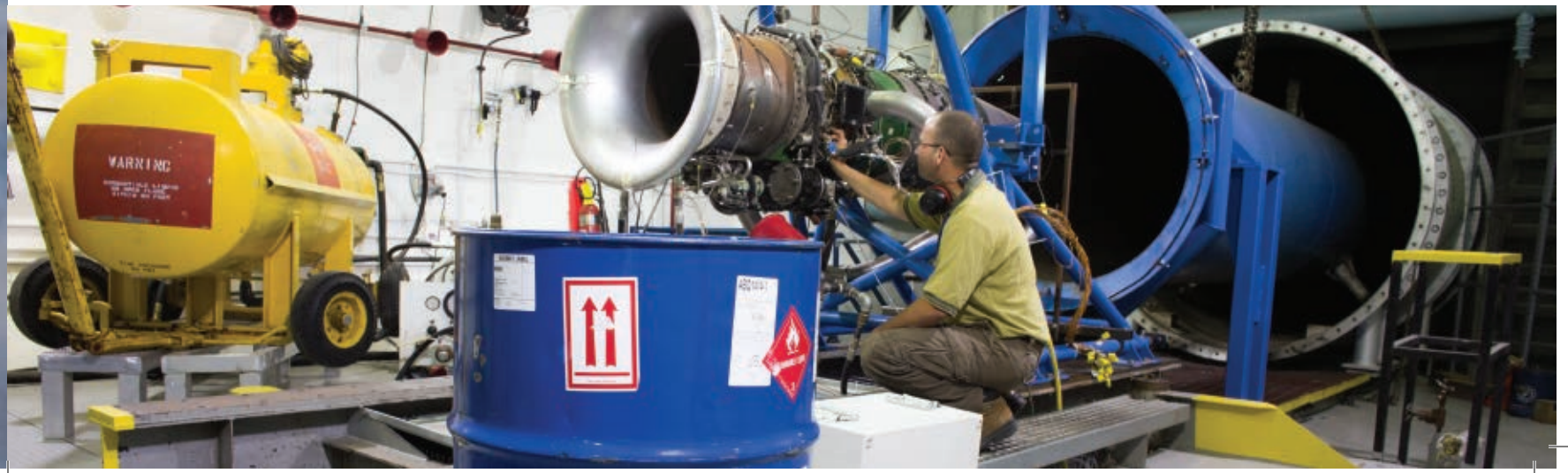
C-FIGO

Alternative jet fuel takes flight

In 2012, NRC achieved an enormous milestone for the aviation industry: it flew the first civil jet powered by 100 percent unblended biofuel, converted from an industrial oilseed crop. The NRC Falcon 20 jet proved that the new biofuel could take off as an alternative to petroleum. The success of that historic flight led to a collaborative agreement between NRC and NASA to study the atmospheric effects of emissions of these fuels.

NRC's research in biofuels is leading the way for the qualification and acceptance of biofuels in aviation. These green fuels benefit the global aerospace industry while protecting and preserving the environment.



Soaring to new heights with Canada's Aphid helicopter

To develop the complex control systems needed to meet the soaring demand for unmanned aerial vehicles (UAVs), Defence Research and Development Canada enlisted the help of experts from NRC.

After six years of developing and testing new sensors and computer programs, the result is a computer-controlled flight system that will help the Canadian aerospace sector to land new opportunities that are certain to take off.

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