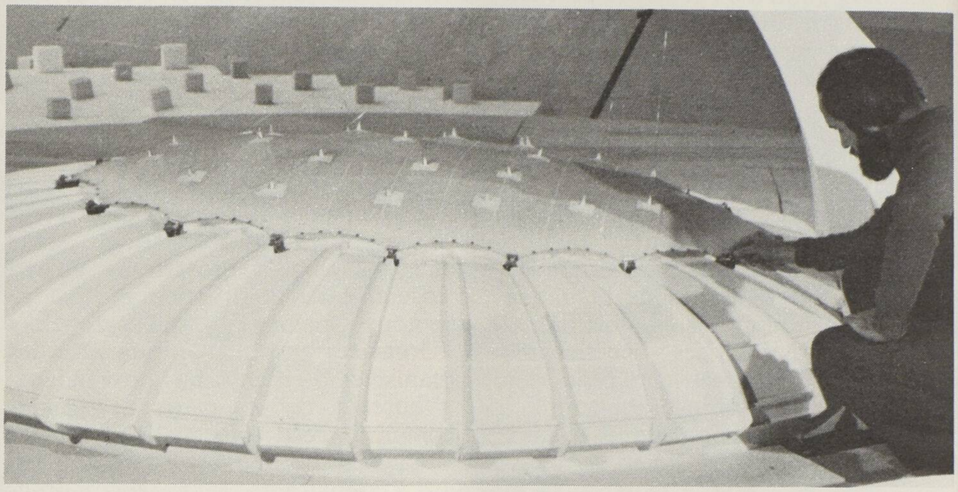
NRC's national facilities
Of wind and water

Certain experimental facilities at NRC have been set up for users outside the Council. Two of these national facilities, the wind tunnels and the ship laboratory, have a special importance to Canadian industry.

To maintain a strong, viable scientific tradition, Canada must have at its disposal instruments that probe both the microcosm of the atomic nucleus and the infinity of space beyond the ken of our planet. Between these two extremes, in the dimensions that concern day-to-day human activities, the nation must also have facilities to test and develop aircraft, ships and land vehicles, machines to traverse a land mass that touches two major oceans, dips farther south than northern California and has as its northern advance a coast short hundreds of leagues from the North Pole.

Research in such areas generally requires equipment that is very expensive to build and maintain. Telescopes to observe the heavens and particle accelerators to do nuclear research are beyond the fiscal scope of most Canadian universities; similarly, the huge ship laboratories and wind tunnels required to develop improved transport vehicles are much too expensive for any one of Canada's shipbuilding or aeronautical industries. To ensure the availability of such equipment to Canadians, the federal government early assumed the responsibility for their construction, designating them national facilities under the supervision of the National Research Council. Though all the facilities have some relevance to industry, those with the greatest impact are the wind tunnels and the ship laboratory.



Bruce Kane, NRC/CNRC

To test the effects of wind on the roof of Montreal's Olympic Stadium, a 1:100 scale model was constructed for tests in the 30-foot wind tunnel.

Pour étudier les effets du vent sur le toit du Stade olympique de Montréal, on a construit une maquette au 1/100 que l'on a essayée dans la soufflerie de 30 pieds.

Wind Tunnels

From the earliest days of the flight era, the performance of aircraft has been evaluated in wind tunnels. In fact, most of the experimental data that underlie the science of aeronautics have been gathered in such structures. The National Research Council's National Aeronautical Establishment (NAE) has 10 wind tunnels at its disposal ranging in size from the gargantuan 30-foot V/STOL tunnel capable of holding large-scale models, to much smaller facilities which measure only inches across at their working sections. Over the years, NAE has made these facilities available to Canadian industry as well as the consultant services of its research staff (primarily to aerospace companies in the past, but increasingly to non-aeronautical users).

The rationale behind wind tunnels is simple: blowing air over an aircraft model creates the same effect as driving it through the air. Such an arrangement allows engineers to bring very sophisticated equipment into play in measuring the aerodynamic forces operating on the model. In recent years, tunnels have also been used to examine the effects of wind on a variety of other model structures: bridges, buildings, cars, trucks, even entire cities. In fact, the problems of "wind engineers" now predominate in the work schedule of certain "low speed" wind tunnels.

National Aeronautical Establishment, NRC/
Établissement aéronautique national, CNRC

A model of Canadair's CL-600 undergoing tests in NAE's trisonic blowdown tunnel.

Maquette du Canadair CL-600 à l'essai dans la soufflerie «trisonique» à rafales de l'ÉAN.

In tunnel operation, an artificial wind is created, either by a rotating fan or the release of compressed air, and after being smoothed out by appropriate filters, it passes through the working area of the facility, called the "test section" (tunnels are usually described by the upper size limit of this section). Today, wind tunnels have highly regulated air streams for aeronautical research, ranging in velocity from a few kilometres per hour to many times the speed of sound; for lower speed non-aeronautical work, special equipment is introduced that breaks up the smooth air flow, thereby simulating natural winds. To handle the large amount of experimental data, the tunnels are equipped with sophisticated computer-assisted data acquisition and reduction systems.

The largest of NAE's low-speed tunnels has a square test section with 30 ft. sides, large enough to test models with wing spans approaching 20 ft. (the Canadian work on vertical and short take-off and landing aircraft, VTOL and STOL, was carried out in this tunnel). For reasons of cost and energy consumption, the higher speed tunnels are generally smaller than the lower speed tunnels. One of the most versatile facilities, the 5-ft. trisonic tunnel, is used to test models under speed conditions that range from subsonic (below Mach 1, the speed of sound) through transonic (just below and above Mach 1) to a maximum supersonic speed of about Mach 4.3. For airspeeds high in the hypersonic range