

Aerophysics was originally established in 1950 with the financial assistance of the Defence Research Board, and the DRB continues to provide financial support in the form of grants-in-aid. However, the DRB is now just one, albeit an important one, source of support for the Institute. The parent University of Toronto is, of course, a main source of strength, but grants in the form of research contracts have also been received from the USAF, and now the Canadian Aircraft Industry is beginning to lend a helping hand.

The Institute is housed at Downs-

view in a low, rambling but otherwise nondescript red brick structure, made conspicuous only by the big silver sphere towering alongside. This is the Hortonsphere, which is used to provide the vacuum necessary to operate two of the Institute's wind tunnels, one of which has a 16 in. by 16 in. working section and can produce Mach numbers up to about 7.0 for periods of 20 seconds; the other has a 5 in. by 7 in. working section and is capable of Mach numbers of 9.0 or 10.0 for periods of many minutes.

Impressive as are these figures and

the equipment that produces them, the most dramatic and far-reaching work is performed with the aid of shock tubes and shock wind tunnels. With these advanced research tools, the Institute's researchers produce Mach numbers of up to 30.0 as a matter of course. They have developed up to as high as a fantastic Mach 300.0 and associated temperatures up to 100,000° Kelvin\*. Thinking is commonly in terms of altitudes of the nature of 500,000 ft.

In their investigations, the Institute's staff covers most aspects of modern fluid dynamics as it concerns flight. Their dealings are with the mechanics of rarefied gases. To enable them to carry out these functions, they simulate conditions from ground level to outer space.

**Areas of Interest:** The Institute is currently interested in two highly important areas; one of these is heat transfer—if new fundamental knowledge is discovered which can lead to the development of radically advanced modes of heat transfer, then the heating effects of skin friction will be reduced to insignificant proportions. A second area of interest is in the aerodynamics of rarefied gases. Dr. Patterson points out that aerodynamics in this case is entirely different than it is at ground level. "There is no comparison at all."

A by-product of the Institute's studies of extreme altitudes has been the discovery of an instrument that seemingly does the impossible. Known as the "free molecule probe", this instrument makes it possible to measure pressure or temperature *without disturbing the air*.

The Institute is also looking into ways and means of producing ionization and dissociation of air in shock tubes. Reduced to the simplest terms, this means that the air breaks down from molecular to atomic structure. Dr. Patterson points out that when a gas becomes ionized, it becomes an electrical conductor. Through ionization, it becomes possible to direct the flow of gases without a physical wall. This has actually been done in Institute laboratory experiments. Known as magneto gas dynamics, it is regarded by the Institute as a whole new field.

Says Dr. Patterson: "We expect in an ionized gas to be able to *produce lift*

\*The Kelvin scale is widely used in scientific work. It is the same as the Centigrade scale except that it begins at absolute zero. That is, 0°K. is equivalent to -273.16°C. Thus, 100,000°K. equals 99,727°C. or 179,566°F.

## .....A BOOST FROM INDUSTRY.....

Two member companies of the A. V. Roe Canada Group—Avro Aircraft Ltd. and Orenda Engines Ltd.—in February presented \$50,000 to the University of Toronto's Institute of Aerophysics to help carry out a relocation and expansion program designed to meet the greatly-increased demand for aeronautical engineers.

Other firms in the industry are being approached with a view to raising the balance of the \$100,000 the Institute estimates it will need from industry to carry out its moving and expansion program.

The University of Toronto has allotted 24 acres near the Connaught Laboratories in north Toronto for the Institute's new quarters. The Institute is at present located on Downsview Airport, also in north Toronto.

In addition to university and industrial support, there will be continuing assistance from the Defence Research Board, for which the Institute has done pioneering work in aeronautical research.

"The need for expansion has been

apparent since the Institute organized in 1955 its first courses to train graduate engineers as aeronautical engineers," according to Dr. G. N. Patterson, director of the Institute. "Almost immediately, applications for enrolment exceeded by a wide margin the number of students we could accommodate. In 1956, while aviation companies faced a continuing shortage of aeronautical engineers, we had to turn away many applicants."

The photo below shows industry and university officials visiting the Institute's existing facilities at the time the A. V. Roe Canada organizations made their contribution to the moving and expansion fund. Left to right are: Dr. G. N. Patterson, director, Institute of Aerophysics; F. T. Smye, president and general manager, Avro Aircraft Ltd.; Dr. Sidney E. Smith, president, University of Toronto; W. R. McLachlan, president and general manager, Orenda Engines Ltd.; and Dr. R. R. McLaughlin, Dean of the Faculty of Applied Science and Engineering, University of Toronto.

