two cycles per second. Since there was nothing on the market to record such a low frequency, Canadair was forced to develop its own special recording and measuring equipment.

Another department concerned directly with the research and development program is the Engineering Experimental Section headed by Lou Chow. Experimental work carried out in this section involves aircraft, systems, and components. This work extends even to testing component parts manufactured elsewhere under sub-contract.

Canadair's Development department comes under the direction of Chief Development Engineer R. D. Richmond and is broken down into four main sections:

Preliminary Design—where the department is given an initial order for a project. This could be a requirement from the RCAF, or it could be a component part. Depending on its complexity, the project could take from two weeks to two years to complete.

Aerodynamics — under which all wind tunnel testing is carried out. This testing takes place at either the National Research Council's wind tunnel facility at Ottawa, or at the Convair plant in California. Although Canadair recognizes the need for facilities of their own, the ultra-high costs involved in setting up an adequate tunnel are considered to be not justified at present.

Experimental—which performs laboratory tests of all systems in an aircraft prior to flight. This includes hydraulic mock-ups, electrical systems, fuel systems and power plant. In the case of the CL-28, one of the engines was mounted on a specially built test stand. Some 500 hours operating time were logged on this test stand before the engine was installed in the aircraft.

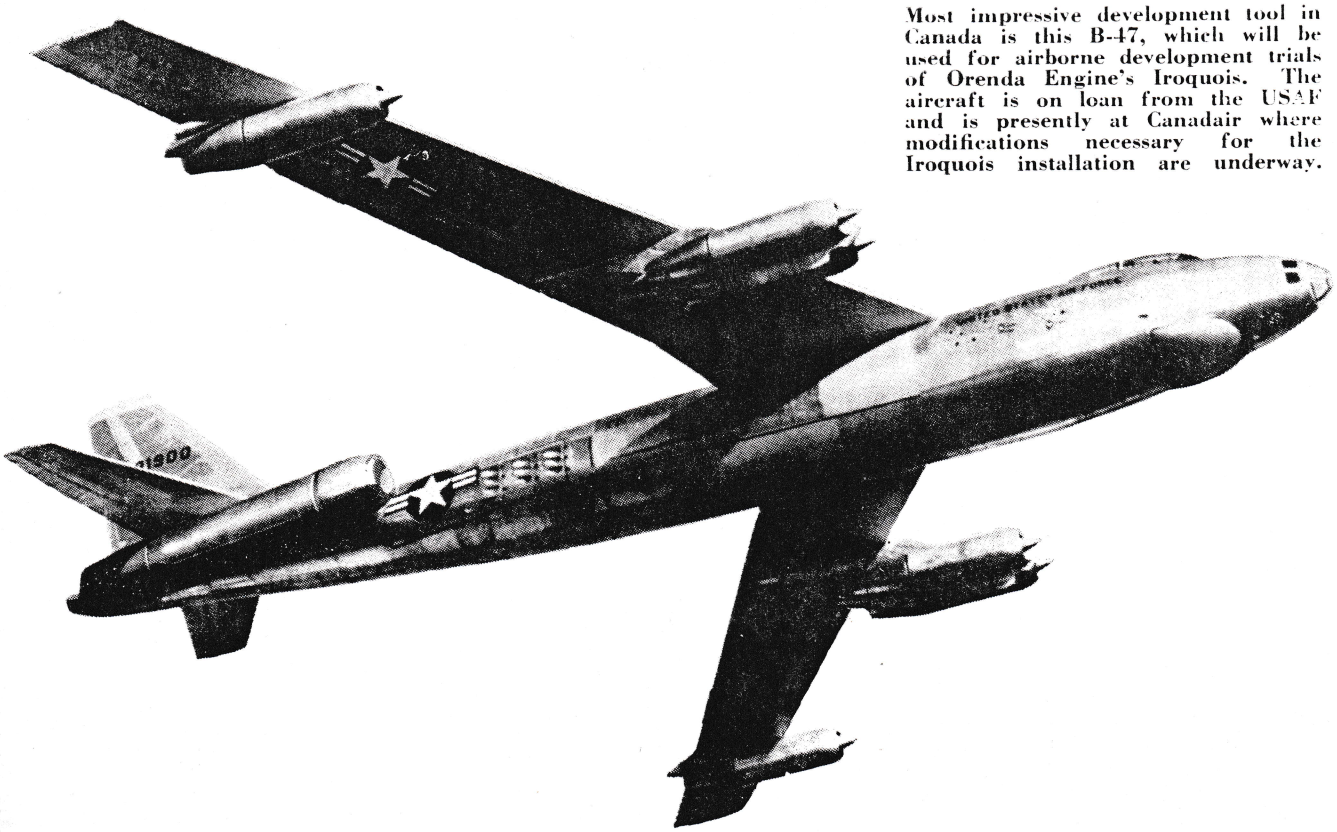
Special Weapons—better known as the Guided Missile Development Facility. Since the government abandoned the Velvet Glove project, the missile engineering set-up at Canadair has been operating at half-steam. Still shrouded in security, the special weapons laboratories seem to be existing for the time when the government decides to get back in the guided missile business. Meanwhile, it is here that Canadair engineers and scientists work out problems in electronic reduction of complicated data on missile performance, the determination of its weight-rolling moment of inertia, and simulation of the missile's operation in flight.

Orenda Engines: A different company with a different set of engineering problems, is Orenda Engines Ltd., at Toronto. Engaged in the mass production of gas turbine engines, Orenda employs more than 5,000 men. Two-fifths of its technical staff, that is: scientists, engineers and technicians, are engaged in research engineering and development work.

The constant need for research in turbine development has resulted in the Orenda company sinking another $7.7 millions into test facilities this year. Included in the multi-million expansion is the construction of afterburner, blade cooling, aerodynamic, combustion and engine altitude test facilities and six additional engine development test cells.

At Nobel, Ont., is Orenda's full-scale engine test establishment. Situated 170 miles north of Malton, the Nobel plant communicates via teletype. Here Orenda engineers seek solutions to basic problems associated with compressors, combustion systems, control systems, turbines and exhaust systems. It is at Nobel where aerodynamic and thermodynamic tests are conducted to prove the theoretical basis of design and to determine the practical limitations of both engines and components. This is accomplished by automatic instrumentation in test equipment. These studies determine the characteristics of blade sections, compressors, turbines and combustion chambers.

At Malton, in the Sir Thomas Sopwith laboratory which came into use



Most impressive development tool in Canada is this B-47, which will be used for airborne development trials of Orenda Engine's Iroquois. The aircraft is on loan from the USAF and is presently at Canadair where modifications necessary for the Iroquois installation are underway.

in early 1955, are five major laboratories. Between these five bodies is divided the research and development work of the company.

Mechanical Laboratory—where complete engines or the major structural components are put under simulated flight load conditions to determine stresses.

Aerodynamics Laboratory — where work centres around the wind tunnel used for aerodynamic investigations of small models.

Materials Laboratory — which contains equipment for chemical analysis, fatigue testing, creep testing, tensile and hardness testing, thermal shock testing and welding investigations.

Instrumentation Laboratory—which has, in addition to other things, facilities for testing specialized electronics devices.

Fuel Systems Laboratory — which features test rigs for all fuel and oil system components and complete systems. It includes also, a temperature controlled, dust-free room for teardown and assembly of finally machined components.

Avro Aircraft: "Across the road", as the saying goes at Malton, is Avro Aircraft Ltd. Employing as it does, some 8,000 people, it is the largest aircraft production company in Canada. At the present time, the Engineering Division's Research & Development Department is busy with security-ridden labors concerning the company's much-heralded "Arrow." Generally, Avro's R & D department is responsible for a variety of testing activity which can be divided into four sections.

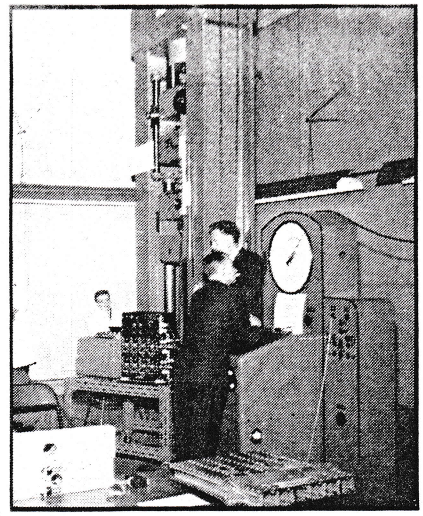
Through their research, Avro metallurgists have produced a corrosion-resisting protective treatment for magnesium alloy. This treatment can be applied in half the time required by previous methods, and makes an acceptable paint base. Before, aircraft structural steel components of 200,000 psi were considered to be of maximum tensile strength. Metallurgy has produced heat treat methods and alloys making steel 30% stronger with no increase in weight.

The second section of the department is the testing of structures, systems and mechanical testing. Starting with the smallest items such as valves and hydraulic jacks, each part of each system is subjected to in flight conditions of load and temperature. To test for such things as metal fatigue, the aircraft must be instrumented and set up for ground engine running with recorders and other paraphernalia hooked on.

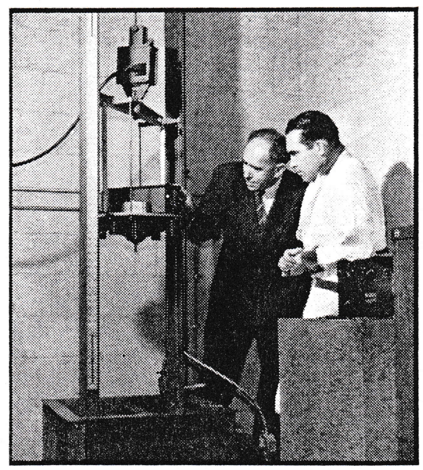
In the flight testing phase, the R & D department strives to check every mechanical function of the aircraft in flight. By the use of the Telemetry Trailer, a large mobile receiving station, signals are collected from airborne test aircraft which are converted into the recorded data needed by the test engineers. Facts such as airspeed, accelerations, vibrations, stick forces are all checked in flight with telemetry.

The final section under the R & D department is that concerned with armament and electronics test. They study such problems as the effect of projectile pods on flight characteristics and methods of jettisoning external stores. The ultimate objective of the tests is to subject the armament and radar installations to a series of simulated combat conditions.

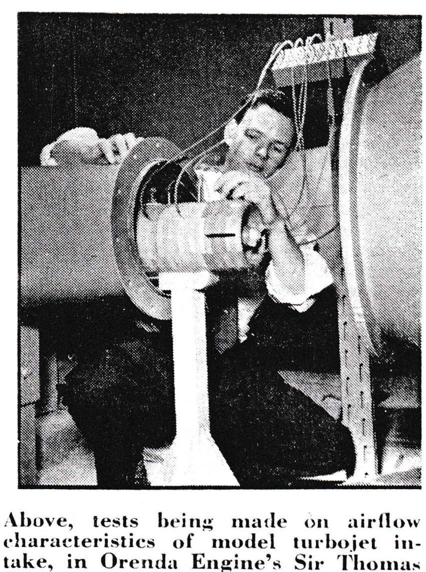
De Havilland Canada: The aircraft development work of The de Havilland Aircraft of Canada Ltd., is well known, with the company being credited with the design and development of four major types of aircraft since the end of World War II. The Chipmunk was followed by the Beaver,



Above left is Canadian Marconi engineering lab. Above is 200 ton tension/compression test machine in Canadair's test and development laboratory.



Above, a drop test machine in the environmental laboratory at PSC Applied Research. In photo, machine is used for shock testing R Theta Computer.



Above, tests being made on airflow characteristics of model turbojet intake, in Orenda Engine's Sir Thomas Sopwith Gas Turbine Exper. Lab.