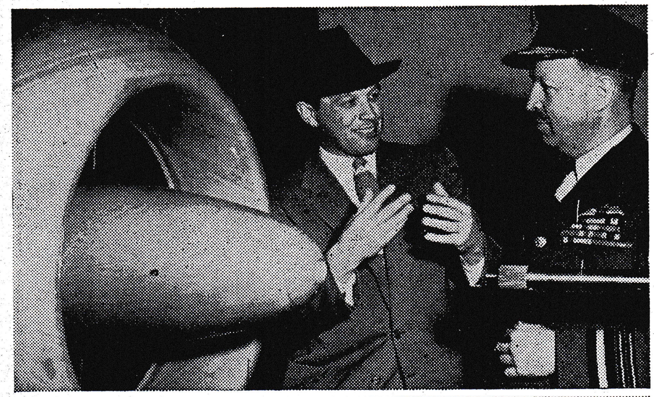
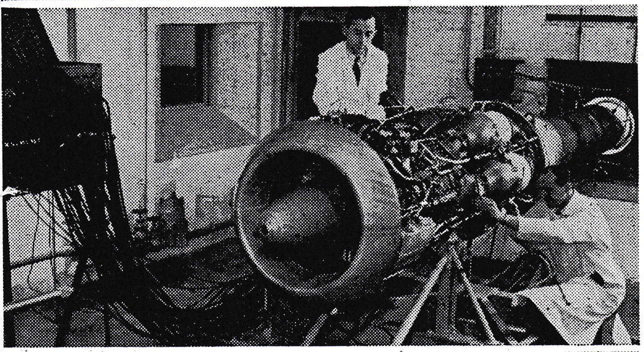
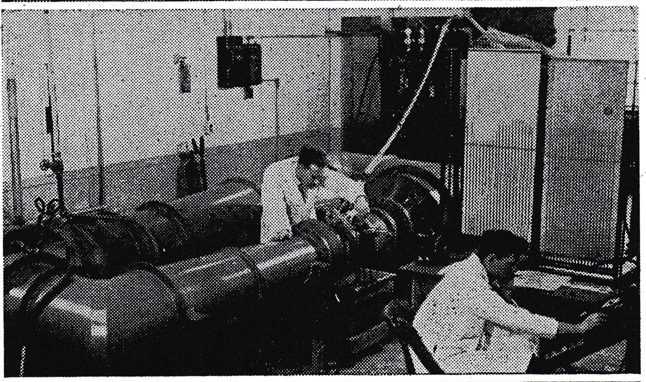
AVRO CHINOOK SUCCESS MARKS



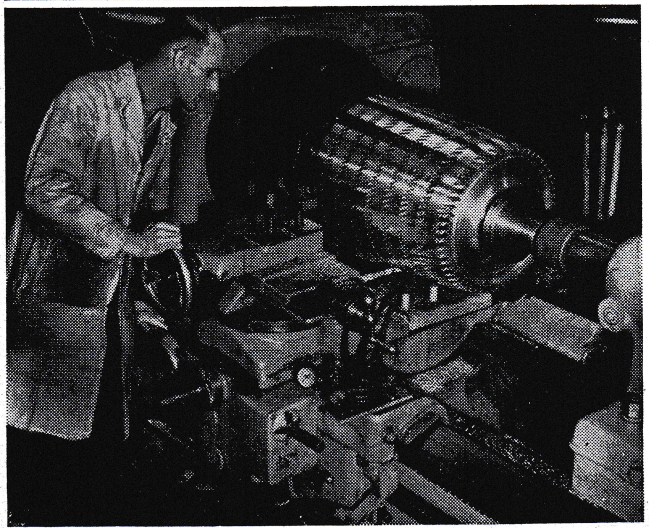
Winnett Boyd, Chief Designer in Avro's Turbine Div., discusses the Chinook with Air Marshal W. A. Curtis, Chief of Air Staff, RCAF.



Chinook on the test bed ready for initial running. Observation window is at left.



The closed - circuit wind tunnel in the Avro plant is used for aerodynamic studies related to the flow of air and gases through the engine.



LOWER LEFT: Turning contour on compressor rotor drum for the Avro Chinook engine.

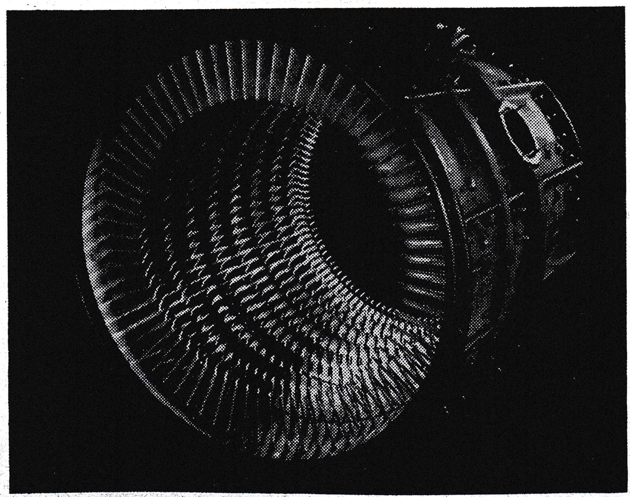
DEBUT of the Chinook jet engine at the Malton plant of A. V. Roe Canada Ltd. marks a new stage in the Canadian aircraft industry. The successful running of this initial "development" engine took on new significance during a survey of the plant where every precise detail of its sleek proportions was designed and manufactured.

One is impressed with the astonishing amount of research and development development work involved in the design of the multiple bits and pieces which combine in a jet engine.

The compressor, stator and rotor blades, for example, represent infinite effort in aerodynamics and related sciences to achieve the exact contours required in 21 variations. Then, after patterns have been made from each of these designs, there is the major assignment of profile milling the actual blades, of which there are 30 to 100 each row. Accuracy is held to plus or minus two thousandths.

The same devotion to detailed accuracy characterizes the other phases of this engine's development. There is, for instance, the overspeed pit where moving parts are whirled at 13,000 rpm in a partial-vacuum steel chamber. There is the instrument lab. for checking thermocouples, thermometers, pressure gauges, etc., with

BELOW: Front view of the Chinook compressor casing with stator blades installed. The nine stages are evident in this picture.



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a dustproof compartment for working on finer instruments.

In the fuel lab., a complete mock-up of the engine's fuel system is used to test fuel pumps and lines. Also, there are specially designed installations to examine fuel spray angles and patterns.

The bearing testing equipment is designed to measure the gyroscopic loads usually encountered in flight manoeuvres as well as the radial and thrust loads on bearings in the normal running of the engine.

This development, initially sponsored by the Dept. of Munitions and Supply under the leadership of the Rt. Hon. C. D. Howe, began during the war years when word was received from the United Kingdom of a new type of aircraft engine of immense possibilities.

The first step took place in 1944, when Turbo Research Limited commenced preliminary investigations on gas turbine engines. In 1946, the next step was taken when Avro Canada absorbed the Turbo Research organization and transferred it to Malton.

At Avro Canada a design team and a manufacturing organization have been created and trained in this new skill. The facilities for progressive

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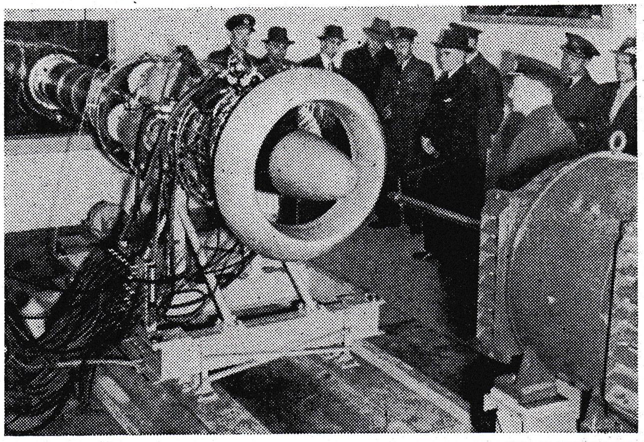
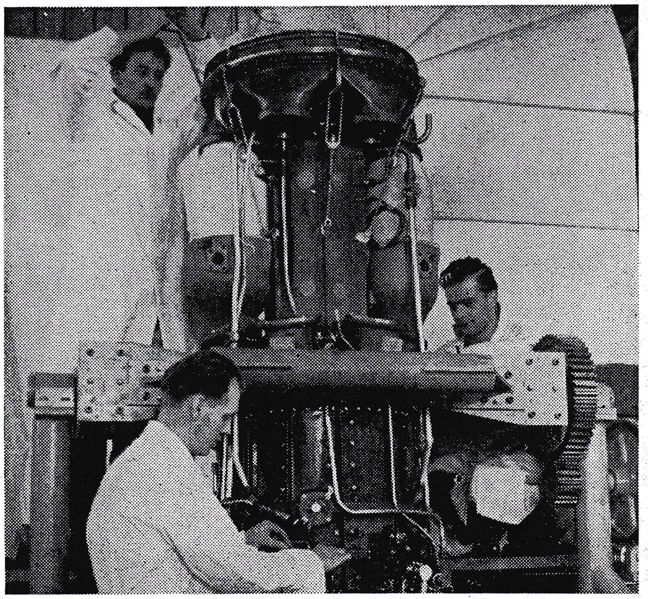
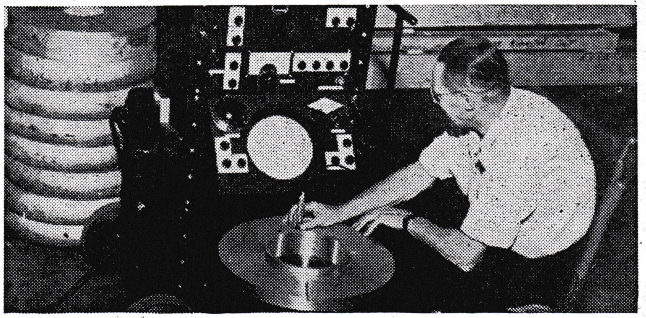


Air Force chiefs from Ottawa view the Chinook during its official debut. The first running of Canada's first jet engine was a success.



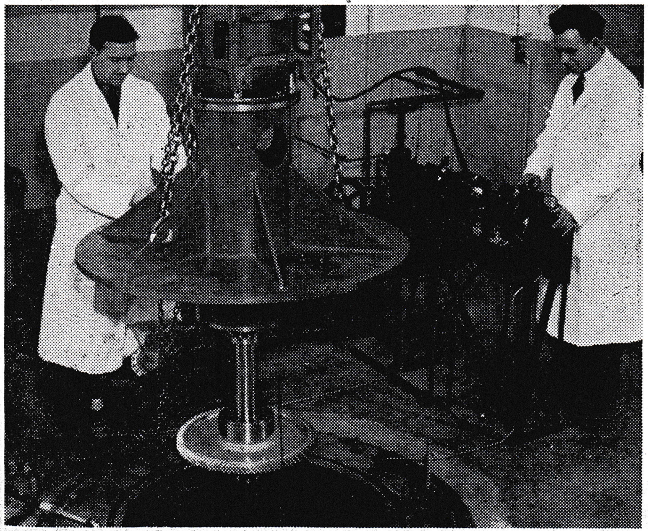
On the final assembly stand, the engine can be held in either the vertical or the horizontal position.



LOWER RIGHT: Supersonic signals passing through a compressor rotor disc detect the slightest flaw. Any discontinuity in the material affects the rate of signal response.

BOTTOM RIGHT: Part of the pattern and model ship in the Gas Turbine Division of the Avro plant.

BELOW: The overspeed test rig used for examining the behavior of rotating parts of the engine at high speed. Here the compressor disc is being lowered into the steel-lined pit.



Chinook Engine

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development work in this new field have also been established.

These facilities are capable of designing and manufacturing new types of aircraft engines for both military and civil needs, to meet conditions peculiar to this country.

Basically the Chinook is a gas turbine jet propulsion engine, consisting of a nine-stage axial-flow compressor, six combustion chambers, a single-stage turbine, and an exhaust tail cone.

In operation, air is first drawn into the engine by the compressor. The compressor in the Chinook engine is made up of nine stages, each stage or row of whirling blades compressing the air a little more until at the end of the ninth stage it has been compressed to about four and a half atmospheres, or 50 lb. per sq. in. This compression also heats the air to about 400 deg. F.

The air at this point is forced into the combustion chambers placed around the engine. Kerosene fuel is pumped into this compressed air in the form of a spray and burned continuously. A spark plug is used to ignite the mixture when starting.

There are some 1,700 compressor and turbine blades in each engine which have to be manufactured to extremely close tolerances, and in many instances Avro Canada has had to develop special equipment to manufacture these blades to the required precision.

Situated several hundred yards from the main plant is an engine test laboratory where completed engines are placed on the test stands and run.

In addition to the laboratories at Malton, there is yet another test facility located at Nobel, Ontario. This plant was selected because of its power plant equipment consisting of a 6,000-hp steam turbine, which is necessary for compressor testing.

A number of large reciprocating air compressors capable of supplying a substantial quantity of high pressure air for combustion and aerodynamic tests are also in operation at Nobel. The facilities are used in the testing and development of the three components of the engine, namely compressors, turbines, and combustion chambers, and also for carrying out miscellaneous aerodynamic tests on sections of the engines.

A study of the test facilities at Avro Canada clearly demonstrates the scope and complexity of the work required in the development of gas turbine engines.