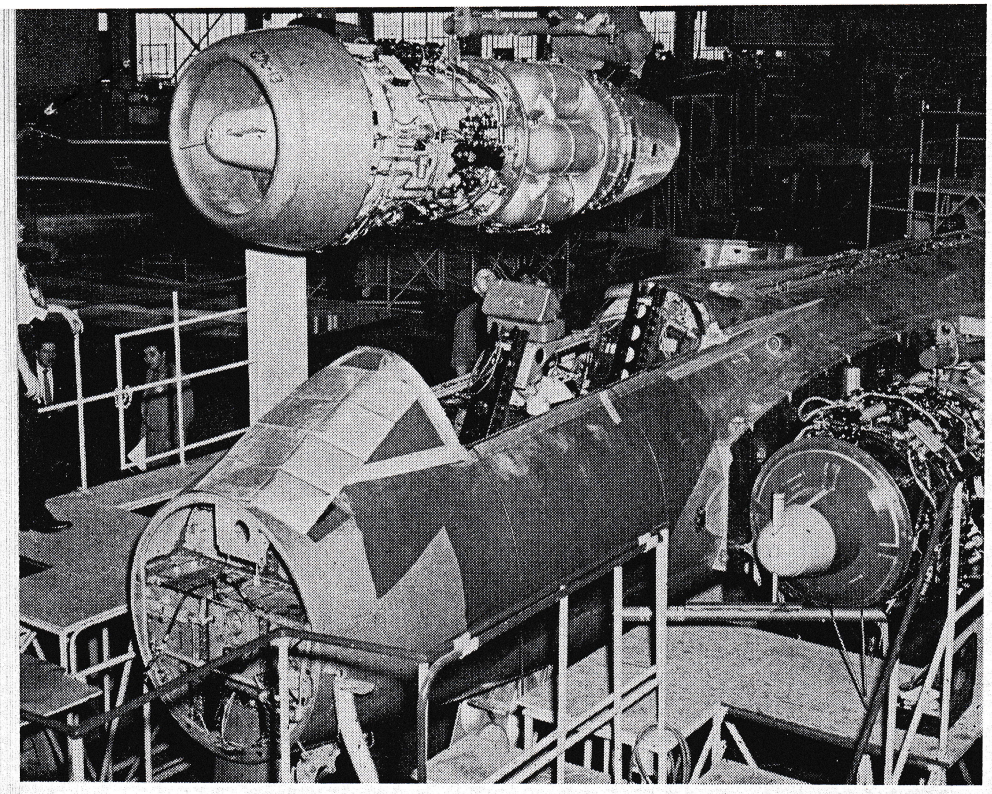
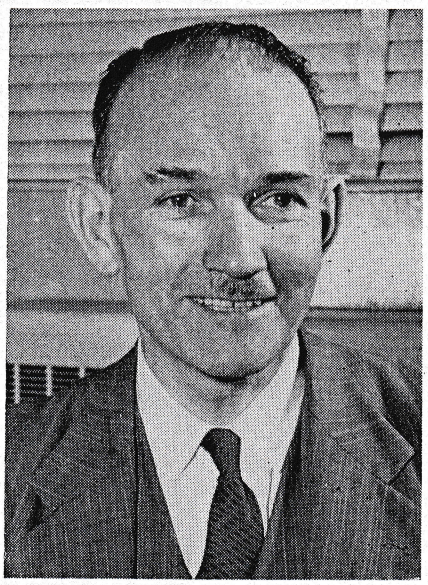


ORENDA turbojet being installed in the CF-100.



CHARLES A. GRINYER

RL 896-1955

Free world

2,000th jet engine proves production

By Charles A. Grinyer
Vice-President, Engineering,
Orenda Engines Ltd.

The milestone we have just passed at Orenda Engines — delivery and acceptance of the 2,000th Orenda — obviously represents a most important engineering and production achievement.

That figure 2,000 of itself does not, of course, signify much. Relate it, however, to the period of production (a little over two years) and the quality of the product (the Orenda has made the Canadair Sabre the most powerful fighter in Europe today) and a significant picture begins to take shape.

As our President, Crawford Gordon Jr. stated recently:

"When the project began we hadn't even attempted to assemble someone else's engine, let alone design one of our own. It is a mark of our (Canadian) inherent ability to get things done that we were able to step right into the tough jet engine business and compete with the best in the United States and Britain on quality, performance, and most important, price."

What are the highlights of this achievement?

Of great significance is the fact that between the first and second thousand came the transition from single-stage to two-stage turbine engines. With this change we have increased power, reduced weight and have improved fuel economy.

- **More Power.** From an initial 5,800 lb. of thrust in the Orenda 2 to 6,355 lb. in the 8, 9 and 10, to over 7,000 lb. in the Series 11 and 14.

- **Less Weight.** Down from 2,685 lb. in the Series 2 to about 2,400 in current production models despite the addition of the extra turbine stage.

We have also reduced our demand for strategic materials, such as nickel, cobalt, tungsten and the like —the current engine requiring almost 40% less than the first models.

▸ **Engineering Development.** Basic engineering work, carried out largely at the full scale test establishment located at Nobel, near Parry Sound, has resulted in other progressive improvements to the engines. For instance, when the RCAF decided to change from kerosene to JP4—a fuel containing a larger proportion of aromatic derivatives—it was found that relighting an engine in the air could not be guaranteed above 12,500 ft. instead of the 20,000 ft. previously possible.

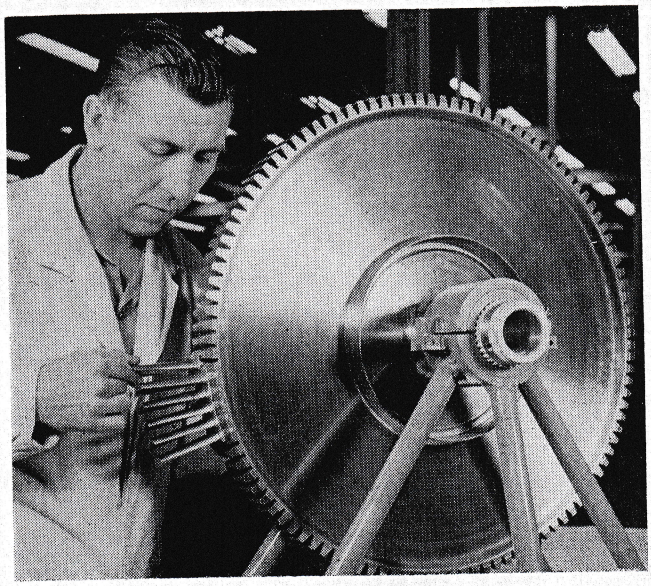
Investigation revealed this to be due to the increased volatility of JP4 and by extending the length of the ignition plugs to place the spark in the combustion chamber rather than in the cross-firing tubes, the original guaranteed minimum altitude was considerably improved upon.

Additional work has since been completed to modify the igniter plug position further, this increases the size of the cross-firing tubes between chambers and utilizes a higher energy ignition system.

The latest engines with this system can relight in flight at all altitudes up to ceiling of the aircraft in which they are installed.

▸ **Increase Thrust.** In a similar manner, compressor development has allowed considerable increases in power output without making the engine any more difficult to handle. Right from the start in fact we were able to dispense with the use of cumbersome blow-off valves or variable incident inlet vanes as used in many highly rated compressors to avoid compressor stall.

Later aerodynamic work actually



TECHNICIAN checks fitting of jet engine blades.

"CANNED ORENDAS" await shipment at Malton.

looks to Orenda research, development

milestone for Canadian industry . . .

improved acceleration characteristics and the present Orenda 11 and 14 engines are better in this respect than the earlier models.

This was achieved by redesigning some of the compressor blading in such a manner that the points at which the compressor would surge were moved further away from the normal operating points. This was enough to increase the air flow through the unit to give the higher thrust of the later engines with less susceptibility to surging than was apparent on the original design.

These are but a few of the highlights of our progress.

★ ★ ★

Feature. Like all aircraft engine manufacturers Orenda has to be thinking in terms of the power plant needed for the planes that will have to fly at speeds far in excess of the speed of sound and at 50,000 ft. and up.

This means power requirements approximately equal to the weight of the aircraft itself. Thus, a 25,000 lb. aircraft will need 25,000 lb. of thrust.

Procurement. When the Orenda engine program got started five years ago 90% of components and materials had to be bought outside Canada. Today that situation is completely reversed: 90% is now manufactured within Canada. And largely by new Canadian industry set up initially to meet Orenda needs.

As an example some seven firms are now making a major contribution to the Orenda program. These, employ some 3,000 persons and are doing a monthly volume of business of around $2 millions.

They are:

- Lucas-Rotax Ltd., Ajax fuel systems, a new Canadian industry which had its origins in England.
- Canadian Steel Improvement Ltd., Toronto, now a member of the A. V. Roe Canada group, which came into being after Steel Improvement of Cleveland were sold on the future of Canada's aircraft industry, to provide a constant and continuing Canadian sources of engine blades.
- Light Alloys Ltd., castings, who started operating in an old church and for whom DDP built a modern magnesium foundry.
- York Gears Ltd., Toronto, set up as a Division of Acme Screw & Gear for the special job of making precision gears for the Orenda.
- Cockshutt Aircraft Ltd. whom were persuaded to move to Renfrew to make combustion systems.
- McDonald Bros. Aircraft Ltd., Winnipeg, who took on the jet pipe and tail cone work after several firms in U. S. with ready-made facilities and then the most logical sources of supply, had refused to undertake this work.
- Shawinigan Chemicals Ltd., Shawinigan Falls, were persuaded to invest $200,000 in the equipment needed to make the great contribution they have to the Orenda program with high-quality castings.

In addition to all this it was necessary to negotiate contracts, attempt to set target prices, to get the subcontractors' production and financial affairs in such a position that A. V. Roe Canada Ltd. could quote target and fixed prices.

The purchasing dept. was at one time making commitments of $8-9 millions a month, which ranged all the way from buildings the size of our engine plant right down to toothpicks.