RL-866-1960

DDP on behalf of the USAF. The equipment is being installed as part of the North American integrated defence system.

The first delivery was on schedule. A sizable proportion of this height-finding radar order has been sub-contracted out to Canadian suppliers. It is expected to be completed in the final quarter of 1960.

Change of Name

Whittaker Electronics Ltd., Ottawa, has taken over representation of firms previously represented by E. E. Whittaker. Stock of several lines will be maintained at the Ottawa office.

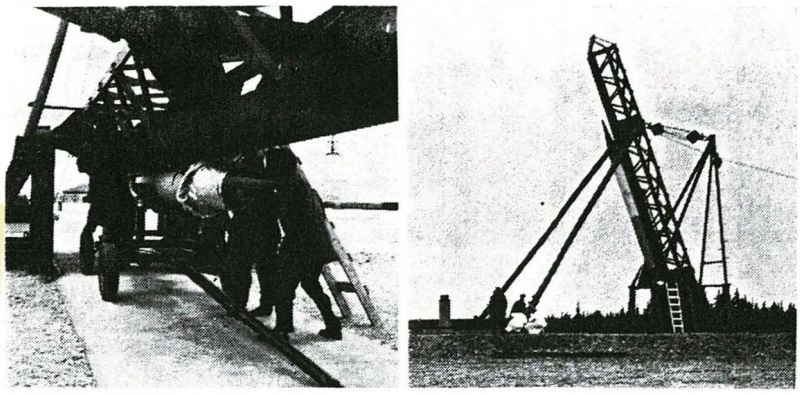
Canada Exports Brains

The export of Canadian brains to the U.S., especially in the engineering ranks, has accelerated at an alarming rate in the past 24 months. This fact was evident in the recently published U.S. Dept. of Immigration figures which show that although the total number of Canadians moving southward is down, the percentage of professional people is drastically up.

In two six-month periods in the last 24 months, the outflow of Canadian-born and Canadian-trained engineers jumped almost 100% from 357 to 713.

Following the Avro Arrow debacle last year, the number of aeronautical engineers leaving for American pastures soared 850%.

During the entire year of 1958, the total number of Canadian engineers emigrating to the U.S. was 720. In the first six months of 1959 (and the last period for which figures are available), a total of 713 engineers moved out.



BLACK BRANT: Shown being placed on inclined launcher at Fort Churchill, Man., is the 17-inch Black Brant rocket engine developed by the CARDE. Right: scientists and technical personnel position the Canadian-developed propulsion test vehicle on the launcher. Four of the vehicles were successfully fired last September. The Black Brant was fabricated by Bristol Aero-Industries' Winnipeg Division.

Contracts Awarded

Contractors awarded business in excess of $10,000 by the Department of Defence Production during the period February 1-29, 1960, include the following. The list does not include orders placed by the Department outside Canada, or with other agencies or increases in orders placed earlier—nor do orders classified as secret appear here.

Names appearing in bold face are current AIRCRAFT advertisers.

Anglo-Canadian Wire Rope Co. Ltd., Montreal, $11,288 for aircraft towed target gear.

Aviation Electric Ltd., Montreal, $10,400 for aircraft oxygen equipment.

British American Oil Co. Ltd., Toronto, $189,115, for aviation turbine fuel during year ending March 31/61.

Burndy Canada Ltd., Scarborough, $13,800, for electrical equipment.

Canadian Petrofina Ltd., Montreal, $1,826,240, for aviation turbine fuel during year ending March 31/61.

Cities Service Oil Co. Ltd., Toronto, $511,270, for aviation gasoline during year ending March 31/61.

Computing Devices of Canada Ltd., Ottawa, $500,000, for aircraft navigational aids.

Computing Devices of Canada Ltd., Ottawa, $23,400, for course selector indicators.

De Havilland Aircraft of Canada Ltd., Toronto, $19,923, for technical services.

De Havilland Aircraft of Canada Ltd., Toronto, $42,726, for airframe components.

Gasaccumulator Co. (Canada) Ltd., Toronto, $29,274, for aerodrome lighting equipment.

B. F. Goodrich Canada Ltd., Kitchener, Ont., $38,821, for aircraft components.

Goodyear Tire & Rubber Co. of Canada Ltd., Toronto, $16,374, for aircraft components.

Honeywell Controls Ltd., Toronto, $1,600,000, for automatic flight control systems.

Imperial Oil Ltd., Ottawa, $525,413, for aviation gasoline during year ending March 31/61.

Imperial Oil Ltd., Ottawa, $5,285,643, for aviation turbine fuel during year ending March 31/61.

Instronics Ltd., Stittsville, Ont., $17,820, for radar test sets.

Maritime Helicopters Ltd., Montreal, $46,600, for charter of helicopter.

Plessey Co. of Canada Ltd., Montreal, $4,970,291, for communication equipment.

Railway & Power Engineering Corp. Ltd., Montreal, $1,658,561, for aircraft instruments.

Rolls-Royce of Canada Ltd., Montreal, $25,000, for aero engine components during year ending March 31/61.

Rolls-Royce of Canada Ltd., Montreal, $10,000, for aero engine engineering change kits.

Shell Oil Co. of Canada Ltd., Toronto, $54,437, for aviation gasoline during year ending March 31/61.

Wainwright Producers & Refiners Ltd., Edmonton, Alta., $202,200, for aviation turbine fuel during year ending March 31/61.

Koppers of Canada Ltd., Toronto, $58,570, for manufacture and installation of exhaust silencer for high speed wind tunnel—Uplands, Ont.

Abercorn Aero Ltd., Montreal, $15,000, for repair & overhaul of air/sea rescue equipment during year ending March 31/61.

Aviation Electric Ltd., Montreal, $1,652,867, for aero engine components.

Aviation Electric Ltd., Montreal, $25,000, for aircraft electrical and instrument equipment during two years ending March 31/62.

Bach-Simpson Ltd., London, Ont., $10,093, for aicraft instruments.

Canadair Ltd., Montreal, $302,064, for aero engine components.

Canadair Ltd., Montreal, $98,794, for aircraft components.

Canadair Ltd., Montreal, $57,950, for aircraft system trainer.

Canadian Applied Research Ltd., Toronto, $22,000, for technical services.

Canadian Marconi Co., Montreal, $73,819, for electronic tubes.

Canadian Pratt & Whitney Aircraft Co. Ltd., Longueuil, Que., $85,000, for repair & overhaul of helicopter airframes and airframe components during period ending March 31/60.

Cities Services Oil Co. Ltd., Toronto, $419,200, for aviation gasoline during year ending March 31/61.

Collins Radio Co. of Canada Ltd., Toronto, $27,027, for electronic components.

De Havilland Aircraft of Canada Ltd., Toronto, $16,000, for technical services.

Goodyear Tire & Rubber Co. of Canada Ltd., Toronto, $72,632, for aircraft components.

Imperial Oil Ltd., Ottawa, Ont., $1,160,850, for aviation gasoline during year ending March 31/61.

Rolls-Royce of Canada Ltd., Montreal, $10,000, for repair & overhaul of aero engines and aero engine components during year ending March 31/61.

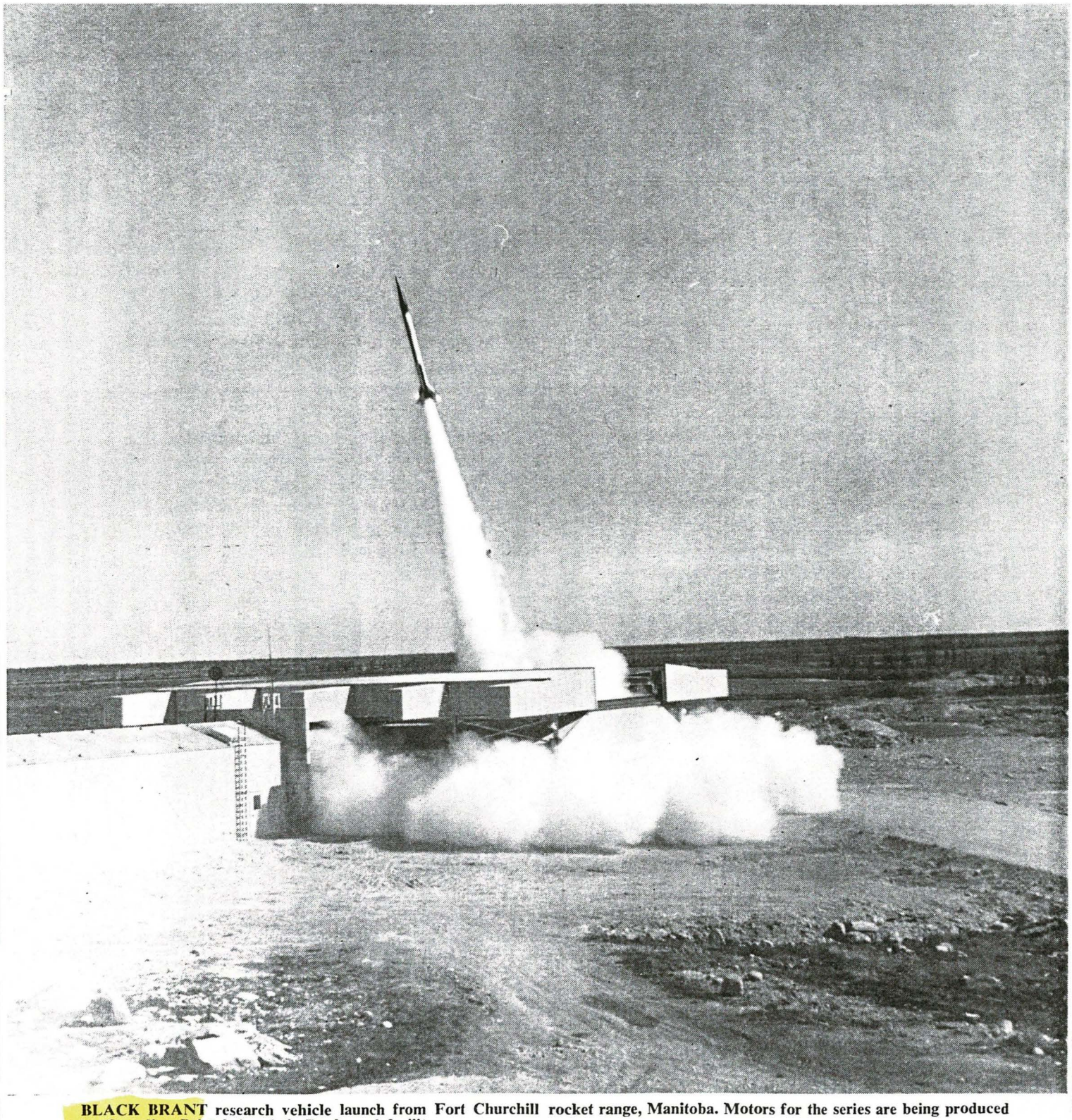
Shell Oil Co. of Canada Ltd., Toronto, $11,691, for aviation turbine fuel during year ending March 31/61.

CL-41 EVALUATION TEAM: During March an RCAF evaluation team gave the Canadair CL-41 a week-long work-out. Seen here from left to right are: F/L M. G. Sauder, of CFS; Ian McTavish, Canadair test pilot; F/L K. Waterhouse, of AFHQ; F. C. Phillips, of Canadair; S/L R. J. Hamilton, AFHQ; and Hedley Everard, of Canadair. The three Air Force pilots made preliminary flight evaluations of the new jet trainer.

RL. 866-1963

Bristol Aerojet reaches out for new space business

By Noel Swann



BLACK BRANT research vehicle launch from Fort Churchill rocket range, Manitoba. Motors for the series are being produced by Canadian Bristol Aerojet's Rockwood facility.

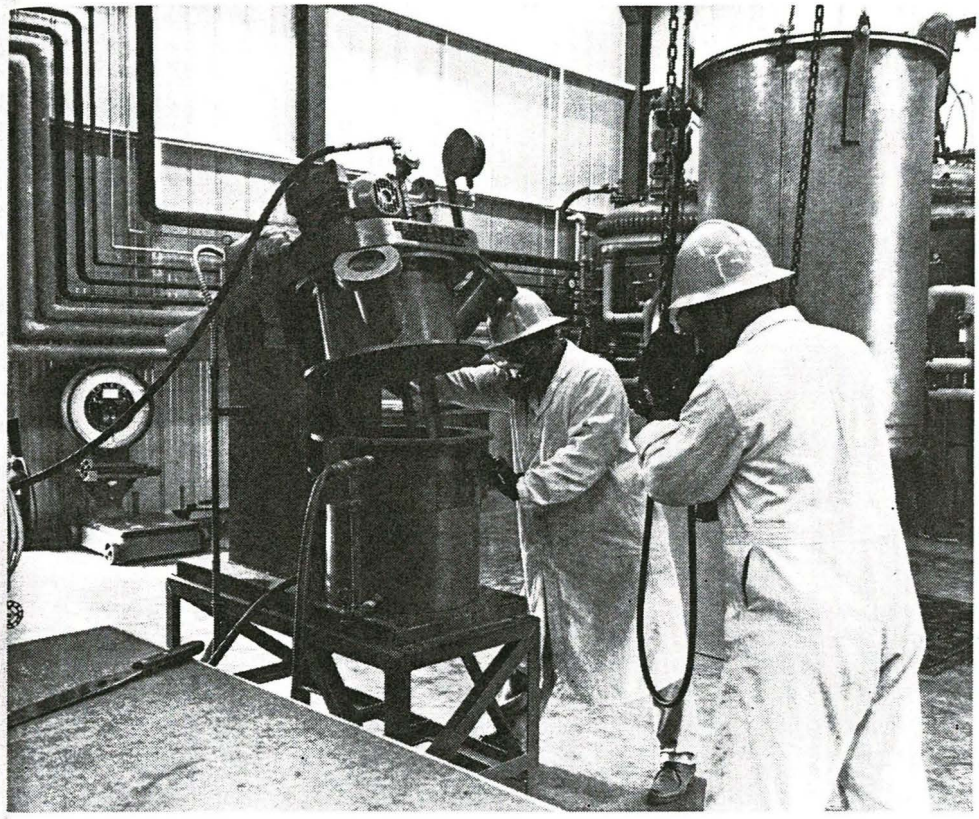
● Canada's space program received a powerful boost when Canadian Bristol Aerojet's new $2,000,000 solid propellant plant at Rockwood, Man., went into production.

The plant, which complements CBA's rocket part and instrumentation manufacturing activities in nearby Winnipeg, can produce 2,250,000 lb of solid fuel a year. The integrated operation — the country's first such commercial venture — could grow into a $10,000,000 industry in three years.

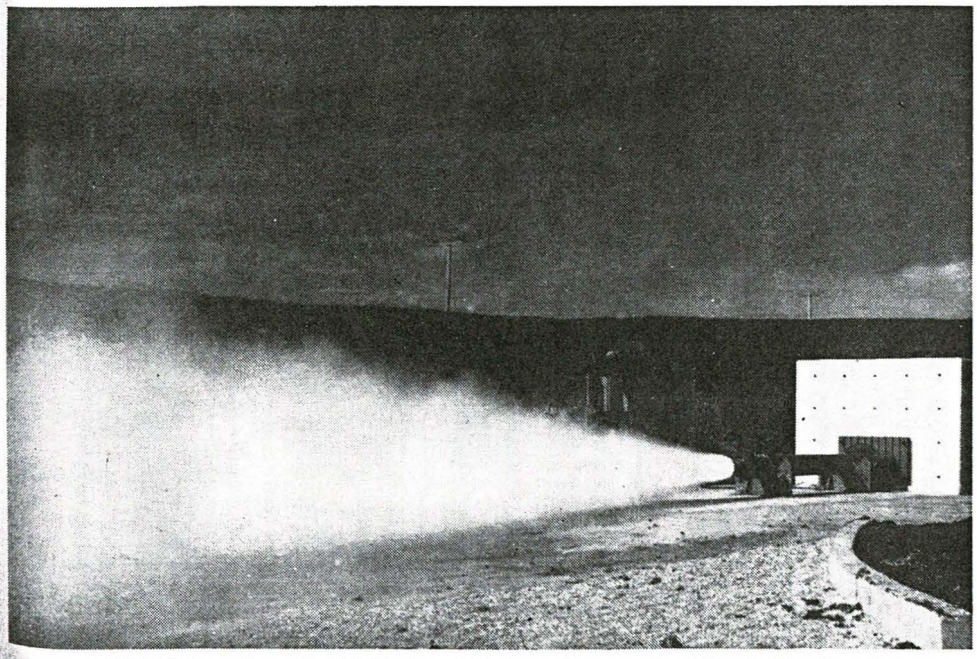
Canadian Bristol Aerojet was formed in May, 1962, under the joint ownership of the Bristol Aeroplane Co. of Canada and Aerojet-General Corp. of El Monte, Calif.

Bristol entered the rocket field in 1959, when it undertook to develop a series of the Black Brant sounding rockets originated by the Canadian Armament Research Development Establishment (CARDE) in 1956.

The Black Brant II and III rockets were made by Bristol's Winnipeg division, Bristol Aero Industries Ltd., and filled with propellant by CARDE. Metal components for the rockets, including the Black Brant IV and V now being developed by CBA, will continue to be made there.



ROCKET motor chamber liner being prepared by masked operators.



TEST firing of an 11,000 lb thrust 10 in. solid propellant Black Brant rocket motor at Rockwood.

The Rockwood plant uses processes developed by both CARDE and Aerojet, and will provide solid fuel for jet-assisted take-off (JATO) motors as well as the Black Brant rockets. The plant complex comprises 13 buildings and several underground bunkers scattered over 3,000 acres.

The CARDE propellant is similar to that which powers the U. S. Polaris submarine-based missile and Minuteman ICBM. Raw materials are the liquid fuel polyurethane, used as a polymer (about 20%) and ammonium perchlorate, used as the oxidizer (about 75%).

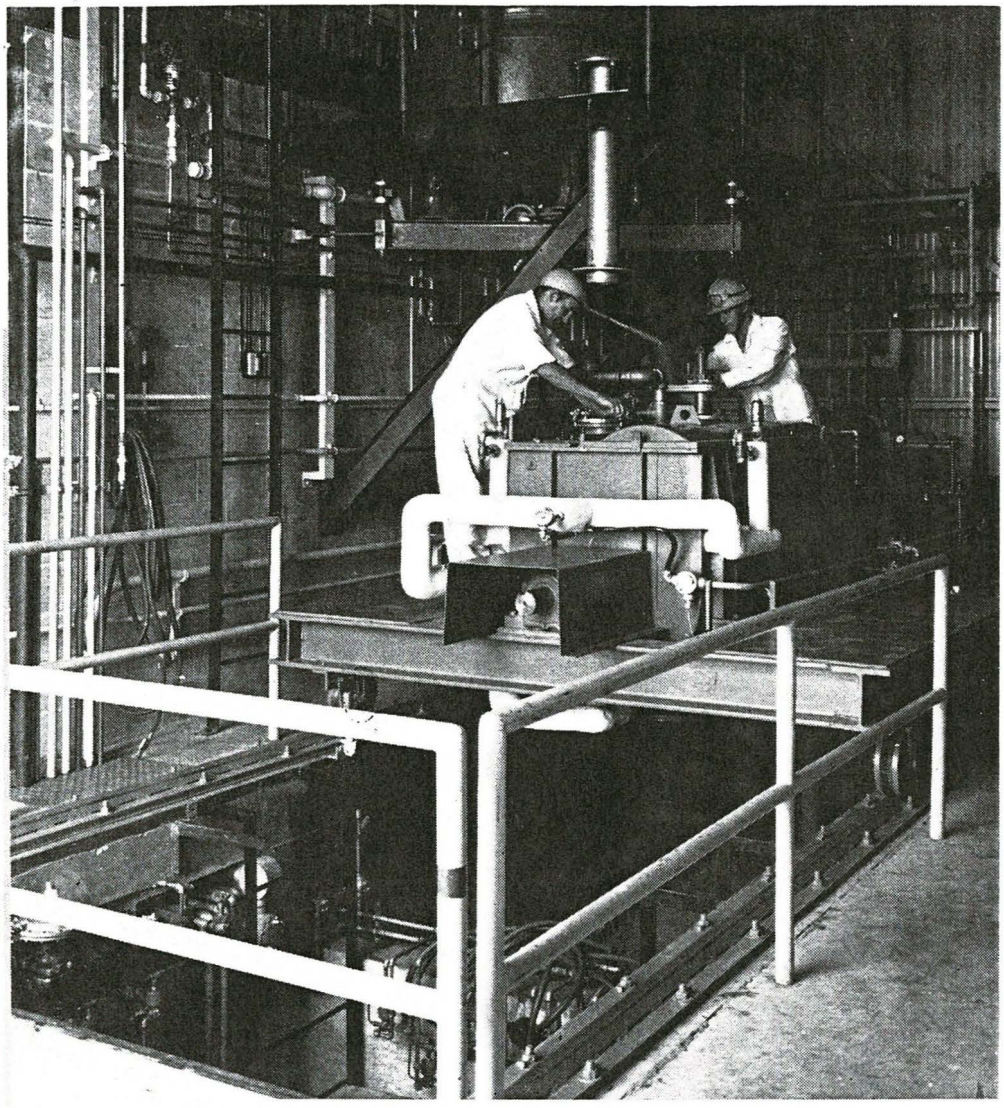
These materials are imported from the United States but as the volume develops Canadian sources may become available.

In the main building, rocket motor casings from the Winnipeg factory are grit blasted, degreased and lined. The lining, a form of plastic resin loaded with mica, is applied to the inside of the casing while it is being rotated to ensure a uniform thickness. The resin provides the bonding to hold the cast solid fuel, while the mica acts as a heat barrier. Three motors can be lined a day. After the lining process, a star-shaped mandrel is fitted through the motor casing centre, forming a core for the later casting operation.

In the same building, the liquid fuel, curing agents and other minor additives are blended and degassed in Pfaudler pots, each holding 600 lb of liquid fuel. This mixture comprises about 25% of the solid propellant ingredient.

Other sections of the building are the main office, staff canteen, material storage facilities, auto maintenance section and the quality control laboratory, where raw materials and samples of the propellant grain in all its stages of production are checked and tested.

The solid ingredient is prepared in the oxidizer building, where the raw ammonium perchlorate is processed in a blender. If it is necessary during the mixing process, a por-



MIXING of a 3,000 lb batch of solid propellant can be done by this equipment. Rocket casing to be filled occupies pit in foreground, which can handle motors 3 ft. in diameter and 23 ft. long.

tion of the material is passed through a Raymond Mikro-Pulverizer, which has a capacity of 2,000 lb an hour, to obtain a balanced particle size for correct burning rate and castability. The object is to get exact distribution of larger and smaller particle sizes, rather than one specific size. The entire process takes place in vessels and pipes lined with stainless steel and is remotely controlled from a concrete bunker.

At the mix and cast station, the solid ingredient goes straight into the mixer (a horizontal, spiral-blade type designed by CARDE) while the liquid ingredient goes into a container above the mixer. Beside the mixer, is a pit into which the empty motor casings are lowered.

While the mixer is in operation, the liquid is fed into it and the two ingredients form a greenish fluid of slurry consistency. In this state, the propellant passes through a casting bell under vacuum into the space between the inside of the motor casing and the mandrel.

Next, the rocket motors go to the cure building. There the heat in the curing cycle starts the polymerization process which transforms the slurry fluid into the rubber-like, solid fuel. After this the mandrel is removed to leave a cavity running through the core of the motor. The cure building can accommodate 24 ten-inch motors and 100 JATO motors at one time.

The motors then go to the final assembly building, where the rough outer edge of the propellant grain is trimmed and the nozzle fitted at the aft end. The assembly of tail fins, the marrying of nose cone to the motor and the threading of the igniter in the opening at the front end, are done at the rocket range shortly before firing.

Other major installations are the test firing pad and the building from which static testing is controlled. In test firing, the rocket is strapped horizontally to the firing bed with its front end pressed against a concrete pad. Electronic equipment feeds information from the pad to the test control building via 20,000 ft of underground cable.

When a rocket is fired, the igniter shoots a tongue of flame down the star-shaped cavity, igniting the entire inner surface of the propellant. The burning process is lateral towards the sides of the casing. Pressure buildup is almost instantaneous and the hot exhaust gases traveling through the cavity to the nozzle, produce the reaction thrust.

Remaining buildings at the plant are for oxidizer storage, storage of complete and semi-complete rocket motors, a temperature conditioning room, a reservoir and pump house and a grain machining shop for JATO motors.

By selling the rockets now as a package deal complete with fuel and instrumentation, CBA president W. S. Haggett feels the company could build up a $10,000,000 business in three years, selling to Canadian space research agencies and export markets.

The success of the Black Brant rocket series is based mainly in their simplicity, efficiency, versatility and competitive price.

The Black Brant II, a 17-in. dia. rocket, can carry a payload of 150 lb to an altitude of 125 miles. The motor contains 1,760 lb of propellant and generates about 280,000 hp in 15 seconds. If sales develop as expected, Bristol will be able to sell it for about $20,000.

The III, a 10-in. rocket, can take a 40-lb payload to 100 miles. Its 435 lb of solid fuel develops 125,000 hp in nine seconds. Bristol hopes to be able to sell it for under $10,000.

The two-stage IV, a combination of the II and III, will carry a 40 lb payload to about 600 miles. Its 2,195 lb of propellant will develop nearly 400,000 hp in 24 seconds. The price: $40,000 or less.

The V, an improved version of the II, is able to take a 150 lb payload to 240 miles. Its 2,000 lb of fuel develop 280,000 hp in 23 seconds and it will be sold for about $30,000.

The IV will probably be tested at Churchill early next year and first flights for the V are scheduled for late 1964.

The plant's first order of JATO motors will be for C-130 transports of Air Transport Command. C-130s of the U. S. Air Force have been using the units for some time, and these will be entering service with the RCAF in the near future. END