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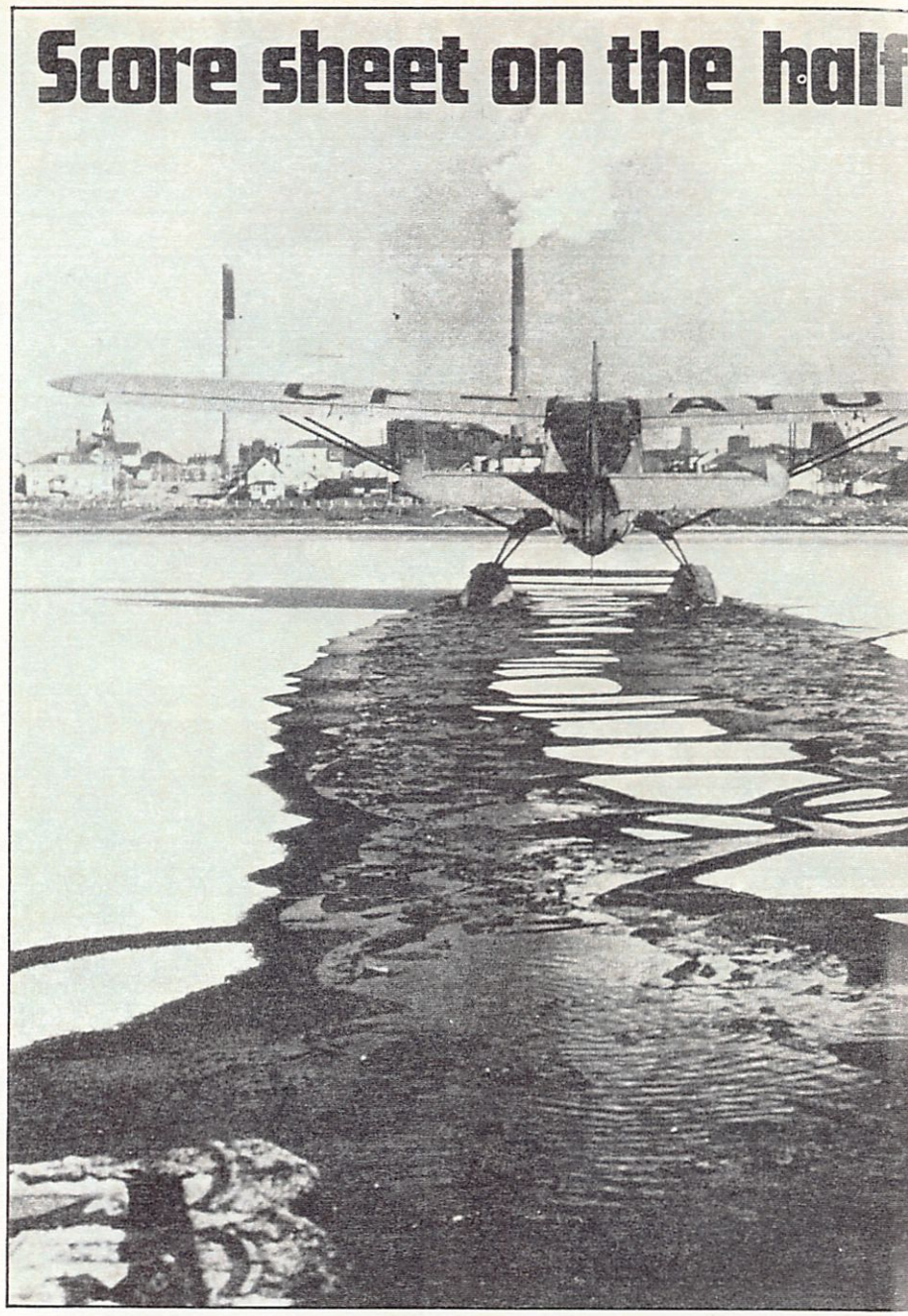


Canada's aviation/ aerospace industry: outstanding under pressure and a demonstrated capability for world leadership.

By David Godfrey

Surveying a half-century of the Canadian airframe and engine industry's evolution shows that the general pattern has been major companies starting as Canadian subsidiaries for sales, service, overhaul and repair of established airframes and engines developed in other countries. Next, these usually progressed to make adaptations of imported designs for the severe Canadian winter and often hostile terrain. Finally, original designs were created both to meet local needs and vie for export sales. In addition to the above, a few small companies were formed expressly to develop original designs.

Several notable aviation events took place in 1928: The first national aircraft display was held at the Canadian National Exhibition; a course in aeronautical engineering was started at the University of Toronto; the Canadian subsidiaries of a British and a U.S. company, enterprises which were to flourish throughout the next half century, were established.

The companies were de Havilland of England and Pratt & Whitney of the U.S. In each case, their products had found wide acceptance around the world and in Canada—notably the Moth light biplane and the Wasp and Hornet air-cooled radial engines—although there was no connection between the two decisions.

The Cirrus Moth had been imported in 1927 for Ontario forestry patrol work. Fitted with Fairey-Reed metal propellers and with alternative wheel/float/ski landing gear, the planes were assembled at Mount Dennis, near Toronto. The Canadian branch of de Havilland was formed in the spring of 1928. Before the end of the year the first DH-60M Metal Moth, with welded steel-tube fuselage, was being evaluated by the RCAF on all three types of landing gear. G-CAVX obviously came through with flying colors: orders placed by the RCAF in 1929 were followed by civil purchases. In all, 40 were assembled, featuring Handley Page slats to improve low-speed flying, and hand-crank starters to avoid propeller swinging.

A new plant at nearby Downsview, opened in August 1929, was soon busy assembling DH-80A Puss Moth metal-fuselage high-wing monoplanes. At first called the "Moth Three" for its three seats, the Puss Moth was ordered by the RCAF and other customers, but a series of crashes due to wing failures—including the death of H. J. "Bert" Hinkler while crossing the Alps in CF-APK—sullied its reputation until modifications were made.

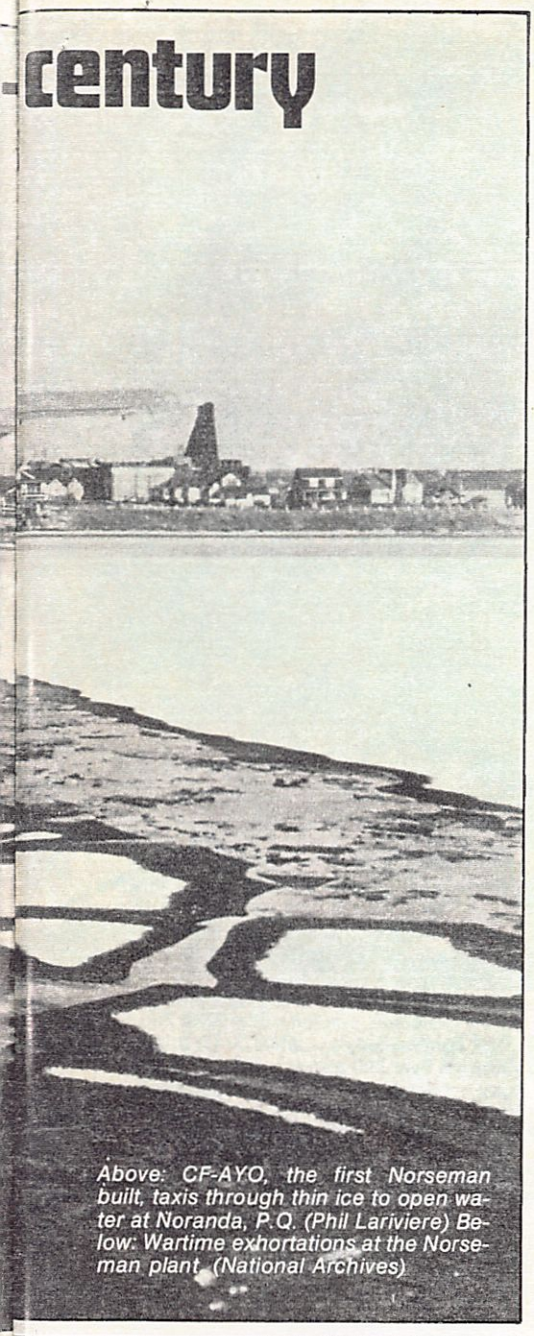
A lone DH-61 Giant Moth—with 2,000-lb. payload, powered by a 500-bhp Hornet with three-blade Hamilton-Standard propeller—was assembled in 1931 for the Ontario Provincial Air Service. Three DH-75A Hawk Moth cabin monoplanes, with geared Armstrong Siddeley Lynx engines in place of the original DH Ghost V-8, were bought by the federal government.

The DH-82A Tiger Moth, an open-cockpit biplane trainer, first flew in Canada in August 1931. CF-APL, powered by a DH Gipsy III, was one of eight modified DH-60Ts. Production airplanes later had the Gipsy Major—one of these being not only the first aircraft built in Toronto since 1918 when it flew in December 1937, but also the first of any type manufactured completely by de Havilland of Canada. Twenty-five DH-82As and 1,528 DH-82Cs were built in Canada; as well as 10 DH-82C2s, a development powered by a Menasco Pirate engine. The Tiger Moth remained in production at Downsview until 1943 when it was replaced on the line by the DH-98 Mosquito.

The last biplane built by de Havilland in Canada was the DH-83 Fox Moth, based on Tiger Moth wings and engine but having a new fuselage with cabin for up to four passengers while the pilot remained in an open cockpit. The prototype was sent to Canada as CF-API in 1932 and remained in Toronto on active service until 1950. Seven Fox Moths were soon assembled at Downsview, but it was not until 1946 that production began there of the three-passenger DH-83C.

In the fall of 1928, Canadian Pratt & Whitney Aircraft took over part of a plant

century



Above: CF-AYO, the first Norseman built, taxis through thin ice to open water at Noranda, P.Q. (Phil Lariviere) Below: Wartime exhortations at the Norseman plant. (National Archives)

at Longueuil, Quebec, near Montreal to service R-1340 Wasp and R-1690 Hornet engines. Many civil airplanes using P&W engines had been bought in Canada so there was a firm need by 1928 for an assembly, repair and overhaul organization here; however, the first order came from Canadian Vickers for a Wasp to replace the Liberty engine which had powered the Douglas MO-2B in which Dalzell McKee and Earl Godfrey made their September 1926 flight from Montreal to Vancouver.

Only 43 engines were assembled and sold in 1929, and the Depression years reduced activities drastically. It was not until 1938 that business picked up, the economy having revived in 1937, when Trans-Canada Air Lines was formed. The decision was made to have all the carrier's planes powered by the P&W-Hamilton-Standard propeller combination, a practice that was to continue until the end of the Second World War.

Vickers had set up an aircraft division at Montreal in 1911, first to import British airplanes and later to develop original designs starting with the Vedette forestry-patrol single-engine biplane flying boat in 1924. Initial design of the Vedette had been started at Weybridge and finished at Montreal by W. T. Reid, by then chief designer of Canadian Vickers. This successful aircraft (61 built) was followed in 1927 by the Varuna twin-engine biplane flying boat (eight built); Vista single-engine monoplane flying boat, Vanessa single-engine cabin biplane on floats and Velos twin-engine cabin sesquiplane (bottom wing smaller than top) on floats (one of each built). In 1929, the Vancouver twin-engine biplane flying boat appeared as a replacement for the Varuna. The Mark 11/SW version of the Vancouver, powered by Wright Whirlwind J6 radials and intended for RCAF coastal patrol was the only design not intended for forestry work.

Canadian Vickers also assembled Fairchild airplanes under license and early in 1929 acquired the rights to build and sell Fokker models. The company announced plans to build 10 Fokker Universals, 20 Super Universals and six Super TriMotors. As subsidiaries, Canadian Vickers had Canadian Wright (140, 200, 300 and 520-bhp engines) and Bristol Aircraft Engines of Canada (450-bhp Jupiter). Canadian Wright also had the license for the 85-bhp ADC Cirrus engine. This diversity continued and six Bellanca Pacemakers were built under licence in 1931-32; Northrop Deltas were ordered in 1937-38-39 for the RCAF; and 40 Supermarine Stranraers were ordered between 1936 and 1939.

W. T. Reid had left Canadian Vickers early in 1928 to found the Reid Aircraft Co. in Montreal and develop the Rambler metal-airframe lightplane, a Warren-girder braced sesquiplane with folding wings. Powered by an ADC Cirrus, the Rambler was a most attractive airplane, seating two in tandem. In December that year, the company became Curtiss-Reid Aircraft Co. with pioneer pilot John A. D. McCurdy as president. The Curtiss Robin three-seat high-wing cabin monoplane was added to its line, and the Rambler was fitted with the Hermes engine. The Rambler Mark III of 1931 had a Gipsy III of 105-120-bhp. Another former Canadian Vickers engineer, R. N. Bell, was engaged to design the Courier single-seat parasol-wing, Gipsy III-powered light mailplane which was rolled out in 1932 and tested at Cartierville, but only one was built.

In 1929, Fairchild Aircraft of Canada was formed at Longueuil. The Vickers license to build FC-2s was cancelled and assembly began of the Fairchild 71B. The company was Canadian-controlled with Hubert Passmore as president and F. P. Hyde Beadle (formerly of the U.S. Fairchild company and Saunders in England) as chief designer. The Fairchild 71B cabin monoplane was used for aerial surveying and mapmaking. In 1934 it was developed into the Super 71 powered by a 520-bhp Wasp T1D1 and carrying a one-ton payload; the wooden wing was retained, but the rest of the airframe was new including a high-cruciform tail and a large side door for cargo loading.

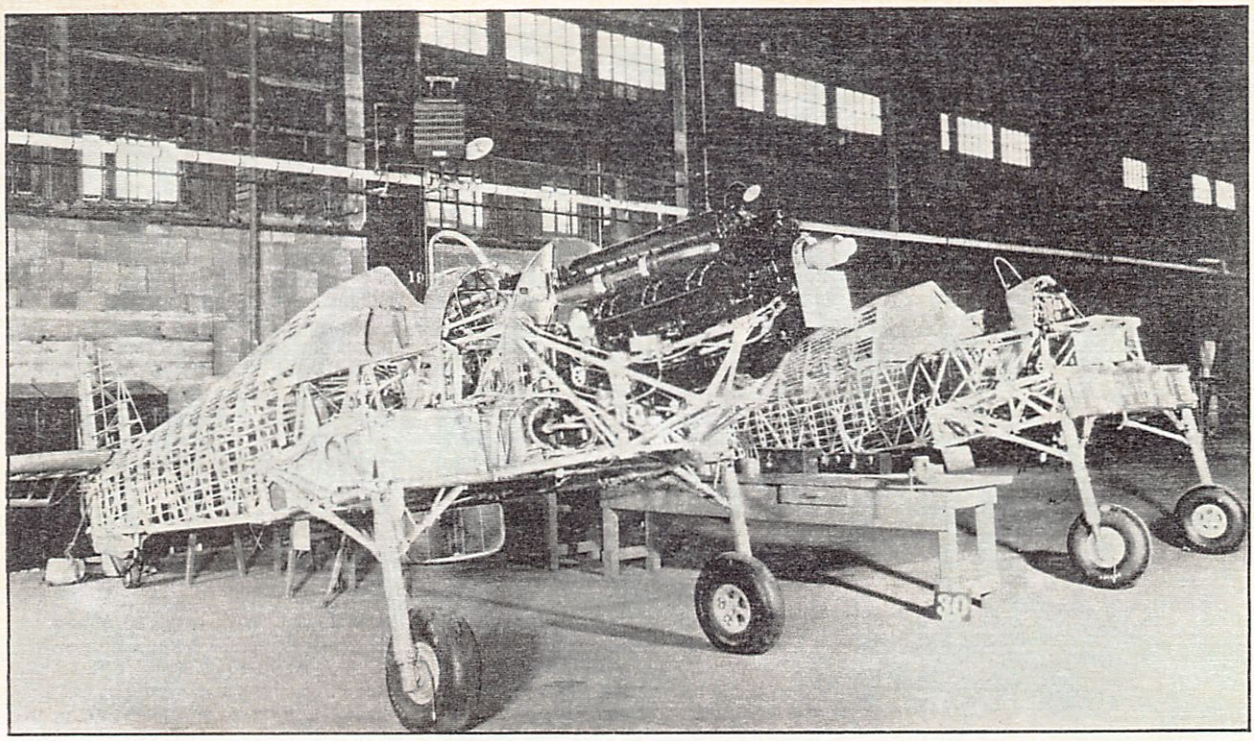
Other new designs that followed included the parasol-wing Model 22 powered by a 95-bhp inverted Cirrus in 1932; the high-wing Model 24 powered by a 145-bhp Warner Super Scarab in 1936; and the high-wing Wasp-powered Model 82. The most original Canadian Fairchild was the Model 45-80 Sekani ("Mountain Dweller") bushplane, powered by two 400-bhp Wasp Juniors, that appeared in the fall of 1937. However, only two were built.

Fleet Aircraft of Fort Erie was organized early in 1930 to build the Model 10 training and sport biplane that had been developed in the U.S. as the Consolidated Husky Junior, later known as the Finch in Canada. Twenty were ordered for the RCAF in 1931 and more than 400 were later ordered for the British Commonwealth Air Training Plan.

March 1, 1938, saw first flight of the Fleet 50 Freighter, a twin-engine biplane which was a daring new concept in design aimed specifically at the Canadian market. It had inverted-gull lower wings carrying floats at their "knuckles." The cockpit was set high so that the cabin provided unobstructed cargo space. Twin endplate fins and rudders were chosen so that the Freighter could get close inshore on a lake for loading without touching trees. The whole airframe could be dismantled for portaging if is sustained damage that could not be repaired in the bush, no part being more than 15 feet long except the fuselage and floats. Power was provided by two 300-330-bhp Jacobs radials, it being possible to load a crated engine up through the cabin floor aft of the cockpit. A landplane version also flew, but planned production of the Freighter never took place.

Robert B. C. Noorduyn, of the Netherlands worked with Sopwith in 1913, then moved to Armstrong Whitworth and BAT in England before joining the Atlantic Aircraft Corp. in the U.S. to design the Fokker Universal and Super Universal. In 1929 he moved to Bellanca as a vice-president and in 1931 went to Pitcairn. When the latter closed down in 1934 he came to Canada to design a bushplane.

In January, 1936, he formed Noorduyn Aircraft in Montreal to build the Norseman, powered by a 420-bhp Canadian Wright engine. The Norseman followed the Fokker practice of welded steel-tube fuselage and wooden wing. It was an immediate success as a bushplane, and as well, the



Hawker Hurricanes under construction at Canadian Car & Foundry (National Archives)

de Havilland workers preparing one of the more than 1,000 Mosquitoes built. (National Archives)

RCAF bought four in 1938 to serve as flying-classroom trainers. Later, as the UC-64, it became the first Canadian-designed and built plane to be ordered in quantity by U.S. operators.

As war clouds gathered in Europe it was evident that Canada's aviation industry would be involved heavily if hostilities should break out. Canada obviously would be invaluable as a location for aircraft manufacture and aircrew training, yet plans were so slow in being implemented that a *Canadian Aviation* editorial of July, 1939, commented, ". . . while Great Britain turns out over 800 warplanes a month, we have not even ordered a single Canadian-built aeroplane in over 18 months!"

Production of military airplanes in Canada was indeed spotty. Boeing Aircraft of Canada at Vancouver was building 17 Blackburn Shark biplanes. Canadian Car and Foundry (CCF) was making a batch of Grumman FF-1 two-seat biplanes and produced a prototype of the FDB-1 gull-wing biplane fighter which flew Feb. 3, 1938, powered by an 890-bhp Canadian Wright Cyclone.

Canadian Vickers had received orders for three more Stranraers in 1938, and six more Northrop Deltas, while Fleet had 70 Model 10 biplane trainers on order; a further 10 Stranraers were ordered in July, 1939. The Maple Leaf II biplane primary trainer designed by Elsie MacGill of CCF flew Oct. 31, 1939. It was powered by a 145-bhp Warner Super Scarab, although the company was also developing the 175-200-bhp seven-cylinder R-500 Maple Leaf radial engine, so probably planned to power the Maple Leaf II with it. This engine was billed as ". . . the first aircraft engine to be designed and manufactured in Canada from Canadian materials."

Early in 1940, Fleet flew the first Model 60 Fort braced low-wing monoplane trainer powered by a 330-bhp Jacobs L-6MB radial. This design was distinctive in having a stepped-up canopy for the rear

seat, a feature emulated by several later trainers. It had an all-metal airframe with fabric covering aft of the spars on wings and tail. More than 200 Forts were ordered but this total was later reduced to 90 when the U.S.-designed Fairchild M-62 Freshman (later renamed Cornell) was selected as the standard basic trainer.

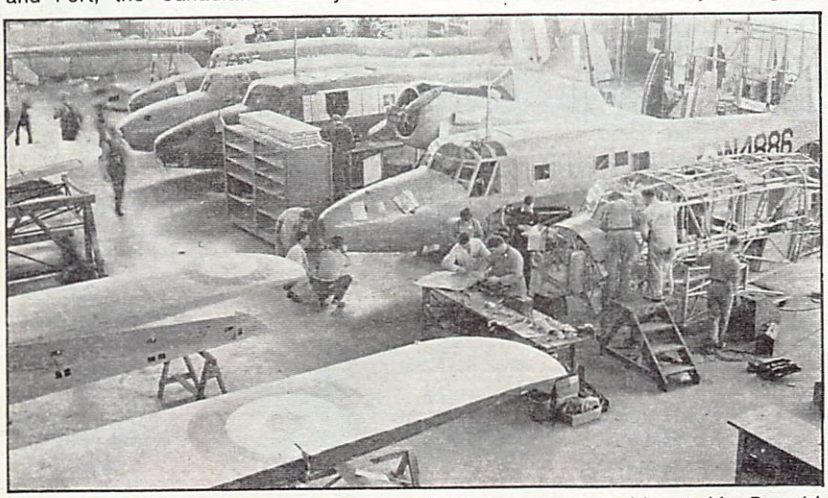
Thus, of the five original Canadian designs extant as the Second World War got under way—CCF Maple Leaf II, CCF Gregor FDB-I, Fleet 50 Freighter, Fleet 60 Fort and Noorduyn Norseman—only the last two were monoplanes, and strut-braced at that.

With the exception of the Norseman and Fort, the Canadian industry was reorganized to manufacture aircraft of British and U.S. origin. At Malton, the aircraft division of National Steel Car was used for assembly of 840 Avro Ansons and 150 Westland Lysanders; plus a consignment of North American Yale trainers (fixed landing-gear predecessor of the Harvard) destined initially for France but not delivered because of capitulation. At Trenton, the first of 739 Fairey Battles were assembled for use as pilot trainers, target tugs and turret trainers; one of them was later fitted with an 840-bhp Wright R-1820 Cyclone by Fairchild as a precaution against the supply of Merlins failing.

Ansons for the Air Training Plan shipped in cases from England for assembly by de Havilland were later to have Canadian-made wings, but with the increasing tempo of the war these deliveries ceased and Federal Aircraft was formed to co-ordinate Anson manufacture in nine Canadian plants. Fairchild built the Bristol Bolingbroke, a Canadian version of the Blenheim IVL. Canadian Associated Aircraft was formed to co-ordinate production of Handley Page Hampden components at CCF, Canadian Vickers, Fairchild, Fleet, National Steel Car and Ottawa Car Manufacturing for final assembly at Malton and St. Hubert, Que.

To replace the Battles, an order was placed in 1940 for 800 North American Harvards, 500 from Noorduyn and 300 from CCF. Plans for production of Short Stirlings and Martin B-26 Marauders, both came to nought, as did a proposal to have Consolidated B-24 Liberators built by CCF; the Fort William plant did, however, go into production with the Hawker Hurricane, building, 1,451 from 1940 onward.

By the end of 1941, the decision was made to concentrate on seven aircraft. The Cornell replaced the Fort at Fleet; Nooduyn made the Harvard in addition to the Norseman; Federal Aircraft co-ordinated manufacture of Ansons; Fairchild continued to build the Bolingbroke; the Consolidated PBY-5 Catalina (Canso) was produced by Boeing of Canada (flying-boat version) and Canadian Vickers (amphibian version); the new Avro Lancaster was made by National Steel Car and CCF; and, in addition to Tiger Moth trainers, de Havilland was to build a "secret fighter" (Mosquito bomber). A little later, the need for dive-bombers was met by adding the Curtiss SB2C Helldiver to the list, 300 being made by Fairchild while CCF built 894.



Avro Anson assembly at MacDonald Bros. Aircraft during the war. These aircraft were assembled only at MacDonald; aircraft had been shipped in crates from the U.K. (CAO)

By 1944 the end of the war was in sight and the British Commonwealth Air Training Plan was reduced. This was followed by production cutbacks for the trainers, as well as the Catalina/Canso, Norseman and Helldiver, leaving most work that remained for the Mosquito and Lancaster.

Naturally, worries were expressed as to the postwar fate of the aircraft industry. Two interesting announcements by Munitions Minister C. D. Howe were the formation of Turbo Research to design and develop jet engines and produce them "in a small way" at Leaside, Toronto, and plans for production of Merlin-powered Douglas DC-4 transports by Canadian Vickers. Fifty of these DC-4Ms were to be made, half of them for TCA.

The various company positions in September, 1945, were that Noorduyn still employed 4,750 on the Norseman and Harvard (compared with peak employment of 11,900); Fairchild was about to lay off 4,000 working on Grumman F7F Tigercat and Vought F4U Corsair parts; Canadair, as Canadian Vickers' government-built aircraft plant in Cartierville had become in 1944, laid off 3,000 Canso workers to rearrange its schedule for DC-4M production; de Havilland laid off 2,700 following receipt of a telegram cancelling the Mosquito program; at Malton some 4,000 were working on the Lincoln and Lancaster (compared with a peak figure of 9,300) when a telegram cancelled them both; Fleet was working on sub-contracts to Victory, but had a civil project, the Model 80 Canuck lightplane developed from the Noury Noranda; Canadian Car and Foundry had its Helldiver contract cancelled, but was developing a version of the Burnelli "no-fuselage" freighter, the CBY-3; and Boeing of Canada had a major cutback in production of B-29 Superfortress centre-sections for the U.S. parent company.

Peak employment during the Second World War had totalled 120,000, compared with only 1,000 when it had begun; 16,448 aircraft had been built, plus overhaul and repair of 6,530 aircraft.

The final note of aviation interest in 1945 was the decision to develop Malton as Toronto's main airport.

Speaking at the annual meeting of the Air Industries and Transport Association, as reported in January, 1946, issue of *Canadian Aviation,* Bob Noorduyn summed up the state of the industry, ". . . today, the overcast Second World War has broken up, but our horizons are still anything but clear." However, in the same issue it was revealed that the government was going into partnership with Hawker Siddeley at Malton and that ". . . plans have been made for the establishment at Victory Aircraft of a basic aeronautical research, design, development and manufacturing business including design and manufacture of jet and turbojet (sic) engines." C. D. Howe, now Reconstruction Minister, stated that the profits from this venture were to be divided. Thus, the A. V. Roe (Canada) postwar enterprise was inaugurated with Sir Roy Dobson as president.

Other interesting news was that the RCAF was co-operating with Turbo Research in developing a turbojet engine to power a new A. V. Roe fighter being designed by a team led by J. H. Atkin from Hawker Siddeley in England.

By April, 1946, Fairchild and A. V. Roe were working on competitive designs for a twin-engine trainer. In Montreal, two helicopters were being developed—the Sznycer and Gottlieb SG Mark VI with conventional main and tail rotors; and the Brzozowski BC-36X powered by a piston engine that drove a compressor to supply air to burners at the rotor tips and so had no anti-torque tail rotor.

Other news was that Fairchild was developing a new bushplane, the Husky, which flew in mid-June.

In view of the earlier announcement about the takeover of Victory Aircraft, it was logical that Turbo Research should also be sold to A. V. Roe, and this happened in June, 1946.

At de Havilland, a team led by W. D. Hunter had designed a basic trainer as the Canadian company's first original product. This airplane, the DHC-1 Chipmunk, powered by the same DH Gipsy Major engine as the ubiquitous Tiger Moth, flew in May and was an instant success, the touchstone of which was that it was later adopted as the new standard trainer for the RAF and put into production in England. (In all, 1,292 were built—218 at Downsview, 1,014 at Hatfield, and 60 in Portugal.)

In mid-July, the prototype Canadair DC-

4M flew at Cartierville and was named "North Star" by Mrs. C. D. Howe. In November it was flown to Santa Monica and checked out by Douglas.

At the end of 1946, Canadian planes for sale included the Husky, Bellanca Skyrocket (Northwest Industries, Edmonton), Canuck, Chipmunk, Cub J3, CCF Burnelli CBY-3 and Norseman (the latter now built by CCF). It was announced that the contract for a twin-engine trainer had been won by A. V. Roe, although it would transpire that this airplane was not to be ordered. At Erindale, Toronto, the two-seat Found FBA-1 was being designed.

An important realignment took place early in 1947 when the Electric Boat Company of Groton, Connecticut, bought Canadair as a subsidiary (the two companies would be the nucleus of General Dynamics, formed in 1952).

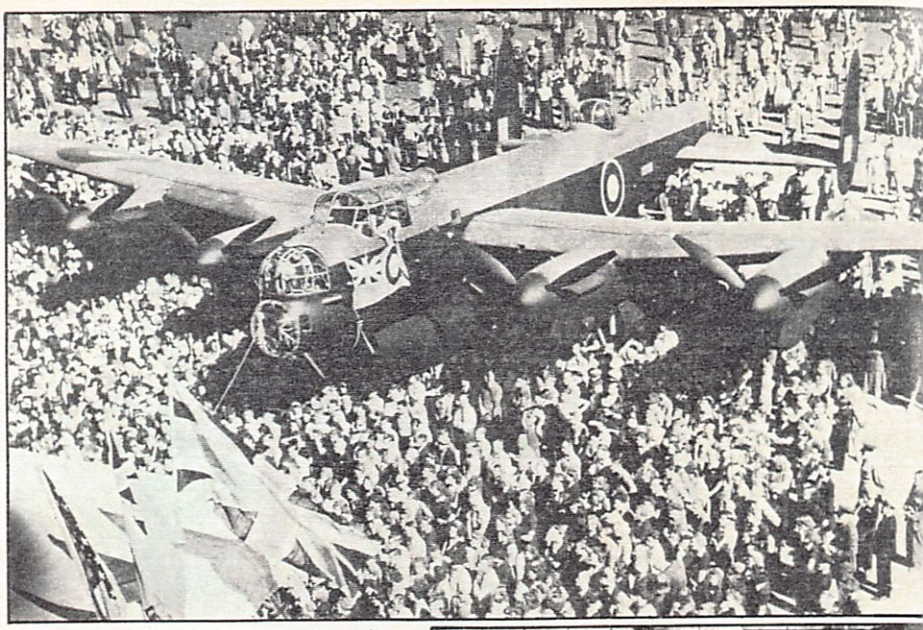
Following completion of its PBY-5 Canso contracts, Canadair had started design of the DC-4M while the plant was used to convert C-47 military transports to DC-3 standard; the old Noorduyn plant was leased for the latter purpose in January, 1946, and 225 DC-3s for 16 airlines were completed in 1947 alone.

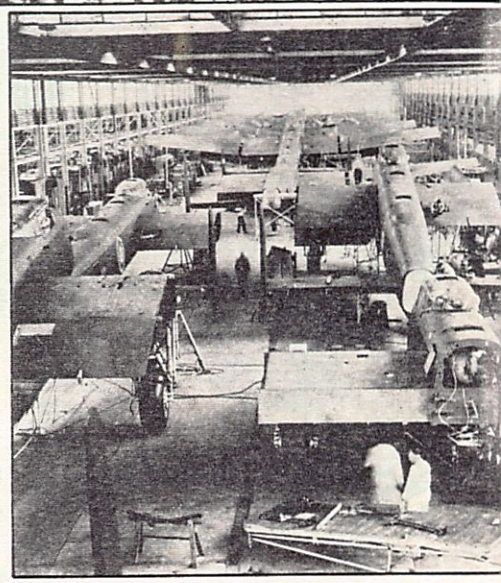
The second original de Havilland design, the DHC-2 Beaver, which flew in August, 1947, set the pattern the company was to follow: a simple airplane designed for minimal maintenance, and possessing STOL qualities. Powered by a Wasp Jr. of 450-bhp, the Beaver was built in large numbers—486 for civil operators and 968 of the L-20A military version for the U.S. Army.

A. V. Roe had several exciting programs under way. A jet transport, the C-102 Jetliner, was projected to have two Rolls-Royce AJ.65 axial-flow turbojets (later known as the Avon) but since this engine was then available only as a military powerplant the airplane layout was modified to take four centrifugal-flow Derwent V engines. A second project was the CF-100 long-range fighter, and a third was a small turbojet engine, the Chinook, of 2,300-lb. thrust which was to be followed by a much larger engine, the Orenda.

By 1948, the Canadian aviation industry was bright with promise. Canadair was confident of selling North Stars abroad; de Havilland had sold the Chipmunk to both the RCAF and the RAF, the Beaver was doing well; A. V. Roe had a clutch of new projects, the Chinook making its first run on March 24; Canadian Pratt & Whitney was making piston-engine spares to free the U.S. parent company for gas turbine work; and prospects for expansion included building the North American F-86 Sabre under license. It was to transpire, however, that at A. V. Roe seeds had been sown for partial destruction a decade later.

Details of the CF-100 twin-engine fighter were leaked in the U.S. in November; the new Orenda turbojet that was to power production models (the prototype had Avons) was first run the following March, one of several notable events in 1949. Others included first delivery of a North Star, renamed "Argonaut", to British Overseas Airways Corporation; the Silver Jubilee of the RCAF; and maiden flight of the Jetliner Aug. 10, soon after the de Havilland Comet had flown in England.





Mid-1950 saw the industry booming again, influenced by the threat of the Korean War. By 1951, steady expansion was established—notably production of the CF-100, and of the F-86 by Canadair—and a big new order for Harvards to be built by Canadian Car and Foundry. Concomitant with the last contract was the need for Canadian Pratt & Whitney to manufacture its first complete engine, the R-1340 Wasp.

Production of both the CF-100 and F-86 was scheduled at the rate of 20 a month; it was confirmed that the production-model CF-100 was to have Orenda engines and a new plant for the latter was organized; the U.S. Army ordered the Beaver; confirmation was given of licensed production of the Lockheed T-33A jet trainer by Canadair as the Silver Star powered by the Rolls-Royce Nene (Rolls-Royce of Canada, set up in 1952, proved its capability for manufacturing engines by making the first 50 of an order for 900 Nenes); a new U.S. twin piston-engine crew trainer, the Beech T-36A, was also to be built in a joint program by both Beech and Canadair; de Havilland anticipated larger export sales of the Beaver and was developing a "King Beaver"—soon to be known as the Otter—which flew Dec. 12, 1951, powered by the same Wasp engine as the Harvard; and the four-seat Found FBA-2 was being built.

Along with the successes came some headaches and one major disappointment as the A.V. Roe Jetliner program was shelved. (See the Avro story for details.)

More production orders came in 1952—Canadair Sabres for the RAF and the U.S. Air Force; and the Beech T-34A Mentor primary trainer to be built by CCF. The new Orenda engine plant was opened in late September. Jan Zurakowski, the renowned Polish test pilot, had joined A. V. Roe Canada in 1952 and achieved supersonic speed in a CF-100 Mk. 4 during a vertical dive.

A bright spot came in May, 1953, when Jacqueline Cochrane set a world speed record for women of 652.6 mph in an Orenda-powered Canadair Sabre. But, a few weeks later the Montreal company suffered a setback when the entire Beech T-36A program was cancelled in the U.S. because of schedule delays; Canadair's contract for 227 trainers, worth $100 million, was voided. This was offset by expectation of an order to develop a maritime reconnaissance airplane from the Bristol Britannia airframe to replace the Lancaster in RCAF service.

A new de Havilland plant was opened at Downsview in 1954, an order for 25 Grumman CS2F Trackers having been received by the company; and it was also announced that the U.S. Army was buying the Otter as the U-1A. The first T-34A Mentor built by CCF was accepted by the U.S. Air Force. Other "news", that in the event did not become reality, was that the SG-6 Mark VI helicopter was going into production at Canamerican in Montreal; and that Fleet was to build both the Doman LZ-5 helicopter and the Helio Courier STOL airplane.

The A. V. Roe Canada project for a "flying saucer," then known as "Project Y" and later as the Avrocar, was shelved because, as C. D. Howe put it, ". . . it did not seem to be the sort of thing for Canada to be developing . . .", because it did not

Left: Rally for Avro Lancaster assembled at Malton. (National Archives) Below left: Lanc' production line at Malton. (National Archives)

Below: Beech T-34A Mentors a-building at Canadian Car & Foundry for RCAF. Production began in 1954. (CAO)

have a useful purpose and would cost $100 million to carry through to completion. The Avrocar, a circular-planform two-seat experimental VTOL craft powered by three J69 turbojets turning a large central fan, was supposed to take-off vertically them move forward and fly out of ground effect to develop aerodynamic lift, but full transition to free forward flight was never achieved and it was dangerously unstable above an altitude of four feet. Developed for the U.S. Department of Defense as Weapon System 606A with the U.S. Army designation VZ-9V, first "flight" was at Malton in December, 1959. The craft later was transferred to NASA-Ames where it was "flown" in May, 1961. One Avrocar was scrapped at Malton, the other was given to the Smithsonian Institute and subsequently went on display at the U.S. Army Transportation Museum at Fort Eustis, Virginia. A. V. Roe had also projected a supersonic fighter development known as the Omega.

The first contract for 13 CL-28s (Canadair's maritime patrol version of the Bristol Britannia), to be known as the CP-107 Argus in RCAF service, was placed in mid-1954 (12 more were to be ordered two years later).

This was a major undertaking since, although the wings and tail of the Britannia airliner were used (with wing spoilers added for greater lateral control at low speeds) the Proteus turboprop engines were replaced by Wright R-3350 Turbo-Compound piston engines for greater low-level economy, and a completely unpressurized fuselage was designed. First flight was to take place in March, 1957, and entry to service in May the following year.

As 1955 began, A. V. Roe Canada had reorganized so that it was now a holding company with three subsidiaries—Avro Aircraft, Orenda Engines and Canadian Steel Improvement—employing a total of 16,000.

The first major postwar construction order involving the industry as a whole was a contract worth $140-million to de Havilland for 100 CS2F Trackers and spares, this extending the earlier order of 25. As prime contractor, DHC built the forward fuselage and flight deck, and did final assembly, wiring, installation of instrumentation and electronic systems. Other airframe parts were subcontracted to CCF, Macdonald Bros., Canadair, Jarry Hydraulics, Dowty Equipment and Fleet. Downsview was buzzing with activity since, in addition to the Tracker work, the first six of 90 Otters were delivered to the U.S. Army and four were ordered for the U.S. Navy.

In Montreal, Canadair had obtained an order from the South African Air Force for 40 Sabres. Also, it had conducted an interesting aerodynamic experiment by adding fuselage fairings to "area-rule" a Sabre for reduced transonic drag. At the international level, Canadair was working with its sister General Dynamics division Convair and with Bristol in England on a project for a new airliner (thin-wing Britannia) to be powered by four Bristol Orion "supercharged" turboprops.

Meanwhile, at Malton the Avro CF-105 Arrow twin-engine supersonic delta-wing interceptor had been ordered off the drawing board, the first five aircraft to have Pratt & Whitney turbojets while later airplanes were to have the new engine being developed by Orenda—then known as the Super Orenda but later to be named "Iroquois". This was to be first the zenith and then the nadir of achievement by the industry.

Total A. V. Roe employment stood at 22,000 in January 1956. In addition to the Arrow, Avro was to direct the Sparrow missile program in Canada for both the CF-100 and the CF-105. Things looked good at Malton, but a sobering note was struck by the statement of Dr. O. M. Solandt, former chairman of the Canadian Defense Research Board, that the Arrow, ". . . might well be the last piloted warplane to be produced in this country . . ."

The first Arrow, piloted by Jan Zurakowski, flew March 25, 1958. Despite unequivocal support for the project and its need from Air Marshal W. A. Curtis, former RCAF Chief of Staff, the government's indecision on ordering the Arrow into production was ominous. In September, 1958, it was announced that development and engineering costs were such that the government felt it could no longer support a policy under which industry produced weapons designed specifically for Canadian needs. Since Canada could not afford both aircraft and missiles, it would choose Bomarc surface-to-air missiles.

The Arrow was not cancelled outright, airframe and engine programs being continued until the following spring but the Astra navigation, flight and fire-control system, and the Sparrow air-to-air missile, were dropped immediately.

Thus, as Canada prepared to celebrate the 50th anniversary of the first powered flight in the British Commonwealth—achieved Feb. 23, 1909, at Baddeck, N.S., by John McCurdy—there was considerable foreboding as to what the year would bring.

One strong ray of hope came from Canadair—which had rolled out its 1,815th and final Sabre the previous October—for a big sale of CL-44D4 swing-tail freighters to the U.S. Having secured North American rights to development of the basic Britannia airframe for the CL-28 Argus anti-submarine warfare airplane, the Montreal company had next designed a long-range turboprop transport, 12 feet longer than the longest of the Britannia series and with much more powerful Rolls-Royce Tyne engines of 5,730 ehp. (The Bristol Orion engine had been dropped as had the projected "thin-wing" Britannia.) As a North Star replacement, 12 CL-44-6 side-loading freighters had been ordered for the RCAF as the CC-106 Yukon.

The end of February saw both the celebration of McCurdy's feat and the final, fatal blow dealt to the Arrow. Ironically, in the previous month 180 Canadair engineers had been lent to Boeing to work on the Bomarc 'B' that Canada was to buy in place of the Arrow interceptor.

It was small consolation that Jan Zurakowski, who had retired at the end of 1958, was awarded the Trans Canada (McKee) Trophy for that year.

Canadair, meanwhile, had succeeded in selling 10 of its 65,000-lb. payload CL-44 freighters to the Flying Tiger Line and five to Seaboard and Western, each cargo airline taking options on five more. Later in the year, the third all-cargo U.S. carrier, Slick Airways, would order two CL-44s with options on four more.

Canadair also had rolled out the demonstrator Canadair/Convair 540 in January, 1959, a 440 airframe with piston engines replaced by Napier Eland turboprops of 40% more power. A batch of 10 had been sold to the RCAF in 1958 as the CC-109 Cosmopolitan and these new airframes were built on jigs transferred from Convair. When the engines worked this was a very impressive airplane, but the airlines were justifiably cautious and no commercial 540s were sold. (In 1966, the RCAF Cosmopolitans were re-engined with Allison T56 turboprops.)

The next big aircraft order was for the Lockheed F-104 Super Starfighter to re-

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SCORESHEET

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place the Sabre. In addition to 200 CF-104s for the RCAF, parts were to be made for 66 F-104Gs ordered from Lockheed by West Germany. This, too, was good news for Canadair since it was able to bid low due to its high workload reducing overhead costs. The $91.5-million order for airframes went to Canadair and the $80-million contract for General Electric J79 engines was awarded to Orenda Engines. Later, Canadair would supply parts to the European consortium of countries building the F-104G, and build a further 140 F-104Gs for the U.S. Air Force Military Assistance Program for distribution to NATO countries without aircraft industries of their own.

Having been successful with initial design of the JT12 (J60) small turbojet, which had then been transferred to the U.S. for development and production, Canadian Pratt & Whitney was embarking on a program for a 500-shp turboprop engine to be known as the PT6. Weighing only about 250 lb., this would be available also as a turboshaft powerplant for helicopters and as an auxiliary power unit for large airplanes.

Before the end of this eventful year, the first DHC-4 Caribou was accepted by the U.S. Army; the RCAF's first Yukon flew; a group of former Avro engineers announced the design of a two-seat 180-bhp gyroplane, the Avian 2/180; and Canadair rolled out the first prototype of its company-financed CL-41 trainer fitted with a JT12 turbojet.

Canadair again made news at the start of 1960 with the first flight of the CL-41 and the strong possibility of selling a large number of CL-44D4 freighters to the Military Air Transport Service (MATS) of the U.S. Air Force.

It was now necessary to consider a replacement for the CF-100 to complement the Bomarc in the Defense Minister's "team of weapons" concept, and it became known that the big sale of CL-44s to MATS would be conditional upon Canada buying either the F-106 or F-101 from the U.S. The year ended without further clarification of this "swap deal". Meanwhile, de Havilland was working on a new design to be powered by two PT6s; the first CL-44D4 flew at Cartierville; the last CS2F Tracker came off the Downsview line; and the Bomarc 'B' was at last accepted for quantity production, which was good news for Canadair since it was the sole source for Bomarc wings and ailerons.

In the absence of a decision on a CF-100 replacement, the "swap deal" fell through and MATS ordered 30 Boeing C-135A jet transports early in 1961. This was a big blow to the marketing hopes for the CL-44 since there had been little doubt that MATS selection would have sparked purchases by U.S. airlines involved in the Civil Reserve Fleet, there being a requirement to re-equip with turbine-engined aircraft to get future MATS contracts.

Thus it was particularly galling six months later when Canada agreed to buy 66 CF-101 Voodoos. This time, explained Prime Minister Diefenbaker, purchase of the Voodoos was part of a three-point deal. The second point was that Canada would assume responsibility for the full cost of 16 Pinetree Line radar sites; third point was that the U.S. would procure in Canada $200 million worth of F-104Gs for NATO service, the cost to be borne 75/25% by the U.S./Canada. The airframes would extend production at Canadair where the first CF-104 had been rolled out in April, and the corresponding engines needed would extend J79 production at Orenda.

Canadair had further good news in September when, during a European sales tour with the CL-41 prototype, it was announced that 190 of these trainers would be ordered for the RCAF as the CT-114 (later named Tutor), although final choice of engine was not decided. Originally, the Fairchild J83 had been chosen, but this was cancelled when the U.S. drone which it was to power was dropped, so the next available engine was the JT12 used to power the two prototypes. Canadair was very happy with this installation, but the government opened engine selection for bidding and in May, 1962, announced that the General Electric J85 would be built for the CT-114 by Orenda.

At de Havilland, flight testing of a Caribou powered by General Electric YT64 turboprops had led to development of a new design of military STOL transport, the DHC-5 Buffalo, funded by the U.S. Army. In May, 1965, the DHC-6 Twin Otter flew, the beginning of a great success story that is still going strong.

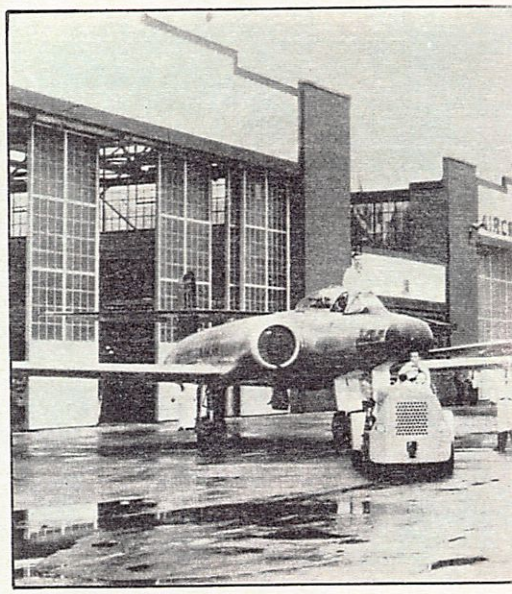
Canadair dabbled with preliminary designs for a fire-bomber, at first the CL-204 twin-float seaplane and later the CL-215 amphibious flying boat. More radical in concept was the CL-84 tilt-wing/deflected-slipstream VTOL design which was rolled out later in 1964, hovered in May, 1965, and was to make full VTOL transition to forward flight and back in January, 1966, piloted by Bill Longhurst. Another project was the CL-89 reconnaissance drone, although it was a long time before details were available because of security.

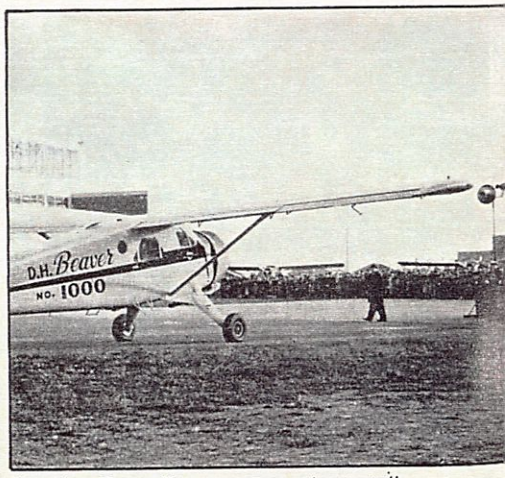
The next major government purchase was of a tactical airplane. The armed forces favored the McDonnell Douglas F-4 Phantom II, but in the event it was the more modest Northrop F-5 that was selected as being the most cost-effective, in July, 1965. Designated CF-5A-15, this airplane was put into production at Canadair while Orenda built more J85s to power it. Some 80% of the $215 million, 115-airplane program was to be Canadian content, and there was no allowance for cost escalation as had occurred with the Arrow and CF-104. (In 1967, the Netherlands ordered 105 NF-5s from Canadair, thereby nearly doubling the initial production run at Cartierville.)

A major industry change came later in 1965 when the Douglas Aircraft Company of Canada was formed to take over DC-9 production work from de Havilland who had been building wings, aft fuselages and tails for this airplane since 1963. A doubling of production rate had increased complexity of the DC-9 work at the Malton plant formerly used by Avron and now leased to Douglas.

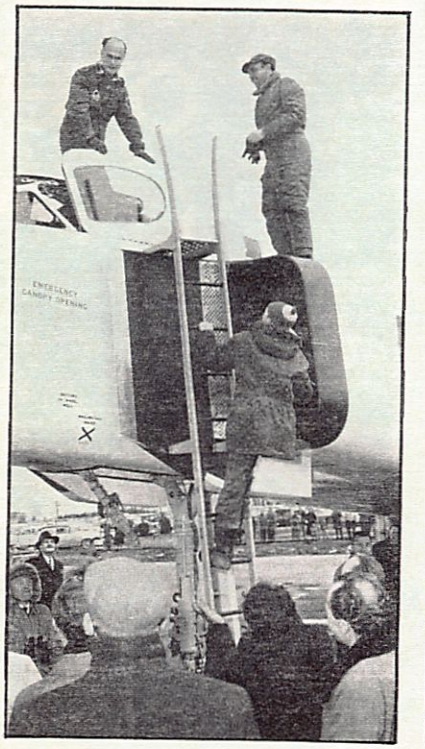
Having obtained federal financial assistance under the Program for the Advancement of Industrial Technology (PAIT),

(Continued on page 123)

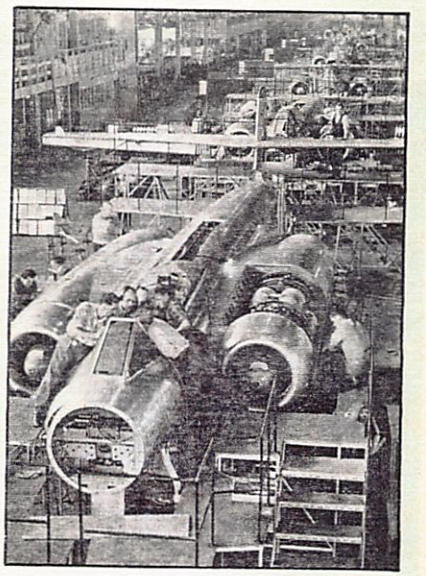




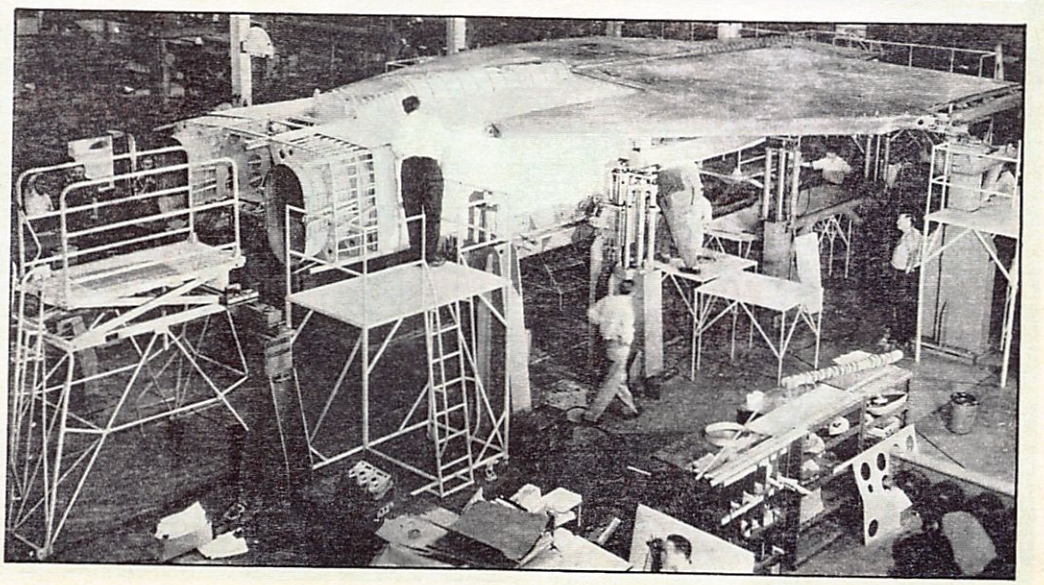
Another Canadian success story—roll-out of the 1,000th de Havilland DHC-2 Beaver, in a special ceremony for the late Phil Garratt. (DHC)



Above: Avro's one and only Jetliner during taxi trials. (M. Cooper-Slipper) Below: Avro CF-100s on the production line. More than 700 were built. (Avro) Left: Test pilot Jan Zurakowski climbs from Arrow after first flight. (Avro)



Top: F-86 Sabre production line at Canadair in 1951. (CAO) Centre: Pride of Avro, the CF-100 and CF-105 together at Malton. (National Archives) Right: The Arrow takes shape . . . an advanced one for its day. (Avro)



TWO DOLLARS

Canadian Aviation

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1928 1978

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