

## Otter Case Solved

Inadvertent flap retraction has been blamed for a fatal accident to an RCAF Otter at Goose Bay on April 10, according to a report issued late last month by The de Havilland Aircraft of Canada Ltd.

Although the report mentions the Goose accident only, it is understood the February 14 mid-air break-up of an Otter over Toronto (in which DHC Test Pilot William Ferderber and three U.S. Army officers were killed), has been traced to a similar cause. Initially, this accident was blamed on turbulence from a CF-100 jet passing some miles away.

The investigation which finally pinpointed the cause of these two accidents has been described as one of the most painstaking and persevering on record. De Havilland Canada engineers who were assigned to the task worked practically around the clock for 120 days continuously, with little thought for either sleep or rest.

According to de Havilland Canada's report: "The evidence sifted and analyzed by the group of experts conducting the enquiry proved that the [Goose Bay] accident was caused by a sudden flap retraction when the flap selector was selected up while the aircraft

was trimmed for full flap down, high speed. The resultant out-of-trim condition can produce a rapid nose down pitch of the aircraft resulting in negative overload conditions which may develop beyond the structural limits of any normal category airplane. In the case under investigation, the nose down pitch was not checked before the rapid build-up of stick forces developed, due to the element of surprise.

"The inadvertent flap retraction was due to the ball in the up side of the check valve becoming jammed in the open position owing to the presence of foreign matter in the hydraulic system. Immediately the flap selector was selected up, the flaps retracted in a matter of approximately two seconds.

"To prevent any further repetition of inadvertent flap retraction, several new features are being introduced into the flap system by de Havilland Canada. The first consists of a filter which will prevent any foreign matter from getting into the system. The second is a new cylinder head for the flap jack which will contain the present check valve and, in addition, a new irreversible valve especially designed to be impervious to foreign matter. Both these valves will be protected by isolating filters."

The modifications which will be required to remove the present limitations on Otter flap retraction are in the course of preparation. Necessary parts are being produced and all Otter owners are to be notified as soon as these parts become available.

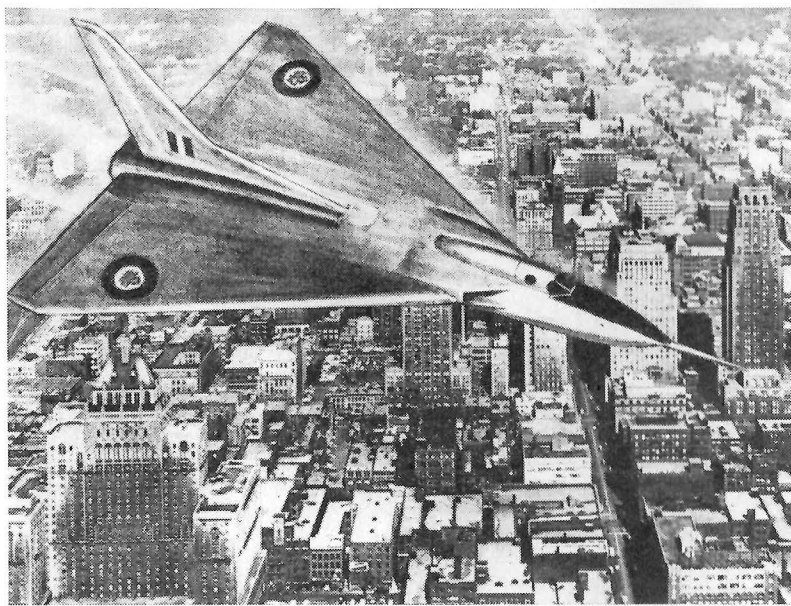
De Havilland Canada points out that some idea of the tremendous task which faced the accident investigating team may be gleaned from the records of the DHC photographic department alone. During the investigation, some 2,200 photos were produced; 2,100 ft. of film and 5,000 ft. of oscillogram recording film were used during the flight trials. Photos were made of all the structural static tests, and over 1,500 ft. of film taken in the air to record flight maneuvers during aerodynamic trials. In addition to some 40 members of DHC's engineering staff, the investigating team included experts from the RCAF, the DoT, the NRC, the USAF, the U.S. Army, the U.S.'s NACA and the U.K.'s RAE.

Reports de Havilland Canada: "During the early stages of investigation, exhaustive tests of the Otter structure were carried out. These revealed that the Otter airframe is exceptionally strong in all respects and capable of withstanding load factors far in excess of International airworthiness requirements.

"The wing, for example, is required by U.S. authorities to develop a negative bending load factor of  $-1.4G$  in normal flight, and an ultimate, or breaking load factor of  $2.1G$  in the normal category. Under an actual test to destruction at 8,000 lb. gross weight, the wing failed in negative bending at a load of  $2.6G$ . This is 125% of the required ultimate load factor, and 185% of the normal load factor for inverted flight.

"A series of flight trials were held in which the Otter was subjected to a punishing ordeal of abnormal flying maneuvers. This phase of the investigation established the fact that the aircraft has absolutely no unusual or dangerous flying characteristics of any kind whatsoever."

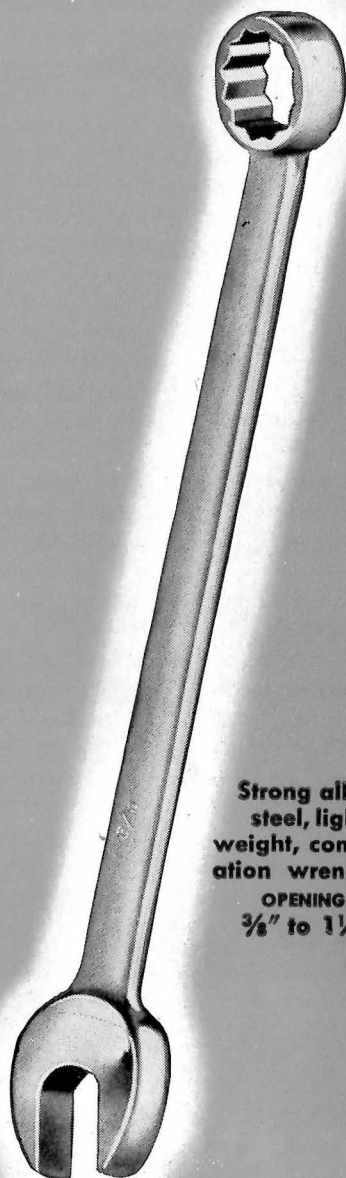
The Otter's manufacturers note that the investigation involved an intensive study of the records of the many Otters now in service. This revealed that some have completed over 3,000 trouble-free hours of flying time under operating conditions as severe as any that aircraft are ever likely to be cal-



CF-105 EXPOSED? Drawing of delta-wing aircraft with RCAF roundels flying over downtown Toronto accompanied —without comment— a recent report from The Garrett Corp., concerning the development of a heat exchanger for use in the Avro Aircraft CF-105 supersonic all-weather delta fighter. The heat exchanger is part of the complete CF-105 air conditioning and pressurizing systems being produced by Garrett's AiResearch Mfg. div. on behalf of The Garrett Mfg. Corp. of Canada Ltd.

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**FIRST OFF:** First CS2F-1 Sentinel to be completed for the RCN by The de Havilland Aircraft of Canada Ltd. appears above and below. The aircraft made its initial flight during the first week of June with DHC Chief Test Pilot George Neal in command, and Tony Verrico as co-pilot. Production of the CS2F is well ahead of schedule. The first two aircraft are to be delivered to the Navy in September.



led upon to survive." It was estimated that Otters in operation have accumulated a total of approximately 75,000 hours of flying time.

### New Potential

A new source of engineer material is about to be tapped at Orenda Engines Ltd. under a plan to prepare technical personnel for examinations by the Association of Professional Engineers of Ontario. The scheme was proposed in July by the Orenda Engineers' Association and was immediately given financial backing by the company.

Lectures will be held three days a week in lecture rooms at the Malton plant with the association providing the lecturers from among the professional engineers at the company. The lecturers will be paid small honorariums by Orenda. The employee candidates will be allowed time off to attend the course, which will be administered by the Orenda Engineers' Association, and the company will lend the students the money to pay the examination fees.

Applications, many from outside the company, have already been received for the first course, which is scheduled

to start in September. Candidates for the course are required to have senior matriculation or its equivalent and be technical personnel presently employed by the company. A total of 30 candidates will be chosen following interviews by the association during the summer months.

They will pay a fee of fifty cents per lecture which will be held in trust by the association and returned in full if the candidate passes all his examinations, or returned in part if the candidate is only partially successful. The time spent on lectures is generally similar to University of Toronto engineering timetables and in some cases exceeds the time allotted by the University. On successful completion of the course (in 1960) the candidates will be recognized as professional engineers. A second course is presently planned to start in September, 1957.

### North Star Overhaul

A contract for the overhaul of three RCAF North Star aircraft has been awarded to Canadair following the discontinuation of the work formerly carried out by The de Havilland Aircraft Canada Ltd. The first of these





**KC-135 ROLL-OUT:** The first production KC-135 jet tanker was rolled out of Boeing Airplane Co.'s Renton, Wash., plant during July. The KC-135 is at right while a left is the last of 888 KC-97 piston-powered tankers built by Boeing. The KC-97 emerged from the plant just minutes before the KC-135. In a flypast at upper right are (front) the Boeing 707 jet transport prototype and (rear) a B-52 bomber.

aircraft is now undergoing work at the Montreal plant. Canadair recently completed the modifications to seven North Stars and is expected to receive modification work on the RCAF C-5 early in September.

## How Tyne Flies

The new Rolls-Royce Tyne turbo-prop has successfully completed its first flight. The engine was installed in the nose of an Avro Lincoln flying test bed where it was used to assist in the take-off. The Tyne ran throughout the flight, which lasted one hour and forty minutes. While airborne, performance testing of the Tyne was commenced and the Lincoln flew with the two outboard Merlin engines feathered.

## CS2F Contract

A contract for the complete rear fuselage assembly on the de Havilland Canada assembled CS2F sub-hunter, has been let to Enheat Aircraft, a

division of Enamel & Heating Products Ltd., Amherst, N.S. The present order is for 24 units but this is expected to be increased. At this time the company is working on units 23 and 24 of the empennage.

Details of the sub assembly tooling will be transferred from the plant of Canadair Ltd., previous sub-contractors, by the end of November with the final assembly tooling expected by February of 1957. Delivery of the first complete rear fuselage unit from the Enheat plant is scheduled for August or September, 1957. This date would appear to maintain the delivery schedule of two per month, beginning in September of this year, as set up by The de Havilland Aircraft of Canada Ltd.

## CF-105 Heat Exchanger

The successful development of a new heat exchanger for the Avro Aircraft CF-105, has been announced by The Garrett Mfg. Corp. of Canada Ltd., Toronto. The Canadian firm, a sales, manufacturing and maintenance or-

ganization, is a subsidiary of The Garrett Corp., Los Angeles.

Developed and produced by Garrett's AiResearch Manufacturing div. in Los Angeles, the heat exchanger is a part of the complete air conditioning and pressurization systems produced by AiResearch. It is said to be the largest stainless steel unit ever manufactured for aircraft use, and will supply cooling air to the cockpit of the fighter.

The new unit functions continuously in cooling compressed air received at high temperatures and pressures. Hot air is bled from the CF-105's two turbojets and while flowing through the heat exchanger is cooled by air ducted from outside the aircraft.

For efficient operation as part of the aircraft's air conditioning system, the AiResearch unit is located between the engine bleed points and an AiResearch cooling turbine, which forces the cooled air into the cockpit.

A new technique — brazing the core of the heat exchanger in a vacuum — was employed by AiResearch, establishing complete homogenous bonds for removal of impurities and gases, the principal causes of contamination and leakage. This uniform bonding is applied to the thin-gauge segments of the cooler, which utilizes plate and fin construction.

Other AiResearch items developed for the 68,000 lb. CF-105 are five oil coolers, one cooling turbine, two actuators and a temperature control system.

## Course Completed

The first six men concerned with the installation of the electronic equipment on the CL-28 Britannia have completed their advance training course at the U.S. Naval Air Base, Norfolk, Virginia. The courses are designed to acquaint the engineers and electronic technicians at Canadair with the operation and maintenance of the radar and anti-submarine devices installed in the CL-28.

## Contracts Awarded

Contractors awarded business in excess of \$10,000 by the Department of Defence Production during the period May 16, to June 15, 1956, include the following. The list does not include orders placed by the Department outside Canada, or with other agencies, and increases in orders placed earlier — nor do orders classified as secret appear here.

(Names appearing in bold face are current *Aircraft* advertisers.)

**Aircraft Industries of Canada Ltd.**, St. John's, Que. \$313,000 for repair & overhaul of airframe spares during period April 1/56 — March 31/57.

**Aircraft Industries of Canada Ltd.**, St.

Johns, Que. \$400,000 for repair & modification of airframes and airframe components during period April 1/56—March 31/57.

Avionics Ltd., St. Catharines, Ont., \$26,531 for wooden tent floors.

Bristol Aero Engines Ltd., Montreal, \$1,235,000 for repair & overhaul of aero engines and engine components during period April 1/56—March 31/57.

Bristol Aircraft (Western) Ltd., Winnipeg Man. \$200,000 for repair & overhaul of jet engine exhaust unit assemblies during period April 1/56—March 31/57.

Bristol Aircraft (Western) Ltd., Winnipeg, \$1,274,000 for repair & overhaul of airframes and airframe components during period April 1/56—March 31/57.

Canadair Ltd., Montreal, \$1,200,000 for repair & modification of airframes and airframe components during period April 1/56—March 31/57.

Canadair Ltd., Montreal, \$30,000 for repair & overhaul of aircraft mobile training units during period April 1/56—March 31/57.

Canadair Ltd., Montreal, \$100,000 for aircraft spares during period April 1/56—March 31/58.

Canadair Ltd., Montreal, \$900,000 for repair & overhaul of airframe spares during period April 1/56 to March 31/57.

Canadian Pacific Airlines (Repairs) Ltd., Calgary, Alta. \$3,060,000 for repair, modification, inspection and storage of aircraft spares and accessories during period April 1/56—March 31/57.

Canadian Pratt & Whitney Aircraft Co. Ltd. Montreal, \$114,200 for helicopter technical publications.

Canadian Pratt & Whitney Aircraft Co. Ltd., Montreal, \$50,000 for repair & overhaul of helicopter airframe spares during period April 1/56—March 31/57.

Canadian Pratt & Whitney Aircraft Co. Ltd., Montreal, \$55,000 for repair & modification of helicopter airframe and airframe components during period April 1/56—March 31/57.

Canadian Pratt & Whitney Aircraft Co. Ltd., Montreal, \$719,000 for repair & overhaul of aero engine components during period April 1/56—March 31/57.

Dorval Air Transport Ltd., Dorval, Que. \$180,242 for charter of aircraft.

Dowty Equipment of Canada Ltd., Ajax, Ont. \$700,000 for repair & overhaul of undercarriage equipment and aircraft accessories during period April 1/56—March 31/57.

Electronic Materials International Ltd., Ottawa, \$107,600 for conversion of airborne communications equipment.

Enamel & Heating Products Ltd., Amherst, N.S., \$600,000 for repair & overhaul of airframe spares during period April 1/56—March 31/57.

Fairey Aviation Co. of Canada Ltd., Eastern Passage, N.S., \$365,000 for repair & overhaul of airframes and airframe components during period April 1/56—March 31/57.

Fairey Aviation Co. of Canada Ltd., Eastern Passage, N.S., \$100,000 for repair & overhaul of airframe spares during period April 1/56—March 31/57.

Fairey Aviation Co. of Canada Ltd., Eastern Passage, N.S., \$190,941 for aircraft spares.

Garret Mfg. Corp. of Canada Ltd., Toronto, \$90,000 for repair & modification of fire control system spares during period April 1/56—March 31/57.

Genaire Ltd., St. Catharines, Ont. \$481,000 for repair & overhaul of airframe components during period April 1/56—March 31/57.

Goodyear Tire & Rubber Co. of Canada Ltd., Toronto, \$77,555 for aircraft spares.

Imperial Oil Ltd., Ottawa \$168,571 for aviation gasoline.

Northwest Industries Ltd., Edmonton, Alta., \$500,000 for repair & overhaul of airframe spares during period April 1/56—March 31/57.

Northwest Industries Ltd., Edmonton, Alta., \$590,000 for repair & modification of airframes and airframe components during period April 1/56—March 31/57.

Northwest Industries Ltd., Edmonton, Alta., \$120,000 for repair & overhaul of airframe and airframe components during period April 1/56—March 31/57.

Orenda Engines Ltd., Toronto, \$744,000 for aero engine spares, tools and ground handling equipment during period April 1/56—March 31/57.

Rolls-Royce of Canada Ltd., Dorval Station Que. \$2,720,000 for repair & overhaul of aero engines and engine components during period April 1/56—March 31/57.

Rolls-Royce of Canada Ltd., Dorval Station, Que. \$100,000 for repair & overhaul of aero engine components during period April 1/56—March 31/57.

Ross-Smith Co. Ltd., Montreal, \$20,000 for aircraft covers.

Standard Aero Engine Ltd., Winnipeg, \$400,000 for repair & overhaul of airframe spares and accessories during period April 1/56—March 31/57.

Vertol Aircraft Co. (Canada) Ltd., Arn-prior, Ont., \$133,235 for helicopter technical publications and transparencies.

Vertol Aircraft Co. (Canada) Ltd., Arn-prior, Ont. \$40,000 for repair, reconditioning inspection and storage of helicopters and components during period April 1/56—March 31/57.

Vertol Aircraft Co. (Canada) Ltd., Arn-prior, Ont., \$107,000 for repair & overhaul of helicopter airframes and airframe components during period April 1/56—March 31/57.

Wheeler Air Lines Ltd., Quebec, Que. \$278,400 for charter of aircraft.

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Wild of Canada Ltd., Ottawa, \$14,568 for surveying equipment.

World Wide Airways Inc., Dorval, Que. \$179,800 for charter of aircraft.

Abercorn Aero Ltd., Montreal, \$23,630, for pyrotechnics.

Aircraft Industries of Canada Ltd., St. Johns, Que. \$25,000 for maintenance including fuelling of aircraft and providing services to visiting aircraft during period April 1/56—March 31/57.

Aviation Electric Ltd., Montreal, \$2,300,000 for repair & overhaul of instruments and miscellaneous material during period April 1/56—March 31/57.

Bristol Aero Engines Ltd., Montreal, \$1,928,000 for overhaul of aero engines and engine components during period April 1/56—March 31/57.

Bristol Aero Engines (Western) Ltd., Vancouver, \$118,000 for repair & overhaul of aero engines and engine components during period April 1/56—March 31/57.

Bristol Aircraft (Western) Ltd., Winnipeg, \$434,000 for repair & overhaul of airframe spares during period April 1/56—March 31/57.

Bristol Aircraft (Western) Ltd., Winnipeg, \$25,000 for repair & overhaul of airframes and airframe components during period April 1/56—March 31/57.

Canadair Ltd., Montreal, \$500,000 for aircraft ground handling equipment.

Canadian Pratt & Whitney Aircraft Co. Ltd., Montreal, \$27,648 for aircraft spares.

Crystal Glass & Plastics Ltd., Toronto, \$82,960 for visors for flying helmets.

Field Aviation Co. Ltd., Oshawa, Ont.

\$500,000 for storage, removal and preparation for flight of aircraft, aero engines and other major equipment.

Field Aviation Co. Ltd., Oshawa, Ont. \$17,709 for aircraft spares.

Imperial Oil Ltd., Ottawa, Ont. \$35,123 for aviation gasoline during period April 1/56 to March 31/57.

Imperial Oil Ltd., Ottawa, Ont. \$179,388 for aviation gasoline.

McColl-Frontenac Oil Co. Ltd., Montreal, \$252,000 for aviation turbine fuel during period ending March 31/57.

Midland Foundry & Machine Co. Ltd., Midland, Ont., \$12,247, for aircraft servicing equipment.

Orenda Engines Ltd., Toronto, \$374,000 for repair & overhaul of aero engine components during period April 1/56—March 31/57.

Railway & Power Engineering Corp., Montreal, \$47,495, for aircraft spares.

Renfrew Aircraft & Engineering Co. Ltd., Renfrew, Ont. \$180,000 for repair & modification of flame tubes during period April 1/56—March 31/57.

Sperry Gyroscope Co. of Canada Ltd., Montreal, \$127,767 for servomotors.

Sperry Gyroscope Ottawa Ltd., Ottawa, \$1,500,000 for repair and overhaul of aircraft instruments and miscellaneous material during period April 1/56—March 31/57.

Standard Aero Engines Ltd., Winnipeg, \$27,500 for repair & overhaul of aero engines and engine components during period April 1/56—March 31/57.

Standard Aero Engines Ltd., Winnipeg, \$374,000 for repair & overhaul of aero engine components during period April 1/56—March 31/57.

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