2791

FIRST HOME on Anglesea Square.

Fifteen

The "founding fathers" of Computing Devices of Canada Ltd. started work in the small store above, on Anglesea Square, Ottawa, in August, 1948. Today, the company occupies about 200,000 sq ft of plant space at Bell's Corners (below) and employs well over 1,000 people.

● There's no trick to running a successful avionics business — provided you have the essential ingredients: ingenuity, good employee relations, fluid production capability, rare technical skills, exhaustive quality control, astute business planning, and the disposition to take risks—to explore beyond the immediate state of the art.

All these qualities seem to abound at Computing Devices of Canada Ltd., which this month celebrates its 15th year in business. With a firmly established position as one of Can-

PART OF THE Computing Devices complex — the administration and engineering divisions.

years of progress

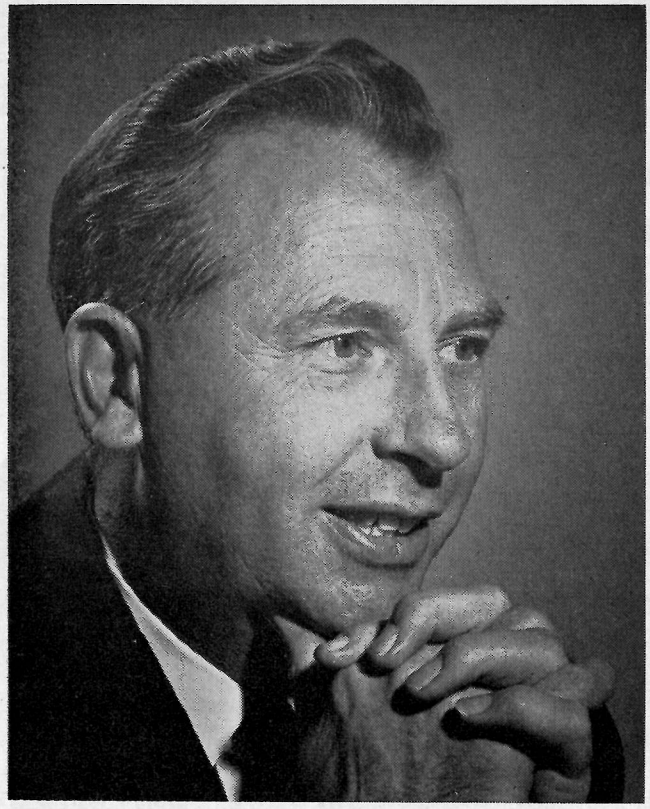
for Computing Devices of Canada

ada's principal avionics manufacturers, this progressive company occupies a position of world eminence in the field of air navigation systems.

Computing Devices equipment provides the primary navigation systems for the air forces of nine NATO nations and Australia. Its products help guide the jetliners of major transAtlantic airlines. Its revolutionary photo-reconnaissance system has been adopted by the RCAF. Advanced navigation and tactical systems are under evaluation by several air forces for ASW, V/STOL and helicopter applications. Two new display systems have aroused a great deal of interest in Britain, several European countries and in the U. S. The company is breaking new ground in aerophysics research and is preparing to take a leading role in the space age.

Charles F. Hembery, chief executive of Computing Devices for the past eleven years, summed up the company's philosophy in the introduction to its brochure "Explorations". In it he stated "The spirit of exploration, perhaps more than any other characteristic, exemplifies the aims and objectives of Computing Devices. From the inception of our company we have striven to provide challenging opportunities for our staff and to establish an environment in which they might apply their exploring creativity most effectively to the solution of our customers' problems.

"While we have encouraged the individual innovator, it is in the power of our teamwork that we feel we have accomplished most. Sound designs, painstaking workmanship, careful quality control—all combine to produce the fine precision products of



Charles F. Hembery, President and General Manager.

which all our personnel are justly proud.

"Through the efforts of this team, our company has achieved a position of leadership in the field of air navigation systems. But leadership carries with it a special obligation — the obligation to excel. It is to this task that all of our personnel are dedicated."

Mr. Hembery and his executive team feel very strongly that the key to continued growth lies in research and new product development. The company has invested more than $4 million of its own funds, during the past four years, in research, new and improved products and new facilities.

Government support

Government departments, particularly the Department of Defence Production, has assisted by funding all or part of a number of product development programs. The Position and Homing Indicator (PHI) now installed in nearly 3,000 aircraft, evolved from a DDP contract for the RCAF. Such support programs have been a two-way street. Royalties paid to the Canadian government to date exceed the original investment by a large margin.

The company's association with the Canadian government goes back to its very beginning in 1948. At that time three people, two technical specialists and an Ottawa businessman joined forces to exploit the then new techniques of digital simulation. The infant organization's very first contract was a study project for the RCN. This eventually grew into the tactical trainer, a 12,000 tube electronic monster, which was probably the largest and most advanced naval war games simulator in the world. Though the project was terminated in 1956, the knowledge gained has proved invaluable in many subsequent projects.

Pattern of growth

The "founding fathers" of Computing Devices were George Glinski, now head of Electrical Engineering at Ottawa University, Joseph Norton, presently Vice-President of Operations, and Ottawa businessman Peter Mahoney. Of the three, only Mr. Norton is still connected with the company.

"It is in the power of our

Operations began in a small store on Anglesea Square in downtown Ottawa. From this modest beginning (first year's sales about $40,000), has grown a complex with over 190,000 sq. ft. of factory space in two plants at Bell's Corners, on the western approach to Ottawa, with annual sales in 1962 of about $19 million. From fewer than 10 people in 1948, the staff has mushroomed to 1,100 of whom 400 are engineers, scientists and technicians. The payroll in 1962 was over $5 million. A new aerophysics research facility occupies 400 acres near Stittsville, 12 miles west of the plant.

Mr. Norton has many stories to tell of the early trials and tribulations. As in any young struggling organization, many of the problems were financial. Mr. Norton recalls asking the staff to hold off cashing their paychecks until funds could be raised to cover the payroll. Harry Dewar, now Purchasing Agent, and one of the first employees, had his start with the company as office boy-janitor-furnace stoker and what-have-you. In those days there was no question of a 40-hour week. The small staff worked night and day to meet their project deadlines. This spirit of dedication has remained throughout the years and accounts, in large measure, for the company's success.

In 1951 the decision was made to diversify into air navigation systems and the long association with the RCAF began shortly thereafter. In addition to the PHI, developed to RCAF specifications, the company designed and built the ANTAC (Air Navigation and Tactical Control) system for anti-submarine application. Over 60 of these systems are now flying with the RCAF's Maritime Command in the CL-28 Argus and the P2V Neptune aircraft.

Computing Devices' growth, in the face of successive trials, when many aviation and avionic companies were wilting and dying, is nothing short of amazing. In 1956 the tactical trainer was terminated, in 1957 the CF-100 Mk. VI program was cancelled, and in 1958 the death of the Avro Arrow rocked the company, along with the rest of the industry. It is a tribute to the company's management acumen that, not only did it bounce back to its feet after each blow, but it continued to expand steadily.

Surprisingly few professional people left the company during the three years of crisis, and it is a matter of considerable pride to management that it has been able to keep its technical nucleus intact over the years despite the call of companies south of the border.

The employee team

The company team now numbers about 1,100, with people representing many countries of the world. The variety and background of its personnel was brought home recently when the Department of Trade and Commerce asked Computing Devices to assist in its Operation World Markets program. The department asked how many languages were spoken in order to know what delegates might visit the plant. The answer went back: twenty-three — from Cantonese to Urdu.

Acquiring and retaining the highly skilled professional and technical staff has not been easy. In the words of E. R. Barrett, Director of Industrial Relations: "The company attracts people because it offers interesting and challenging jobs that intrigue the scientific type of person. Many jobs in other companies do not provide this challenge to the imagination. Our policy of new product development enables us to open up new and exciting opportunities. This year we have taken on over twenty university graduates."

Salary scales are comparable to similar industry in the larger centres and, said Mr. Barrett: "Our employee benefit program is outstanding and we apply it uniformly to machinists, clerks, engineers and supervisors, alike."

Concern for employees is top priority with management and this progressive attitude goes a long way to explain the fine employee relations enjoyed.

"Two years ago our employees formed their own association," continued Mr. Barrett. "It is a recognized bargaining agent and we have a formal collective agreement with the association. We welcome comments from the employees' representatives and have regular meetings to iron out our problems before they become grievances."

In addition to drawing staff from all over the world, Computing Devices distributes people just as widely. They can be found throughout the free world, underlining the international nature of the company's operations. To assist licensees in setting up PHI production lines, a number of quality control and manufacturing men have visited France, Italy and Germany.

During the company's early years it was almost completely engineering-oriented. But when wide acceptance of the PHI was achieved the production side of operations grew rapidly until today, Computing Devices has one of the industry's best equipped facilities. In 1962, the equivalent of 850 PHI systems was shipped.

Striving for improvement

Said P. G. Hughes, Manager of Manufacturing: "We believe our fabrication and assembly operations are equal to any in Canadian industry. Working metal to a ten-thousandth of an inch is an everyday occurrence. Our methods are efficient and we are constantly striving to improve them by the acquisition of new machines. Typical, is the purchase of a numerical controlled jig-mill, now being installed. This represents a large capital investment, but we are confident it will pay off in lower costs."

Computing Devices has a progressive approach to quality control. Because so much of its output is for military use the ability to meet rigid and demanding specifications is mandatory. Explained R. N. Chandler, Manager of Quality Control: "The key to production efficiency is to make the part right the first time. Pride of workmanship on the bench or at the machine is the strongest motivating force possible. We are doing all we can to encourage this attitude and to reduce the amount of inspection time in all fabrication and assembly operations. We are going heavily for statistical quality control techniques in our plant and for correlation inspection for purchased material and the results have been very encouraging."

But QC means far more than inspection at Computing Devices. QC engineers take part in nearly all phases of the engineering design cycle as well, working closely with the designers and the production engineers.

A design review board has been established, charged with the scrutiny of all new designs. On it sit, representatives from engineering, quality control, manufacturing and field service. Contracts' personnel, representing the customer, also attend regularly.

Reliance upon quality purchased parts was stressed by D. A. Bassett, Manager of Materials. "We buy a high percentage of components from many specialty suppliers. This is inevitable in the avionics business."

The materials division is charged with getting good material on time for the right price — a tall order when fantastically close tolerances are involved and engineering designs are constantly pressing the state of the art.

Supplier relations

"Good supplier relations are a must," Mr. Bassett said. "Not only does this pay off in better purchased

LINE ASSEMBLY of VICOM photo-reconnaissance system pods.

Export growth in recent years

	Exports ($)	Total Sales	Employment
1959	600,000	7,205,000	640
1960	4,100,000	10,436,000	883
1961	6,700,000	15,066,000	1,005
1962	10,500,000	18,804,000	1,060

SIGNIFICANT growth of the exports of Computing Devices of Canada Ltd., is shown by table. Since 1959, total sales have grown rather less than three-fold, while exports have multiplied almost 18 times—for less than a doubling of personnel.

parts at lower cost, but we are often able to pick up new manufacturing techniques that assist our in-plant operations." He cited the Canton hole borer as a good example. "A supplier of gear heads and motors invited us to see this machine in operation. Our people were so impressed that we obtained our own machine, which speeded up precision hole boring operations and enabled us to lower costs significantly over previous methods, while maintaining or improving accuracy."

Ensuring a continuing flow of new and improved products is the responsibility of the engineering division, headed by Chief Engineer, B. F. Chown, who describes the business of trying to foresee the needs of customers several years in advance, as "industrial gamesmanship of the highest order."

"The task is made more difficult because our customers often do not know what they want," Mr. Chown continued. "We work very closely with our contracts staff, and our systems engineers frequently accompany marketing people, when they visit customers. Because of the complex nature of our systems, this engineering-marketing combination is an essential factor."

J. E. Smith, Vice-President of Engineering and Marketing explained the company's approach this way: "The best way to convince a customer that your product satisfies his need is to give him the actual hardware to evaluate under service conditions. This necessarily increases the risk because it usually means you must carry the development and prototype construction costs yourself. However, in many cases it is the most effective way." Here Mr. Smith acknowledged the willing assistance of DDP and the RCAF in making units produced for the Canadian government available for demonstration to other customers.

Operation bootstrap

Rapid expansion of company facilities has placed a heavy drain on its financial resources. Management has always given first priority to the building of a solid base for future growth. While a profit has been made every year, not one dollar was paid in dividends until 1961 — and then the shareholders were asked to loan the money back.

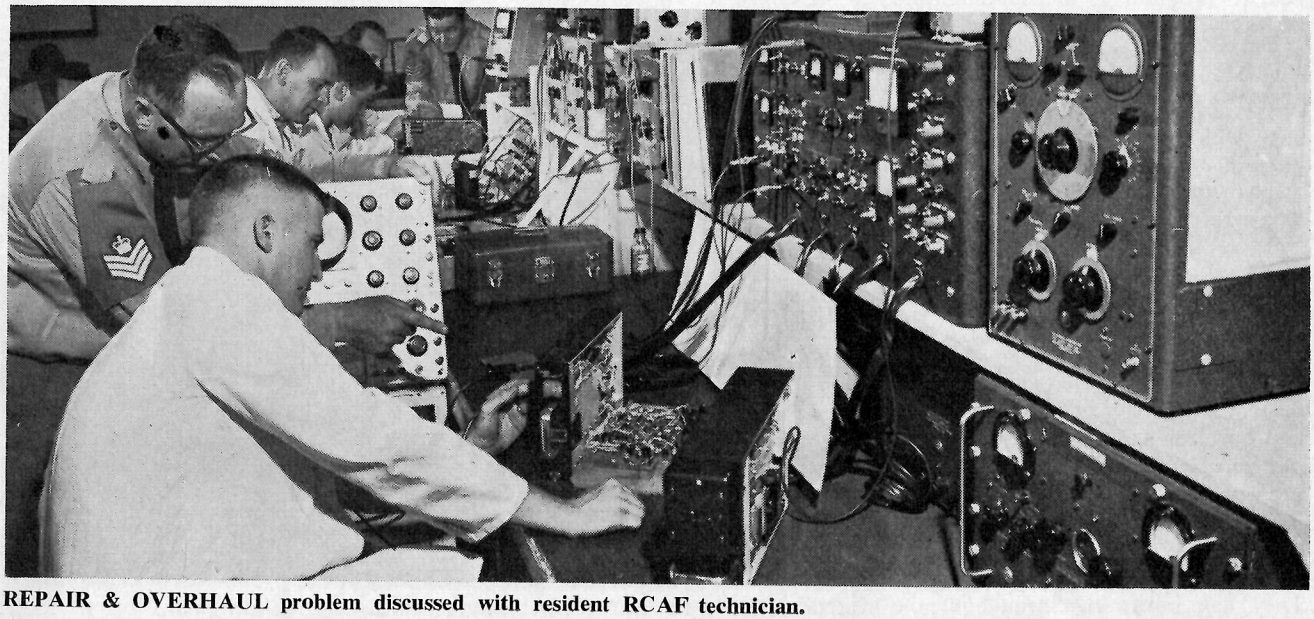
"We make no apologies for this approach," Mr. Hembery stated. "The shareholders have been completely in agreement. I believe their faith and forebearance has been amply justified by the results achieved."

But there was a limit to the funds that could be derived from profits and, like many other young organizations, Computing Devices went looking for outside capital. Negotiations were opened up with The Bendix Corporation (at that time The Bendix Aviation Corporation), a major U. S. military and industrial supplier with headquarters in Detroit.

C. K. Wolff, Vice President of Finance and Administration explained: "We affiliated with Bendix for several important reasons: We were able to obtain urgently needed capital to finance our growth; we were given access to a vast new area of advanced technology; we became sales representatives for several major product lines of related Bendix Divisions; we were given the opportunity to manufacture Bendix products under license; we had available to us the world-wide marketing organization of Bendix International Operations."

At first, Bendix acquired a 40% interest, then 70%. The remaining 30% is held by the Canadian directors and company executives.

"One of the reasons we decided to approach Bendix," Mr. Hembery disclosed, "was their reputation for allowing the existing management to run its own affairs — provided that it did so successfully. We have enjoyed the most satisfactory relations with the Bendix senior people and have found them to be fair and rea-



REPAIR & OVERHAUL problem discussed with resident RCAF technician.

sonable and understanding at all times. We very quickly came to respect their business know-how and the penetrating questions they have asked at directors' meetings not only indicated their grasp of our operations but have greatly helped us to chart our own course more effectively."

An appreciation of how successfully that course has been charted may be gained from the fact that almost 4,000 aircraft carry units or systems developed by Computing Devices.

Worldwide acceptance

PHI systems fly in the RCAF's CF-104s; in the F-104Gs of Germany, Italy, Belgium, and Netherlands; in the G-91s of Germany, Italy, Turkey and Greece; in the French Naval Air Arms' Etendards; and in the RAAF's Mirage IIIs. The Skyline computer and controller have been incorporated in the Bendix doppler radar system adopted by a number of major international airlines.

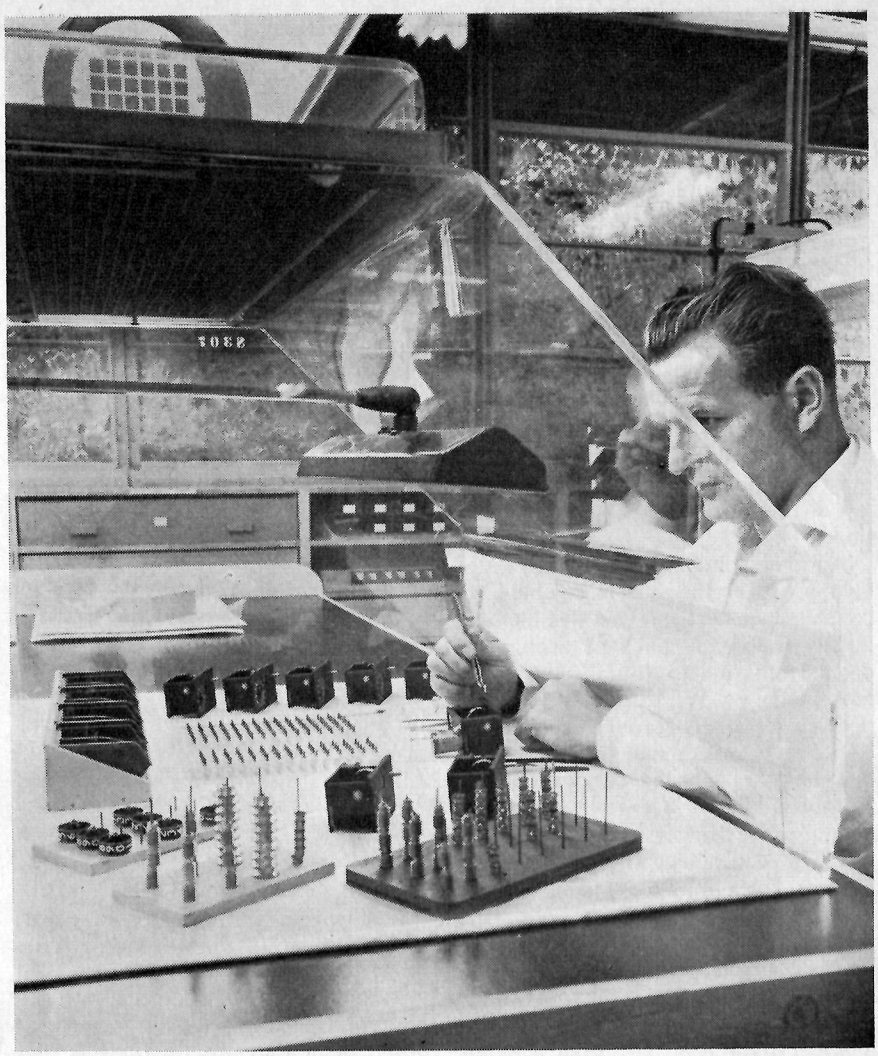
TCA's DC-8s carry the synchronous astrocompass controller to assist the navigators on transAtlantic flights. The ANTAC system is installed on the RCAF Argus, and the French government has selected the Integrated Destination Indicator, an ANTAC subsystem, for use in the Breguet Atlantic.

Computing Devices engineers are working on several advanced versions of the PHI and ANTAC. The PHI-100 has been designed for supersonic VTOL aircraft; the PHI-200 series is for use in helicopters in ASW or assault roles. New problems had to be overcome because of the need to accept speeds down to zero and negative velocities and because of the wide speed range of modern VTOL aircraft.

Feature of the 200 series is the provision of a moving base console, which permits the mother ship's movements to be incorporated in the helicopter's navigation computation. This enables the pilot to return to the moving base by pushing a button, as with the regular PHI systems. Interest in the helicopter version has been aroused in U. S. military circles and flight trials have been arranged. The system works with either Doppler radar or inertial platform sensors and TACAN information can be displayed.

GAINS (Global Airborne Integrated Navigation System) is a second generation derivative of ANTAC with greater operational flexibility, increased accuracy and reliability but lower weight and smaller volume.

The company's interest in displays dates back to the early days of the tactical trainer, but has been renewed in two display developments for aircraft use, which grew out of an association with the British government and industry. These are the Tactical Moving Map Display and Spectocom head-up display.



COMPONENT ASSEMBLY under dust-free, controlled atmosphere conditions.

The former is redevelopment of a device developed by the Royal Aeronautical Establishment for the U. K. Ministry of Aviation. The maps required for any given area are photographed and stored on 35mm color film. These are projected on a brightly illuminated screen with the aircraft's position in the centre of the display. The pilot is thus able to see his position in relation to the topographic details. The map projection moves synchronously with the aircraft's movement maintaining the aircraft position in the centre.

Change to automatic

The film magazine contains maps covering an area 1,800 x 1,800 nautical miles square. At the smallest of two scales (1: 500,000 and 1: 1,000,000) available, the film width represents a distance of 200 nautical miles. Aircraft flying at Mach 2 will cross such a strip in a few minutes, and in the original design, strip changes were made manually. Computing Devices' engineers devised a method of doing this automatically.

The display incorporates a look-ahead feature, whereby the pilot may manually slew the map to display any area. The map automatically returns to its original position. The indicator also displays desired course, track error and range to destination, when fed with suitable computer inputs, such as the PHI.

Provision is made for destination insertion and position up-dating (from an on-top fix), and supplementary flight information such as target or airport approach data, and air traffic control procedures, may also be displayed. The unit has been flight-evaluated by the RAF, and flight trials by the U. S. are in preparation. Incorporation into the Hawker P-1154 VTOL aircraft is being considered.

The Spectocom head-up display is a joint development of Specto Avionics Ltd., in the U. K., and Comput-

ing Devices. This enables the pilot to fly high-speed, low-level missions with maximum concentration on his tactical task. Essential flight information is displayed on a dichroic mirror directly in the pilot's line of vision, so that he need not look down to his instrument panel. The display data available is varied and flexible and includes modes for take-off and climb-out, mid-course navigation and terrain following, attack, in-flight refueling and approach and landing.

The pilot's display unit incorporates a projection cathode-ray tube and has sufficient intensity to enable the symbols to be seen against a background of bright sunlit clouds. For lower light levels there is automatic compensation.

Another joint Canadian-British development is the VICOM photo-reconnaissance system. This flexible and largely automatic package accommodates from one to four 70mm cameras made by W. Vinten Ltd., London, England. The four camera version has been adopted by the RCAF and is now entering service on the European based CF-104 strike reconnaissance fighters. By locating the VICOM equipment in a belly pod, aircraft roles may be changed in a half-hour.

The system enables the pilot to set up his controls well in advance of his target area. With the equipment automatically adjusting exposure to the ambient light level the pilot's action over the target is reduced to pushing a button on the joystick with the equipment automatically firing a predetermined number of correctly exposed frames.

If the light level should fall below the usable minimum, the pilot receives a warning signal. An outstanding feature of VICOM is that it enables the aircraft's position to be photographed on each frame of the film if a suitable navigation computer, such as the PHI, is incorporated. This facilitates the interpretation of the film when it has been processed. In-flight processing of the film, to reduce the time between exposure and interpretation, is being developed.

Looking to space

Interest in guided missiles dates back to the early days of the Velvet Glove project. Company technical staff took an active part in the missile flight trials and developed an instrumented tip-tank pod for the CF-100 chase aircraft. At the time the Arrow program was cancelled, the Company was well into the preparations for the manufacture of the seeker head unit for the Sparrow missile. But it really broke into the missile and space age with the establishment of the first Canadian privately owned industrial aerophysics research facility on a 400-acre site near its main plant.

Work started early in 1961 and the investment is now approaching the million dollar mark. The aerophysics range has several launchers. The light gas gun now installed has a 1½ in. bore and enables missile models or other comparatively light projectiles to be fired at speeds up to 20,000 fps. A second gun with a 0.5 in. barrel will enable higher speeds (about 30,000 fps) to be reached. These guns fire into a controlled atmosphere range which can be evacuated to simulate conditions at altitudes up to 250,000 ft above sea level.

For sea-level firings at lower speeds, heavier and larger models may be fired (up to 7,000 fps) from a modified 4-in. naval gun or even larger models (up to 2,000 fps) from a 12-in. compressed air launcher. Range instrumentation includes velocity measuring systems and photographic recording apparatus for flow visualization studies. Cameras are triggered automatically by the model as it is fired; the shutter is left open and a flash of light records the action. Observation of the progress of the model is aided by a series of yaw cards—large sheets of paper suspended at regular intervals inside the chamber, and if required, for a considerable distance beyond the chamber and outside the building in a tunnel extension made of prefabricated metal sections. The attitude of the model is revealed by the shapes of the holes made in the yaw cards.

Instrumentation for hypervelocity impact studies includes spectrographic equipment and high speed multiframe X-ray and image converter tube cameras. So fast is the projectile moving that a collision with any substantial target causes a brilliant flash of light as it destroys itself in a puff of vapor.

One of the many fascinating projects undertaken by the aerophysics research staff is the development of high-g telemetry packages. These are encapsulated transistorized radio transmitters which send out such in-flight data as acceleration, pressure and temperature to receiving stations located nearby. The telemetered signals are recorded on high speed tape units for later analysis.

These units are capable of withstanding enormous acceleration forces equivalent to 200,000 times the force of gravity. Such units would be capable of operation after a hard missile landing on the moon.

New mirror technique

The company's technical men are always on the alert for new product possibilities. One example is a new technique for making mirrors up to 2 or 3 feet in diameter out of aluminized plastics. This technique was used to provide low cost parabolic reflectors, for camera work at the range. These would have cost several thousand dollars if produced from optical glass, and patents are now pending for commercial production of the plastic reflectors. By taking a somewhat different approach, the aerophysicists have evolved a technique

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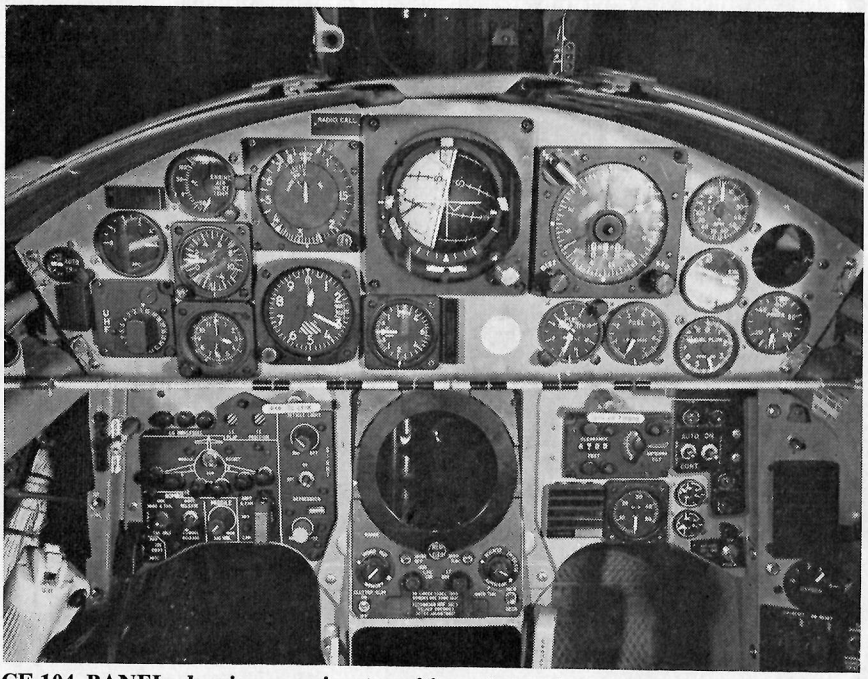
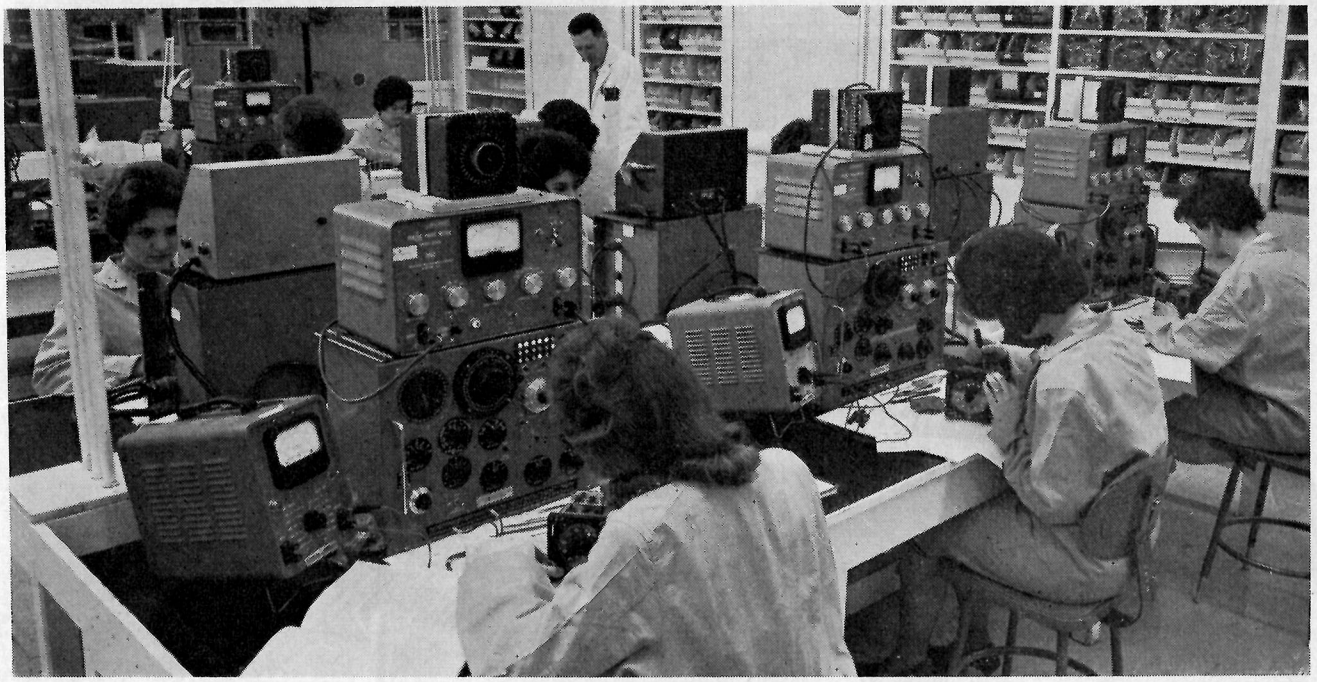


CF-104 PANEL showing prominent position of Position & Homing Indicator (top right).



POSITION & HOMING Indicators receive final testing in atmosphere-controlled white room.

for inflating mirrors in outer space and have submitted proposals for solar concentrators and radar reflectors for use on space satellites.

Not all the company's technical staff is located at Bell's Corners. A large contingent is scattered among several wings at Canadian Armament Research and Development Establishment, Valcartier, Que., working on advanced projects for the Defence Research Board. A smaller group operates the data reduction centre at the RCAF's flight proving station at Cold Lake, Alta.

Field service representatives go wherever products are in service, and technicians are posted at several airframe plants to assist in equipment installation. Technical representatives were located in Europe to assist licensees and military users when PHIs first went into service with NATO countries.

Some members of the new industrial division are working with the Department of Mines and Technical Surveys on the Polar Ice Shelf Project and others with a U. S. company in the Caribbean.

In a move to increase the proportion of non-military business, an industrial division was recently created under R. G. Salusbury. This incorporates two departments that previously handled agency sales activities. The sale of equipment manufactured by others will continue to form a large part of its activities but the new division has been given a mandate to develop commercial and industrial products. This is a long-term program, but the company looks forward to new product lines to sell to new and untapped market areas.

A relatively small but important activity is the repair and overhaul department, whose technicians handle military and commercial electronic and avionic equipment. The department works under contract to the RCAF to the same high standards as those in the main production facility.

New corporate image

Some time ago Computing Devices realized it needed a revitalized corporate image to replace the "CDC" roundel it had been using in its advertising and sales literature. The initials were being used by so many other companies at home and abroad that it was losing significance. In France the situation was even more awkward because a company in a related field with the same initials threatened legal action. A new and larger U. S. company, Control Data Corporation was also looming on the horizon. (By a strange quirk of fate Control Data has purchased the Bendix Computer Division and Computing Devices is now selling Control Data Computer products in Canada).

W. F. MacRae, Manager of Advertising and Public Relations came up with the Explorations theme and the idea of using Champlain's statue against the background of the parliament building at Ottawa. Champlain's astrolabe, an ancient surveying and navigating instrument, has been used to amplify the explorations theme.

Several replicas of the astrolabe were made in the model shop after one of the staff visited the Historical Museum in New York and took the exact measurements from the astrolabe that Champlain lost near Arnprior, Ontario, in 1613. One of the replicas was presented to the Hon. Raymond O'Hurley when he opened the addition to Plant 2 last December.

Computing Devices exhibited its products at the Paris Air Show this June, and another astrolabe replica was presented to Monsier Henri Delouver, Mayor of Hier - Brouage, Champlain's birthplace. The mayor reciprocated by presenting to the company the deed to the property where Champlain was born, and the company plans to acquire some additional property adjacent to the small plot and present it to the people of Canada during the centennial celebrations in 1967.

Confidence in future

Computing Devices faces the future confident that it can continue to mix the ingredients as successfully as it has in the past. Mr. Hembery describes the present corporate posture as one of "consolidation and adjustment after a very rapid expansion."

"We have a great deal on our plate now" he said "and we want to examine carefully our aims and objectives before mapping out new plans for action. At the present time we are preparing a new five-year company plan and after the completion of this activity we shall be able to see more clearly where we intend going.

"One thing is certain, we intend to continue to be a major supplier to government and industry throughout the free world. We have the products, the staff, the facilities and the will to succeed. We believe the combination is a winning one." END