Flight Research at Uplands

UPLANDS LOOKS TO A FUTURE AS CANADA'S CENTRE OF AERO RESEARCH

SOME DAY in the future, Ottawa's Uplands Airport may be one of the world's foremost centres of flight research. It will have a supersonic wind tunnel that will rate among the most advanced of aeronautical research tools anywhere. Aircraft being used for research and development work will fly off a runway 25,000 feet long. These and many other things are in the cards for Uplands if long range plans to turn it into the focal point of Canadian aeronautical research are eventually realized.

Actually the first phase of this long range plan has for some time been completed. This involved the moving of the National Aeronautical Establishment's Flight Research Section from its original base at Arnprior, Ont., where it had been originally set up in 1946 as a joint operation of the National Research Council and the RCAF. To accomplish this move, it was necessary to build new quarters for the Section at Uplands. These quarters took the form of a gleaming white concrete arch hangar, with integrated workshops and administrative quarters.

At the same time, the first stage of the Uplands runway extension program was carried out, with the main runway being stretched to 8,800 feet. There is to be a second extension which will take this runway to about 15,000 feet, and a third and final one which will bring it to 25,000 feet. These last two stages are, of course, some time in the future.

In addition to the main hangar building already mentioned, the Flight Research Section has a number of other buildings in the vicinity, these including a heating plant, a storage and motor transport building, and a cafeteria.

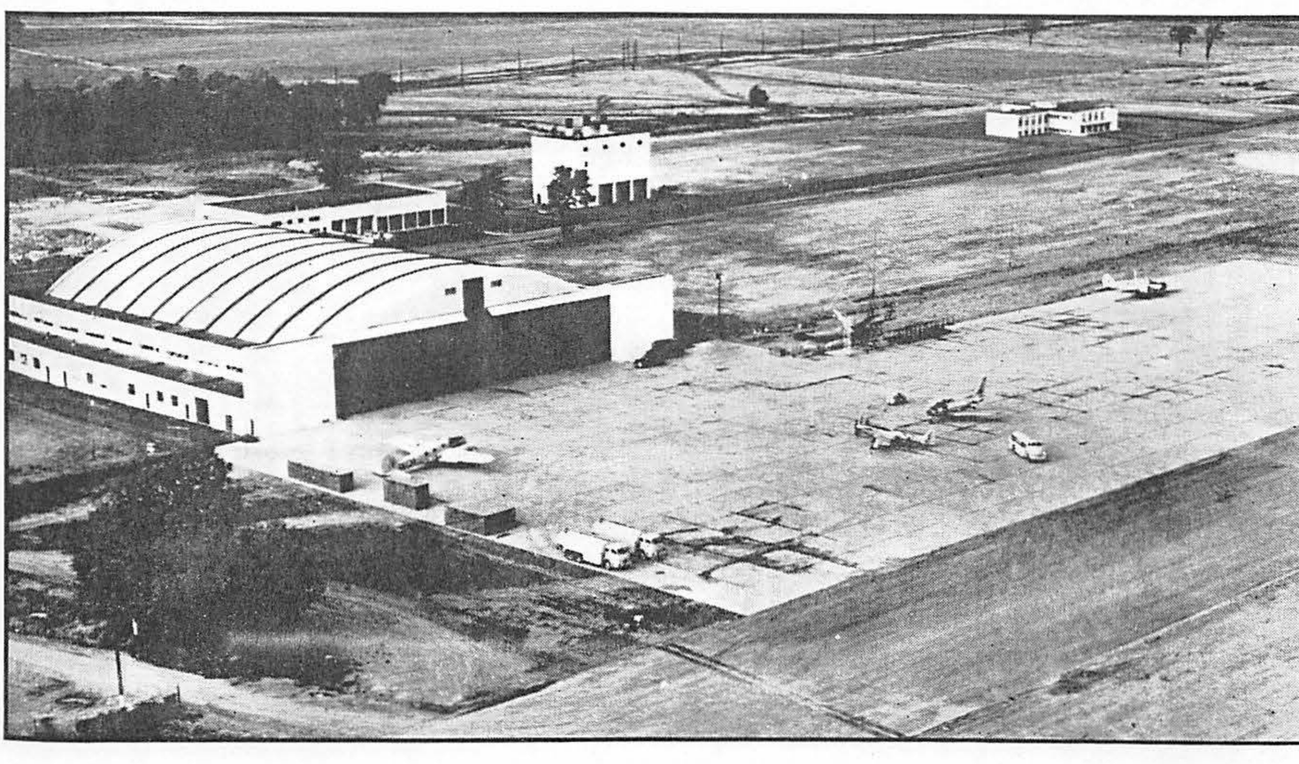
As it now stands, the Flight Research Section has reached the first plateau of the program to develop it into a Canadian centre of advanced aeronautical research. Steps are always underway to take the action necessary to reach the second plateau.

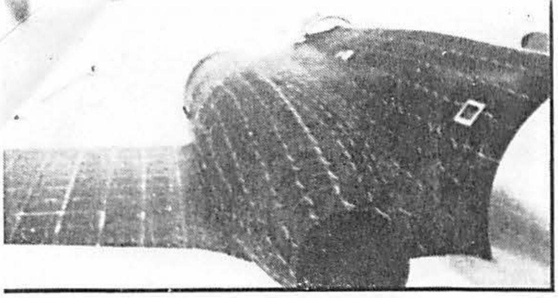
These involve the building of the long-mooted supersonic wind tunnel. This project has been delayed for some time because of difficulties in getting sufficient funds, there being something like $6,000,000 involved. However, it now appears that these difficulties are near resolution.

With the completion of the wind tunnel, an interesting change will take place in the administration of the Flight Research Section in that its operation will be taken over by the Defence Research Board. To date, it has been administered by the NRC. Even after the Section is taken over by the DRB, however, it will continue to be known as the "NAE" Flight Research Section.

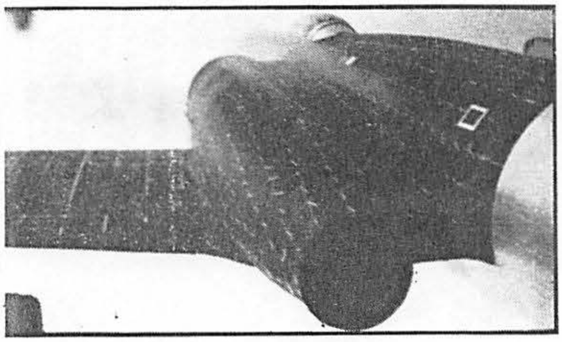
The installation of the wind tunnel at Uplands will in time be followed

Picture below shows most of the existing facilities of the NAE's Flight Research Section at Uplands. Left foreground is the main hangar; just behind the hangar is the storage and garage building; centre rear, the powerhouse and steam plant; upper right, cafeteria. Not in this picture is the helicopter icing rig, which is located in area to right of hangar. New, advanced supersonic wind tunnel will be built to rear of and between powerhouse and cafeteria building.

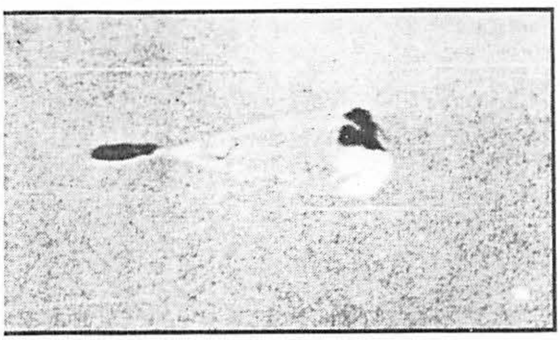




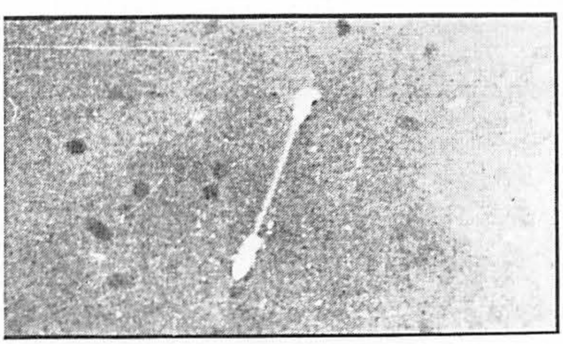
Photographs above, below, and to right illustrate NAE experiments with vortex generators, a typical installation being shown at right on a T-33 wing.



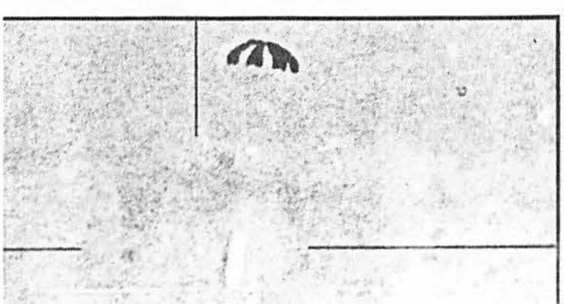
Above, stabilizer-mounted camera pictures tuft studies with a vortex generator-fitted CF-100. Top, in pre-buffet condition; above, buffet onset.

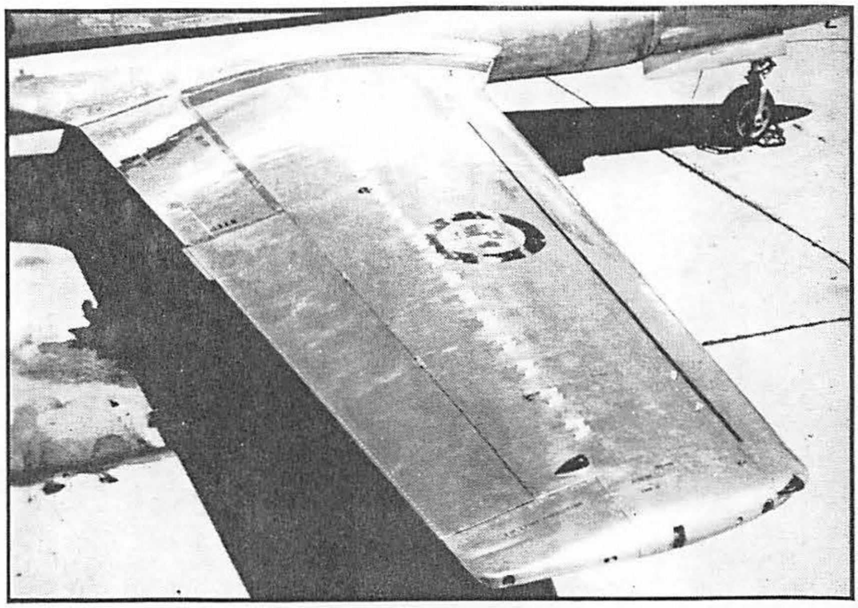


Picture sequence shows action of repeating parachute developed by NAE's Flight Research Section. Above, open; below, closed; and bottom, re-opened.



Open and close action of repeating parachute can be made to repeat as many times as desired. Parachute makes possible more accurate drops.





by the building of other research tools on the same site, as their need becomes necessary . . . and the necessary funds become available.

Since the Flight Research Section was established in 1946, it has made many significant contributions to aeronautical knowledge. A number of interesting research techniques have been developed and at the same time, numerous developments of immediate practical value to the aviation industry in Canada have been carried out.

Among the first projects carried out by the Flight Research Section was the flight testing of the NRC tailless glider. Built at the Montreal Road laboratories of the NRC, most of the flying program was conducted from Edmonton's Namao Airport over a period of three summers.

Although this project produced useful design data and considerable experience in instrumentation and testing techniques, no further development was considered since the immediate future for aircraft in many categories appeared to lie in the direction of higher speeds utilizing comparatively thin wings.

Another interesting program that was carried out shortly after the termination of the tailless glider work, involved the transonic testing of models by the wing-flow technique, a method which had its origin at the NACA in the U.S. To appreciate the value of this development, it is necessary to realize that at that time Canada had no transonic wind tunnels and no jet aircraft capable of transonic flight. Though this was only a few short years ago, the current glut of Sabres and CF-100's was some time off.

This wing-flow technique involved the acquisition of an RCAF Mustang. The wings of the aircraft were modified by the addition of a 32 in. wide fibreglass hump on each upper mainplane, thereby increasing the camber of the wing in a 32 in. portion of the span on each side. Since the airflow over this humped section must of necessity have been much faster than the forward speed of the aircraft, the resultant Mach number of the model mounted on the hump was therefore higher than the aircraft Mach number. By flying the aircraft at speeds up to Mach 0.75, it was possible to obtain local flow velocities at the model position varying from Mach 0.4 to Mach 1.2. Balance equipment and other instrumentation to record the effects of the tests on the model were installed in the Mustang's ammunition bays.

Among the projects that were put through their early transonic paces in this manner were the CF-100, the CARDE-developed "Heller" anti-tank rocket, and the Velvet Glove guided missile.

In the last few years, the Flight Research Section has been associated with such projects as the design and development of Velvet Glove launchers for both the Sabre and the CF-100, as well as the flight testing of these. It has also carried out all the flight testing in connection with the NAE-developed reheat system.

A unique development of the Flight Research Section has been the repeat-

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Phoenix claims is second to none in the field and moreover, this accuracy is maintained over exceptionally wide temperature and acceleration ranges. Inductive type, variable reluctance type and differential transformer type transducers have been designed, developed and prototyped by Phoenix and these in turn have been stepping stones to the manufacture of precision apparatus such as angle of pitch and yaw transducers, relative wind sensors, pressure transducers of all kinds including differential types, accelerometers including airborne recording types, remote position indicators (servo types for stress testing).

PSC Applied Research: As this company's name implies, its activities are aimed mainly at research and development, though it has now become active in the production side as well, as a result of the success of some of its products. An outstanding example of this is the R Theta Computer navigation aid which is now in production for the RCAF.

Originally set up as the research division of Photographic Survey Corp., ARL was later incorporated as a separate entity specializing in design engineering and production of aircraft instrumentation and controls; photogrammetric and optical instruments; airborne geophysical survey equipment; photographic equipment. Products developed, besides the R Theta Computer include instrumentation cameras, rocket fire control intervalometers, dual-probe ice detectors, and specialized armament control equipment.

Canadian General Electric: The development activities of this company which are of particular interest to the aviation field are handled mainly by the Electronic Equipment & Tube Department. Suitable facilities and personnel are maintained to provide consulting, engineering and manufacturing services for the development and production of military electronic equipment and systems.

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ing parachute, which by automatically opening and closing (the canopy is collapsed by twisting the shroud lines, which then unwind, allowing the canopy to open again) makes possible more accurate dropping of supplies and equipment.

Of more recent interest are the Section's investigations into the effects of vortex generators and, more to the point, the causes of these effects. Vortex generators are well-known and have been widely used to improve the characteristics of subsonic wind tunnel diffusers and to suppress shock-induced separation on aircraft wings. In general, vortex generators are small wings mounted at right angles to a surface; the tip vortices of these wings is used to alleviate separation of the boundary layer from the surface. A typical configuration and application is shown in photos accompanying this article.

This program started in 1954 and is still continuing. Both a T-33 and a CF-100 have been used in connection with the allied flight testing. Tests have also been carried out in a low speed wind tunnel.

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situation would be to be able to prevent this noise from penetrating inside the fuselage, without having to resort to