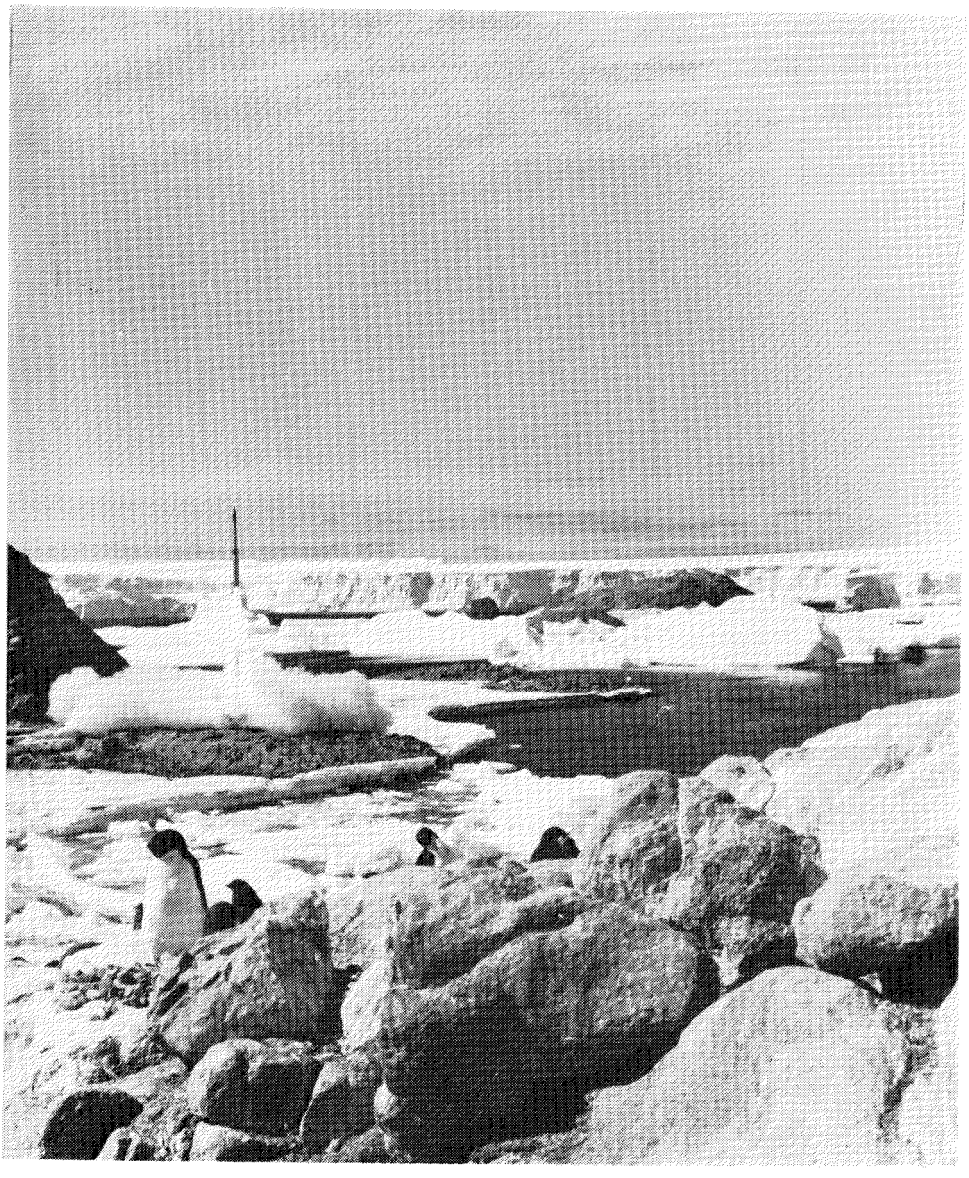

Photo: J. C. Loison

One of four rockets launched by Expéditions Polaires Françaises from Adelie-Land in January 1967 for the purpose of studying the ionosphere. The rockets are of the *Dragon* type and reach altitudes of 350 km.

Twentieth Anniversary of Expéditions Polaires Françaises (*Missions Paul-Emile Victor*)

On 14 May 1948, the polar vessel *Force,* carrying the first expedition to Greenland organized by the Expéditions Polaires Françaises (Missions Paul-Emile Victor), sailed from Rouen. On 26 November 1948, the polar sloop *Commandant Charcot* left Brest carrying the first expedition to Adelie Land organized by Expéditions Polaires Françaises (EPF).

Today, the EPF has behind it twenty years of almost continuous activity. In the course of these twenty years, thirty-three expeditions have been sent out both to the Greenland ice cap and to Adelie Land, that is, to the Arctic as well as to the Antarctic; in addition two research ventures have been sent to the Vatnajökull ice dome in Iceland. At various times during these twenty years the EPF has been working simultaneously in both polar regions for periods of several years.

To sum up this activity is a difficult and delicate task. It could be reduced to statistics and be no more than a series of figures, though possibly eloquent ones, and it could also read like an advertisement. It could very likely include both figures and techniques. But this method would overshadow the contributions of the team, the men who made it all possible and, more specifically, the working climate and the spirit characteristic of the EPF that these men helped to create — the spirit enabling them to carry out serious work without taking themselves seriously.

GENERAL ACTIVITIES

The Expéditions Polaires Françaises was founded on 27 February 1947 by a decision of the Cabinet approving a project of Paul-Emile Victor, who was then given the task of organizing and carrying out scientific research expeditions in the polar regions. The initial mission involved, on the one hand, a study of the Greenland ice cap and its influence on the Northern Hemisphere and, on the other hand, the establishment of France in Adelie Land for the purpose of exploration and scientific research.

Under the joint sponsorship of the Ministry of Education (National Centre for Scientific Research) and the Ministry of State for Overseas Departments and Territories (French Austral and Antarctic Territories), and with the authorization of the Danish Government with respect to Greenland, this mission has been expanded. Its present purposes are: to increase all aspects of knowledge of the polar and sub-polar regions; to organize and carry out expeditions in these regions or others with similar characteristics; to initiate, organize, carry out or support

all scientific and technological research in these regions; to publish and distribute the results obtained; and to gather all available documentation and to establish contacts for this purpose.

The work has so far been carried out mainly in two regions: Greenland in the Arctic, and Adelie Land in the Antarctic; but also occasionally in Iceland, in the French Austral Territories, and in other areas of the Antarctic. It has taken the form of wholly French expeditions, of participation in international teams in collaboration with other organizations, or of sending specialists with foreign expeditions.

During the past twenty years, faced with the importance and increasing specialization of scientific research and international cooperation in the polar regions, the Expéditions Polaires Françaises has evolved towards the more rational and more logical concept of a mainly logistic organization. The scientific programs and their implementation are now the responsibility of national or international commissions and the respective specialized scientific institutions.

The EPF was the first to introduce to scientific research in the polar regions new techniques discovered and developed during the last war, such as the use of motorized tractor convoys, air transport, parachutes, and new materials, all commonly used in most expeditions today.

Long-distance traverses were made across the ice caps; at the same time fixed observation stations were set up in Greenland (Central Station, Dumont Station, Jarl-Joset Station), on the Adelie Coast (Port-Martin, Marret, Dumont d'Urville), and in the interior of the Antarctic Continent (Charcot).

Since 1947, 33 expeditions have been completed: 1,000 scientists and technicians have participated in them; more than 250,000 kilometres have been covered in tractor vehicles; more than 4,000 hours of flying time have gone into the air support provided by planes and helicopters; and 29 vessels (18 for Adelie Land and 11 for Greenland) have been chartered to transport 12,000 tons of supplies and equipment of all types.

The observations published officially by EPF have so far amounted to some three hundred volumes and brochures; to this number must be added many scientific and technical articles, as well as some of informational and general interest. Among the most significant results of the expeditions have been an increase in the knowledge of Greenland's ice wasteland and its geophysical characteristics, and of the geography and cartography of Adelie Land. In addition, throughout the last twenty years there has been almost continuous research in the following disciplines:

(1) *Earth sciences:* geomagnetics, gravimetry, seismology, geology, geomorphology, geodetics and land surveying, physical oceanography, hydrography, glaciology, meteorology, atmospheric physics, aerosol radioactivity, night skies and auroras, ionospheric phenomena, electromagnetic diffusion, and cosmic radiation.

(2) *Life sciences:* biology, human physiology, psychopathology, animal and marine biology, ecology, algology, and botany.

Finally, thanks to these various expeditions, polar techniques have continued to improve. The following are the most important innovations:

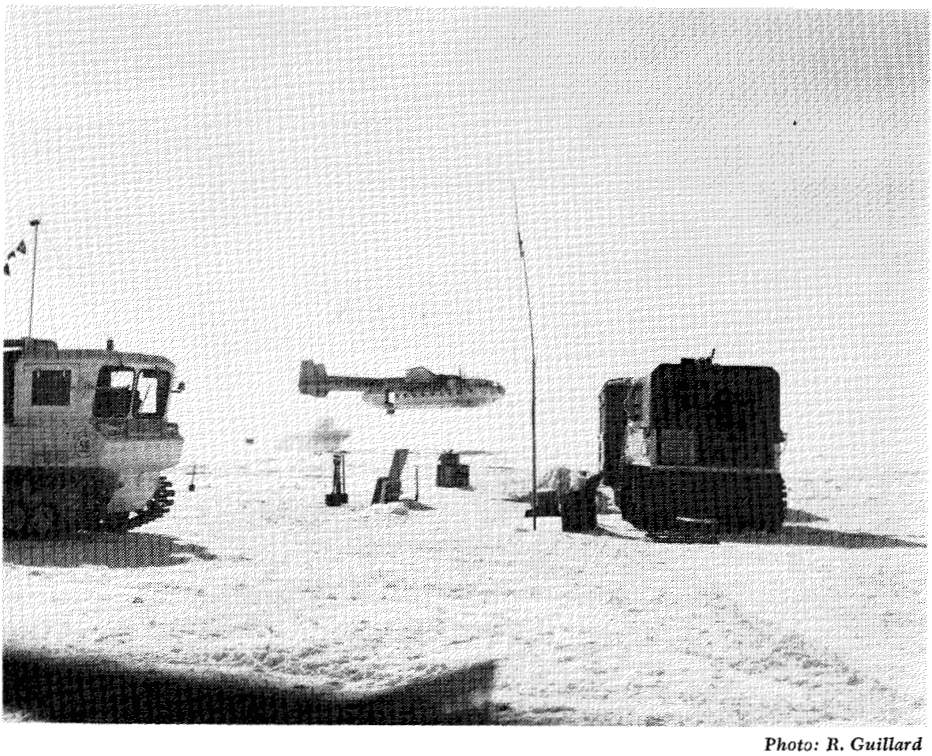

Photo: R. Guillard

Air-drop on Greenland Ice Cap in the summer of 1967. The French Air Force airplane is a NORD 2501. The vehicles are of the EPF CASTOR type newly developed in France as a replacement for the Weasel.

- the use, for long distance trips, of tractor vehicles equipped to provide living accommodation for personnel; the use of light-weight metal sleds for transporting heavy loads; the development of a new polar vehicle;
- the air transportation and low-level dropping of supplies;
- the widespread use of plastics as construction material, a new concept of building in the polar regions;
- the production of electricity by windmill generators under extreme conditions of wind and temperature;
- the production of fresh water through the conversion of sea water at low temperatures.

At the international level, several countries have called upon the EPF. In 1952, through the University of Georgetown, Washington, D.C. and the Stanford Research Institute, California, the American Armed Forces appealed to the EPF to organize for them, and along with them, certain scientific expeditions to Greenland. This collaboration lasted until 1958, either in the field, or using EPF technical consultants.

In 1955 the Snow and Ice Commission of the International Union of Geodetics and Geophysics asked the EPF to organize and direct the International Glaciological Expedition to Greenland; since 1957 five European countries have participated

in that Expedition.

In 1955, after a study of the various world polar organizations, Japan created the Japan Antarctic Research Expeditions modelled on the EPF. In 1956, following a similar study, Belgium created its Antarctic Expeditions adopting in its entirety the set-up of the EPF.

In 1961, the Academy of Science of the U.S.S.R. asked the EPF to participate in a glaciological study of the antarctic platform between Mirnyy and Vostok Stations. This cooperation produced the joint operation Expéditions Antarctiques Soviétiques-Expéditions Polaires Françaises 1964-1965; the operation is to be repeated in 1968-69.

Elsewhere, the EPF has been represented on numerous foreign expeditions.

EXPEDITIONS TO ADELIE LAND

Since 20 January 1840, when Dumont D'Urville planted the French flag on Debarquement Island in Adelie Land which he had just discovered, no one had returned to this sector of the antarctic coast. In 1948, aboard the polar sloop *Commandant Charcot,* which the EPF had acquired and converted on behalf of the Ministry for Overseas France, and which had been equipped by the French Navy, the first expedition returned to Adelie Land. The vessel was commanded by Commodore Max Douguet, and the leader of the expedition was André-Franck Liotard. The crew of sixty-five men had a staff of nine officers. There were thirteen men involved in the expedition itself, including J. A. Martin, Robert Pommier, and Yves Valette who had conceived the idea of such an expedition. After two weeks of unsuccessful attempts to break through a thick ice pack some 70 miles wide, the vessel carried out the hydrographic survey of the Balleny Islands, and then went back to France.

The expedition set out again the following year aboard the same vessel with a group of fifteen men, eleven of whom were to remain all winter. On 20 January 1950, one hundred and ten years after Dumont d'Urville's discovery, the landing began. The base was named Port-Martin after J. A. Martin who died at sea during the journey, and by 3 February the French flag was once again flying over Adelie Land. Since that date, the only break in the succession of wintering parties occurred between January 1953 and January 1956.

During the first series of expeditions, January 1950 to January 1953, while the geographic exploration of Adelie Land and the drafting of its map were progressing, a program of scientific research was begun. Its plans had been drawn up by the Scientific Committee of the Expéditions Polaires Françaises, presided over by Father Lejay of the Academy of Science. This program was a prototype of the one to be undertaken for the International Geophysical Year 1957-58. In January 1952, during an extremely violent storm, the main building at the base camp at Port-Martin was destroyed by fire. A team reduced to seven men wintered on Petrel Island in the Geology Point Archipelago where, since 1956, the present base has been located.

In 1956, a new three-year expedition was organized by the EPF under the leadership of Bertrand Imbert; this was France's contribution to the International

Geophysical Year (IGY). A new base, originally intended for use during IGY only, was established on Petrel Island and named Dumont d'Urville. A secondary station, named Charcot Station, located close to the Magnetic South Pole, 320 km. from the coast and at an altitude of 2,400 m., operated for two years with two successive parties of three men.

PERMANENT EXPEDITIONS

In 1958, the French Government, becoming aware of the growing scientific importance of the polar regions, decided that the Adelie Land expeditions should become permanent.

The French Antarctic Sub-Committee of IGY, headed by Paul-Emile Victor, had replaced the Scientific Committee of the EPF. It then became the French National Committee for Antarctic Research. A. Gougenheim was the first president, followed by G. Laclavere. Since then, the EPF has been organizing expeditions to Adelie Land on behalf of the Ministry for Overseas Departments and Territories, French Austral and Antarctic Territories (TAAF), now headed by P. Rolland. Although the Dumont d'Urville base, which had been designed for three years' use only, continued to function, it clearly no longer fulfilled the requirements of a permanent base or of research expansion. Consequently, during the past five years, with the approval of TAAF, the EPF has studied and undertaken a broad program for the technological overhaul of the base. For example, the former electrical power plant was equipped with three electrical generators of 20 kw.; the new plant has four generators of 115 kw. The relatively primitive but, until then, adequate landing facilities have been replaced by port installations, including a wharf, a 5-ton crane, and roads. As the work progresses, the existing buildings are converted to storage sheds and are replaced by a series of modern constructions made of prefabricated wall panels of a fiberglass-polyester compound over a cellular core; these constructions are specifically designed to serve as laboratories, lounges, recreation and sleeping facilities, and so on. Moreover, despite the limitations of surface and size (an island cannot be extended), the master plan allows for the number of personnel wintering at the base to be increased from twenty to forty, and up to one hundred in summer if necessary. Finally, it is expected that someday (hopefully not too far off) it will again be possible to set up a station on the antarctic plateau.

In 1966, an important program of ionospheric research (supplementing the existing program) was undertaken by the National Space Studies Centre (CNES) and the Ionospheric Research Group (GRI) of the National Centre for the Study of Telecommunications (CNET), in collaboration with the EPF.

To fulfil this program a 73 m. antenna pole was built, as well as a rocket-launching pad and an assembly hangar. The rocket program was achieved in January 1967 with the launching of four Dragon-type rocket probes at intervals of a few days in order to study the electronic density and electronic temperature at altitudes of about 350 km., as well as electron and proton spectroscopy in the ionosphere. These were the first scientific rockets to be launched from the continent of Antarctica (*see frontispiece*).

It seems certain that in the near future an increase and expansion of the activities in Adelie Land will take place. The polar regions, and Antarctica in particular, are becoming increasingly important in the search for solutions to the problems raised by today's great realms of study of space, biology, hydrology, and oceanography. And with regard to space, for example, Adelie Land occupies a position of vital importance in view of its immediate proximity to the magnetic South Pole, which is shifting at the present time less than 100 km. from Dumont d'Urville base.

EXPEDITIONS TO GREENLAND

Whereas the Adelie Land expeditions until now have had as their basic purpose the carrying out of observations in geophysics and more specifically high atmosphere physics within the scope of a world-wide program, those of the Greenland ice cap have a more localized aim: the study of this immense ice wasteland, its anatomy, its physiology, or if you prefer, its life and its influence. The first preliminary expedition in 1948, which had selected a point of access close to the Eqe Glacier in the northeast part of Disko Bay on the west coast of Greenland, had as its main tasks the building of a trail 10 km. long and a 200 m. cable lift to carry equipment to the edge of the ice. This work, as well as certain scientific observations, was performed by the twenty-eight scientists and technologists of the expedition, who worked as stevedores, earth movers, and blasters.

In 1949, in spite of the enormous problems involved, thirty-five men, including a wintering party of eight, managed to set up a winter station in central Greenland with the help of air support provided by a Liberator LB30. They carried out certain scientific observations, including seismic studies to determine ice thickness.

Fortified by experience, the forty-seven men of the 1950 expedition, including a relief winter party of nine men, had completed the prescribed program by the middle of July; the seismic, gravimetry, and geodetics teams had finished their assigned jobs; the glaciology and drilling crews had been on location for several weeks; and the wintering party at Central Station was relaying instructions to the relief party. It was thus possible to enlarge the program significantly by extending the itineraries to the southeast and northeast as far as the east coast, allowing the various scientific groups to carry out additional observations and research. Whereas in 1948, 1949, and 1950 the head of the field party was Paul-Emile Victor, the 1951 party composed of thirty-two men was placed under the leadership of Gaston Rouillon, and Paul-Emile Victor directed the air support from Iceland. The program was the continuation of those of previous years and included the repatriation of the second wintering party.

In 1952 and 1953 limited expeditions were sent out to retrieve any valuable equipment and to undertake a certain amount of supplementary research.

At the same time, scientific expeditions led by Paul-Emile Victor were under way in the extreme northern part of the ice cap; these were undertaken on behalf of American universities under contract to the U.S. Air Force. These expeditions were concerned with locating and establishing the route out of Thule

towards and across the Indlandsis, with the crossing from Thule to Danmarksfjord, and with other routes.

INTERNATIONAL EXPEDITION

In 1956, at the request of the Snow and Ice Commission of the International Association for Scientific Hydrology, the EPF assumed the responsibility for the technical and logistic organization and the operational direction of an expedition which was to continue work undertaken by the EPF in previous years. Austria, Denmark, France, Germany, and Switzerland participated in and made scientific contributions to this expedition. An International Management Committee was created to define the scientific program and to supervise its implementation. (At present the Committee is presided over by M. Eske Brun, former Permanent Undersecretary of State for Greenland.) Paul-Emile Victor was appointed leader of the expedition known as the International Glaciological Expedition to Greenland (EGIG).

The first phase of EGIG was carried out from 1957 to 1960, and the second phase was resumed in 1967 after a preparatory trip in 1964. The essential characteristics of EGIG are that the selection of the field parties is made according to scientific and technical requirements without distinction as to the nationality of the participants, and that the program in each discipline is established by one of the participating countries irrespective of the nationality of the men ultimately responsible for its implementation.

The first important operation which followed three preparatory reconnaissance trips, mainly by helicopter, in the spring and summer of 1957 and the summer of 1958, took place between March 1959 and September 1960. Several hundred men took part, including seven groups (a total of fifty-two men) who were stationed on the ice cap. Substantial air support (Nord 2501 cargo planes and two Alouette 11 helicopters) was supplied during the entire operation by the French Air Force. For transportation and journeys by land across the ice cap sixteen Weasel M29C tractor vehicles, most of them equipped for living and working purposes, nine trailers on runners, seven sleds, and two equipment sleds were used. In addition, two ships participated in the operation: the German oceanographic vessel *Gauss* and the Danish geodetic vessel *Ole Romer*. A new winter station, Jarl-Joset Station, named in memory of two members of the 1951 expedition who perished in a crevasse, was established in central Greenland close to Dumont Station. Four men and their equipment had been dropped there by parachute by the Jean Dumont Expedition in 1956 to spend the winter preparing for the work of EGIG.

Six men spent the winter of 1959-60 at Jarl-Joset Station in a building of an entirely new design: a two-story igloo made of sandwich-like prefabricated panels (a fiberglass-polyester composite material over a cellular core). In 1960 a twelve-man expedition continued certain scientific observations and repatriated the wintering party.

The second important operation of EGIG began in March 1967 following two preparatory expeditions. In 1964 three vehicles had crossed Greenland, following the line of beacons set up in 1959, to conduct scientific operations and to restore

the beacons; and in 1966 the heavy equipment required for the 1967 and 1968 operations had been carried by ship to Søndre Strømfjord and stored there.

Finally, in March 1967 the important operations of EGIG's second campaign were begun. There were more than one hundred participants, forty-eight of whom were divided into seven parties and stationed over the ice cap. As in 1959-60, heavy air support (Nord 2501 cargo planes and two Alouette 11 helicopters) was provided by the French Air Force; early in the operation the U.S. Air Force lifted men and materials over the rough, crevassed marginal zone. These land traverses of the ice wasteland of the Indlandsis also involved the use of considerable equipment: twelve Weasels; five Castor HB 40's, new light-tread tractor vehicles of French make perfected by the EPF; eight trailers on runners; thirteen equipment sleds, and other machines. Jarl-Joset Station was restored to operating condition to meet the requirements of the 1968 scientific program. The first part of this operation ended in September 1967, the heavy scientific program having been fully completed despite the generally unfavourable weather conditions. The second stage, which will last from March to September 1968, involves a similar number of personnel divided into various scientific parties; this work will supplement that completed in 1967.

The work carried out during these two campaigns (1957-60 and 1964-68) will produce the findings anticipated by the International Ice and Snow Commission.

OTHER ACTIVITIES

In 1950-51 seismic and gravimetric studies were carried out on the Vatnajökull ice dome in Iceland in collaboration with the Icelandic Centre for Scientific Research (Rannsoknarad Rikisins).

In 1957 a three-man reconnaissance party was sent to the summit of Mt. Aconcagua to study the possibility of setting up a high altitude study station which would be over 6,800 m.

Finally, in 1963, at the invitation of the Academy of Science of the U.S.S.R., a team of five EPF specialists joined a comparable Soviet scientific team to form the glaciology group of the ninth Soviet Antarctic Expedition. The expedition set out from Vostok (1,500 km. from the coast and at an altitude of 3,500 m.) and crossed to Mirnyy Station on the coast. Within the framework of this collaboration between the EPF and Soviet Antarctic Expeditions, a similar Franco-Soviet expedition is planned for 1968-69 to carry out the same observations along the same route.