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SWITZERLAND'S CONTRIBUTION TO SPACE RESEARCH

It is generally believed that only the great powers are able to play a role in space research and technology. Nevertheless, a small country like Switzerland also takes part, and to a larger extent than is commonly thought possible, in the development of space technology, by supplying control, telecommunications and measuring appliances and instruments produced by her specialised precision industries.

Indispensable co-operation

In order to interest the general Swiss public and numerous foreign tourists in space exploration, while at the same time showing the invaluable contribution made by the country's technology and research, the Swiss Transport Museum in Lucerne (the museum with the highest attendance figures in the country) has organised an exhibition entitled " Space and Switzerland " which was inaugurated at the beginning of May this year and is due to remain open till the end of September. In the speech he made at the opening ceremony, the representative of the Swiss Government responsible for space research pointed out that Swiss industry, with its highly qualified teams of scientists, technicians and specialised workers, would find an interesting new field of activity ideally suited to its own special gifts in the already large market of space exploration equipment. In Switzerland, science possessed several very promising points of departure enabling it to make valuable contributions to space exploration. Admittedly, the restrictions on capital and labour would compel it to make a rigorous selection among the many possibilities and oblige it to co-operate with other countries, a condition essential to success. On the national level too, stated the above representative of the Government, only close co-operation between industry, the higher institutes of learning and the Confederation would enable Switzerland to make a contribution to space exploration worthy of the country's potential and its reputation as a highly industrialised country.

The watchmaking industry in the service of space exploration

The inventive imagination and the precise workmanship responsible for the reputation of the Swiss watchmaking industry play a leading role in applied electronics itself indispensable to the working of spacecraft. It was only natural, therefore, that the watchmaking industry should go in for electronics and that it should meet with success. First of all, it produced electronic clocks, followed by watches for everyday use, regulated by a tuning-fork, and then by a quartz crystal of almost absolute precision. These timekeepers occupy an important place in space exploration technology, in the instruments used for the command and control of delicate scientific experiments both on the ground and in space.

Some of them involve not only the simple measurement of time, but the co-ordination of several operations according to a common reference measurement, usually called " the time ", that is to say the time as given by the position of our planet in space and determined by astronomical observatories. For Western Europe, the problem of the transmission of the exact time has been solved in Switzerland by broadcasting the Neuchâtel Observatory time signal, 24 hours out of 24, on a special wave by means of the HDG transmitter at Prangins (near Geneva). A portable T 75 A radio receiver, made in Switzerland, is used for the reception of this time signal within a radius of 900 to 1,350 miles. This receiver, running on batteries, can be used in the watchmaking industry, electronic laboratories, space research laboratories, astronomical laboratories, control stations for air and sea navigation, surveying institutes, institutes of applied geophysics and seismology, etc.

Swiss industry's achievements in the field of satellites . . .

For several years now the Swiss Post, Telegraph and Telephone Service has made use of the possibility of transmitting news by satellites *via* a ground station working with the Early Bird satellite. In addition, an industrial radio-electricity company is particularly interested in the use of scientific and commercial satellites; on the international level, it has co-operated in the equipping of ESRO (European Space Research Organisation) launching and control stations, at the launching centre at Kiruna (Sweden), as well as the stations belonging to the satellite observation network in several European countries and even as far away as Alaska and the Falkland Islands. In addition, in co-operation with another Swiss company, it has built a system for the reception of data transmitted by meteorological satellites. Stations of this kind are already in operation in Switzerland and Austria; there will soon be some in Australia, while a certain number of other countries are already showing interest in this new meteorological technique. Agreements signed with Swiss universities and scientific and industrial research groups in Switzerland and abroad will enable this company to perfect and manufacture electronic systems for equipment on board satellites as well as for space stations used in telecommunications.

A manufacturer of telephone equipment and teleprinters has made a PCM telecommunications apparatus for the transmission of signals on a frequency modulation coded by impulses. This instrument makes it possible for messages transmitted by telephone cable, directed waves

or laser beams to be rendered unintelligible by coding and to be decoded again on reception. In connection with lasers, it should be mentioned that a number of Swiss firms are studying their application to the field of communications and telemetry on the ground and in space, and that one firm uses the laser beam in machines for microtooling (drilling, welding, etc.), indispensable to the miniaturisation of equipment for spacecraft. It is also interesting to know that it was with a synthetic ruby manufactured in Switzerland that the first laser effect was achieved; the synthetic jewels factory in question is at present one of the leading producers in the world in this field and its contribution to space technology is not limited to this since it also supplies the small corundum plates used to protect the solar cells of satellites from erosion by meteorites. Although not included in the Lucerne exhibition, these Swiss contributions to laser technique deserve mention here.

. . . and in that of rockets

In the field of space rockets, mention must be made of the electronic equipment which makes it possible, by means of synchronised theodolites, to follow from the ground the trajectory of teleguided rockets, to ascertain their relative position and to supply many other details concerning their behaviour. This EOTS equipment, which records the data on film, is used during the research required for the production of new types of instruments. Another manufacturer has supplied similar instruments to foreign space research organisations, for the study of the behaviour of certain parts in flight. Finally, it should be mentioned that Swiss industry is capable of supplying many other high precision parts of very small size for use in one way or another in space projects; here, by way of example, we shall mention only miniature ball-bearings, which are commonly produced down to the minimum dimension of 1.1 mm. total diameter.

The contribution of university laboratories

This brief survey of some of Switzerland's industrial achievements in the field of space research must not make us forget the essential contribution of the country's university laboratories in this field. The first Swiss high altitude exploration rocket "Zenit" was equipped with "Redhead" captors for measuring the density of the atmosphere at altitudes of over 56 miles, built by the Physics Institute of the University of Berne. For an ESRO rocket, to be launched at Kiruna (Sweden) next year, the same institute has produced a small spectrometer for measuring the ionised and neutral components of the atmosphere at altitudes of over 60 miles and transmitting these measurements to the ground. This Institute has perfected such a refined technique for the analysis of isotopes of meteorites that it is one of the laboratories chosen to receive, for the purpose of analysis, the samples of lunar soil to be brought back to our planet by NASA astronauts in the course of the 1969/70 Apollo project.

The organisation of another experiment within the framework of NASA's Apollo project has been entrusted to the Physics Institute of the University of Berne and the Institute of Crystallography and Petrography of the Federal Institute of Technology in Zurich. The purpose of the experiment, which will have to be carried out on the surface of the moon, is to measure the "solar wind"; this experiment will be the first to enable scientists to determine the frequency of the isotopes in the solar wind. The Institute of Applied Physics of the University of Basle and the Physics Institute of the University of Berne have together perfected an automatic field selector for the commutation of the sensitivity of indications of a rocket spectrometer. Finally, the Observatory at Geneva University is represented at the Lucerne exhibition by two exhibits: first of all a photometer for determining the distribution of ozone in the earth's atmosphere, which gave entire satisfaction when used on board a "Zenit" rocket, launched in Sardinia last autumn; then an entirely automatic observation station weighing 274 lb. used for the observation of the ultra-violet radiation of the stars in the upper atmosphere. This instrument has already been used eleven times on board free balloons, which have lifted it to a height of 20 miles, from where it drops to the ground by parachute. During a single flight, the programme for this station, set in advance, comprised no fewer than 600 orders.

These few very brief details show the extremely wide range of instruments and experiments made and carried out by Swiss manufacturers and scientific institutes in the field of space research. They show clearly, as we said at the start of this article, that even though Switzerland cannot take part in the "space race", she is nonetheless able, through her scientific supplies, to make an effective contribution to the advancement of technology and science in this field.

(*O.S.E.C. Swiss Office for Development of Trade.*)

ANGLO-SWISS NEWS ITEMS

The Swiss company of Sulzer Brothers in Winterthur will take part in the building of "Concorde" — the firm has in fact received an order from the British Royal Aircraft Establishment to supply the equipment for examining the outside surface of this European supersonic airliner for signs of fatigue. (O.S.E.C.)

Sir Arthur Vere Harvey, M.P., President of the Ciba U.K. Ltd., was the guest of honour at a luncheon given in Lausanne by the British Chamber of Commerce in Switzerland after their General Meeting.

Wiggins Teape Ltd., Britain's third-largest paper producers, have announced the formation of a Swiss branch in Zug. Mr. W. Imfeld will be in charge.

By 24th June, it was reported from Switzerland that the "English invasion" had started with the first waves of foreign tourists, above all from Great Britain. That week-end, over 80 landings had been made at Basle Airport alone by British charter flights. In addition, Swissair had made 54 touch-downs in Basle.

Two English teachers at the Rosenberg Institute St. Gall had a serious accident in the Saentis region, due to a storm. Miss Mary Taylor was killed instantly, and her companion badly injured.

In an interview for the "Schweizerisches Kaufmänniches Zentralblatt", the British Consul in Zurich said that he felt happy in Switzerland which he considered lovely, clean and impressive. Even a short Sunday afternoon walk in side-lanes could be a real pleasure. The people with whom he had private and official contacts, were pleasant and ready to help.

The Royal Geographical Society in London has awarded the "Golden Patron's Medal 1968" to Prof. Dr. Augusto Gansser, Director of the Geological Institute of the ETH (Federal Institute of Technology in Zurich), in recognition of his geological research in the Himalayas.

[A.T.S.]