News of Science

Project Rockoon

The Naval Research Laboratory recently completed an unusual series of upper atmosphere experiments. Known informally as "Project Rockoon" [*Science* **124**, 213 (3 Aug. 1956)], the experiments were conducted with the objective of obtaining data on the strength of x-ray and ultraviolet radiations from solar flares. Ten flights were attempted as a preliminary to more extensive studies of solar flares during the International Geophysical Year (July 1957 to December 1958).

Solar flares are bright bursts of light emitted from individually active areas of the sun. The emissions reach a peak in a manner of minutes, but their effects may last for many hours. One of these effects is a partial or complete fadeout of radio signals of medium and short wavelengths.

A group of scientists under the direction of H. Friedman of the NRL optics division staged the experiments on the Pacific Ocean some 200 to 400 miles southwest of San Diego, Calif. Rockoons (rocket-balloon combinations) were launched from the *U.S.S. Colonial* on successive mornings during the 2-week period beginning 16 July. Members of the expedition included T. A. Chubb, J. E. Kupperian, Jr., R. W. Kreplin, W. A. Nichols, J. J. Nemecek, and D. Brousseau, all of NRL, and D. McNutt of the University of Wisconsin, A. Knudsen of Johns Hopkins University, and A. Unzicker of the State University of Iowa.

The Rockoon technique was originally developed by J. A. Van Allen of Iowa in cooperation with the Office of Naval Research. In all earlier experiments it had been the practice to hang a small rocket on a Skyhook balloon and permit the rocket to be fired by a pressure switch when it reached an altitude of between 60,000 and 80,000 feet. For the flare experiment the rocket was equipped with a radio relay receiver so that the firing circuit could be operated from the *Colonial*. The use of ground-controlled firings provided a practical solution to the problem of having the scientific instruments aloft coincident with the occurrence of a solar flare. Since these flares rise to a maximum in a few minutes, it is essential to accomplish as quickly as possible the threefold task of detecting the flares from the ground (a ship in this instance), launching the rocket, and gaining the necessary altitude for scientific observation.

The choice of the experimental area was based on a number of considerations. The investigators had to choose an area away from auroral zones, which also cause radio disturbances, to insure that local radio fadeout observations could be correlated with solar flares. They had to stage their launchings away from established air lanes and at a spot so remote that the rockets would not fall on inhabited areas. From a weather standpoint, a stable high-pressure area with low surface winds was desirable to facilitate balloon launchings, and low winds (less than 15 knots) at high altitudes were desirable to minimize balloon drift. Good visibility from shipboard and adequate sun elevation above the horizon for at least 8 hours were also desirable. The only area that appeared to meet all of these criteria, and which was also within radio reception range of the observatories at Climax and Sacramento Peak, was the one selected on the Pacific. The destroyer *U.S.S. Perkins* supported the launching ship (*U.S.S. Colonial*) by tracking the Rockoon with its radar gear, and Navy patrol planes based at San Diego patrolled the rocket landing area to insure safety to shipping.

Helium-filled Skyhook plastic balloons, 72 feet in diameter, supported 12-foot long Deacon rockets that had been equipped with instruments by NRL. In addition to the telemetering transmitter, each rocket contained detectors (ionization chambers and photon counters) that were sensitive to radiation from the sun in three wavelengths—1216A, 1A to 10A, and 0.05A to 1A. These wavelengths correspond to the Lyman-alpha line of hydrogen, "soft" x-rays, and "hard" x-rays, respectively, which are believed to have independent but cumulative effects on the ionosphere, and hence on radio fadeouts.

One Rockoon was launched each morning and allowed to float above the ocean at constant altitude of 80,000 feet while the men aboard the *Colonial* waited to detect a flare by observing a sudden radio fadeout. A second method of flare detection designed by D. E. Billings, R. Lee, and G. Newkirk of the High Altitude Observatory at Boulder, Colo., made use of an optical telescope coupled to a closed-circuit television system, with a violet color filter corresponding to the light of the calcium K line in solar plage regions. Unfortunately, for the entire trip there was almost a solid cloud cover and the group aboard the *Colonial* never had a chance to view the sun with their telescope. This solar blindness, however, was compensated for by the good radio communications with Climax and Sacramento Peak observatories.

When the decision had been made to fire a rocket, coded signals from a shipboard transmitter turned on the electronic instruments in the nose section of the rocket, and also energized the receiver that controlled the rocket igniter. Within 1½ to 2 minutes after the rocket was fired, it reached an altitude of 60 to 70 miles above the earth (within the ionosphere), and data obtained by the rocket-borne instruments on the strength of x-rays and ultraviolet radiations from the flare were radioed back to the observing station aboard the ship.

At this time of year a flare of size Class 1 or greater may be expected to occur about once every 50 hours. For the 11 days from start to finish there were one Class-1 flare and two Class-2 flares. Both Class-2 flares showed up clearly on the fadeout detectors, but unfortunately they occurred on Sunday, which was the one day out of eleven that was not scheduled for a launching. It is clear from observations on the one which was detected that the solar flare process is certainly not confined to the emission of the Lyman alpha line in the region of ionizing wavelengths, and that x-rays play an important part in it.

The Class-1 flare was too weak to produce a radio fadeout but was detected visually by D. Hansen with a spectrograph at Climax. He sent this information to the *Colonial* by radio rapidly enough to permit firing the rocket while the flare was still in progress. Although the rocket reached altitude after the flash phase of the flare, the detectors indicated an unusually high intensity of x-rays extending to wavelengths as short as 3 angstroms. Furthermore, these x-rays were detected at 77 km, which is well within the D-region of ionization. At the same time the intensity of Lyman alpha was comparatively normal. It seems reasonable to expect that x-rays of wavelength as short as 1 or 2 angstroms would be produced in larger flares, and the intensity would be high enough to explain many of the hitherto puzzling details of solar-flare effects in the ionosphere.

The absence of any marked increase in Lyman alpha does not mean that this

radiation is absent in the flare. It may be that the enhancement of Lyman alpha occurs in the flash phase and the NRL rocket did not reach altitude early enough to detect the flash. It is interesting to note that the normal x-ray spectrum from a quiet sun implies a coronal temperature of about 700,000°K. The flare region that produced the 3-angstrom radiation must have been heated to perhaps 10 million degrees to account for the observed intensity.

These flare studies will be continued through the International Geophysical Year. Approximately 40 flights are planned, either with the Rockoon system or with the ground fired Dan, which is a combination of the Nike booster and the Deacon rocket.

Blood Groups and Disease

A correlation between a person's blood group and the diseases to which he is susceptible was reported by J. A. Fraser Roberts of the London School of Hygiene and Tropical Medicine, at the recent annual meeting of the British Association for the Advancement of Science. Discussing the blood groups A, B, and O, Roberts cited the following three associations, which he said were supported by "overwhelming" evidence:

1) The incidence of duodenal ulcer is now known to be 40 percent higher in persons with group O blood than in those with other types of blood.

2) Gastric ulcer is 25 percent more common among members of the same group, and persons in group A appear to be abnormally susceptible to cancer of the stomach.

3) Persons with O or B blood are more than normally likely to get diabetes and pernicious anemia.

USDA Animal Disease Laboratory Dedicated

The new $10-million research building of the U.S. Department of Agriculture's Plum Island Animal Disease Laboratory was dedicated on 26 Sept. The laboratory, which has been in limited operation since July 1954, is devoted to research on foreign diseases of livestock —particularly foot-and-mouth disease— that are potential threats to the U.S. livestock industry.

Following the public open house and dedication ceremonies there was a scientific symposium for invited specialists concerned with foreign livestock diseases. Among the scientists from abroad who participated were Ian A. Galloway, director of the Research Institute, Pirbright, Surrey, England; Jacob G. van Bekkum, State Veterinary Research Institute, Amsterdam, the Netherlands; Charles A. Mitchell, chief of the Animal Diseases Research Institute of the Canadian Department of Agriculture, Hull, Canada; Georges A. Moosbrugger, director of the Federal Vaccine Institute, Basel, Switzerland; and Erik G. Fogedby, Food and Agriculture Organization of the United Nations, Rome, Italy.

Canadian Industry and the Scientific Manpower Shortage

At Canada's first national conference on engineering, scientific, and technical manpower, about 100 industrial leaders joined to create the Industrial Foundation on Education. The conference, held at St. Andrews, New Brunswick, was sponsored by the A. V. Roe Canada Ltd., an aviation company. Almost $100,000 was pledged to finance the new organization, and the first year's budget of $50,000 was underwritten by the Roe Company.

The aims of the foundation are: (i) to speak for industry in matters of education; (ii) to represent industry in any nation-wide program for training skilled manpower; (iii) to study the role of industry in education in general; and (iv) to engage in research in education in the light of industrial needs.

There have been increasing indications of a shortage in engineers and scientists as Canadian industry expands. Statistics show that Canadian schools are turning out about 1700 engineering graduates a year. One speaker at the conference estimated that Canadian industry requires 3000 a year, and another placed the figure at 6000, pointing out that in recent years Canada has filled many of its industrial engineering positions with immigrants. Approximately 8000 to 9000 professional men and women from abroad are taken into Canadian industry annually.

The creation of the Foundation on Industrial Education was the first action of its kind in Canada instituted by a cross-section of industry. Hitherto, the basic problems of education have been left to educators and to the provincial governments.

Geological Survey Water Resources Division

Reorganization of the Water Resources Division of the Geological Survey has been announced. The revised structure is designed to integrate the program planning and the operations of the division, to decentralize its administration, and to improve facilities for the increasingly important general hydrologic studies. This in turn will permit a more effective utilization of the survey's scientists in basic research on the occurrence and behavior of water and in the interpretation of the basic water data.

The new organization plan for the division provides an assistant chief of division for operations, Raymond L. Nace; an assistant chief of division for program and development, Luna B. Leopold; an administrative officer in the immediate office of the division chief, Frank Barrick, Jr. In addition two field representatives of the division chief, to be known as division hydrologists, have been named: Arthur M. Piper for the Pacific Coast area, with headquarters at the Survey's field center in Menlo Park, Calif.; and George E. Ferguson for the Atlantic Coast area, with his office in Arlington, Va.

Two other division hydrologists for the Rocky Mountain and Mid-Continent areas will be named later. Within the division a new branch has been added, that of general hydrology, headed by Charles C. McDonald. Thus there are now four branches: ground water, surface water, quality of water, and general hydrology.

Soviet Satellite Program

The U.S.S.R. confirmed the existence of its satellite program and made it officially part of the International Geophysical Year at the recent meeting in Barcelona, Spain, of the Comité Spécial de l'Anné Géophysique Internationale. This is the committee of some 50 nations that is coordinating the over-all plans for the IGY. The Soviet statement said only that a satellite program was being prepared, that it had begun quite recently, and that details could not be furnished until later.

News Briefs

■ Supernovae may be the source of cosmic rays, according to a report by Philip Morrison of Cornell University on the findings of two Soviet scientists, Shklovsky and J. L. Ginzburg, and a Dutch astronomer, J. H. Oort. At the recent meeting in Seattle, Wash., of the International Congress on Theoretical Physics, Morrison stated that as result of their work, "the probable origin of cosmic rays has passed from the area of free speculation into one in which direct observation is brought to bear."

■ Research on the propulsion of rockets by nuclear energy is being conducted for the Atomic Energy Commission in two laboratories of the University of California—the Livermore Branch of the Berkeley Radiation Laboratory and the