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The United States Program for the International Geophysical Year

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PROGRESS has been made in developing the program of geophysical observations to be carried out during the years 1957–58 as part of the many-nation cooperative undertaking known as the International Geophysical Year (IGY). A Coordinating Group, appointed by the United States National Committee last November (*See* NEWS REPORT, Vol. III, No. 6), convened on January 14 and 15 and prepared drafts of the various programs that might be undertaken by the United States.

Based on these drafts, a tentative program-budget document was prepared and submitted to the National Science Board on January 19 in the hope that the National Science Foundation would undertake the securing of funds. Since then the Coordinating Group, members of the Committee, the Administrative Secretary, and various scientific colleagues have been engaged in the revision of this provisional document, which is essentially fiscal. The meeting of the Committee on April 8 and 9 was devoted to a review of these drafts and the preparation of the United States program document to be submitted by May 15 to the Secretary-General of the Special Committee set up by the International Council of Scientific Unions. This Special Committee will meet in Rome, October 1–4, to consider all the national proposals.

It is apparent at this time that an appreciable and significant United States program is fast taking shape. Ten fields of activity have been chosen for the IGY: *1*) meteorology, *2*) latitude and longitude determinations, *3*) geomagnetism, *4*) the ionosphere, *5*) aurora and airglow, *6*) solar activity, *7*) cosmic rays, *8*) glaciology, *9*) oceanography, and *10*) rocket exploration of the upper atmosphere. The general nature of the proposed activities in each of these fields is suggested by the following summaries.

1) *Meteorology.* The meteorological program is designed to produce significant data in three areas—the lower atmosphere in the Northern Hemisphere, where existing stations will provide data in their normal course of operation; the lower at-

mosphere of the Southern Hemisphere, where some key stations will be established for the IGY; and the upper atmosphere, from which data will be obtained in the rocket program. Three pole-to-pole world lines are proposed for the IGY. The United States line is the 80th meridian west which now terminates in Panama and which will be extended to the South Pole through eight additional stations. The stations in the Antarctic—at the South Pole, Little America, and 80° S., 120° W.—will provide data from this relatively unknown meteorological region which may exercise a disproportionately great impact on world weather. The data from these stations will be useful in transport problems; in determinations of the location, strength, and movement of various jet streams; and in the study of the possible interdependence of the atmospheric circulations of both hemispheres.

2) *Longitude and latitude.* Highly precise longitude and latitude measurements can now be made by the Markowitz technique of direct photography of the moon and stars nearby. With international cooperation it thus becomes possible for the first time during the IGY to triangulate the whole earth. Observations are planned for more than fifteen stations over the earth. The resulting data will yield longitudes and latitudes at all stations and, with the use of existing geodetic nets, the exact distance in miles between all stations can be determined with a precision of 90 feet. The new technique adds greatly to the precision with which changes in the speed of the rotation of the earth can be measured, and the observational material obtained for the geodetic program may be expected to shed new light on the inner constitution of the earth.

3) *Geomagnetism.* Magnetic storms and other little understood transient effects are the chief objectives of the program in geomagnetism. Two temporary observatories will be established at Big Delta and McKinley Park in Alaska, which together with the one at College, Alaska, will form a tripartite array for the recording of electric currents characteristic of the auroral zone. Magnetic field gradients will be studied at College and two outpost stations. Special rapid-run magnetographs will be employed at seven observatories, and apparatus for the study of magnetic oscillations in the 1–10,000 cycles-per-second range will be installed at four observatories. Two observatories will be set up in the Antarctic, and a semiautomatic station will be installed at Jarvis Island in the Pacific, which is near the junction of the magnetic and geographic equators.

4) *Ionosphere.* Studies of the ionosphere will be carried out in Arctic and Antarctic regions as well as the mid-latitudes of the Northern and Southern Hemispheres. Emphasis will be placed on vertical incidence and scatter soundings, while some work also will be done on ionospheric motions and particle dynamics. Vertical incidence sounding stations will be established where major gaps exist in the chain of ionospheric stations extending from pole to pole. To supplement the specific but geographically restricted data provided by vertical incidence measurements, fixed-frequency and multifrequency scatter sounding stations will be established at some twelve sites. These will yield less specific but spatially extensive data.

5) *Aurora and Airglow.* Four principal problems in this field will be studied: *a*) airglow latitude intensity profile; *b*) aurora latitude spectrum and frequency profile; *c*) auroral longitude spectrum, frequency, and continuity profile; and *d*) Northern-Southern Hemisphere correlations. Visual synoptic data will be collected through a network of 30 stations in the United States and Alaska. The motions of charged particles at auroral heights and the absorption of interstellar radio waves passing through the aurora will be studied using radio astronomic techniques. A network of 17 stations will be concerned with radio reflections from the aurora, and 26 stations will form a spectrographic patrol, photographing the distinctive radiation emitted by the aurora and airglow. Roach-type photometers will be used at a number of stations in both the Northern and Southern Hemispheres to scan the sky and measure the intensity of airglow.

6) *Solar Activity.* Flare patrols are in operation at some five American and fifteen foreign observatories. It is important that

every solar flare be observed and recorded for correlation with geomagnetic, ionospheric, auroral, and cosmic ray variations and disturbances. This will require additional observers and coordination among the various observatories. Several special studies also will be made, such as the determination of the light intensity of solar flares by measurements of the red line emitted by hydrogen atoms and observations of the inner part of the corona using a special white-light photometer. One of the immediate uses to which solar flares will be put during the IGY has to do with the Warning Service Program. While regularly planned measurements will go on during the IGY period, it is especially important that experiments be conducted simultaneously throughout the world during periods of unusual solar activity. The Warning Service will collect data from all fields and will broadcast the onset or presence of unusual geophysical effects—solar flares, magnetic storms, ionospheric fadeouts, and blackouts, etc.—signaling the observers to proceed with their special preestablished studies.

7) *Cosmic Rays.* The program calls for the investigation of three types of problems: *a*) exploration of the variations in mass and energy of primary and cosmic radiation; *b*) exploration of the variations in cosmic radiation with both altitude and latitude; and *c*) investigations of the long-time fluctuations in the neutron component of cosmic rays. Some 130 balloon flights are planned for six sites in the Northern and Southern Hemispheres, fixed high altitude stations will be used, and aircraft flights are planned at constant altitudes along a longitudinal meridian.

8) *Glaciology.* Four studies are contemplated, two in the Northern Hemisphere and two in the Antarctic. One study is expected to be concentrated in the vicinity of the Juneau Ice Field Project of the American Geographical Society. Studies of portions of the Ice Cap and fringe area in Greenland will be undertaken in cooperation with Danish scientists associated with the IGY. In the Antarctic, a group will study the Ross Shelf and survey the 400-mile front of this glacial feature, while another group will secure glaciological data from the high polar plateau at the South Pole.

9) *Oceanography.* Tide gauges, surge recorders, and similar automatic recording devices will be installed at some forty sites in the Southern Hemisphere, Antarctica, and at islands in the Pacific. The data collected will represent valuable additions to those available from existing stations. A second major area of activity during the IGY will be the study of the sub-Antarctic waters. The structure and dynamics of currents, as well as other aspects of this oceanic region, will be explored intensively between 30° and 60° south latitude. Four oceanographic research vessels are expected to participate in the study; and, while the Antarctic Circumpolar Current will be the major topic, associated experiments in obtaining submarine profiles, sediment cores, magnetic fields, plankton samples, and seismic studies will be undertaken.

10) *Rocket Exploration.* Rockoons (small balloon-launched rockets) and Airobee rockets will be launched from sites in New Mexico, Greenland, Canada, and Alaska. Each rocket will carry a variety of instruments to measure a large number of such phenomena and quantities as atmospheric pressure, temperature and density, magnetic fields, night and day airglow, ultraviolet light and X-rays, auroral particles, ozone distribution, ionospheric charge densities, and cosmic radiation. These direct results will be integrated and correlated with the large bodies of indirect data provided by other techniques in the relevant geophysical fields. The launching of rockets at special times (World Days) of unusual solar or magnetic activity (or quiet) should be particularly fruitful.

It can be seen from the brief review of this United States program that the IGY will attempt, at least in part, to supplement with short-time geophysical observations made over as much of the surface of the earth as practicable the present long-time programs on which most of modern geophysics is based. It is hoped that prior to the meetings of several scientific groups in Europe during the summer of 1954 all interested scientists will give the United States National Committee the benefit of their comments, criticisms, and suggestions.

THE INTERNATIONAL GEOPHYSICAL YEAR, 1957-1958

(Organized by the International Council of Scientific Unions)

The National Academy of Sciences–National Research Council, which adheres to the International Council of Scientific Unions on behalf of the United States, is responsible for developing the program of geophysical observations to be carried out by the United States during the International Geophysical Year. To discharge this responsibility, the Chairman of the National Research Council in February 1953 appointed a United States National Committee composed of scientists representing the various fields of geophysics. The program summarized in the preceding pages was prepared by this Committee.

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