By use of the reaction controls—the small jets placed around the capsule—the attitude of the container will be changed so that the firing of the retro-thrust rockets at the base of the cone will start the capsule back toward the earth. The eventual impact area can be predetermined because of this control over the capsule's point of reentry into the atmosphere. As the capsule reenters the earth's atmosphere and slows to a speed approximately that of sound, a drogue parachute will open to stabilize the vehicle. At this time radar chaff will be released to pinpoint the capsule's location. When the velocity of the capsule decreases to a predetermined rate, a landing parachute will open. The parachute will open at an altitude high enough to permit a safe landing on land or water. The capsule will be buoyant and stable in water.

The nature of one element of the recovery system has not been definitely decided upon. This is the impact bag which appears as a large doughnut-shaped object in Fig. 3. Several approaches are being weighed by NASA personnel at the Langley Research Center, Langley Field, Va. One would have the impact bag an inflatable structure which would be tightly compressed under the heat shield during reentry and then expanded after the shield had been dropped and the parachute had opened. A second approach would have the impact bag made of a material similar to that which is used in air-dropping supplies and vehicles during air-borne operations. Such a material would have a very fine honeycomb structure to control the rate of collapse and thereby protect the capsule and pilot. Decision on this point, which will come of cooperation between NASA and McDonnell Aircraft Corporation, will determine the final configuration of the satellite.

As the manned capsule approaches the impact area it will be the focus of a variety of location and recovery procedures. By the fact that control will have been exercised over the timing of the reentry, ground equipment, presumably computers, and capsule equipment will be able to predict the general area of impact. To this information will be added the exact pinpointing allowed by the release of radar chaff—metallic tinsel of the type used for radio jamming. Triangulation on radio signals from the satellite will offer a supplemental means of location, as will visual observation if the reentry occurs during the daylight hours. Once the capsule is down, recovery aids such as tracking beacons, high-intensity flashing light systems, the two-way voice radio system, and, for water landings, sofar bombs (for sending underwater impulses) and dye markers will begin operation. In an operation of this nature, it can be assumed that ships, submarines, and aircraft will be assigned to cover the predicted impact area. Recovery of the capsule and its occupant will be virtually assured.

Responsibility for Project Mercury

In a project of the complexity and significance of Project Mercury the contributions of many federal agencies, the military services, and industry must be joined. Areas of responsibility for the many aspects of Project Mercury are as follows. Program management: National Aeronautics and Space Administration with the aid and assistance of the Department of Defense's Advanced Research Projects Agency. Technical direction: National Aeronautics and Space Administration. Capsule: McDonnell. Booster: industry. Launching and flight operations: National Aeronautics and Space Administration, military services, and industry. Supplemental research: government laboratories and industry. Crew selection, training, and in-flight evaluation: the aeromedical community.

Underground Nuclear Test Data

On 16 January the Department of Defense made public some details concerning the new seismic data on underground tests that have so affected the negotiations at the International Conference on Nuclear Test Control that is taking place in Geneva [*Science* **129**, 200 (23 Jan. 1959)]. The information released is that which was given to the Soviet and United Kingdom delegations at Geneva on 5 January, when the conference resumed after a Christmas recess.

Background

Since the conference of experts in Geneva reached its conclusions on 20 August 1958, the United States has conducted a series of underground nuclear explosions which were completed prior to 31 October 1958. There have been available to the conference of experts data on only one nuclear explosion—that of Rainier, 1.7 kilotons. In order to approximately augment the Rainier data for the purpose of more thoroughly understanding the problem of detection and identification of underground explosions, the yields of the recent underground tests were selected to fill in the range from 0.1 to about 20 kilotons. Each of the tests was extensively monitored with seismographs. As a result, data bearing on the detection and identification problems are now available.

While these new data are still undergoing evaluation by United States experts and only preliminary interpretations are at present available, the basic data and preliminary interpretations are felt to be sufficiently firm to permit derivation of certain conclusions.

To obtain the new data, temporary seismic stations were established at a number of locations along a line extending eastward from the Nevada Proving Ground to Arkansas and thence northeastward to Maine. The nearest station was about 100 kilometers from the shot points, while the most distant station was slightly more than 4000 kilometers distant. Each operating site was carefully selected by a team of geologists, who located suitable outcrops of hard rock remote from sources of man-made noise. Some 16 stations in all were equipped with Benioff short-period vertical seismographs and with auxiliary equipment for assuring proper interpretation of the recordings.

Seismographic recordings were made at these stations for the Blanca event on 30 October 1958, which had a yield of about 23 kilotons equivalent; for Logan on 16 October 1958, with a yield of about 5 kilotons equivalent; and for Tamalpais on 8 October, which had a yield of about 0.1 kiloton equivalent.

Conclusions

The following preliminary evaluation of the data obtained for these three events was given:

1) In the range of yields of 0.1 to 23 kilotons equivalent, the amplitude of the seismic wave varies approximately as the first power of the kiloton equivalent yield of the explosion.

2) The Blanca and Logan explosions produced artificial earthquakes equivalent in size to shocks of magnitude 4.8 and 4.4, respectively, on the Richter earthquake magnitude scale. The earlier estimate of the magnitude of the Rainier explosion was too high because it was based on a selection of data from a few stations which typically give larger-than-average amplitude. Consequently, the revised magnitude of Rainier is about 4.1, rather than 4.25 as previously estimated. It therefore appears that the previous estimate of the number of earthquakes per year equivalent to a given yield in kilotons requires revision upward.

3) The principal method recommended by the Geneva conference of experts for distinguishing earthquakes from explosions is of less utility than was thought prior to the three recent underground nuclear explosions—for example, the determination of the direction of first motion is much more difficult than had been anticipated at Geneva. It appears from the recent data that first motion is not usable as an identification characteristic of earthquakes that are equivalent to 20 kilotons or less when recorded at distances between 1100 and 2500 kilometers from the burst. At a distance of 200 kilometers the amplitude of first mo-

tion was less than one-third of the peak amplitude in the first pulse and at 1000 kilometers less than one-fifth. Consequently, it is now estimated that the first motion must exceed the background noise, or natural unrest of the earth, by at least a factor of 3 to 1 instead of the previous estimate of 2 to 1 if the direction of first motion is to be reliably determined.

Summary

The method for distinguishing earthquakes from explosion by direction of first motion is less effective than was previously estimated; the number of earthquakes equivalent to a given kiloton yield is about double the previous estimate. As a result of these two conclusions, the annual number of unidentifiable continental earthquakes equivalent to 5 kilotons or more will be greater than that previously estimated by the Geneva conference of experts by a factor of 10 or more.

Graphs and Recordings Provided

In addition to a report, the following graphs and copies of recordings were transmitted to the United Kingdom and U.S.S.R. delegations:

1) Copies of 36 seismographic recordings made of the three Hardtack II underground explosions.

2) A curve showing the response characteristics of the Benioff seismograph.

3) A table of estimates of Blanca, Logan, and Rainier magnitudes as estimated from various individual station recordings.

4) A curve showing the estimate, prior to and following Hardtack II, of the world's total number of earthquakes per year versus kiloton yield equivalent.

5) A curve showing the amplitude of the longitudinal waves as a function of the distance from the origin and also the amplitude of first motion as a function of the distance from the origin.

6) Curves showing the estimated total annual number of continental earthquakes as a function of kiloton yield equivalent.

Copies of these graphs and recordings are available for study. It is expected that the complete technical information will be made available to scientific journals in the near future.

The members of the panel that produced the conclusions presented were as follows: Carl Romney, U.S. Air Force, chairman; Billy G. Brooks, chief seismologist, The Geotechnical Corporation; Perry Byerly, director of the Seismographic Stations, University of California; Dean S. Carder, chief seismologist, U.S. Coast and Geodetic Survey; Frank Press, director, Seismological Laboratory, California Institute of Technology; Jack Oliver, professor of geophysics, Columbia University; James T. Wilson, chairman, department of geology, University of Michigan; Hans A. Bethe, Cornell University; D. T. Griggs, University of California, Los Angeles; Kenneth Street, University of California Radiation Laboratory; and Carson Mark, Los Alamos Scientific Laboratory.

East-West Scientific Exhibits

The United States and the All-Union Chamber of Commerce of the Soviet Union have reached agreement on the regulations and procedures to govern the exchange of national exhibitions of science, technology, and culture to take place next summer. The agreement, signed on 29 December, confirms earlier exchange agreements worked out in Moscow in October and November and in Washington in December.

The U.S. exhibit will occupy two buildings in Sokolniki Park in Moscow. The Soviet exhibit will be shown on two floors of the Coliseum in New York City for 4 weeks beginning 21 June.

This latest agreement makes the point that the success of the exchange of exhibitions requires "a substantial degree of flexibility and discretion" for each party to determine the scope, nature, and content of its exhibition as well as "a high degree of trust and cooperation." Further, each party may show "such motion pictures . . . as it deems appropriate which would be cultural and nonpolitical in character, devoted to an objective presentation of various aspects of its science, technology, or culture." Explanatory publications relating to the various displays may also be distributed by each party.

Rocket Development at Los Alamos

A method of propelling a rocket by a series of small nuclear explosions is being studied by a group of theoretical physicists and mathematicians at the University of California's Los Alamos (N.M.) Scientific Laboratory. This method was first outlined in 1947 by Stanislaw Ulam, research adviser at the laboratory and codeveloper of the hydrogen bomb. It was later taken up and extended by T. B. Taylor, former staff member at Los Alamos, who is now with General Atomic.

Studies at Los Alamos will determine how effectively blasts from explosions can be directed to get the maximum push on the rocket from given masses of exploding materials. Each explosion would give the rocket an extra push forward. Care has to be taken to avoid subjecting the rocket structure to excessively high pressures and temperatures, but Ulam believes this method might give several times more push for each pound of propellant than the reactor method.

If studies are successful, they will point the way to a possible method of propelling space ships through the solar system. In development of this concept, the laboratory will share ideas and information with the group at General Atomic, which has a contract to consider the possible structure and operation of such a space ship.

Science Information Council

The National Science Foundation has announced the appointment of scientists, leaders in the field of scientific documentation, and representatives of the public to the newly constituted 19-member Science Information Council. These members will serve with four ex-officio members as consultants to the foundation's Science Information Service, which was established in December [*Science* **128**, 1616 (26 Dec. 1958)].

The council will provide the Science Information Service with a broad range of technical skills and experience on problems in the dissemination of scientific information and the communication needs of scientists. The Science Information Service was set up to make scientific literature in all languages more readily available in order to shorten the time spent by scientists and engineers in searching for needed information. The service also seeks to bring about effective coordination of the various scientific information activities within the Federal Government and to improve cooperation between government and private scientific information programs.

Council members are as follows: William O. Baker, vice president of Bell Telephone Laboratories, Inc.; Graham P. DuShane, editor of *Science*; John M. Fogg, director of the Morris Arboretum, University of Pennsylvania; Elmer Hutchisson, director of the American Institute of Physics; Merritt L. Kastens, assistant director of the Stanford Research Institute; H. W. Russell, technical director of Battelle Memorial Institute; Verner W. Clapp, president of the Council on Library Resources, Inc.; E. J. Crane of Chemical Abstracts, Ohio State University; W. T. Knox, director of the Technical Information Division of Esso Research and Engineering; William N. Locke, head of the department of modern languages and director of libraries at Massachusetts Institute of Technology; John W. Mauchly, director of the Univac Applications Research Center of the Remington Rand Univac Division, Sperry Rand Corporation; Donald R. Swanson of the Infor-