Congressional Response

The act fulfills all of the requirements of the President's message in this matter. It lists the three functions of the Director of Defense Research and Engineering as the President had enumerated them, and implies others about which he had been specific. The full meaning and intent of the President's recommendations are realized in the act.

Changes Effected

Two major significant changes are effected by the Reorganization Act in the matter of military research. The first is one of status. Appointment of a Director of Defense Research and Engineering reflects the formal recognition of science's critical role in the military. The Committee on Armed Services of the House, chaired by Carl Vinson, put its views in this way in a committee report: "From the testimony presented, and from prior hearings on the subject of research and development, the committee is of the firm opinion that the Secretary of Defense has need for a principal assistant on scientific and technical matters. The research and engineering activities of the Department have become so extensive and varied in nature as to require a director whose sole function is to perform overall supervision of those activities and to direct and control those which the Secretary considers to require centralized management. The responsibilities of the Director of Defense Research and Engineering will be of such far-reaching importance to the Department as a whole that the committee feels he should be a member of the Armed Forces Policy Council, and have so provided in this legislation." The importance of the position is further emphasized by the adoption of the President's recommendation that the new Director should rank above the Assistant Secretaries of Defense, and should receive compensation equivalent to that of the Secretaries of the services.

Advance Research Projects Agency

A second major change is that which affects the Advanced Research Projects Agency (ARPA). The bill deletes from section 7 of the Act of 12 February 1958 the authority for the Secretary of Defense, or his designee, to contract for research and development work. The intent of this change is to take away from the Advanced Research Projects Agency the authority to enter into research and development contracts, since the Director of Defense Research and Engineering will supervise the Advanced Research Projects Agency and can receive the necessary power to contract by delegation from the Secretary of Defense.

As it would appear now, before the Reorganization Act goes into effect and the all-important question of who will take the post of Director of Defense Research and Engineering is decided, the main effect of the provisions concerning the Advanced Research Projects Agency will be a matter of the channeling of funds. The function of the agency has not been altered; only the route by which it receives its appropriations. The man occupying the post, one "known nationally as a leader in science and technology," if the President's specifications are met, would presumably be well inclined toward the aims of the agency—research and developments with regard to advanced space projects—and, with the new power of his position, would be able to aid in their achievement to a greater degree of effectiveness than the now existing Assistant Secretaries of Defense for Research and Engineering.

A second possible change concerning ARPA involves an eventual shift of certain aspects of its work to the office of the Director of Defense Research and Engineering. In report 1765 of the House Armed Services Committee, quoted above, the following statement appears: "The committee recognizes that the Advanced Research Projects Agency will continue to have authority to engage in advanced space projects until 12 February, 1959, unless otherwise restricted by law or by the direction of the Secretary of Defense. At the same time, it recognizes that some such projects will be of primary military significance and that some provision must be made for continued military participation in this area. Therefore, in section 9 of the bill, the Secretary of Defense or his designee, subject to the approval of the President, is authorized to engage in basic and applied research projects essential to military requirements. It is intended by these provisions to authorize the Secretary of Defense, or his designee, to engage in outer space projects beyond February 12, 1959, if such projects have primary military significance, and are not precluded by law and are approved by the President."

This shift of essentially military projects from the Advanced Research Projects Agency to the Director of Defense Research and Engineering is accomplished by the relevant deletion in the legislation establishing ARPA and the inclusion in the new bill of the provision: "The Secretary of Defense shall assign any weapons system to such military department or departments for production and operational control as he may determine."

Benefits of New Position

The establishment of the position of the Director of Defense Research and Engineering under the Department of Defense Reorganization Act of 1958 accomplishes three major ends which are designed to ameliorate the conditions under which the department's scientific activity is carried on. The first aim is consolidating and streamlining. The responsibilities for research are brought together in one post. The person filling this post would serve as the "principal assistant on scientific and technical matters" to the Secretary of Defense. Research and development projects which have primary significance in their military applications would come under his control and funds for these projects would be channeled through him from the Secretary of Defense.

To emphasize his role, and through it, the role of science and technology in the nation's defense activity, the Director of Defense Research and Engineering is given the two prestige marks requested by the chief executive—rank above the Assistant Secretaries of Defense and compensation equal to that of the Secretaries of Army, Navy, and Air Force.

And lastly, he is given specific authority to "direct and control research and engineering activities that the Secretary of Defense deems to require centralized management."

By these means, the Director of Defense Research and Engineering should have the position, the prestige, and the explicit authority to control from a superior position the scientific and technical projects of the Department of Defense, to establish, fund, and direct them with a freedom of action and directness of delegation hitherto unattainable.

Explorer IV

The United States launched its fourth and heaviest satellite—38.43 pounds—on 26 July. Explorer IV (1958 Epsilon) is designed for an intensive study of corpuscular radiation in space as part of the International Geophysical Year program. It is the first of this country's satellites to be launched in a northern direction from the Missile Test Center at Cape Canaveral, Fla., and it will report information from higher latitudes not previously explored by U.S. satellites.

Explorer IV was put in orbit by a Jupiter C launching vehicle developed jointly by the Army Ballistic Missile Agency and the California Institute of Technology Jet Propulsion Laboratory. The four-stage Jupiter C missile also was used to launch Explorers I and III [*Science* **127**, 330 (14 February 1958)]. The new satellite circles the earth in 110.224 minutes, with a apogee of 1379.8 statute miles and a perigee of 157.3.

Explorer IV is heavier by 7 pounds than I and III, but identical in size and configuration (80 inches long). Earlier temperature and micrometeorite experiments have been eliminated in favor of four separate cosmic ray detectors that will provide the most detailed radiation data yet obtained by a U.S. IGY satellite. The added weight is in instrumentation and was made possible by improvements made at the Jet Propulsion Laboratory in the solid fuels in the two upper stages of the Jupiter C missile.

Launching was made in a northeasterly direction, which took the satellite on its first pass along the eastern coast of the United States and Newfoundland, over England, central Europe, southern Russia, India, Australia, and up across the Pacific Ocean and the United States.

The new orbit will take the satellite up to approximately 51 degrees north latitude. Earlier Explorers had not gone farther north than 35 degrees. This means that Explorer IV's orbit is over areas of greater population than were the paths of Explorers I and III.

The Jet Propulsion Laboratory's contributions to the Explorer IV project were directed by J. E. Froelich. He works under William H. Pickering, laboratory director.

JPL's responsibility in the Explorer IV program included development of the three upper high-speed stages, the low-power radio beacon and subcarrier oscillators, fabrication of the steel shell of the satellite, except the nose cone which was produced by the Army Ballistic Missile Agency. The Pasadena laboratory, ABMA, Army Ballistic Research Laboratory, Aberdeen, Md., and the Army Signal Corps cooperated in establishing and operating the Microlock ground radio network. The Microlock system was developed by JPL.

The radiation package was developed by James A. Van Allen's physics department at the State University of Iowa at the request of the satellite panel of the National Academy of Sciences IGY Committee. The Naval Research Laboratory provided the high-power beacon, and the Army Signal Corps supplied the battery packs.

The satellite carries two Geiger-Mueller tubes and two scintillation counters to measure cosmic ray intensities. One of each is shielded to eliminate data below certain energy levels, and the unshielded scintillation counter's data is directed into two radio channels reporting different levels of energy. This gives ground radio stations five channels of information.

Explorer IV thus will handle not only a far greater range of cosmic ray data, but will break the information down into levels of intensity. Previous satellites reported only the gross amount of radiation they encountered.

This means that Explorer IV will be able to differentiate between the energy levels of the cosmic rays that strike its counters. The data will show not only the total number of particles but also what fraction of this total falls within certain preselected energy ranges.

For example, Explorers I and III showed a counting rate of more than 20,000 counts per second in the high-altitude portion of the orbit. It is suspected that only a small fraction, about one-tenth of 1 percent, of this total was caused by those high-energy particles which physicists have seen before and identified as cosmic rays. This suspicion implies that almost all of these particles were of a new low-energy type.

However, since Explorers I and III could not differentiate between energy levels, this suspicion could neither be proved nor disproved. Now in Explorer IV the shielded counters will respond only to the high-energy particles, while the unshielded counters will see everything. Furthermore, the unshielded scintillation counter will be provided with special pickups which can further differentiate between energy levels.

Both the high-power and low-power radio beacons will transmit continuously for an expected life of 2 months. The low-power beacon radiates 10 milliwatts of energy. The low-power beacon will be used mainly for tracking, but it will also report the same data as the high-power transmitter. The high-power transmitter radiates 30 milliwatts.

Explorer IV carries no tape recorder such as that in Explorer III. Decision to devote the entire payload to cosmic ray studies was made after the instruments in the first two Explorers were swamped at times by the unexpected intensity of cosmic ray activity in space.

Space Science Board

The National Academy of Sciences–National Research Council has announced the formation of a 16-man Space Science Board, "to survey in concert the scientific problems, opportunities and implications of man's advance into space." Lloyd V. Berkner, president of Associated Universities, Inc., and president of the International Council of Scientific Unions, has been appointed chairman.

Named as executive director of the new board was Hugh Odishaw, who also serves the Academy–Research Council as executive director of the U.S. National Committee for the IGY. A permanent staff will be recruited to serve as a secretariat.

The board, besides acting as the focal point for all Academy–Research Council activities connected with space–science research, will coordinate its work with appropriate civilian and government agencies, particularly the National Aeronautics and Space Administration [*Science* **128**, 290 (8 August 1958)], the National Science Foundation, and the Advanced Research Projects Agency (see lead news article, this issue), and with foreign groups active in this field.

The functions of the Space Science Board will include studies of research opportunities and needs opened up by the advent of modern rocket and satellite tools, advice and recommendations on space science to interested agencies and institutions, stimulation of research interest in the rocket and satellite fields, and cooperative activities in this area with academies and similar institutions abroad.

Eleven ad hoc committees have already been organized to carry on the work of the board. These committees, together with their chairmen and vice chairmen (who comprise the membership of the board), follow:

1) Geochemistry of Space and Exploration of Moon and Planets—chairman, Harold C. Urey, professor of chemistry, University of California, La Jolla; Vice Chairman, Harrison S. Brown, professor of geochemistry, California Institute of Technology.

2) Astronomy and Radio Astronomy —chairman, Leo Goldberg, chairman of the department of astronomy, University of Michigan.

3) Future Vehicular Development (beyond vehicles immediately available and including possible space stations and interplanetary vehicles for scientific research)—chairman, Donald F. Hornig, professor of chemistry, Princeton University.

4) International Relations Field (coordination with International Council of Scientific Unions and other national scientific bodies on problems in international sharing of payloads, international cooperation in space activities, and advice on the formulation and effects of regulatory policies)—chairman, W. A. Noyes, dean of the College of Arts and Science, University of Rochester.

5) Immediate Problems (space laboratories, orbits, currently feasible research projects, and liaison with the Technical Panel on the Earth Satellite Program of the U.S. National Committee for the International Geophysical Year during terminal phases of IGY)—chairman, R. W. Porter, chairman of the USNC–IGY Technical Panel on the Earth Satellite Program, and consultant (communication and control) Engineering Services, General Electric Company, New York.