radiation or chemical means. Dubinin lost his research post in 1948 when Lysenko was working under the aegis of Stalin. He was reinstated during Khrushchev's leadership. And, writing in *Izvestia*, S. Alikhanyan, a biologist with the Institute of Atomic Energy, stressed the use of radiation as a means of producing mutations. "Unfortunately," he stated, "the introduction of these methods into plant-breeding practices as well as the development of the appropriate branches of genetics and selection work have been held back by the dogmatic views of some scholars." No public rebuttals from either Lysenko or his followers have appeared.

The ups and downs of Lysenko and his associates over the past 15 years should induce humility in any speculation on just what the renewed flaring of the controversy may mean for the future of Soviet science. Since Khrushchev disappeared from power in the wink of an eye, it would seem to be a relatively simple matter to apply the same procedure to Lysenko. But since he undoubtedly has many followers in the Soviet scientific community, and since the Soviet leadership seems to be paying increasing court to intellectual freedom, it is quite possible that the political leadership will let the scientists slug it out in the professional and popular journals without imposing a solution from above.

Keldysh's *Pravda* review of Soviet science and technology was quite restrained on the matter of Lysenko, and carried no suggestion that his presence in the Soviet scientific leadership is intolerable. What was perhaps most striking about Keldysh's article was that it sounded very much like many of the papers that American scientific leaders have drawn up at the invitation of the various congressional committees that have been studying federal support of science. In fact, if the homage to communism and to the wisdom of the Communist Party were removed it might pass unnoticed as a typical plea for ample government support of science and technology. For example: "The high level of theoretical science is one of the basic prerequisites for the successful advancement toward Communism. This is why it is necessary to spend a great deal of time for its development, continuously raising the level of scientific research. . . . The means spent on [the development of computer technology] will be repaid a hundred-fold. The highly qualified cadres and the mighty material basis of scientific research are the necessary conditions to our achieving a leading position in the scientific world. . . ."

Perhaps the most significant departure from prevalent American thinking was in regard to the relationship between basic research and industrial technology. On this subject, a good number of leaders of the American scientific community feel that closer ties should be developed between basic science and industry. But it is probably safe to say that the majority are either indifferent to the problem or distinctly opposed to orienting basic research toward industrial goals. Keldysh, however, urges that basic research must not be permitted to exist as an entity remote from Soviet economic needs. Basic research, he stated, must be increased, but "it is necessary to pay serious attention . . . [to the] rapid use of results in the national economy. The scientist must not only develop the theory, but he must understand in time the meaning of the discovery, bring it . . . to life, which is important for the development of the national economy. This can only be attained with a close contact between the Academy of Sciences of the USSR, and the higher institutions of learning, along with the Government's industrial committee, having constant contacts between theoretical science, the specialized institutes, and industry. . . . It is highly important to organize theoretical research in such a way that industry would receive the resulting data of science necessary for the creation of new technological processes."

It would seem from all this that the Soviet Academy President may have more important things on his mind than the ancient Lysenko affair.

—D. S. GREENBERG

Space: National Academy Panel Recommends Exploration of Mars as Major Goal in 1971–85 Period

Since the spring of 1961, when a manned landing on the moon by 1970 became a certified national goal, the United States space program has been essentially a buildup to the lunar landing. In the past year, however, space planners have begun to look seriously beyond the moon, and on Tuesday the National Academy of Sciences released a statement of its space science board, on "National Goals in Space, 1971–1985."

In this statement the board designates "exploration of the nearer planets as the most rewarding goal on which to focus national attention for the ten to fifteen years following the lunar landing." Mars is put at the top of the list as the "primary goal," with exploration to be carried out initially by unmanned vehicles and a hope held out for manned exploration by 1985.

The recommendations in the report are not startling. They are quite general and have been foreshadowed in informal statements from National Aeronautics and Space Administration officials and from non-NASA space scientists. Space-program planning is influenced not only by scientific priorities, however, but also by questions of national prestige and national security and by consideration of the very large sums of money involved, and the space science board's statement must be viewed in this larger context.

In its relations with Congress and the public, NASA and the administration are aware of a danger of anticlimax. While it is certainly not all NASA's fault, the lunar landing program has been represented as a kind of space Olympics test against the Russians and a *sine qua non* of national security. If the public does, in fact, regard a successful manned round trip to the moon as a kind of conquest of Everest in space, there may be less public support and enthusiasm and less support for more difficult and more expensive tasks afterward.

A shift of major emphasis to the exploration of Mars is likely to further offend those who feel that the military implications of the space program have not received sufficient attention. A "bomb in orbit" is perhaps the best-known threat cited by those who think that much more attention should be paid to increasing the capacity of the U.S. to operate in space between earth and the moon.

An "on to Mars" policy would also be likely to arouse displeasure among those scientists who think that the dazzling technological advances being made in the moon program should be exploited for the sake of science by a greatly stepped-up program of investigations on and around the moon through both manned and unmanned flights.

The board, in fact, has suggested "alternative goals" for the 1971–1985 period, explaining that "extensive manned lunar exploration—including base construction and major manned orbiting space station and laboratory programs—have sufficient merit to war-

rant significant programs, but are not regarded as primary because they have far less scientific importance."

Clearly, the board was not unaware of the opposition it might arouse, and in the conclusion to the opening section of the statement it provides this rationale for its recommendations:

"The argument for unmanned investigation of Mars as the major effort for the 1971–1985 period is not presented solely in the interests of pure research. The Board takes for granted that broad, multi-faceted national interests lie behind an effective space program; the Board has long and consistently taken this view. The argument for unmanned investigation *is* an argument for the pursuit in an orderly way of what now appear to be the most rewarding objectives. Such a program would be planned to (1) capitalize upon each stage of technological capability, (2) yield tangible, meaningful results at appropriate intervals with no potentially critical gap, (3) secure environmental data essential to manned ventures, and (4) provide time for proper development of extended manned activities in space."

Perhaps the most succinct summary of the board's* views is to be found in a letter written by NAS president Frederick Seitz in transmitting the statement to NASA administrator James E. Webb. Seitz made six major points:

"1. The Mars program should be the major goal past 1970, starting unmanned with the Saturn class of vehicles with suitable decontamination.

"2. The lunar program should be continued but subordinated to the Mars effort, recognizing continued lunar scientific goals.

"3. A continued program in space is essential with respect to (a) Earth itself, (b) interplanetary space, (c) solar physics and preliminary exploration of space objects, (d) astronomical observations outside the atmosphere.

This program is essential to the accumulation of basic information for manned programs. The development of standardized vehicles would reduce its cost.

"4. The manned Earth orbital program should be developed for rescue service of unmanned vehicles, and several military objectives such as inspection, but should be a secondary—not a primary—goal.

"5. Flexibility should be provided in all these programs to permit exploitation of any major, unforeseen breakthrough or discovery. The Board agrees that our space program must satisfy all national objectives, but that to do this the scientific programs must make a maximum of sense.

"6. Obvious applications should be exploited quickly, as now planned."

Attraction of Mars

While the scientific background of the statement is necessarily provided only sketchily, the reasons for concentrating on Mars are given in the following fairly extended fashion:

". . . Mars is of great scientific interest first because it offers the best possibility in our solar system for shedding light on extraterrestrial life and, second, because as a planet it is dimensionally quite comparable to our own. One of the most exciting questions, and in the view of many scientists the outstanding problem of our times, is whether or not living forms have developed on Mars. It may be that organic compounds of inorganic origin may be found on or near its surface; such compounds, the progenitors of life systems, could lead to an understanding of the origin of terrestial life. It may be that forms of life radically different from our own may be discovered, different in their chemistry, different in their cell structure, and different in their metabolism. Or perhaps we may find fossil evidence of earlier Martian life when Mars may have had a denser atmosphere and conditions more favorable to biological processes. The discovery of any of these situations would be of enormous scientific interest and perhaps the most important discovery of space research in our generation.

"Mars is also an object of great physical and geological interest. For example, how does it compare with the Earth? Is it differentiated, like the Earth? Does it have a magnetic field indicative of a molten core? Has it a crust differentiated from a mantle? Scientists are in the tantalizing position of trying to discover the general laws of planetary formation and evolution on the basis of one example—the Earth—plus deductions from meteorites."

The report says that the "ultimate scientific exploration of Mars will require that man be present when it becomes technologically feasible to include him," and stresses that intensive research is needed to overcome the "biomedical difficulties" which now prevent man from making long journeys in space.

The board's statement leaves much room for elaboration, and Seitz in his cover letter notes that "the board plans to study the several aspects of these goals in more detail and is working with [Dr. Homer E. Newell, associate administrator for space science and applications] and his staff to develop specific plans for a concerted effort during the current year."

The origins of the new statement can be traced directly to a letter which President Johnson wrote to NASA administrator Webb last spring asking for a full report on NASA plans, including those for the post-Apollo period.

NASA would have liked the board to update the comprehensive review of research done under board auspices at the so-called summer study at Iowa State University in 1962, but NAS officials argued that such an effort would not be practicable in the time available, and an agreement to produce the much less detailed statement was reached.

This statement is the latest product of a close working relationship between NASA and the NAS group. The space science board was established by NAS in 1958, before NASA was officially born, to study research opportunities implicit in rockets and satellites. One practical function of the board was to help maintain momentum in international space research developed during the IGY. Lloyd Berkner, now president of the Graduate Research Center of the Southwest and a prime mover in the IGY, was the space science board's first chairman. The board still functions as the Academy's agent in international activities in space sciences.

In its other role, that of advisor on the national space effort, the board solicited and reviewed suggestions from the scientific community for the fledgling space agency. In those early days the board established itself as a sort of two-way circuit between NASA and university-based scientists. The board was very influential, and the early

* The space science board currently has 13 active members well known in space research, plus more than 100 consultants and members of permanent and *ad hoc* committees. Members of the board are Harry H. Hess, Princeton, chairman; Lloyd V. Berkner, Graduate Research Center of the Southwest; Allan H. Brown, University of Pennsylvania; John W. Findlay, National Radio Astronomy Observatory; Herbert Friedman, U.S. Naval Research Laboratory; William W. Kellogg, National Center for Atmospheric Research; Gordon J. F. MacDonald, U.C.L.A.; Nicholas U. Mayall, Kitt Peak National Observatory; Richard W. Porter, General Electric Company; Bruno B. Rossi, M.I.T.; John A. Simpson, University of Chicago; James A. Van Allen, University of Iowa; and George P. Woollard, University of Hawaii.

NASA program was in large measure its brainchild.

With the acceptance of the lunar landing as a national goal and the resulting growth in NASA budget and staff, however, the role of the board inevitably changed.

The space science board had recommended elevating a manned lunar landing to the status of a national goal even before President Kennedy asked Congress for the supplementary appropriation with which the moon project was christened. But the board recommendation put the manned lunar landing in the broad perspective of the scientific exploration of the moon and planets and did not affix a 1970 deadline.

As the Mercury and Apollo programs gained impetus the more expensive and spectacular manned program dominated space agency planning. The original space science board–NASA plans for exploration of the near-earth environment have been little affected by the Apollo program, and very important results have been obtained. In the case of unmanned investigations of the moon, despite brilliant successes with the Mariner II and Ranger VII spacecraft, pre-Apollo aspirations have not been fulfilled.

The board retains its influence on scientific questions such as the matter of sterilization of space vehicles destined to land on other planets, but there can be no doubt that the group has lost its dominant position in planning and provides—as it might be phrased at NASA—only one input.

While the board furnishes advice on space operations to all federal agencies, its close ties to NASA are indicated by the fact that NASA, starting next year, will provide all the funds for the board's $200,000-a-year budget, which in recent years has been financed by equal payments from NASA and the National Science Foundation.

Members of the space science board and its committees tend also to serve on NASA internal committees, and this is one factor which has led to a feeling among some members of the Academy that, because of the board's long and close relationship with NASA personnel and NASA plans, the board has lost some of the detachment appropriate to an NAS committee.

It is pointed out that the only other high-level independent committee advising the government on space policy is a panel of the President's Science Advisory Committee, and it is widely thought that the PSAC panel yielded standing as an effective critical force on space policy when it lost a wrangle with NASA about the overall plans for making a lunar landing.

It should be noted that close association between NASA and scientists whose work depends on experiments in the upper atmosphere and space has a look of inevitability. Not only is NASA by far the biggest patron of space research, but it has a virtual corner on the means of getting nonclassified research packages off the ground.

Because of the complicated hardware and large amounts of money involved, scientists who do research which depends on experiments in the outer reaches of the earth's atmosphere and beyond have grown accustomed to relying on teamwork to get their results. And cooperation means compromise.

Scientists alone don't call the tune in the space program, and many researchers unquestionably regret this. The space science board has evidently adopted the view that it can do the best job for science by taking into account the nonscientific elements in decisions about space—there are and have been dissenters to this view on the board—and the board seems to accept the view that making space policy involves the exercise of the art of the possible, just as do more conventional forms of politics.

—JOHN WALSH

Announcements

The establishment this fall of Florida Atlantic University, as part of the state university system, has been announced. The new university will consist of five colleges—business administration, education, humanities, science, and social science—and will also offer an **ocean engineering** curriculum. The department of ocean engineering will emphasize underwater acoustics, power, structure, instrumentation, mining, and corrosion. A summer trimester will be devoted entirely to practical work in seamanship, navigation, data processing, exploration, and oceanographic work at sea. Further information on the new department is available from its chairman, Charles R. Stephan, Florida Atlantic University, Boca Raton, Florida 33432.

The School of Foreign Affairs of the Foreign Service Institute, Department of State, will begin a pilot seminar on **science, technology and foreign affairs** in January. The 4-week course, for a selected group of foreign service and departmental officers and participants from other government agencies, will examine the interaction between science, technology, and foreign affairs.

Meeting Notes

An International Symposium on **Radioisotope Sample Measurement Techniques in Medicine and Biology** is scheduled 24–28 May in Vienna, Austria. It will be sponsored by the International Atomic Energy Agency. Topics to be included are: liquid scintillation counting, assay of beta-ray emitting isotopes, assay of gamma-ray isotopes, and assay of alpha-ray emitting isotopes. Deadline for 250- to 350-word abstracts: *19 December*. (J. H. Kane, Chief, International Conferences Branch, Division of Special Projects, U.S. Atomic Energy Commission, Washington, D.C. 20545)

The Indian Society of Genetics and Plant Breeding will sponsor an international symposium on the **Impact of Mendelism on Agriculture, Biology, and Medicine**, scheduled 15–20 February in New Delhi, India. Topics to be included are Mendelism and evolution, genetics in plant breeding, cytology and cytogenetics, mutation, human and animal genetics, biochemical genetics, and teaching of genetics. (A. T. Natarajan, Secretary, Indian Soc. of Genetics and Plant Breeding, Division of Botany, Indian Agricultural Research Institute, New Delhi 12, India)

About 500 scientists and engineers are expected to attend the American Society of Testing and Materials national meeting on **steel**, 25–29 January in Mexico City. U.S. and Mexican steel specialists will present papers on production, testing, and utilization. (ASTM, 1916 Race St., Philadelphia, Pa. 19103)

The 1965 **National Telemetering Conference** is scheduled 13–15 April, in Houston, Texas. It will be sponsored by the American Institute of Aeronautics and Astronautics, the Institute of Electrical and Electronics Engineers, and the Instrument Society of America. Papers for the Conference in the fields of aerospace, bio-medicine, oceanography, and industrial telemetering are be-