periments had not been "conclusively established."

Thus the evidence cited to prove that the Smithsonian has been used as a "screen" or "cover" seems flimsy indeed. It consists of a confused description of a military test in which the Smithsonian does not seem to have been directly involved; a casual charge by a former senator who says he got his information from NBC and admits he could be wrong; and an uncorroborated letter to the Foreign Relations Committee which quoted an anonymous source and which, incidentally, never once mentioned the word "cover."

Some press reports linked a Smithsonian project in the Amazon delta, also directed by Humphrey, with the Pacific Bird Project. The Amazon project involves a collaborative effort, with the Brazilian government, to study the ecology of a tropical rain forest, including birds and virus diseases. No one seems to have charged that this project, too, is a "cover," but some reporters have suggested that the findings might be useful in CBW. The project, which is unclassified, is supported by the Brazilian Ministry of Agriculture, the National Institutes of Health, the Rockefeller Foundation, the Smithsonian, and, at Humphrey's request, the U.S. Army and Air Force.

Smithsonian officials are outraged at what they regard as "irresponsible reporting" by the mass media. Project director Humphrey, who presumably knows more about the bird study than anyone else, says he was never contacted by NBC. Galler, the Smithsonian's assistant secretary for science, says he had one brief phone conversation with Tom Pettit, in which Pettit asked several general questions but never once raised the question of CBW. However, Pettit told *Science* his notes indicate he specifically asked Galler if the Smithsonian knew of a relationship between the Pacific Ocean Biological Survey and chemical and biological warfare testing. Pettit says Galler replied: "To the very best of our knowledge there is absolutely no relationship."

Any ethical judgment as to whether the Smithsonian's bird project is "good" or "bad" depends, of course, on one's own moral code. But from a practical standpoint, one can question whether it was wise for an institution with highly sensitive international dealings to accept a classified defense contract, or to send a man along on a military expedition, however innocent his role may have been. Perhaps the real lesson of the whole episode is that, in these highly charged times, an institution that wishes to maintain an unblemished reputation can't merely follow its traditional mores—it must consider the changing values of the public as well.

—PHILIP M. BOFFEY

Earth Resources Satellite: Finally off the Ground?

If the taxpayer ever gets the bountiful economic payoff from the space program that the National Aeronautics and Space Administration has promised him, the credit almost certainly will go in part to an as yet unbuilt device known as "ERTS"—the earth resources technology satellite. This project, which now at last seems to be gaining momentum after having long languished in the shadow of NASA's manned flight program, promises to give such earth-bound agencies as the U.S. Department of Agriculture and the Department of the Interior a remarkable new diagnostic device for carrying out their missions. Further, while much advanced technology is of little use to the underdeveloped nations, ERTS seems likely to prove an exception, for it should allow the United States, or perhaps an international agency, to establish a variety of useful data services for these nations at modest cost.

It is expected that earth resources satellites will permit the United States, and other nations, to make revolutionary improvements in cartography, allowing them for the first time to bring their maps up to date and keep them that way. Today, according to the U.S. Geological Survey, all of the world's small-scale maps are either inadequate, out of date, or a combination of both.

These satellites, using sophisticated remote-sensing techniques, should also make possible numerous other valuable services, such as surveying water supplies and the quantity and quality of farm crops, monitoring pollution, and identifying geologic areas that are promising for petroleum and minerals prospecting. Most of the remote-sensing technology necessary for the achievement of these benefits is still in the development and testing stage. Yet, according to a report* issued on 10 February by the National Research Council committee on space applications, it may be possible to have an operational ERTS system, useful in a variety of earth resources fields, within the next 10 years.

The ERTS project, though a slow starter, may get off the ground this year. NASA has, for the first time, submitted to Congress a budget requesting the money necessary to start construction of an experimental ERTS system. Whether Congress will in fact provide these funds is hard to predict. But ERTS does have a strongly committed, and strategically placed, supporter in Representative Joseph E. Karth (D–Minn.), chairman of the House subcommittee on space science and applications. From the point of view of gaining economic returns, Karth regards ERTS as possibly NASA's most promising project; a start on building this satellite is, he feels, long overdue.

Should all go well, the first ERTS satellite will be launched in late 1971 or early 1972, with a second to follow about a year later. The satellite would be placed in a sun-synchronous polar orbit at an altitude of 500 miles. It would provide virtually global coverage, with repetitive observations being made of specific areas about every 17 days.

This first-generation ERTS, designed for a minimum life in orbit of 1 year, would be equipped primarily with three high-resolution television cameras. Two of these cameras would look within the visible spectral range, while the third would look within the near-infrared. Each picture would take in an area of about 100 square nautical miles. Ulti-

* *Useful Applications of Earth-Oriented Satellites.* Available at $2 a copy (34 pages) from the Printing and Publishing Office, National Academy of Sciences, 2101 Constitution Avenue, NW, Washington, D.C. 20418.

mately, earth resources satellite systems will make use of a number of other devices, such as side-looking radar and thermal-infrared and passive microwave sensors.

And if the R & D work now in progress lives up to its promise, those who interpret the data produced by ERTS sensors will be able to identify the spectral signatures or "fingerprints" of a wide variety of soils, plants, rocks, and the like. As ERTS specialists point out, such fingerprint reading is possible because every object on the earth's surface—and every feature of the terrain—reflects, absorbs, or emits electromagnetic energy at distinctive wavelengths. Moreover, the fingerprint of a tree or plant varies according to whether the plant is healthy or sick, and this should allow earth resources satellites to detect plant maladies at an early stage, when remedial action may still be possible.

Such is his belief in the promise of ERTS that Congressman Karth, as a member of the Science and Astronautics Committtе's subcommittee on NASA oversight, recently took the trouble to prepare a report* criticizing NASA for having failed to give ERTS the priority he felt it deserved. And, even now, he would have NASA accelerate the program and try for an initial ERTS launch earlier than the late-1971 launch date scheduled.

For a couple of years Karth has been goading NASA about this project, and some of ERTS's potential "user agencies," particularly the Department of the Interior, have been doing so as well. In fact, Interior, pressing to get an earth resources satellite program going back in 1966, executed a remarkably bold bureaucratic maneuver, one all the more suprising in that it seems to have been led by perhaps the government's most staid and dignified scientific agency, the U.S. Geological Survey (USGS).

NASA, using aircraft as the testing platform, had begun developing remote-sensing devices for earth resources studies in 1964. The Department of Agriculture, the Naval Oceanographic Office, and USGS participated in this work. NASA, partly at USGS's urging, included a project to develop a small earth resources satellite in its planning prospectus. In 1966, however, this project was omitted from a new NASA

* *Earth Resources Satellite System.* A limited number of copies available, at no charge, from the House Committee on Science and Astronautics, U.S. House of Representatives, Washington, D.C. 20515.

Science Policy Meeting at M.I.T.

The most important discussions concerning U.S. science policy are usually held behind closed doors. On 7 February, an interesting private meeting about the character of science organization in the federal government was held at M.I.T. The discussion, which began over lunch and lasted throughout the afternoon, brought together many of those who are most knowledgeable about science and government in the United States.

All former Presidential science advisers—Donald F. Hornig, Jerome B. Wiesner, George B. Kistiakowsky, and James R. Killian—were present, as well as three of the congressmen important to the welfare of science—George P. Miller (D–Calif.), chairman of the House Science and Astronautics Committee; Emilio Q. Daddario (D–Conn.), the active chairman of the group's science subcommittee; and Charles A. Mosher (R–Ohio), the second ranking Republican on the House Committee. Other participants included the members of the Committee's eight-man Research Management Advisory Panel*; the meeting was another of the Miller committee's occasional gatherings with the Research Panel. Although such sessions are sometimes held outside Washington, the 7 February get-together was the first held away from the Capital in the past 2 years.

The M.I.T. meeting was an informal affair and was not designed to produce a formal record. However, from interviews with several of the participants, especially participants from Congress, it can be concluded that the following themes were among those in the discussion:

► Although there have been several noteworthy proposals, recently, to create an all-encompassing Federal Department of Science and Technology at the Cabinet level, this idea seems not to have found favor at the meeting. "The more I think about it, the more I question a Department of Science," chairman Miller said in an interview. Kistiakowsky dismisses the idea of such a department as "totally unrealistic"; Killian is "unconvinced." Mosher said, "I don't find any sentiment for a Department of Science," but stated that he would not rule out establishment of a major new scientific agency which would include the National Science Foundation and the recently suggested National Oceanic and Atmospheric Agency (*Science*, 17 January).

► Not surprisingly, several of the participants interviewed have concluded that the President's science adviser occupies a central and increasingly important role and should not become the spokesman for any one government agency.

► Even though a department of science and technology is not especially needed, the federal government should do more to support science and the universities and should find ways to encourage more people to enter scientific careers.

The participants were pleased at the amount accomplished in their discussion. Kistiakowsky called it "a very informative, very useful meeting." Harvard's Don Price, a leading scholar of government and science, said that "the discussion made a lot more sense than most I have attended on the subject." Mosher commented that "it was sort of a historic thing" to have all four former Presidential science advisers in a discussion about the government and science and that the meeting could have "historic consequences." Mosher noted that federal science organization may be the subject of hearings held by the House committee this year.—BRYCE NELSON

* Members of the Research Management Advisory Panel of the House Committee on Science and Astronautics are as follows: James B. Fisk, president, Bell Laboratories; James M. Gavin, chairman, Arthur D. Little, Inc.; Samuel Lenher, vice president, E. I. du Pont de Nemours & Company; Wilfred J. McNeil, president, Grace Line; Don Price, dean of the John F. Kennedy School of Government, Harvard; C. Guy Suits, director of research, General Electric Company (retired); and Jerome B. Wiesner, provost, M.I.T.; Michael Michaelis, director of Arthur D. Little's Washington office, serves as executive director of the panel.

prospectus, and USGS officials were dismayed.

They promptly set about having their own department take the initiative, and on 21 September 1966 Secretary of the Interior Stewart L. Udall announced a new Interior program, to be known by the provocative title of "EROS" (for earth resources observation satellites). "It is because of the vision and support of NASA that we are able to plan this program," Udall said.

Never has a government press release been put to more imaginative or creative use, for EROS was not much more than an idea, with little money and certainly no rockets behind it. The EROS "program head," William T. Pecora, director of USGS, had no more means than the Prince of Liechtenstein of building a satellite and putting it in orbit.

NASA knew that the Udall announcement was coming, but it had made no commitments. The agency, when asked for comment by reporters puzzled at Interior's venture into space, said, in effect, that Interior's announcement was premature and that there was neither money nor a flight plan to back it up. Moreover, NASA said that, "before a fully worked out program to use operational satellites can be approved, a long period of experimental work must take place."

Karth suspects, however, that NASA was unwilling to press ahead rapidly with an automated ERTS project because it wanted to include the earth resources survey mission in plans for long-duration manned orbital workshop flights. "Presumably such experiments have been viewed as a partial justification for the [orbital workshop] program," Karth observed in his recent report. He found it significant that, when NASA began its investigation of remote-sensing techniques in 1964, this work was assigned to the Manned Spacecraft Center at Houston.

In March of 1967, however, NASA had the Goddard Space Flight Center, in Maryland, undertake a study for an automated ERTS system, with a view to a launch in late 1969 or 1970. But, as Karth sees it, this decision to have the earth resources survey mission carried out by such a satellite came only after it was apparent that appropriations for an extensive orbital workshop program might not be forthcoming.

In any case, the Goddard study, together with an encouraging report from a 1967 summer study by the National Research Council committee on space applications, led NASA to seek funds to start work on an experimental satellite. Twice this request has been rejected by the Bureau of the Budget, in 1967 and again last fall; on the second occasion, NASA's appeal to the President was successful and $14.1 million has been budgeted, subject to congressional approval, for the ERTS project (the total cost of building and launching the two satellites is estimated at $50 million or less). USGS hopes to get $3.8 million this year, to be used for data processing equipment and studies on how to make the best use of information from the ERTS system.

In sum, while there may be truth to it, Karth's charge that NASA deliberately dragged its feet on the ERTS project with a view to making the earth resources surveys part of the manned flight program is hard to prove. It is indisputable, however, that NASA has been preoccupied with its manned flight activities, especially its Apollo moon landing mission, and has given much less emphasis to proposals for practical applications of space technology. The total "space applications" budget for fiscal 1970 is $135.8 million (which includes funds for weather satellites), this out of a total NASA budget of nearly $4 billion. In past years the proportionate share for space applications has been even smaller.

But, if such NASA overseers as Karth have their way, the agency will go into the post-Apollo period scrambling to deliver tangible economic returns for the nation's multibillion-dollar investment in space. The National Research Council committee has recommended that spending for such applications be at least doubled; further, it has said that NASA should look to automated, not manned, systems for its earth resources surveys and other space applications missions. In view of its declining budget and Congress' refusal so far to support an extensive manned flight program in the post-Apollo era, NASA would seem to have little choice but to try to make the most of ERTS and other projects for which it may be possible to drum up political support.

In this regard, NASA's friends over at Interior will be glad to help. Pecora and one of his lieutenants on the EROS team last year are said to have spoken to over 100,000 people about what earth resources satellites could accomplish. Besides making the rounds of scientific and technical societies, these evangelists have even appeared before groups such as the Hickory (North Carolina) Rotary Club, cultivating the grass roots and trying to make EROS a household word.—LUTHER J. CARTER

RECENT DEATHS

Frederick P. Brooks, 68; physician in general practice and former chairman of the department of health and physical education at East Carolina University; 21 January.

M. Robert Cobbledick, 66; former director of admissions at Connecticut College; 10 February.

Robert A. Cooley, 95; former senior entomologist, U.S. Public Health Service, Rocky Mountain Laboratory; 17 November.

Warren DeSorbo, 51; staff member of the General Electric Research and Development Center; 18 January.

Theodore S. Gilman, 50; associate professor of chemistry at the University of Colorado; 11 February.

James W. Goddard, 75; former research associate in the department of endocrinology at the Jefferson Medical College; 14 January.

James I. Hambleton, 74; head of the division of bee culture investigation in the Department of Agriculture; 4 January.

Cornelia Kennedy, 89; associate professor of biochemistry emeritus at the University of Minnesota; 13 January.

John C. McClintock, 62; associate clinical professor of surgery at Albany Medical Hospital; 3 February.

Raymond Morgan, 75; former head of the department of physics at the University of Maryland; 3 February.

Hans Rademacher, 76; emeritus professor of mathematics at the University of Pennsylvania; 7 February.

M. Lyle Spencer, 87; former president of the University of Washington; 10 February.

Ernest P. Walker, 77; former assistant director of the National Zoological Park; 30 January.

William D. Wilkinson, 67; chairman of the department of geology at Oregon State University; 3 January.

Erratum: In "Dallas: Larger education role proposed for research center" (13 Dec. 1968, p. 1252) it was stated erroneously that Texas Woman's University (TWU) at Denton, Texas, was a former state teachers college and that it was not, in the late 1950's, offering Ph.D. programs in science. TWU is, in fact, a former liberal arts college; Ph.D.'s in several technical disciplines, such as nutrition and textile technology, were conferred as early as 1953 and 1954.