The bureaucratic odyssey of a space mapping camera

How military security and interagency politics have delayed civilian earth-resource observations

by Everly Driscoll

Photographs of earth from space brought new perspective to the growing awareness of the frailty of this planet's ecosystems and the need for conservative use of it's resources. It logically followed that space would be a natural vantage point for earth research.

But jurisdiction over earth resources in the United States is divided among the Departments of State, Defense, Agriculture, Interior and Commerce. Many useful things that could be done from space become bogged down in interagency politics. As a result space experiments are often compromised.

A case in point is the strange odyssey of a space topographic, or metric, camera through the labyrinth of Defense classification, Office of Management and Budget (OMB) evaluation and into the snarl of the interagency politics.

In 1964 the National Aeronautics and Space Administration set up a Photographic Advisory Team. The group recommended in 1965 that NASA fly as an experiment a metric camera to obtain base maps of the United States. Current mapping techniques involve a tedious process using aircraft flying at varying altitudes. To produce the standard quadrangle map takes an average of about three years. Composite topographic maps of the United States are usually outdated by publication time.

The recommended camera had a focal length of 300 millimeters (12 inches) and a format (frame size) of 230 x 370 millimeters (9x14.5 inches). The committee recommended that it fly in an experimental satellite at an altitude of 160 to 200 kilometers. The camera alone would obtain 10-meter ground resolution photos and provide three-dimensional terrain information. Photographs would be used to compile maps of the United States on a scale of 1:250,000 and establish control for large-scale 1:24,000 maps. The advisory team was subsequently dissolved and the proposed camera system disappeared behind the "classified" door.

In the summers of 1967 and 1968, the National Academy of Sciences (NAS) conducted a study at Woods Hole, Mass., with input from leading photogrammetrists. The study concerned "Useful Applications of Earth-Oriented Satellites." Chapter 13, entitled "Geodesy and Cartography," proposed several unmanned mapping camera systems for initial mapping of the U.S. and periodic updates of the maps. The primary recommendation was the same 300-millimeter camera system defined by the NASA Photo Team. The chapter was held up for release for more than a year, and only after a thorough check for classification sensitivities was it released in 1969.

In December 1970 the Department of the Interior proposed to NASA an unmanned film-return earth-sensing experiment to be flown as the Earth Resources Technology Satellites (ERTS) C and D to complement ERTS A and B. The photographs would complement data from the already approved ERTS as well as earth resources photography to be taken on Skylab in 1973. ERTS C and D were not approved by the OMB, and Interior has never had a response from NASA.

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In May 1970 an NAS advisory committee to Interior—the Committee on Space Programs for Earth Observations (COSPEAR)—endorsed the proposal for ERTS C and D and sent the endorsement to Interior's Earth Resources Observation Systems program director.

In August 1971 COSPEAR sent to Interior a "Reaffirmation of need for mapping camera experiments from earth orbit—the development and implementation of the mapping [metric quality] camera experiments from earth orbit for obtaining geodetic-topographic end products." The purposes: "to provide an adequate cartographic base for the earth resources surveys from space and from aircraft; to provide development of cartographic techniques of great potential scientific and economic benefits." For this the committee recommended a 300-millimeter focal length metric camera with a 230 x 370 millimeter format—the same camera.

COSPEAR closed with "there can be no doubt that the effectiveness of earth resources surveys from aircraft and spacecraft will depend in very large measure on the adequacy of the cartographic base provided. . . . Further delay in instituting recommended programs will, in the opinion of the committee, be to the detriment of the fields of cartography and geodesy and severely and unnecessarily constrain the value of important earth resources survey programs."

This August COSPEAR position was a restatement of recommendations that had been made yearly for the past six years by various groups, without effect.

What was the hang up?

"The problem is one of international politics and defense mentality," says one defense contractor. "Space camera systems are like sea monsters deep in the ocean that no one ever sees—all one sees are the ripples on the surface."

Defense had decided that the metric camera system proposed by the NASA Photo Team would satisfy its own requirements, and so the 12-inch camera, instead of flying on a civilian satellite was now destined to fly on a spy satellite, "Big Bird," in 1972, even though the rationale and parameters for the system had emerged from the civilian sector.

A whole structure of classification exists in the defense area around space camera systems, and the survival of the structure rests on the continued classification of the cameras and other remote-sensing equipment. Mapping responsibilities had long before been given to the Interior for the United States and to Defense for overseas areas. The Interior recommendations for the mapping system were funneled through Defense, through OMB and through several national security offices, where the Defense answer to Interior was: "The system is now classified; we will supply you with information from which you can make line maps, but you may not release the photographs."

Since the recommendation for the experiment had been directed to NASA, NASA had to take a position. It was:

"A mapping camera is an operational system; we can fly only experiments."

Similar administrative judgments had been made regarding communications and weather satellites. NASA had developed the systems, flown them as experiments to see if they would work, and then had had to turn operational systems over to appropriate agencies.

Why not use the same rationale in flying an experimental mapping camera system? The NASA response: "We know you can do topographic mapping from space. It would not be an experiment."

NASA would, however, according to one spokesman, be willing to fly an operational system if Interior would pay for it. (The system would cost anywhere from $30 to $50 million, but the NAS Woods Hole study estimated that direct dollar benefits in the United States would be $138.2 million annually.) The entire annual budget in Interior for cartography is only $33 million. And it is not likely that OMB would approve that much money for a system that is already flying on a Defense satellite.

The third possibility is that DOD might be willing to declassify the camera system for topographic mapping of the United States only. Talks on this are currently under way.

"The problem is definitely not a question of the state of the art," says one photogrammetrist. "We are flying better cameras in lunar orbit. It's just the bureaucratic hang up with space cameras."

Intelligence impediments that have existed all along to mapping systems are not likely to fade away. A recent example indicates that better cameras would not, as yet, be acceptable. In making contingency plans for an abort in earth orbit for Apollo 15, NASA explored an alternative earth-orbital mission, in which the astronauts would make detailed observations of the earth. (Apollo 15 contained an orbital science package with a panoramic and metric camera system that obtained 3-meter resolution photographs of the moon.) After much furor, it was agreed that the astronauts, in case of an abort, could do an earth-orbital mission, using all of the instruments aboard, but that the pictures taken during the mission could not be released.

The rationale for the camera emerged from the civilian sector, but Defense has preempted it for use in its Big Bird spy satellite in 1972.

Various photographs taken by astronauts from earth orbit over the past ten years have been withheld from release by DOD; others have been purposely blurred. Defense is usually concerned that no agency reveal what can really be detected from earth orbit.

Current Defense Department policy limits the resolution quality of photographs taken from space by any mapping camera of a civilian agency. For example, if a spacecraft is orbiting at an altitude of 150 kilometers any resolution better than 15 meters is prohibited.

Some progress has been made, however. An example is Skylab. (SN: 10/10/70, p. 303). The space laboratory will orbit at 435 kilometers and carry several camera systems for multispectral observations of earth resources. Approved in June 1971 as a complement to this package is a U. S. Geological Survey proposal to include the Hycon camera flown on Apollo 14. (For Skylab it is renamed the Earth Terrain Camera.) The camera is capable under the best conditions—high-resolution film, high-contrast targets—of obtaining a ground resolution of 5 meters. In practice, however, the camera's resolution is expected to be about 10 to 20 meters with black and white film, 20 meters with color film and 30 meters with color infrared. The camera is not suitable for mapping. Its angular field is too narrow to provide adequate stereo overlap for determining terrain elevation.

The larger concern is not with one 12-inch camera but with the entire area of remote sensing. Before the Defense Department transferred its remote-sensing activities to unmanned satellites, much of the proposed effort in space sensing was to be centered in the Air Force's Manned Orbiting Laboratory (MOL). In the 1960's when MOL was struggling for economic survival, the Air Force campaigned for control over all remote sensing of earth. Under this plan, the Air Force would have been the gatherer of data on crops, soil, snowfall, ocean depths and water temperatures. It would then have supplied the information to the various agencies. During this time many sensors were classified.

This sensor legacy has affected the quality of remote sensing that can be done experimentally by NASA. The Earth Resources Technology Satellites were first recommended to NASA for consideration in 1966. The battle for approval was a long one.

ERTS was finally approved in 1970. ERTS A, originally scheduled for early 1972, however, has most recently been postponed again to June or later. But when it is launched, it will pass over the same areas of earth every 18 days. The stated goals include detection of changes in water, soil and land use, vegetation, and crops.

NASA chose a vidicon system over a film system for ERTS in order to provide repeated coverage over the same areas. The system will use electronics for automatic data return that can be processed through computers. "It [the vidicon system] was a trade-off between resolution and areal coverage," says one NASA official. Initially it was thought the system would yield images of 30-meter resolution (100 feet), but now it appears the system will have a 150-meter resolution (500 feet). NASA hopes it will get a resolution of 90 meters (300 feet).

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Defense concerns are not the only ones involved in the whole problem of quality of remote sensing from space. Other nations hardly relish the idea of the United States' flying sensors over their countries (although reputedly the Soviet Union is buying 12-inch camera systems from the West Germans for their aircraft or space systems). Such a coverage would provide a third party with a complete inventory of any nation's natural resources. While flying the experimental ERTS, NASA has invited other nations to be users of the data acquired over their territories, and thus has insured that the satellites will fly, at least as experiments. Whether there would ever be a global earth resources program that was operational is a question for international politics.

The larger issues of remote sensing still remain. How far can one go in terms of resolution on a global scale and still have worldwide acceptance? How many spacecraft will have to be flown before sophisticated, state-of-the-art techniques are flown on them? Where do defense needs end and civilian needs begin? At the White House or National Security Council level, who speaks up for civilian requirements and needs versus military classification? At what point is there a crossover between national defense needs and the needs of the environment and civilian sector? Who decides when these criteria for classification can slide to meet civilian interests?

Much has been recommended; very little has been done. □