

back to their original contour. Then the area can be fertilized and be seeded with grasses and legumes. Given the usual ecological succession, climax species such as hardwood trees will return in 10 to 20 years, says Dr. Hill.

The cost of such a plan would be around \$500 to \$1,000 per acre if carried out immediately after mining, and nearer \$1,600 later, says Dr. Hill. He believes the cost of reclamation per ton of coal would rarely be higher than 25 cents and sometimes as low as 2 or 3 cents. Even the 25-cent figure is well within the means of coal companies, he believes. The ecological problems involved with mining of more level areas are considerably less perplexing than those from contour mining, he says.

Hechler insists, however, that the ecological problems for both are far more complex than Hill's proposal acknowledges. Evidence is, he says, that some West Virginia strip-mined land may take 400 years to get back to its original condition. Dr. Robert R. Curry of the University of Montana scorns the practice of merely applying fertilizers to denuded land, pointing out that a soil complex conducive to full ecological vigor takes thousands of years to develop, through complicated chemical, geological and biological processes (see p. 302). Without this substrate of nature-conditioned soil, he says, fertilizers will simply run off with water. And Dr. Hill concedes water quality is still affected five years after reclamation.

But Dr. William Sopper of Pennsylvania State University reports that in a single growing season he produced lush ground cover and a high survival rate for many trees on previously sterile strip-mine spoil materials by spraying treated sewage effluent on the materials (SN: 4/24/71, p. 286). The purpose of Dr. Sopper's work was to purify the effluents, and the highly successful spoil fertility results were a happy by-product. Dr. Rolf Eliassen of Stanford University this week suggested a coal sewage symbiosis that would have rail cars hauling coal to population centers; the then empty cars would haul sewage sludge back to fertilize spoil banks.

A number of bills now in Congress—including an Administration bill—evidence faith in techniques such as those proposed by Drs. Hill, Sopper and Eliassen. The bills rely primarily on Federal inspection and enforcement of reclamation rather than on outright closing down of strip mines. Whether or not reclamation is applicable to significant acreages will depend on the results of large-scale demonstrations of the techniques. In the meantime, in view of state governments' performance to date, environmentalists insist the Federal takeover of enforcement is the least that can be done. □

## FIRST SPACE STATION

### Soyuz 10 link a mystery

The Soviet Union made good its official hints last week and launched a three-man Soyuz crew into space April 23 to dock with the orbiting space station Salyut launched four days earlier (SN: 4/24/71, p. 278). They also made good their aim to beat the United States again in space—this time with the first space station. A more unusual achievement of sorts was the duration of the Soyuz 10 flight—less than two days—making it the shortest three-man space flight in history.

All this, coupled with the usual Soviet secrecy, has kept the real mission of Soyuz 10 shrouded in mystery, and Western space watchers leaping from one explanation to another.

Meanwhile, the Soviets seem unruffled. The Soyuz 10 cosmonauts—veterans commander Vladimir Shatalov and flight engineer Alexei Yeliseyev and rookie test engineer Nikolai Rukavishnikov—made a soft landing in the early morning darkness about 44 yards from a lake near Karaganda, Kazakhstan, April 25. After the landing, Shatalov said of his latest venture: "Now it can be said that the Soviet Union's research in the field of opening up space is continuing . . . along the road toward the creation of orbital research stations. . . . The previous five-year period was directed toward a step-by-step solution of this problem. This flight is a routine step on the road to creation of such stations. . . ."

**Western observers had thought Salyut was such a station—and therefore the "creation" had already been accomplished.**

Information from Tass and other Soviet news sources as well as interviews with the cosmonauts helped to fill in some of the blanks.

The Soyuz 10 spacecraft was a modified space ship—perhaps the first in a new series of what Shatalov calls a "remarkable multipurpose machine." An *Izvestia* report describes the design of the new craft as aptly combining "elements of a cargo ship and an orbital station. . . ."

The engine and fuel reserves of the craft enable it to perform wide maneuvers in near-earth orbit (about 100 to 130 miles) to altitudes of up to 1,500 kilometers (930 miles).

The flight unfolded slowly. On Saturday Soyuz 10 docked with the space lab Salyut and remained docked for five and a half hours. (There was no mention of the expected transfer of crew from Soyuz through a possible new docking tunnel to Salyut.) The docking itself was a combined automatic and manual task. Soyuz approached within 180 meters of Salyut

automatically. The further "approach and berthing," say the cosmonauts, "were then carried out by the crew."

"We first saw Salyut on the screen of an optical instrument at a distance of 15 kilometers," says Yeliseyev. "The station has special light beacons which make its detection easier." A television camera mounted on Soyuz transmitted pictures to ground control. "It was a very impressive picture," says Yeliseyev. "An object with a tremendous amount of instruments and various antennas."

Although the Soviets have not officially mentioned the size or weight of Salyut, several hints, subject to interpretation, were offered. "The docking of this type is a more difficult task as compared with the docking of two Soyuz or Cosmos spaceships—craft of roughly the same mass," explains cosmonaut-scientist Konstantin Feoktistov. Cosmonaut Yeliseyev described the docking haltingly, "I don't even know what to compare it with. It was, you know, it was a little like a train entering a railroad terminal. That's how we felt as our rather big Soyuz eased up to the station."

But the French came up with some exact statistics: Salyut is four times the size of Soyuz—36 cubic meters (about 1,271 cubic feet and probably room for 24 cosmonauts). It has four docking tunnels, adds the French news service Agence France Press (United States space officials had estimated it to be larger than the 17-ton Proton 4 cosmic-ray satellite launched in 1968).

If the docking were accomplished with no problems however, the major question puzzling Western observers is why the crew did not transfer to Salyut and why such an expensive mission with three men was so short.

**Commander Shatalov explained:** "By duration the flight was a short one, but a very big and tense one by volume of works, aims and tasks. We were instructed to perform comprehensive trials of the modified Soyuz 10 jointly with the research orbital station Salyut. We performed this work, tested the ship, checked the station systems during joint flight and practiced joint maneuvering with it. . . ."

Feoktistov described the main purpose of the brief flight as "undoubtedly . . . the testing of a new technical means for docking in space."

But a Tass article the day of the launch had been more ambitious, outlining three aims for Soyuz 10: to conduct joint experiments with the orbital station and make a comprehensive check of the ship's onboard systems; to test further the manual and automatic control systems, and the orientation and stabilization by the ship in different flight conditions; and to hold medico-biological research to study the influence of space flight factors on the

human organism (a job that would seem to take more than two days).

The last goal drew some inflight comments from the rookie Rukavishnikov. During one session, he noted that the presence and advice of the two veterans had helped him to get "accustomed to weightlessness, overcome unusual and rather unpleasant feelings arising as a result of the increased blood flow to the head," according to a news report.

In spite of the underlying tone of success following the Soyuz crew's return, Western space observers were puzzled by several other characteristics of the flight that had led some to speculate that something went wrong with one of the craft. One was the unexpected four-day gap between the launches of Salyut 1 and Soyuz (the Russians have the ability for multiple launches and they have in the past launched three manned Soyuz on consecutive days). And according to one scientist, Soyuz was launched at an hour that when plotted with the launch-hours and mission-durations of Soyuz 1 through 9 would have meant that Soyuz 10 should have stayed in orbit from 25 to 30 days (although there is some question of the capability of staying that long with three men).

The most plausible explanation comes from the French AFP out of Moscow, which quotes "reliable sources" as saying that the Salyut launch was to have occurred March 27, and had to be delayed because of some problem. The French continue "the mission of Soyuz 10 . . . was to check the anomalies in the behavior of Salyut and draw up a new system of telemetry retransmission."

If this report is true, it could explain why there were two engineers on the flight. A Soviet Government report of an interview with Cosmonaut Rukavishnikov stressed the spaceman's hobby—"a passion to remake everything . . . from refrigerators to radio receivers." If the cosmonauts succeeded in repairing the lab, however, the question still remains why they should have returned as early as they did.

While Western officials are still searching for clues to the mission of Soyuz 10, the official Government announcements out of Moscow have ceased talking of the flight and have switched to discussions of the next steps—continued work with Salyut from ground control and strong hints of more manned launches to dock with the lab. The French reports estimate that Soyuz 11 will be launched the latter part of May.

Meanwhile the Kremlin this week congratulated the cosmonauts and confirmed that Soyuz 10—whatever its mission—was only the beginning of an extensive project with the lab. □

## IGNORED NO LONGER

### New visibility at the NAS

The National Academy of Sciences sometimes used to worry that it suffered from a lack of visibility. There was concern at times that, outside high-level scientific-Government circles, it seemed that nobody knew or cared that the organization existed.

That perception may have been more or less accurate a few years ago. But in recent months the Academy has been showered with concern and interest from the outside. One of the more unusual circumstances of this week's annual meeting of the Academy in Washington, for instance, was the presence of more than two dozen reporters at each of two briefings for the press after sessions of the NAS's closed business meetings, briefings that in most previous years stimulated at best the dutiful attendance of a handful of science press corps regulars, who politely took notes and left with a few hohums. This year there was even a petition signed by newsmen to allow future NAS business meetings to be open to the press. Public criticisms of the Academy in the past year (some less well-founded than others), the initiation of a Ralph Nader-sponsored study of its activities (SN: 4/10, p. 247), requests by Congress for advice on several controversial matters, and disgruntlement by one or two Academy members who have provided material to newsmen—all help account for the new level of concern. The Academy is clearly moving into the public light.

One action approved in the business meeting, which this year lasted through Wednesday morning, was to change the bylaws to allow election of more members from the clinical medical sciences and the social and behavioral sciences. Instead of electing 50 new members, as it did this year, the Academy will elect 75 next year, 100 in 1973, and then taper down to a steady level of 60 in 1977 and succeeding years. This may seem to some a trivial in-house action, but NAS President Philip Handler was probably on firm ground in calling it a large move for the Academy. "It is a symbol of our intentions to become more usefully engaged in the larger problems of the United States." Full recognition of the behavioral and social sciences and clinical sciences was a long time coming at the Academy. The action will give a broader representation on which to draw in recognizing and dealing with social and health problems.

In another action, the Academy rejected two of the three recommendations of its Committee on Policy with Respect to Studies of Genetic Quality.



NAS

*Handler: Concern with larger issues.*

The committee was formed in 1969 in response to a proposal that the Academy urge the nation to give particular attention to the study of "hereditary aspects of our national human quality problems." Stanford University physicist William B. Shockley has been trying to promote official Academy interest in "reducing the environment-heredity uncertainty" since the fall of 1966. Academy members have been reluctant to involve the organization in the sensitive issue. They have had doubts about the validity of available information and felt that the racial overtones involved would cloud the matter.

The committee assigned to examine the issue recommended that the "National Science Foundation consult with other Federal agencies . . . in collating disparate knowledge and adding new knowledge" with respect to the possible educational implications of human behavioral genetics. It also asked that the Academy establish a working group to study the feasibility of an effective, long-range program of study in this area. Both recommendations were defeated by a voice vote of Academy members Wednesday.

A long statement by the committee assessing present knowledge of the behavioral and social aspects of human genetics was approved, however, and will be published by the Academy. It in effect respects the validity of the questions involved, but emphasizes the difficulties and costs of such studies and questions their high priority.

Another issue that has surfaced in recent years is the degree of involvement by the Academy—an official, but private, adviser to the Government—in classified advisory studies for the military. These represent a small share of the NAS's operations, but Dr. Richard Lewontin of the University of Chicago moved to forbid all studies that couldn't be made available to all members. The action was, in effect, tabled. Lewontin said he would resign. □