



L5 NEWS

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Front Cover: Interior view of a Bernal Sphere space colony one mile in diameter housing ten thousand people. A detail of this picture is shown in **The High Frontier**, by G.K. O'Neill, paperback, Bantam Books, 1978. (*Art work courtesy Don Davis.*)

Sunsat Energy Council Formed



Peter Glaser, shown standing, at the first organizational meeting of the Sunsat Energy Council Dec. 7, 1977. Glaser, founder of the Council, is the originator of the solar power satellite concept and a Vice President of Arthur D. Little, Inc.

Representatives of 42 major American energy and aerospace companies joined in Washington, D.C. April 6 to announce formation of the "Sunsat Energy Council," a group promoting production of electric power from solar energy as a long term solution to U.S. energy problems.

According to the council, electricity would be produced from sunlight by large

power plants orbiting in space. This electricity would be sent back to earth for use in homes and factories. Each of the satellite designs now under study by NASA could supply enough electricity to run a city the size of New York. "Solar electric power would be clean and inexpensive," says Art Dula, aerospace lawyer and Sunsat member, "both industry and government

studies show that by generating electricity in space, where sunlight is strong and continuous, enough energy could be provided to reduce U.S. dependence on imported oil and allow continued economic growth."

Studies by Boeing and Arthur D. Little suggest that the first commercial satellite could be in operation as early as 1995.

Jimmy C. Will Increase NASA's Budget If Good Friend Jerry B. Will Take Permanent Space Walk

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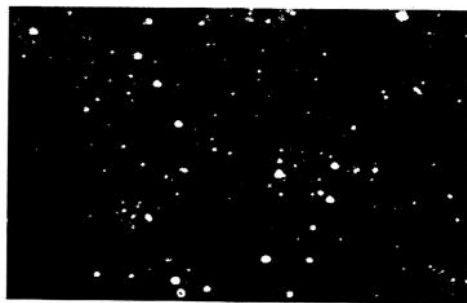
Jimmy Carter, who as late as the last presidential election was known as a master of political symbolism, has not escaped the cosmical message of the man with an even more perfect grasp -- the 39-year-old perfect master of political symbolism, Jerry Brown. Brown's most recent display came in his flashy support for American space initiatives -- support which could cause a skittish President to cripple the federal program.

"There seems to be a back-lash from the White House whenever Brown talks about space," a senior staff scientist at NASA headquarters in Washington told us. "Every time Jerry Brown says something about space, the OMB (Office of Management and Budget) comes after our budget," another high NASA official said.

NASA contractors reportedly have been "encouraged" to steer clear of Brown, on pain of thinner contracts.

Brown's fabulously ambitious California dreaming goes far beyond little things like the White House: Last August, Brown and his state hosted a convocation of aerospace executives, NASA officials and media and space supporters for something called Space Day. Rockwell International -- central contractor for the space shuttle -- paid for the celebration. Introducing his cabinet, Brown chilled White House spines with his unveiled ecotopian threat: "We have plenty of money for space. In fact, I'd like to point out that our state surplus is just slightly smaller than the entire NASA budget. I'm not offering it . . . (laughter) but I do set it as a yardstick of what's possible."

Astronaut Jack Swigert (Apollo 13) recently announced his candidacy as Republican nominee for the Senate seat held by the Democrat incumbent in Colorado. He joins Astronauts John Glenn and Harrison Schmidt in turning to politics as a career choice.



Dear President Carter:

I respectfully urge maximum feasible funding of the nation's space program.

Space is the energy and resources frontier of the future--the only genuine frontier we have left. Sharp cutbacks in NASA's budget now, just as we are discovering the unexpected, practical payoffs of the space program under presidents Kennedy and Johnson would be to let go fallow the enormous capital investment the nation has already made in space and to delay momentous developments in energy, resources, communications, and environmental management systems which are now within our technological grasp and capability.

I received a copy of Majority Leader Jim Wright's letter to you of 29 March 1977, and also of Bert Lance's reply to Mr. Wright's of 16 June 1977. I fully support Jim Wright's pleading for the Solar Power Satellite project, and was extremely disappointed by the tenor of Mr. Lance's reply. I have the sense we are "stalling out" just at the time we should be making a maximum effort in this vital area.

As a Democrat, a businessman, and one of your strongest supporters, I plead with you to reconsider and not shortchange the needs of the U.S. Space Program.

Respectfully yours,
Sam E. Dunnam
Austin, TX

High Frontier Bill Introduced

Senator Harrison A. Williams, Jr. (D-NJ) has introduced a bill which calls for a 2 year, \$1 million study on solar power satellites by the National Science Foundation. "The two-year investigation I propose," Williams said, "would be the necessary first step, and a decision whether to proceed could be made by 1980. . . . If Dr. O'Neill and his colleagues are correct, solar satellite power generation, at the very least, would supply cheap energy for half the world's electricity needs, without the need for major technological breakthroughs."

The legislation would provide for an analysis of the benefits, costs, and impacts of implementing the "High Frontier" program in relation to jobs, environment, international relations, and national security. Williams asked that \$1,000,000 be authorized for fiscal years 1979 and 1980 to the National Science Foundation which would make recommendations to Congress and the President, based on data obtained during the study to determine whether the program should be adopted as a national goal, as was the moon program in 1961.

"Congress has been inundated with energy legislation to correct the immediate and short-term supply problems," Williams said, "but it is necessary to consider long-range solutions and alternatives for future generations as well. The High Frontier program could offer such an energy alternative, and I hope that action will be taken quickly on this legislation." The bill will fall under the jurisdiction of the Senate Committee on Human Resources, which Williams chairs.

Convair to Design System For Space Orbit Assembly

General Dynamics has received a contract from the U.S. Air Force to provide a conceptual design of a large space system that could be assembled in orbit using the Space Shuttle Orbiter.

Convair division was awarded the \$750,000 contract by the Air Force's Space and Missile Systems Organization (SAMSO) who also awarded a competing parallel contract to Martin Marietta Aerospace. The basic task will be to develop a conceptual design of a spacecraft that will be assembled in space from large deployable modules. The assembled modules will result in a final spacecraft that is between 600 and 1,000 feet in diameter.

According to Russ Thomas, Program Manager, Convair will also design a prototype spacecraft to demonstrate the deployment and on-orbit assembly technologies using a single Shuttle flight. "We see this design as being a total space system; a spacecraft with an upper stage, avionics and guidance package," he said.

Mr. Thomas regards the new Air Force contract as a significant addition to the company's Advanced Space Programs and one which complements existing National Aeronautics and Space Administration programs.

"Our initial effort," he said, "will define an operational spacecraft system. We will then define the flight demonstration model."

Subsequent phases of the project involve ground validation, including simulation of techniques for rendezvous, alignment and final docking.

The hexagon-shaped modules are envisioned as large as 400 feet across. Three or more of the modules linked together would form the spacecraft antenna system which would be used for general communications or as a space-based radar. Thomas said that each packaged module would first be carried into a 180-mile low earth orbit in the Orbiter's cargo bay. After deployment from the Orbiter and erection, a transfer stage would then boost the system into a 22,000-mile-high earth synchronous orbit, where it would dock with previously deployed elements.

According to SAMSO, the prototype demonstration model could provide a platform to perform tasks unique to the space environment, such as servicing, rendezvous and docking as well as testing. Plans call for automated assembly in space with manned supervision.

The flight demonstration article will be used to verify the Shuttle's capability to deploy future Department of Defense spacecraft that might require assembly in orbit.

Thomas said the on-orbit assembly could mature into an operational system in 1986 with continuing missions at least 10 years beyond that.

U.N. Committee Discusses Space Issues

New York -- The 15th annual meeting of the Scientific and Technical Subcommittee of the U.N. Outer Space Committee concluded on March 2. The Subcommittee spent much of its time discussing questions raised by Cosmos 954, the nuclear-powered Soviet radar ocean reconnaissance satellite that disintegrated over Canada in January. The full Outer Space Committee may decide to set up a study to look into possible regulations or safety standards for nuclear power sources in space.

On remote sensing, the Soviet Union proposed a cutoff at 50 meters resolution on the dissemination of data. Other delegations expressed doubt about the utility of resolution as a criterion to justify control of dissemination, but most did feel that control of some kind would be appropriate for information about natural resources. Some third world countries supported the idea of creating a panel of experts to coordinate the activities of states and organizations in the remote sensing field. The Subcommittee also discussed the monitoring of pollution by remote sensing.

Certain equatorial countries insisted that the question of sovereignty over geosynchronous orbit be referred to the full Outer Space Committee, despite the U.S. position that there is no scientific or technical basis for any claim of extension of national sovereignty to portions of geosynchronous orbit.

Looking toward the future, the Subcommittee set the stage for a final decision in 1979 on a world conference on outer space. At the initiative of the USSR, the Subcommittee also recommended that it add one new item to its agenda for 1979: questions relating to space transportation systems.

TETHERED SATELLITES TO BE STUDIED

by *Phill Parker*

Two companies, Martin Marietta and Ball Brothers, have been selected by NASA to look into tethered satellites. Such a satellite, attached to an orbiting Space Shuttle by a cable up to 62 miles long, has several potential applications. The primary application would be to gain scientific data from the Earth's upper atmosphere in order to map the Earth's magnetic and gravity fields and to assist in the studies of atmospheric or plasma physics. Other potential applications are: cargo transfer between space vehicles; retrieval of satellites or debris without having to maneuver the Shuttle; and transfer of large amounts of energy to a remote experiment or from a remote, possibly dangerous, power source to a space station.

ART FORM FOR SPACE?

A Canadian art workshop, Resolute Art Works of Toronto, announced plans for a possible orbiting artform, on the 27th November 1977. This group initiated a project to place a work of art into a 1½ hour orbit.

In describing the project, Resolute Art Works announced that they were approaching NASA on the feasibility of a 1980 space shuttle launch for this sculpture. The work would be a series of nine silvery spheres, each of 300 feet diameter, placed in orbit 100 feet apart giving a total length of 3500 feet. The spheres would be made of segmented sections of thin plastic membranes with specially prepared reflective surfaces for maximum visibility. The spheres would have a skin thickness of 0.004 inches and be made of aluminised mylar. The total surface area of each sphere would be about 6½ acres. The spheres will be gas-inflated, using sublimating powder, in orbit. Each sphere will be packaged into a launching canister, this splitting into two halves on reaching orbit, 'when the gas inflation takes place. The orbital height being suggested is for this art work is apogee -- 290 miles, perigee -- 250 miles and inclination 49 degrees, revolution period 96 minutes.

Describing the work, the Resolute Art Works say that what makes this a 'work of art' would be the tension in it between the natural and the artificial. It makes its appearance in the natural sky, neither dominating it or being dominated by the sky. It bears a resemblance to stars but the resemblance is superficial since nine stars of equal size do not occur together in a straight line spaced equally apart nor traverse the sky every 96 minutes. They reason that the orbiting art work is an experiment in monumental building and that it is conceived as a monument appropriate to the Twentieth Century.

Shuttle Update

Next fall, more than three years since the last Saturn roared skyward from launch complex 39, the characteristic hustle and bustle of piloted space flight once again will dominate the scene at the Kennedy Space Center.

It will begin next October when orbiter 102, fresh from the assembly line in California, soars piggyback into KSC atop its 747 carrier aircraft. The stubby delta-winged craft—designed to rumble into orbit like a rocket, maneuver beyond the atmosphere like a spaceship and return to earth and land on a runway like an airplane—will be the first of its kind to test the rigors of celestial flight.

In November and December, the remainder of the Space Shuttle flight kit -- orbiter main engines, external tank and solid rocket booster motors (SRBs) -- will arrive at KSC. Along with the orbiter, they will enter the test, assembly and checkout pipeline that will culminate in a scheduled launch from complex 39 in March of the following year.

After completion of six development flights, including four landings at the Dryden Space Flight Center, the Space Shuttle will commence operational missions from the Kennedy center in May 1980. KSC was selected in 1972 as the primary launch and landing site for Shuttle operations.

Construction of new facilities and modifications to existing ones are proceeding on schedule at KSC to support the Shuttle's debut.

The landing facility, where the Shuttle orbiter will land on its return to Earth, was completed last August. Supporting facilities such as the mate-demate device, to offload the orbiter from its 747 carrier aircraft, and the microwave landing system, to guide the orbiter to an automatic landing, will be completed in April 1978. Meteorological sites to support landing operations were completed in November 1977.

One of the world's longest concrete runways, the orbiter landing facility is 4.5 kilometers long, 91 meters wide and has a 300-m safety overrun at each end. The facility is located northwest of the vehicle assembly building (VAB).

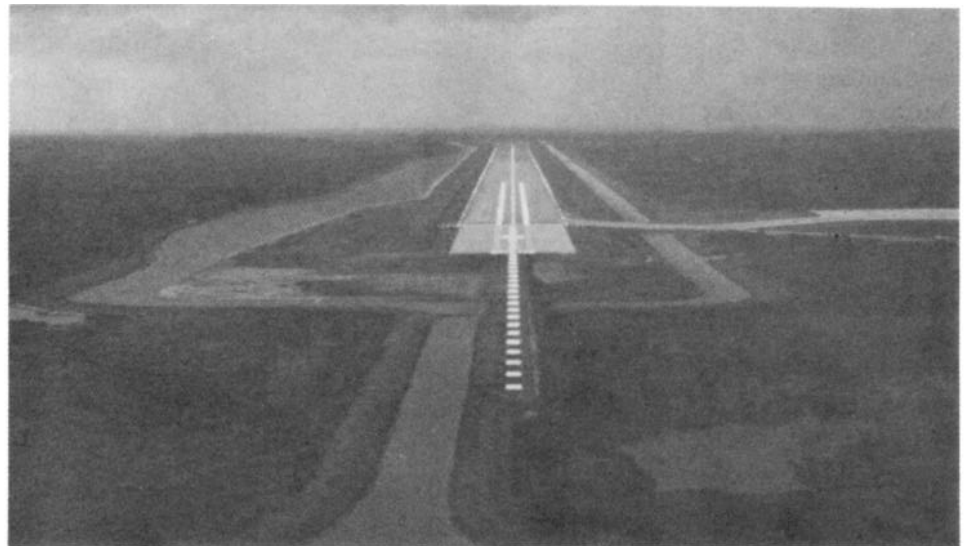
The orbiter processing facility, located adjacent to the VAB and connected to the landing facility by a 3.2-km towway, is essentially completed except for the

installation of some remaining stands and systems expected to be in place by April. The two-bay structure will serve as an aircraft "hangar." It is here, in a "clean room" environment, that ordnance and residual fuels will be rendered safe, flight and landing systems will be refurbished and payloads will be removed and installed.

The orbiter landing facility and the orbiter processing facility are the only new facilities required to support Shuttle operations at KSC. The remaining Shuttle preparations consist of modifications to existing facilities originally designed and built to support the Apollo lunar landing missions.

Only one structure on Cape Canaveral Air Force Station will be modified to support Shuttle operations. Hangar AF will be transformed into a solid rocket booster recovery and disassembly facility. It will serve as a receiving and disassembly site for the reusable SRBs after their retrieval from the ocean following Shuttle launches. Modifications, which began in January, will be completed in the last quarter of next year, and will include a barge slip at the rear of the building.

The eventual cost of construction, modification work and ground support equipment to support Space Shuttle operations at the Kennedy Space Center will be about \$700-800 million.



Shuttle's Runway



Orbiter Processing Facility—An artist's view of the almost completed processing facility for the Space Shuttle orbiter, located adjacent to the VAB and connected to the landing facility, at the Kennedy center.

So You Want To Be An Astronaut?

Astronaut Candidates Selected

So you are a would-be astronaut with three strikes against you. . . but you aren't out yet, by any means. Not by a long shot.

Strike one: you aren't an experienced jet fighter pilot with thousands of hours of flight time, so you weren't picked as a pilot-astronaut and have little chance of ever being picked.

Strike two: You didn't make the 'Mission Specialist' selection either, as a test engineer or as a scientist. You might someday, but the odds are not good.

Strike three: You couldn't get close to the Spacelab 'payload specialist' selection panel either. These part-time researchers will be nominated by the panel of "Principal Investigators" who themselves were picked by NASA boards determined to get the most productive science and engineering from each Spacelab mission.

But you are not out., because most of the Space Shuttle seats for the 1980s are still empty, still unassigned. They are possibly still available for use. Only user demand will open them up.

These are the four extra seats on each ferry Shuttle flight, the missions devoted to launching synchronous comsats or other cargo payloads. Nominally, these flights will carry three people: two pilots and an engineer, and will last for one to three days. Their sole purpose will be running freight service into orbit -- but even on earth, freighters carry passengers sometimes, too. One seat on the flight deck, and all three on the middeck, are empty. And that doesn't count three more possible seats ("rescue configuration") in the middeck.

Putting people into those four 'empty seats' on the freighter missions would not cost much extra, since the weight is negligible and the consumables are standard. So, if it is to be possible to hitch-hike a three-day space ride, how can it be done?

NASA has not set up mechanisms for this, and has not considered it in any detail. But it is these seats which will be used to fulfill NASA's unwritten promise to send a representative of the news media into orbit in 1981-1982. Other occupants of these seats could be poets, medical patients, visiting scientists, and the President of the United States. And you.

So how? More than curiosity will be needed as justification. Propose an experiment or some other activity to NASA. Create a market, and compel the Space Shuttle management to consider this option.

Fill those seats! Forget the three strikes: the game has just begun.

NASA Administrator Dr. Robert A. Frosch recently announced the selection of 35 new astronaut candidates for the Space Shuttle program. The group will report to the Johnson Space Center July 1, 1978, where they will join the astronauts currently on flight status.

NASA received 8,079 applications during a year-long recruiting period which ended June 30, 1977. Since August, 208 finalists have been interviewed and have undergone medical examinations at the Johnson center.

After two years of training and evaluation there, successful candidates will become astronauts and enter the Shuttle training program leading to selection on a Space Shuttle flight crew.

Those chosen as pilots will operate the Space Shuttle orbiter, maneuvering it in Earth orbit and flying it to Earth for a runway landing. Mission specialist astronauts will be responsible for the coordination, with the commander and pilot, of Space Shuttle operations involving crew activity planning, the use of consumables, and other Space Shuttle activities affecting experiment operations. They may participate in extravehicular activities (space walks), perform special payload handling or maintenance operations using the Space Shuttle remote manipulator system, and assist in specific experiment operation at the discretion of sponsors of given experiments.

The newly selected candidates include 14 civilians and 21 military officers. Of the group, six are women, and four are members of minority groups. Currently there are 27 astronauts on active status (17 pilots and 10 scientist astronauts) and one on leave of absence.

The new astronaut candidates are:
Maj. Guion S. Bluford, 35, Air Force engineering specialist, from Dayton, Ohio
Lt. Cdr. Daniel C. Brandenstein, 35, Navy pilot, of Oak Harbor, Wash.
Capt. James F. Buchli, Marine, 32, of Lexington Park, Md.
Lt. Cdr. Michael L. Coats, Navy pilot, of Great Mills, Md.
Maj. Richard O. Covey, Air Force Pilot, 32, of Fort Walton Beach, Fla.
Lt. Cdr. John O. Creighton, 32, Navy pilot of Lexington Park, Md.

Maj. John M. Fabian, 39, Air Force astronautical engineer, of Colorado Springs.
Dr. Anna L. Fisher, 28, physician, of Rancho Palos Verdes, Calif.
Lt. Dale A. Gardner, 30, Navy physician, of Camarillo, Calif.
Lt. Robert L. Gibson, 31, Navy pilot, of Leonardtown, Md.
Maj. Frederick D. Gregory, 37, Air Force pilot, now attending the Armed Forces Staff College in Norfolk, Va.
Stanley D. Griggs, 38, NASA engineer, of Seabrook, Texas.
Terry J. Hart, 31, Bell Telephone Laboratories engineer, of Long Valley, N.J.
Cdr. Frederick H. Hauck, 36, Navy pilot, of Oak Harbor, Wash.
Dr. Steven A. Hawley, 27, astronomer, of Santa Cruz, Calif.
Dr. Jeffrey A. Hoffman, 34, astrophysicist at the Mass. Institute of Technology.
Dr. Shannon W. Lucid, 35, biochemist, of Oklahoma City.
Lt. Cdr. Jon A. McBride, 34, Navy pilot, of Edwards, Calif.
Dr. Ronald E. McNair, 27, physicist at the Hughes Research Laboratories, Malibu, Calif.
Capt. Richard M. Mullane, 32, Air Force engineer, of Fort Walton Beach, Fla.
Capt. Steven R. Nagel, 31, Air Force pilot, of Edwards, Calif.
Dr. George D. Nelson, 27, astronomer at the University of Washington, Seattle.
Capt. Ellison S. Onizuka, 31, Air Force engineer from Kealahou, Hawaii.
Dr. Judith A. Resnick, 28, electrical engineer, Xerox Corp., El Segundo, Calif.
Sally K. Ride, 27, researcher at Stanford University, Calif.
Maj. Francis R. Scobee, 38, Air Force pilot, of Edwards, Calif.
Dr. Margaret R. Seddon, 30, surgical resident at the Memphis City Hospital, Tenn.
Capt. Brewster H. Shaw, 32, Air Force pilot of Edwards, Calif.
Capt. Loren J. Shriver, 33, Air Force pilot, of Edwards, Calif.
Maj. Robert L. Stewart, 35, Army aeronautical engineer, of Edwards, Calif.
Kathryn D. Sullivan, 26, geologist, of Cupertino, Calif.
Dr. Norman E. Thagard, 39, a physician, of James Island, S.C.
Dr. James D. van Hoften, 33, engineer, of Houston, Texas.
Lt. Cdr. David M. Walker, 33, Navy pilot, of Virginia Beach, Va.
Lt. Cdr. Donald E. Williams, 36, Navy pilot, of Lemoore, Calif.

BE YOUR OWN ASTRONAUT

by Paul Siegler

Would you like to be an astronaut? Robert Truax, of Saratoga, California, thinks he has just the solution. For \$1 million, he'll put together a launch vehicle which will lift you to 50 miles -- to the edge of space. From your vantage point in the rocket, you'll briefly be able to view thousands of square miles of the earth's surface, as well as peer into the near-black of interstellar space. This-the dream of a rocket pioneer from the beginning of our nation's space program.

Robert Truax has experience in designing rockets. After leaving Aerojet General, he built a steam-rocket powered racing car. He's also the person responsible for building the rocket which lifted Evel Knievel over Snake River Canyon several years ago. Now he's graduated to a more powerful vehicle which can lift a human payload to 50 miles.

Basically a sounding rocket, Truax's vehicle is composed of parts from many other programs. The four 1000 pound thrust engines are surplus vernier engines from the Atlas program. The basic gyros will come from a Nike Hercules, and others parts may come from the X-15 and Polaris programs. The benefit of this technique is to reduce the cost and increase the reliability of the whole program by using tried and true components-therby saving unnecessary development cost and time, and using parts with known reliability factors.

The vehicle itself will be 24 feet long, with 25 inches outside diameter. (This narrow diameter means the astronaut will be somewhat cramped and will have to squat inside the payload compartment to fit.) Fully fueled, it weighs 3100 pounds; dry, it weighs 1100 pounds. The four engines give a total thrust of 4000 pounds, which means the astronaut will experience a maximum of 3G thrust during ascent.

Before flight, there will be many ground tests to assure as high a reliability as possible. (Truax estimates a 90% to 98% chance for survival in the first piloted flight.) There have already been some tests of the engine components.

On the day of launch, all will be set up at a base near a large body of water-such as the Pacific Ocean or a large lake. According to Truax, the vehicle will be

erected on the pad and serviced until almost ready for flight-without the nose cone. Nearby, the astronaut will be put into the nose cone-which has a shirtsleeve environment-and the life support system will be activated. There will be just enough air inside to last 30 minutes. Quickly, a crane will hoist the nose cone with astronaut atop the vehicle, and the countdown will continue on to firing. At liftoff there will be television crews to monitor the whole flight-as well as a TV camera inside the vehicle showing viewers what the astronaut is seeing outside the window. Maximum acceleration of 3G will come at about 100,000 feet. At that point, engines will shut off and the vehicle will coast to 50 miles.

The astronaut will have a clear view of the earth and sky through the window, and will be likely be describing the experience to viewers on the ground through a special communications link. At some point the vehicle may begin to tumble. This tumbling is undesirable, but cannot be remedied until the vehicle is back down to about 100,000 feet altitude. At that point the drogue chute will pop out to stabilize the system and help slow the descent. By the time it reaches 20,000 feet, its rate of descent will have slowed to about 400 miles per hour, and the main chute will pop open. This will be a 48 foot diameter chute of a type tested successfully and used many times. Also, a port will be opened at 20,000 feet to replenish the air in the nose cone. By the time it lands in the water, flight time will have been ten minutes. A recovery fleet will lx on its way in minutes. Truax's recovery fleet consists of a 120 foot cutter with two helicopters and a fixed wing airplane. Skin divers make up part of the team.

The Volks-Rockets, as Truax like to call it, would then be recovered and reused for future flights, and the astronaut will have made headlines across the country. When could all this come about? Perhaps no later than 1980, depending on when funding becomes available. In a sense, Truax hopes his vehicle would be the world's first reusable shuttle. And therein lies part of the object of his intent. He's doing this not just to make money (and let there be no doubt that monetary gain is one of the

objectives), but also to show NASA engineers that they're going in the wrong direction by powering the Space Shuttle with large solid rockets. Instead, Truax feels the best solution is to use "big dumb boosters" of a liquid fuel type. He wants to simplify the overall approach to the Shuttle. To the contrary, he says, the Shuttle program is too sophisticated, making for unacceptable turnaround times. He further feels that a ballistic type recoverable vehicle stands a better chance than a winged glider. A parachute is lighter and simpler than wings, possibly more reliable, having been proven many times in past programs such as Mercury, Gemini, and Apollo. In his words, designing a spacecraft to land at an airport makes about as much sense as designing an aircraft to land at a railroad station.

This project, dubbed Project Private Enterprise, has already evoked considerable interest from the TV networks. As a backup to the astronaut's own one million dollars, the networks would likely pay almost the whole amount for viewing rights. Most of the gain from this first flight, says Truax, would be used to make the system even more reliable. Subsequent flights would cost but \$10,000. Who's interested? Truax has already had several people approach him to be the first astronaut in his vehicle. One potential astronaut is selling T-shirts to try to finance his way. The first person to come up with the money will be the first person to go.

* * *

Like Lutz Kayser of Germany, Robert Truax is moving out on his own, using private capital in an attempt to accomplish a space first and make some money doing it. Also like Kayser, Truax is using simple components in an attempt to keep the total cost down and reliability high. And it looks like he might succeed.

The requirements are simple. And if you're the first with the million dollars, the TV networks will likely repay you in full. Consider Robert Truax's dream, then, as your opportunity to be the first private astronaut in the world-with all the accompanying benefits. He's waiting to hear from you, right now.

Space Mines, Space Law, and the Third World

by K. Eric Drexler

Can a U.S. company legally mine the moon? Some lawyers say yes, others say no. Some say a special international entity must do the job. The 1967 Outer Space Treaty, the primary source of law on such matters, says:

"The exploration and use of outer space, including the moon and other celestial bodies, shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development, and shall be the province of all mankind." (Article I, first paragraph)

"Outer space, including the moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means." (Article II)

Jack Salmon states (*L-5 News*, May 1977): "... Certainly the mining of lunar materials and their transport into space for construction purposes is more than a strict reading of the treaty permits; J.H. Glazer has even argued that construction of a fixed-orbit colony might be construed as 'national appropriation' of a portion of outer space."

However, a strict reading of the treaty would prohibit activities that are apparently considered to be legal. Current military activities are a use of outer space not "in the interests of all countries," while operation of current communications satellite systems are a use of outer space not "carried out for the benefit . . . of all countries, irrespective of their degree of economic or scientific development." Whatever the first paragraph of article I may mean, precedent suggests that it does not prohibit a nation from using outer space for the benefit of itself or whoever it pleases.

With regard to "national appropriation," we must remember that the treaty says nothing about scale. If collecting a few rocks during project Apollo did not constitute "national appropriation" of the moon, neither will collecting more rocks during mining operations. If orbiting a small inhabited spacecraft for a few days fails to violate the treaty, orbiting a colony for a few centuries can do no worse.

Moreover, since the treaty explicitly permits the use and occupation of outer space, article II can scarcely prohibit them. In fact, article II declares that outer space is not subject to national appropriation by any means whatsoever. This suggests that "national appropriation" is not an accidental byproduct of

space activities, but would require a national intent-to-appropriate.

Because all relevant paragraphs of the treaty refer to "outer space, including the moon and other celestial bodies," use of the moon is no more restricted than use of space. Space has been used freely by individual nations and companies with no legal challenge. Because all relevant paragraphs of the treaty refer to "exploration and use," use of the moon is no more restricted than exploration of the moon. A single nation explored the moon (initially) and removed lunar material without legal challenge. Nowhere in the relevant paragraphs does the treaty make any distinction between actions permissible in the use of the moon, the use of space, and the exploration of the moon.

We should also note paragraph two of article I:

"Outer space, including the moon and other celestial bodies, shall be free for exploration and use by all States without discrimination of any kind, on a basis of equality, and in accordance with international law, and there shall be free access to all areas of celestial bodies."

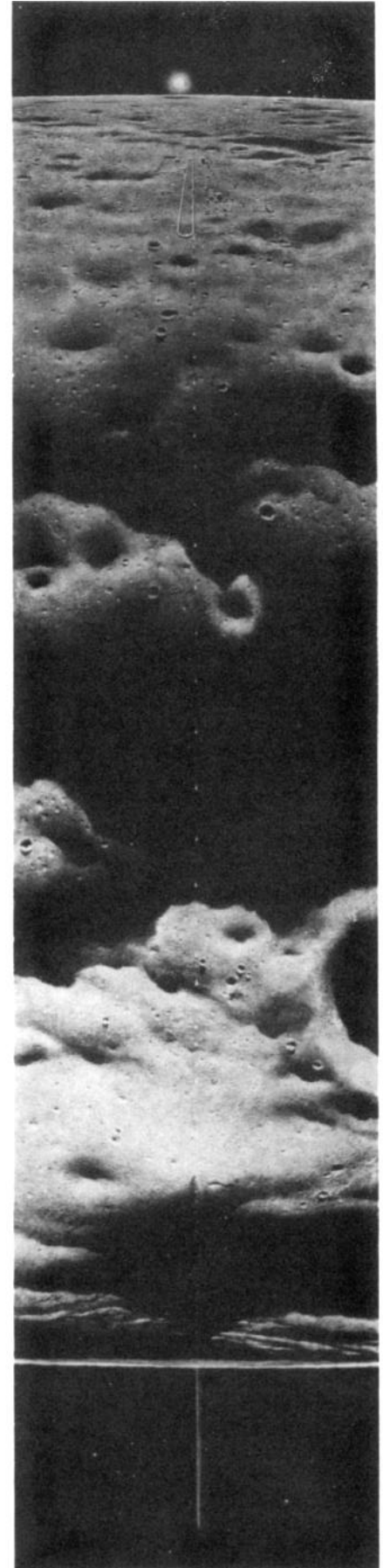
This appears to guarantee free use of celestial bodies by all nations, without need for the special international agreements that some claim are required. Please note that the treaty says nothing to suggest that mining is a special or proscribed form of use.

Article IV states:

"States party to the Treaty shall bear international responsibility for national activities in outer space, including the moon and other celestial bodies, whether such activities are carried out by governmental agencies or by non-governmental entities . . ."

This appears to imply the right of nongovernmental entities, including companies, to operate on the moon or other celestial bodies.

To summarize, no precedent exists for interpretations of the treaty which would require special international agreement to permit use of outer space, including the moon and other celestial bodies. No precedent exists for interpretations requiring specially negotiated international distribution of benefits from such use. Precedent exists for removal of lunar materials, and the treaty does not suggest



A mass driver flinging lunar ore into space.

that such activities constitute national appropriation of the moon. The treaty establishes that non-governmental entities may carry out activities in space under national supervision. From this we may conclude that U.S. companies can, with federal permission and oversight, legally mine the moon.

I am not a lawyer, and the above interpretation may prove faulty. If so, article XVI provides a way out:

"Any State Party to the Treaty may give notice of its withdrawal from the Treaty one year after its entry into force by written notification to the Depository Governments. Such withdrawal shall take effect one year from the date of receipt of this notification."

The 1967 Outer Space Treaty seems incapable of blocking space mining, but more than just signed treaties affects international relations. Many have suggested seabed mining as a legal analogy to space mining. Fruitless negotiations continue on a comprehensive Law of the Sea Treaty (see L-5 News, January 1978). Disagreement in these negotiations centers on the concept of the "common heritage of mankind," which supposedly describes the seabed and other extranational resources. Developing countries are said to "contend that the concept prohibits the United States, or any other nation with the technological ability to do so, to develop these resources or reduce them to possession." Regardless of treaties, this position could pose a political problem if extended to space resources. The developing countries' reflex response to talk of space mining seems to be "Stop! Leave some for us!" Need such conflicts arise?

The developing countries have good reason to block exploitation of the seabed. Exploitation of seabed resources by the advanced nations would hurt some developing economies by undercutting the market for their mineral resources, which are all many of them have to sell. Exploitation could well deplete seabed resources before the developing countries become capable of benefiting from them. They have nothing to lose and everything to gain from delay.

Nevertheless, the developing countries have good reason to favor exploitation of space. Space will return energy (and eventually materials) at a future time when the world's supplies may be running short and the developing countries' demand should be rising sharply. Exploitation, far from depleting space resources, would make them increasingly available as the developing countries become able to use them. In space, with the long lead times for resource development, the developing countries have nothing to gain and quite a bit to lose from delay.

Much conflict could be avoided if everyone concerned realized that the resources of space are effectively limitless. In every second, the sun pours out

two million year supply of energy. A single asteroid, Ceres, contains resources enough to build a land area over 600 times that of Earth -- assuming we construct enormous, inefficient colonies with lots of dirt. Fears that the developed world could soon gobble up the third world's share of space resources are groundless, yet fears continue.

Educating the world about space resources would dispel these fears, but educating the world is an awesome task. A more practical solution would be to make a dramatic concession to the developing countries. Congress could pass a resolution limiting U.S. exploitation of space resources over the next century (or until an international allocation agreement is reached) to no more than 1/1000 of the resources of the asteroid belt, or of the moon, or of any other celestial body, with no more than 1/100,000 to be consumed in any given year. Simple calculations show this resolution to be a mere gesture: the U.S. couldn't come close to exceeding this limit if it tried. Now, consider the propaganda value: "Look! We're opening space to the world and using less than our share of its resources. In fact, we are leaving over 99.9% to the future and to the third world!" Such a resolution would help defuse objections to space mining, and help to shock people into a sorely needed new pattern of thinking.



Russia's BIOS-3 Mini-Colony

Some years ago, back in 1972/73, the Soviet Union conducted a six month experiment of a closed-loop environment using people and higher plants. This small-scale experiment has many fascinating aspects that have relevance to space colony design. The BIOS-3 experiment points successfully to the possibility of totally closed ecological systems on space colonies.

The BIOS-3 unit comprised a stainless steel body of 9 x 14 x 2.5 meters with

four compartments. Two compartments were called phytotrons and housed, at different stages of the experiment, higher plants such as wheat and vegetables, while the third compartment was used, at some stages, to house *Chlorella* unicellular algae. The fourth compartment was the crew compartment with three cabins, kitchen, laundry, toilet and washing facilities. Each phytotron had 20.4 sq. meters of growing area, each equipped with trays for aerial sub-irrigation culture of wheat and for growing vegetables in hydroponics on a porous clay filler, a system for distributing nutrient solutions and for ventilation and heat dissipation. Twenty valves were installed to imitate sunshine guides. The rated capacity was 1,000 liters of oxygen per 24 hours per phytotron. The food requirements of the three man crew were provided by the higher plants.

A six month program was carried out with the BIOS-3 unit. The first stage of the experiment lasted two months. They used the two phytotrons in a "man-higher plant" system. The two phytotrons were planted with wheat, Bordeaux cabbage, Chante carrots, Dill, Petrovsky turnip, Peking leaf cabbage, Virovsky white raddish, Batun onions, Din-Zo-On cucumbers and sorrel. Culture conditions were 145-180 W/m² of uninterrupted illumination, an air temperature of 22-25°C relative humidity of 72-78% and a carbon dioxide concentration of 0.2-1.5%. The results from this first stage were very encouraging and seemed to point the way to a successful cycle of closed ecological systems. However, for the second and third stages of the experiment, one of the phytotrons was replaced by a compartment of *Chlorella*. In the second stage, wheat was planted. It appears that the wheat was severely affected by the presence of the *Chlorella* in the system and the toxic levels in the vegetables also rose. The third stage saw only the vegetables and *Chlorella* being planted and grown. Again, high toxic levels were found although the crew were able to function normally. It seems the toxicity was due to the presence of the *Chlorella* in the system. The overall result of this experiment, however, is that it does appear to be possible to create a biological life support system within limited space and that that system be controlled from within i.e. space colony style.

(PJP)
(Readers of the above article are directed to a more detailed account of the BIOS-3 unit and the results from the experiments contained with 'Acta Astronautica', Vol. 3 pp.633-650 under the title "Life support System With Autonomous Control Employing Plant Photosynthesis" by I.I. Gitelson, et al, of the L.V. Kirensky Physics Institute of the Siberian Branch of the USSR Academy of Sciences, Krasnoyarsk, USSR).

Compliments And Caveats

The Soviets have made a noteworthy accomplishment. Climaxing a decade of concerted and often disappointing effort, they have succeeded in establishing a space station in orbit. Their Salyut 6 has supported the cosmonauts Grechko and Romanenko in orbit for some three months, as this is written; and they have successfully resupplied the orbiting Salyut via shuttle rockets from Earth.

In the history of astronautics, the permanent space station is a desideratum which has served to focus effort and study from the earliest days of the science. The classic concept is the orbiting wheel of von Braun or of Arthur Clarke -- a design closely resembling the Stanford Torus space colony. Indeed, a quarter-century ago, von Braun's ideas were receiving the same sort of attention as the ideas of space colonization are receiving today.

In the real world, the early von Braun and Clarke concepts have not been realized. Yet the Salyut must be regarded as a true space station, albeit one not so elaborate as one might wish. Such a statement follows from an understanding

of the question: What is a space station? What is the threshold which separates a true space station from a long-duration manned orbiting flight?

I think the common judgment would be that this threshold consists of maintaining the station as a long-term facility, resupplied by flights from Earth. This is distinct from even a very long flight by a spacecraft, if that craft is not resupplied but instead returns to Earth after its mission.

The U.S. Skylab was also a space station; it was abandoned after being in use less than a year. It may yet see further service in the shuttle era. Plans are afoot for an early shuttle flight to boost it to higher orbit; but such plans must go forward quickly, for Skylab's orbit is decaying.

There are several ways in which these early space stations are pertinent to the goal of space colonization. One is that the history of the space station may be, to an extent, repeated: Twenty-five years after the initial public discussions of elaborate concepts, there may be space systems which, while much less elaborate, still

truly accomplish the goals of those earlier ideas.

What, then, would be a threshold for space colonization? How would one distinguish a large space station from an embryonic space colony? I would argue that the difference is reliance on nonterrestrial resources: Once there is a lunar mine and a mass-driver serving a space manufacturing plant, then we will be at the "Salyut 6" stage of space colonization.

But will the Soviets play a leading role? Here the technical gulf between a space station and a space colony yawns wide. For operations in high Earth orbit, or on the Moon, the use of hydrogen as a propellant is essential. The Soviets have yet to demonstrate its use. We flew our first hydrogen-fueled stage in 1962.

Beyond that, for all the hopes of U.S. -- Soviet space cooperation, there still is this: The U.S. space program is civilian in character; the Soviet's is entirely controlled by their military. It is the Soviet army and air force which set their priorities in space. And no consideration of space cooperation can ignore this.

SALYUT-6 FACTS & FIGURES

JAMES E. OBERG

The following data is extracted in rough arrangement from the Soviet press, describing various features of the mission of Salyut-6. Soviet sources have been quite explicit and forthright about many aspects of this mission, but, regrettably, much of the interesting data has not been relayed to the Western public.

The Salyut-Soyuz combination weighs in excess of 26,000 kg and has an interior volume of more than 100 cubic meters. The length of the complex is more than 20 meters. The Salyut has three cylinders: the transfer compartment, sealed at each end by a hatch, and possessing a 'side-door' for EVA--this compartment is about two meters in diameter and 2.5 meters long. Next is the so-called 'working compartment' with a diameter of 2.9 meters and a length of 3.8 meters. The widest section of the station houses most of the scientific apparatus (total weight of apparatus: 1500 kg), and is 4.15 meters in

diameter and 6 meters long (of which only 4.1 is pressurized -- the rest houses the maneuvering engines, fuel tanks, and aft docking equipment).

Three solar power wings are attached to the middle compartment. They measure 3 by 15 meters and can articulate to follow the sun. Their peak power is 4000 watts, although accounting for battery charging for darkness, normal operating power is 2000 watts.

The maneuvering engines are straddling the docking port at the aft end. Their total thrust is 600 kg. Fuel is not described (NOTE: We suspect it is hydrazine and nitric acid).

The Salyut-6 is a 'heavy spacecraft of a new type.' It has on-board standard equipment which was tested on earlier flights: the 'Stroka' teletype, an installation for recycling water which is 95% closed loop; a spacecraft orientation system based on a rapidly spinning spherical weight which is suspended

between magnets and which can be spun up or down along any axis to trim the attitude of the whole vehicle; an improved ventilation system; a modified and more sensitive thermal control system; an automatic navigation system called the 'Delta' which computes orbit, AOS/LOS, sunrise/sunset, and other scheduled events.

The 'Delta' autonomous on-board navigation system is a small computer, about the size of a small suitcase. It connects to a radio altimeter, velocity measuring devices, and astronavigational sensors, and outputs navigation data, via a link to the 'Stroka' teletype. As the station passes over radio beacons in the USSR, Doppler shifts are used to compute radial velocity. Rising and setting of celestial bodies are noted, and the position of the horizon (NOTE: Also, the flow of atmospheric ions past the spacecraft can provide a velocity vector determination to within a degree or two).

The 'Delta' provides data as mentioned

earlier. It automatically switches on/off the station's communications gear. Via a push-button at the end of a cord, the cosmonauts can precisely fix any given moment on board, such as during visual observations, in Moscow time, with exact reference to the orbital position of the station at that moment.

The orbit of the space station complex is inclined to the equator by 51.6 degrees. The standard altitude is about 350 km with a period of 91.34 minutes, which allows for the same azimuth pass over the launch site every second day 48 minutes earlier (31 revolutions apart). The orbit slowly decays due to air drag (NOTE: Rule of thumb, about .02 minutes shorter period per week) so periodic blasts of the maneuvering engine are required. Alternately, the engine of a docked Soyuz or Progress ship can be fired to boost the station. This was done with the engine of Soyuz-26 on December 29, and with the engine of Progress-1 on February 5. Since the Salyut was injected into a low orbit by the Proton booster on September 29 (about 220 by 275 km, period 89.1 minutes), the payload had to use up a great deal of fuel to raise itself to the operating altitude at 350 km.

The launch of the Progress-1 space cargo/tanker was played up big (well, they deserve the applause). The ship carried 2500 kg of cargo: fresh supplies of oxygen/nitrogen to raise the Salyut cabin pressure, propellants, oxygen regenerators (cannisters containing sheets of potassium superoxide which reacts with air humidity to absorb some CO-2 and give off oxygen), air filters, water, clean clothes, film, letters and newspapers from home, new documentation for experiments, a geographic atlas, a Vesna-2 portable tape recorder with music cassettes, and various pieces of unspecified scientific gear. The total spaceship weight was given as 7000 kg. Externally it is said to closely resemble the Soyuz, with a higher level (if that's possible: Ed) of automation. The service module is slightly enlarged. The Soyuz command ('descent') module is modified by removal of heat shield, parachute, couches, periscope, etc., and installation of tanks of fuel, oxidizer (Not liquid oxygen as an ignorant Western correspondent guessed), oxygen and nitrogen for the cabin air, and gas to pneumatically push the fluids into the tanks of the Salyut. The Soyuz 'orbital module' became a cargo hold, which the cosmonauts could enter. As they removed one bank of supplies, they replaced that volume with trash and spent equipment from the Salyut.

The docking of the Progress to the Salyut-G/Soyuz-27 was done by autopilot. The cosmonauts observed the approach at

a console in the Salyut, and if something unforeseen had happened, could push a button to 'blind' the autopilot, halting the approach of the Progress. That was evidently the only control the cosmonauts had over the Progress. They could also turn on the Salyut engines and pull away from a bad Progress.

Progress-1 transferred about 1000 kg of propellants and air, so that might be the whole load. The total weight transferred from Progress-1 was more than 2300 kg, so about 1300 kg was 'dry weight.' (NOTE: The Soviet data says that the cosmonauts use of 20-30 kg of material per day of flight, leading to the estimate of a Progress visit needed every 43 to 65 days). Whether that figure also includes air losses during EVA, maneuvering fuel, etc., is unknown.

The Progress delivered new weighted training (anti-weightlessness) suits for the cosmonauts, as well as medical supplies to replace expired medicines in the lot originally launched on board Salyut-6. Carbon dioxide filters (presumably lithium hydroxide) were also included; as well as new bed linen and new safety straps for the chairs, and more fans.

A **Pravda**, Jan. 24 interview with Academician Boris Raushenbakh states: "Docking with two space vehicles makes it possible to hand over the station and its apparatus to replacement crews 'in flight,' without any interruption in its work.:" this avoids time wasted in mothballing and de-mothballing the station, and switching to and from automatic/remote control. So I suspect this means that Salyut-6 will never be uninhabited again, although this will call for some pretty fancy juggling of Soyuz and Progress ships at the forward and aft docking ports.

The whole Progress unloading took two weeks of almost full time and deliberate work. Special admiration should be reserved for the fuel transfer: I don't like handling nitric acid and hydrazine on the ground, let alone in space. After the transfer, the cosmonauts finished by purging the fuel transfer lines so nothing would contaminate the outside of the Salyut at separation. The Progress did two days of test maneuvers, then fired its maneuvering engine to re-enter over the north Pacific and burn up-thousands of miles short of Canada.

NOTE: The launching of Soyuz-27 seems to have been a makeshift mission whose sole purpose was to get the crew's Soyuz to the forward docking port, clearing the way for the Progress to use the aft port. The failure of Soyuz-25 in October forced the next crew to use the wrong port due to suspicions that the forward port was damaged. With the return to earth of

Soyuz-26 and the 'visiting cosmonauts,' the on-board crew was in the configuration they should have been in three months before, but with the additional expenditure of two Soyuz spacecraft/boosters (my guess at cost? In excess of a hundred million dollars each. No wonder the Soyuz-25 crew had their wrists slapped!)

The rendezvous of the Soyuz-27 was not routine, since the Soviets pointed out that "the Soyuz-26 spaceship was blocking the station's rear radio antennas, (so) the Soyuz-27 had to be (ground) guided not merely into the vicinity of the station, but precisely in line with the forward antennas in order to be in radio contact with Salyut-6." Sounds like a punt to me.

Soyuz-27 also brought new film for the on-board "MKF-6M" multi-spectral earth resources camera, made in East Germany at the Karl Zeiss-Jena plant. An earlier model of this camera was flown on the solo eight day Soyuz-22 mission in September 1976. NOTE: I suspect that film which was launched on board the Salyut-6 in September had expired by the time the Soyuz-26 cosmonauts got there, so new replacement film had to be launched on the next available transport.

The MKF camera is used in the 'Raduga' (rainbow) experiment, which records views of the earth in six bands (not specified); 90% of the photo tasks are for economic purposes, while 10% is for research in remote sensing. Since Soyuz-22, the camera was improved by the addition of an extra electronics backup unit, and two extra film cassette slots were built in. Each picture covers an area of 165 by 220 km, and each cassette carries film for 250 shots.

The two docking mechanisms, at opposite ends of the Salyut, are functionally identical (BUT NOTE: the Progress supply/tanker can apparently only pump fuel in from the AFT docking position). Once a ship is docked, a plastic air hose with installed fan is extended from a position in the station into the cabin of the docked ship.

When the two Soyuz ships were docking to the Salyut in January, there were a total of eight hatches separating the two crews: the command module hatch, the orbital module forward hatch, the docking port hatch, the aft transfer tunnel hatch, the working/transfer tunnel hatch, the forward docking hatch, the other Soyuz orbital module hatch, and the other Soyuz command module hatch.

Russia's first space walk in almost nine years took place on December 20, near midnight Moscow time. The walk had to take place over Soviet territory for communications requirements, but this

required that it take place in the middle of the normal sleep cycle and in the dark. This underlined the urgency of the walk, which was to check out possible damage to the forward docking port by the Soyuz-25 docking abort in October (NOTE: It should be recorded here that the crew of that mission, unlike EVERY previous crew, did NOT receive the standard 'Hero of the Soviet Union' award, but instead were granted a much lesser medal, clear indication that they were being held in part responsible for the failure).

The crew was in vacuum 88 minutes but reportedly Grechko only spent about twenty minutes outside, while Romanenko remained in the transfer module monitoring the EVA. Photos released by NOVOSTI show that a work platform, including handrails and restraints, has been installed on the exterior of the Salyut.

The cosmonauts spent the previous two days preparing for the spacewalk, then went to sleep early and awoke a few hours before midnight. After the walk, they stowed equipment and did not go to sleep until about 8 AM, sleeping until 4 PM. Their normal sleep cycle is a standard 8 AM to midnight awake. The EVA really messed it up.

The spacesuit has a 'hard' torso, like a cuirass of medieval armor. In the back of the cuirass is a large hatch, mounted upon which is the autonomous life support system. The cosmonaut enters the suit through this hatch and closes it by pulling on a D-ring attached to the front. Final sealing is accomplished by pulling forward and upwards on another lever on the front of the suit. The suit can be donned unaided in five minutes.

Underneath the pressure suit the cosmonaut wears another suit of elastic tubing through which water circulates for cooling. The control pack is located on the chest, with written instructions inscribed in reverse, since the cosmonaut views the dials of the control pack via a mirror mounted on his arm. The suit is so flexible that the hands can be clasped behind the head, and the gloves are sensitive enough to permit the wearer to handle small instruments or even write with a pen.

The suits are mounted on special racks in the transfer compartment. They are of one basic size to fit all cosmonauts of any height.

The Salyut has an exercycle and a treadmill, along with stress suits such as the 'Penguin' and 'Athlete' gadgets which maintain stress against the muscular and skeletal systems of the cosmonauts. Medical tests are done with a clinical multi-functional apparatus called the Polinom-2M (tested on earlier flights) and

the 'Rheograph.'

Another piece of medical equipment is the 'Beta-3' device, which records ballistocardiograms. Tests are made before, during, and after runs on the exercycle, treadmill, and the 'Chibis' vacuum suit (NOTE: This is evidently a 'lower body negative pressure' chamber like that used on Skylab).

The station has about twenty portholes of various sizes. One experiment is to determine the effect of space conditions on the optical properties and surfaces of these portholes. The crew found a scratch 1.5 millimeters deep on one porthole and it is assumed it was caused by a meteorite. In the first 1000 revolutions of the Salyut, only one 'large' particle was recorded by micro-meteoroid sensors.

Another medical device was included: the Amak-3 autonomous microanalyzer for blood samples. Possibly this device was delivered in the Progress-1, since no mention of it was made before January 27.

Footnote: A six month long 'bedrest' experiment under the direction of chief Soviet space doctor Oleg Gazenko was conducted at the 'Institute of Medical and Biological Problems' from October 4, 1976 (note space anniversary connection) through April 1977. Eighteen persons were involved in three groups: six tested preventive measures against the effects of weightlessness, six tested the measures only half as much, and six used no measures at all. All remained prone with their heads slightly lower than their feet. Gazenko is reported to have said at the end of the experiment that "it can be said with certainty that the limit for man's flight in space goes beyond six months."

Biological experiments are also important. The growth dynamics of chlorella algae are being studied, along with the effects of weightlessness on cell division.

An experiment called 'Resonance' involved jumping around in various modules of the complex and observing motion and flexure at joints to other modules. This experiment was done in all combinations of Soyuz/dual-Soyuz/Soyuz-Progress docking configurations.

The 'Medusa' experiment calls for special flasks of bio-polymers mounted on the outside of the station, exposed to vacuum and cosmic radiation. Control flasks are inside the station. They will be retrieved and returned to earth to see if living spores could indeed have crossed open space and begun life on earth.

The crew's adaptation to weightlessness proceeded normally. All negative effects of weightlessness (dizziness, nausea, headache) had disappeared by the seventh day. Every two or three days, readings with

the Beta-3 instrument are taken. Every five or six days, a more thorough examination is conducted with the Polinom-2M apparatus.

A 'group for psychological support' has been working to keep the crew psychologically healthy. Cosmonaut mood is monitored via analyzing harmonics in their voices to detect hidden tension. Special projects are undertaken to avoid any possible 'sensory deprivation' problems. Soyuz-27 brought up a tape recorder and cassettes. A videotape recorder and movies are also on board.

Vladimir Shatalov writing in 'Air Transport,' reported by TASS over Radio Moscow on January 16, tells us that the visit of Soyuz-27 crewmen to Salyut-6 means "it will be possible to send 'narrow' specialists for staging some local experiments and then quickly returning to earth." Together with the announcement that there are now "physician-cosmonauts" in training (Russia's first real "scientist-astronauts" since 1964), this suggests that a long endurance flight crew will be occasionally visited by a space medicine expert for a 'house call in orbit' and for tests to determine if the crew can continue their months-long marathon.

COMMENT: With the capability of resupplying ALL consumables of the Salyut-6, all bets on total mission duration are OFF. I would not be surprised to see cosmonauts using the Salyut-6 five years from now. By then, bigger and better things will be in orbit, but Salyut-6 could still be operational as well. And I believe Gazenko: we'll see a 180 day space visit by a crew (or single cosmonaut, as colleagues are rotated) this year.

For the first time, the Salyut crew is maintaining the same working hours as the ground support people in Moscow. This is possible because of improved communication even outside of range of Soviet in-country tracking sites.

For personal hygiene, an isolated sanitation system, and a folding shower (first on a Soviet space station) are provided.

Contact with the Salyut-6 is being maintained via the Soviet in-country tracking sites (Yevpatoriya, Tbilisi, Baikonur, Kolpashevo, Irkutsk, Ussuriysk, and Petropavlovsk) and via tracking ships at sea: the 'Volkov,' newly commissioned, is off Cuba; the 'Gagarin,' flagship of the tracking fleet, is off the coast of Nova Scotia; the 'Komarov' is in the Mediterranean. Smaller ships are in the South Atlantic. The other major tracking ship, the 'Korolev,' is in port. Three new tracking ships are in various stages of sea trials or construction: the 'Belyayev,' the 'Dobrovolskiy,' and the 'Patsayev.'

OTRAG News



The fantasy: Penthouse's version of OTRAG's rocket tests.

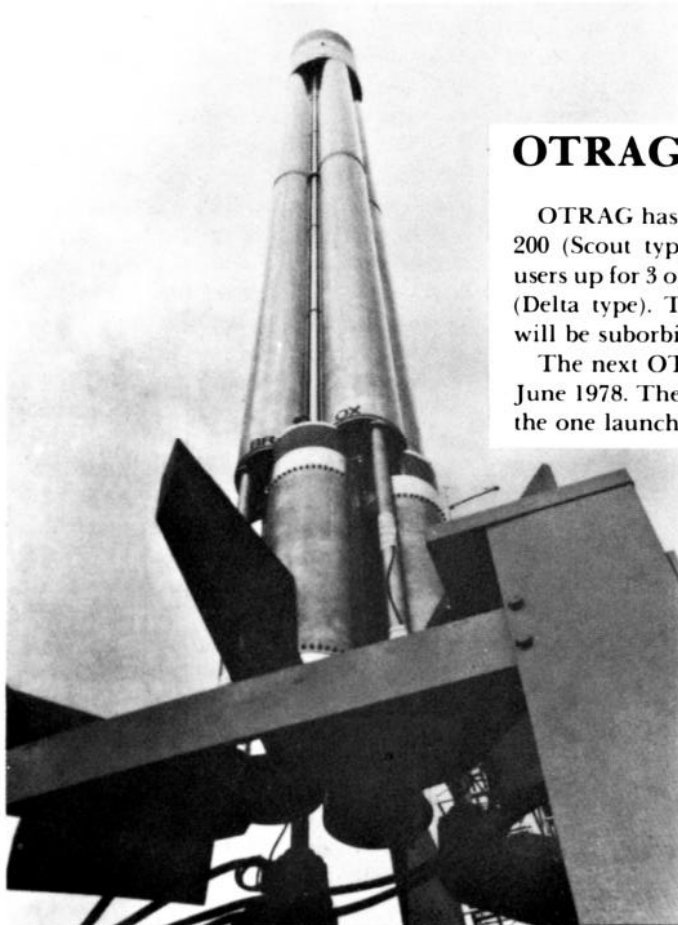
I have rarely read such a heap of fabrications and distortions as the Tad Szulc article on "Germany Rearms" in the March issue of **Penthouse**.

Szulc accuses the US of being secretly involved with German testing of cruise missiles for nuclear warheads at a secret military center in the Congo-Zaire. His article consists of a series of baseless assertions, phony 'straw men', radical clichés inconsistencies internally, and stupidities. Worst of all are the deliberate omissions of facts which do not fit.

The general consensus on Lutz Kayser and OTRAG, and on the space transportation system allegedly being built in competition with French and NASA boosters, is that Kayser is a flamboyant con man raising money for a space-age scam before absconding to Rio. On the other hand, his cheap expendable space launch booster might indeed work. It is barely conceivable that he is a front for someone else, but a few facts reveal the absurdity of that paranoid fraud.

Szulc claims that "weather satellites" are the OTRAG justification. Baloney. OTRAG says that it can build cheap boosters to undersell any client's need for

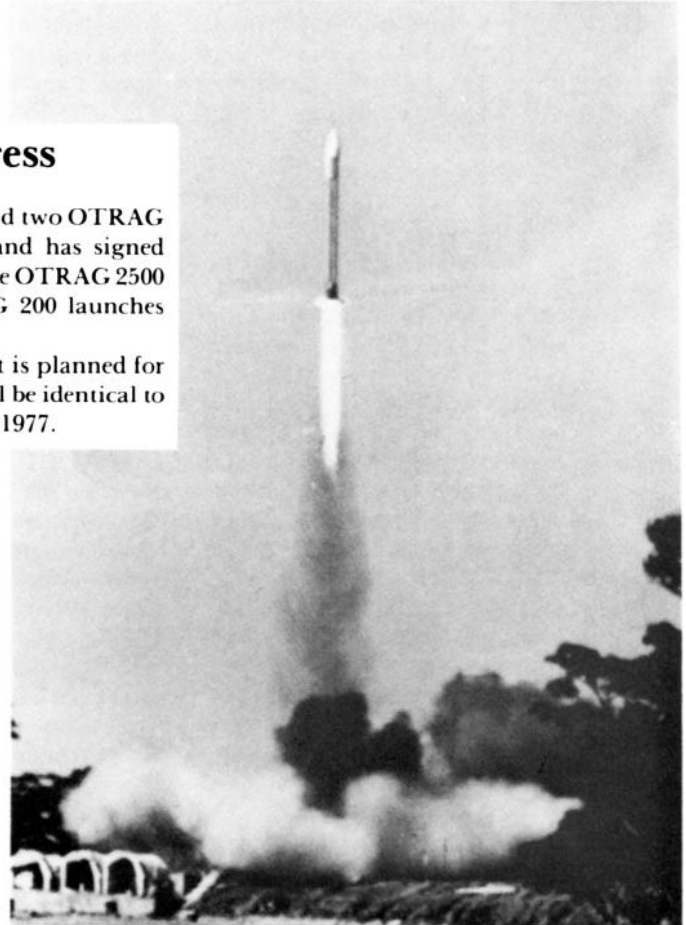
The reality: OTRAG's first rocket test May 17, 1977. Photos courtesy of Theo Pirard.



OTRAG Progress

OTRAG has recently sold two OTRAG 200 (Scout type) rockets and has signed users up for 3 options on the OTRAG 2500 (Delta type). The OTRAG 200 launches will be suborbital flights.

The next OTRAG flight is planned for June 1978. The vehicle will be identical to the one launched May 17, 1977.



1st OTRAG rocket is launched successfully from Manono, North of Shaba.

The first OTRAG rocket: an assembly of 4 independent modules which burn diesel oil and nitric acid.

satellite launchings, mainly for communications satellites. An equatorial site makes the most advantage of the earth's rotation speed. Szulc hints ominously about the nature of OTRAG's "clients", but he seems not to know (or want his readers to know) that most artificial satellites launched today by NASA are for private clients.

Inconsistencies: in one paragraph, Zaire receives "vast American economic and military assistance" . . . and in another, "American military aid to Zaire has been kept down to a small volume". Who did Szulc's research?

Stupidities: the assertion that an IRBM with a range of 1500 miles is about to be test fired from a range 300 miles across, make a full duration flight, and return to the test range!

Omissions: The Germans, as part of European space activities, have for more than ten years been working on various rocket stages for orbital launch rockets. The latest is a stage of the 'Ariane' booster now being built mainly by the French for ESA, the European Space Agency. How is this OTRAG activity any more a treaty violation than the earlier space rockets? Who did Szulc's research?

Omission: Moscow has unleashed a major wave of hysterical publicity against the OTRAG activities, seeing in them a good gimmick to whip up anti-German sentiment at home and anti-Western sentiment in Africa. Szulc does not mention this massive propaganda campaign, and why not? Could his 'sources' and 'quotes' and various 'high-level hints' all be part of the well-known disinformation activities of the USSR?

Who did Szulc's research? He tells us who by a revealing spelling error. He spells the name of MBB corporation's middle partner as "BELKOV" when it is actually "BOELKOW". It is "BELKOV" only on documents in Russian or translated from the Russian. Is that where Szulc got all his juicy anti-German "information"? And the third member is "BLOHM" not "BLAUM" as Szulc (and the Russians) misspell it. Caught in his own trap of fabrications?

Szulc's eager participation in the Moscow-inspired anti-OTRAG campaign, and his use of Moscow-supplied information without telling his readers where it came from, must disappoint readers who remember his former journalistic scruples and standards. This OTRAG abortion does not measure up to such standards of accuracy or honesty. His 'accusations' have instead pointed the finger of accusation directly back at him.

James E. Oberg
Associate Editor
SPACE WORLD magazine

While the L-5 News may have been the first publication to report on weak points in Tad Szulc's analysis of the OTRAG operation ("Penthouse Slams OTRAG", L-5 News, Jan 1978), it is not the only one.



Build your own: you, too can become a cruise missile threat with a powered, flying, 12 inch long scale model of the controversial weapon. Nuclear warheads

not included. Write or call Centuri Flying Model Rockets, Box 1988, Phoenix, AZ 85001. 602/264-0325 for details.

The Feb. 26 **Boston Sunday Globe** carried an article by Andrew Wilson which claims that "it can now be established that the East bloc of countries must have known all along that their allegations about the use of the Zaire range for military purposes are, like stories of the building of a huge military airfield and of OTRAG operating a CIA-type airline, totally without foundation . . . Three basic facts make the OTRAG type rockets unsuitable for military use. First, the diesel -- nitric acid fuel cannot be stored in the rocket tubes without danger of an explosion. . . Second, there are grave doubts as to whether Kayser can lick outstanding problems of guidance and combustion which make the OTRAG rocket a hazardous vehicle for the launching of hugely expensive spy satellites. Third, the great weight of fuel required (85% of the total launch weight), plus the weight of standard engineering components like valves, raises doubts about the payload that Kayser's larger rockets will eventually be able to carry."

Wilson notes that Tad Szulc's **Penthouse** article bears a "close resemblance to

reports in a French Marxist magazine called **Asie-Afrique**, which has been closely following the Soviet line on OTRAG. Wilson reports that the motivation behind these attacks is that "an approach has been made to OTRAG by the Chinese." Observing that they have suspended their space program since 1976, apparently due to launch problems. Wilson reports that "When recently asked whether OTRAG had actually begun negotiations with Peking, Kayser declined to comment. But when asked if OTRAG would be prepared to provide launch facilities for a Chinese reconnaissance satellite, he answered without hesitation. "The answer is yes. I do not see anything wrong with the Chinese doing the same as both the Americans and the Russians have been doing for years." Wilson also reminds us that "Russia is trying to persuade a majority of signatories to the United Nations Space Treaty to amend the treaty with a clause banning the proliferation of spy satellites (which would confirm the Russian-American duopoly in this area)."

The High Frontier

by G.K. O'Neill, paperback,
Bantam Books, 1978

Imagine a self-sufficient colonial paradise, hovering between the Earth and the moon, without cars, pollution, heatwaves or blizzards. Imagine being one of thousands of settlers from Earth, helping to build a whole universe of floating worlds.

Gerard K. O'Neill, the world's leading authority on human space colonization -- who first developed this exciting and practical concept in 1969 -- now reveals in documented detail exactly how these wonders can be accomplished within our lifetime in **The High Frontier**.

First published in William Morrow hardcover a year ago, this landmark work was released in a completely revised, updated and illustrated paperback edition from Bantam Books in January. Approximately 60 specially commissioned black and white drawings by Don Davis are featured throughout the book, illustrating the human and technical aspects of colonies in space.

Though O'Neill originated his concept for space colonization eight years ago, it is only within the past several years that it has begun to bear fruit, as NASA and many physical and social scientists, engineers and governmental and business concerns -- who once scoffed at the idea -- have become directly involved in the



Assembling solar panel arrays and concentrating mirrors of power satellite.

planning of future high-orbital communities.

In his book, O'Neill predicts that human space colonies -- "communities in which manufacturing, farming, and all other human activities can be carried out" -- will be established by the end of the century. "The normal first reaction to such a statement," he writes, "is disbelief: isn't such a development beyond us? Not at all: the settlement of space by humans could be carried out without ever exceeding the limits of the technology of this decade."

A program of expansion into the "High Frontier," according to O'Neill, would produce substantial benefits, ranging from the immediate and severely practical one of solving the energy crisis we face on Earth, to dealing with the slightly longer-term problem of population size and Earth's capacity to support it, to the non-material yet compelling notion of the opportunity for increased human options and diversity of development.

To that end, his book discusses the concrete plans which could result in such communities. He begins with a first community of 10,000 people, 4,000 of whom would work at building additional colonies, while the remaining 6,000 would produce satellite solar power stations to supply inexpensive, inexhaustible power to earth.

The High Frontier is filled with details of who will work in space and how they will get there; how gravity, agriculture, climate and time will be controlled; how each colony might choose to govern itself; and how, though the initial cost might be as high as \$100 billion, each colony will eventually pay for itself through the opening of new sources of energy and materials, while preserving our environment.

Gerard K. O'Neill is a Princeton University physicist whose studies on the humanization of space began in 1969 as a result of his undergraduate teaching. Dr. O'Neill was selected by the editors of **Aviation Week** as one of the Americans who contributed most to the development of the aerospace field in 1975. During the 1976-77 academic year, while on sabbatical leave from Princeton, he visited the Massachusetts Institute of Technology as the Jerome Clarke Hunsaker Professor of Aerospace. Most recently he was named recipient of the 1977 Phi Beta Kappa Award and was also the subject of a feature profile on CBS-TV's "60 Minutes." Dr. O'Neill lectures frequently and has contributed many articles on space colonization to scientific publications.

Lobbying for Space

by Robert A. Freitas, Jr.

Review by Carolyn Henson

Lobbying for Space is a privately published pamphlet which contains everything you could possibly want to know about the politics of space in the United States. Subtitled "The 1978 Space Lobbyist's Handbook", it is up-to-date and crammed with facts ranging from the history of NASA funding to the space related voting records of all the members of Congress. It tells you how the NASA appropriations process works, how to write effective letters, and where to write. It contains a listing of over 100 space oriented publications, including addresses and capsule descriptions, as well as the text of the 1967 Outer Space Treaty and the maps of all the Congressional districts.

In order to receive this 63 page pamphlet, send a check or money order for \$4.20 to: Space Initiative, Box 353, Santa Clara, CA 95050

I hear that you have a copy of **Lobbying For Space** by Robert A. Freitas Jr., and that you are considering reviewing it soon in the pages of *L-5 News*. You might be interested in the field testing that I have been giving it. Herewith, some statistics. Before I acquired a copy of **Lobbying For Space**, I had written a grand total of one letter to our federal government in my entire lifetime. Now, however, armed with the names, addresses, and zip codes in the pages of my **Lobbying For Space** handbook, I have been averaging about one letter per week encouraging, or chastising, various public officials for their stand on our space program. I call that a dramatic improvement. And I hope that you can convey my feelings for the tremendous utility of **Lobbying For Space** to the readers of *L-5 News*.

Jonathan Boswell
Charlottesville, VA

A Call for Space Literature

The **Michigan Quarterly Review**, formerly a literary magazine, has become an interdisciplinary journal devoted to exploring significant issues. The spring 1979 issue will be devoted entirely to the theme, 'The Moon Landing and its Aftermath.' The publication hopes to assemble as much as 200 pages of essays, memoirs, interviews, fiction, poetry, graphic works-writing in any literate form-that will illuminate the last decade of space consciousness.

It is looking for work that is thoughtful, original, a new perspective on a much publicized event. Not public relations material, but creative, individual responses. It welcomes material of any length, though anything beyond 30 typed pages stands a poor chance of being selected. All manuscripts must be accompanied by a stamped, self-addressed envelope. Payment is on acceptance and runs about \$5 to \$8 a printed page. Deadline is Nov. 1, 1978.

It is interested also in graphic materials, particularly photographs, previously unpublished, to accompany the texts.

Submissions or requests for additional information should be sent to: Laurence Goldstein, Editor, **Michigan Quarterly Review**, 3032 Rackham Bldg., Ann Arbor, Mich. 48109. Telephone number is (313) 764-9265.

Bibliography Update

by Conrad Schneiker

California Suggests Secession
New Times, November 25, 1977

This article appears unconnected with space. But among the "... top aids of California Governor Jerry Brown [who] have supplanted their dreams of national glory with the pleasant little fantasy of secession" is Stewart Brand. Brand has popularized space colonies via the *Coevolution Quarterly* and a recently published book. He also introduced Brown to the idea. The result was California's Space Day and a shift in rhetoric from the "Era of Limits" to the "Era of Possibilities," reflecting Brown's new passion for space. Brown pointed out that California's

text of the Bantam edition.

Called by Isaac Asimov "an encyclopedia of gravity-free life that ought to be on the shelf of everyone interested in writing or reading science fiction" *A HOUSE IN SPACE* describes life on Skylab from the launching and arrival of the first astronaut crew on May 26, 1973, to the departure of the third and final crew on February 8, 1974. That last crew of three men had lived in space for 84 days, the longest period in the history. Their "house in space" was a "can" (as they called it), 48 feet long and 21 feet in diameter, orbiting the earth every 93 minutes at a distance of 269 miles. Now abandoned, it is still in orbit.

The book gives a vivid reconstruction of Skylab's workday regimen, the relationships among the different crews and with ground control (the crews conversations are made public here for the first time), the scientific findings and accomplishments, and all of the expected and unexpected problems of people living and working in weightlessness. Focusing on the third and last of the crews, the author profiles the three men who stayed up the longest and proved the most independent, causing some unprogrammed differences with ground controllers.

"The best part of *A HOUSE IN SPACE*," said Apollo astronaut Michael Collins, Director of the National Air and Space Museum, "is Cooper's ability to describe the astronauts as individuals, each quite different from his crew mates, rather than homogeneous automatons."

Henry S.F. Cooper, Jr., is a staff writer for *The New Yorker* who has specialized in covering the NASA space missions. His accounts of the Apollo program were among the most popular and highly regarded reportage on our first ventures into space and were the basis of three successful books: *Apollo on the Moon*, *Moon Rocks*, and *13: The Flight That Failed*.

budget surplus is roughly the size of NASA's funding for the year. California's "GNP" ranks high compared with the GNPs of developed countries, California has astronaut Rusty Schweickart as an advisor. Note "Sacramento's stand in favor of solar over nuclear power. . ." in contrast to "plutonium and gas-crazy Washington." Nothing solid here but it makes for interesting speculation. What if . . .

Learning to Build Large Structures In Space

Thomas Hagler, Herbert G. Patterson, C. Allen Nathan

Astronautics & Aeronautics, December 1977

Suggests orbital demonstration projects to verify space construction techniques and technology needed for building large space structures.

Return To Mars

Richard C. Hoagland

Analog, May 1977

Describes possible manned and unmanned trips to Mars that are made possible using solar sails put in space by the space shuttle. Note: these are what might be termed "old technology" solar sails in contrast to the newer, more efficient "built in space" designs.

Space Roles For The Less Than Superpowers

James J. Harford

Astronautics & Aeronautics, December 1977

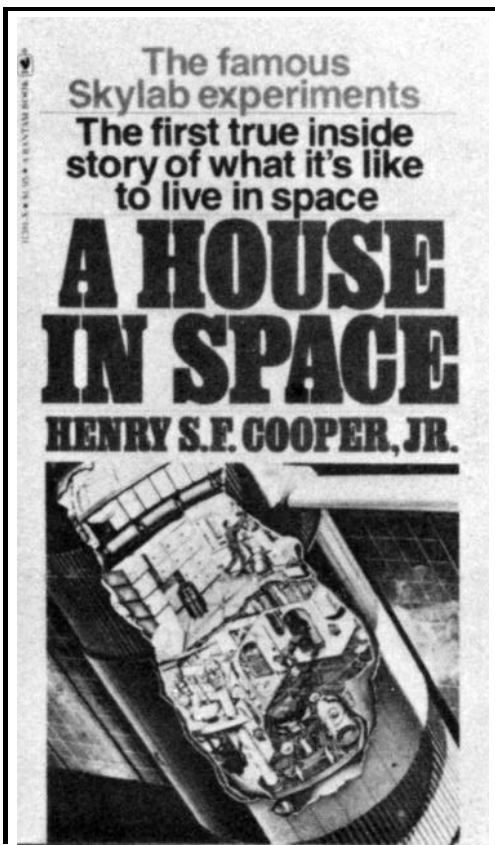
At the 28th International Astronautical Congress, Arthur C. Clarke (and others) criticized O'Neill's paper for his cost estimates of space industrialization. Clarke guessed that they were low by a factor of a hundred, contrary to every major study on the subject. O'Neill rejoined, "I propose a codicil to the third Arthur Clarke theorem, 'after engineers and scientists go on record with expressions of opinion, no matter what data are presented, no opinion is going to change.'" (Clarke's law concerns the fallability of distinguished old scientists who go on record stating that something is impossible to do.)

Frontier Law

Arthur M. Dula

Analog, August 1977

The development of space law and the major factors that have shaped it are discussed. "A continuing question that will face space law in the distant future will be which system of laws will direct the lives and economic production of the people who live in space. At the present time we have two candidates for the position: free enterprise from the United States and central state planning from the Soviet Union."



Bantam Books, 1978

How does it feel to live in space? What is it like to eat, sleep, breathe and communicate in a gravity-free atmosphere?

The recent Skylab program -- our first successful experiment in living in space -- provided some of the answers and probably has even greater significance for the future of space exploration than the Apollo moon missions. The first book to present in sharp, behind-the-scenes detail just what happened aboard Skylab, *A HOUSE IN SPACE* by Henry S.F. Cooper, Jr., was published in paperback by Bantam Books on February 1. Fifty-four extraordinary NASA photographs are interspersed throughout the

The REALITY of the NEAR FUTURE -- 1992

A Course Offered at California State University, Northridge, California (Sociology 396D), Summer Session, June 27 - August 4, 1978.

Course Objective: The focus will be on the sociological dimensions relating to the possibilities of creating a better life in space and on earth by investigating the problems involved in the development of community social and cultural systems for large space habitats. In order to bring home the near reality of the whole venture, some speakers will cover the technological parameters and current possibilities for actually building habitats in space and working in them. Others will consider the impact life in space will have upon people in space communities and here on earth.

Course Outline:

- I. The Near Reality of Living and Working in Space: Getting There, Building There, Working There, and Living There.
- II. The Impact for Earth: Technological, Economic, Political, and Social.
- III. Difficulties and Risks: Military, Political, Economic, and Social.
- IV. The Chances for Making a Better Life for Humankind: Effects on the Third World, Humanity's Changing Consciousness, Planning for Freedom, and Life Beyond the Galaxy.

Some **Possible** Topics:

- "Star Wars: What is Technically Possible Today"
- "Industrialization -- The Long Range View and the Near and Immediate Steps"
- "Getting There via Shuttle and Space Lab"
- "Consequences of Isolation and Confinement"
- "Breaking the Limits to Growth -- Economic, Social, and Personal Implications of Space"
- "War and the Military in Space"
- "The Extraterrestrial Imperative: The Next Step in the Evolution of Man's Social Life"
- "The Evolution of Consciousness"
- "Space is for People"
- "New Products from Space: Optics, Medicines, Electronics, Metals, etc."
- "What the Future will Look Like -- a visual and auditory preview"

"Building New Community Systems in Space"
"Solar Power"

FEATURES:

Talks by about fifteen people now working on space activities in Private Industry, NASA, the military, and the university;
Trips to see the Orbiter being built and other space technology;
Luncheon Meetings where 3 to 4 people will have lunch with at least one of the speakers;
Slides and Space Materials from NASA and Private Industry will be made available for teachers for use in their classes;
Development of Units on Space Settlements can be selected by teachers as a term project;
Class Discussions of how man can make a better life in space and for the earth.

SOME OF THE PARTICIPANTS WILL BE:

- Richard Johnson, Ph.D.*
Chief of the Biosystems Division
NASA/Ames
Director of the 1975 study on Space Colonization and Member of the Viking biology experiment team.
- Eric Burgess*
Co-founder of the British Interplanetary Society
Author and lecturer on Space
- Charles L. Gould*
Project Manager for NASA Space Industrialization Contract,
Rockwell International Corporation
- J. Peter Vajk, Ph.D.*
Staff Scientist of Science Applications, Inc. on long range planning for NASA on space industrialization;
Author of an article, "The Impact of Space Colonization on World Dynamics" and a forthcoming book, *Foundations For a Choiceful Future* which examines the emerging potential for humanity on Earth, both in outer space and inner space.
- Captain Stanley G. Rosen, USAF*
Space and Missile Systems Organization
Author of "Mind in Space"
- Harrold Emigh*
Planning and Design Systems for Space Transportation
Rockwell International Corporation
- Faren R. Akins, Ph.D.*
National Research Council Research Associate
Effects of Isolation and Confinement
NASA/Ames
and others

This Program is being supported by a grant from Rockwell International Corporation.

For Further Information:

Call or Write: Dr. B.J. Bluth
Associate Professor of Sociology
California State University,
Northridge, Ca. 91330
213-885-3591 (Leave your number and a good time to return your call)

If people want to register for the course by mail, the following information is important:

All mail registration must be made between May 1 and May 26.

All fees must accompany the application.

Audit or Credit	
at \$39.00 per unit	\$117.00
Student fees	11.00
Total	\$128.00

The application should include the following information:

Name, address, phone, sex, birthdate, class level and present school if relevant, and course and ticket number. Applications will be taken in order of reception.

There is a limit of 48 places in the course. Send to:

Office of Continuing Education
Calif. State University, Northridge
Northridge, Ca. 91330

Anyone interested in housing can write the Housing Office (same address) or call 213-885-2396.

15th Space Congress

Four generations of Astronauts will participate in a panel discussion with Kennedy Space Center Director Lee Scherer as panel chairman at the Fifteenth Space Congress, April 26, 27 & 28 in Cocoa Beach, Florida, Bill Holmes, Space Congress General Chairman, announced today.

Deke Slayton (Mercury & Apollo/Soyuz Test Project), Manager of the Space Shuttle Orbital Test Flights; John Young (Gemini 3 & 10, Apollo 10 & 16), Chief of the Astronaut Office; Vance Brand (C.M. Pilot - ASTP) Shuttle Orbital Flight Test Training; and Joe Engle, Pilot of the Space Shuttle "Enterprise" will join Lee Scherer in "Meet the Astronauts," a panel session free and open to everyone in the universe beginning at 7:30 p.m., Thursday, April 27, in the Cape Colony Convention Center, featuring opening remarks followed by an audience question and answer period. This will be one of three panel sessions

held throughout the S-day symposium.

The first panel, titled "Space Today," will be chaired by John Yardley, Associate Administrator for Space Flight, NASA Headquarters, Washington D.C., and will begin the Congress Wednesday morning at 8:30 a.m. also in the Cape Colony Convention Center.

On Friday, April 28 at 8:30 a.m., the theme of the 15th Space Congress: "Space -- The Best Is Yet To Come" will be the topic of the final panel to be held at the Atlantis Beach Convention Center. Dr. George Morgenthauer, Vice President and General Manager, Martin Marietta Aerospace, Baltimore Division will be Chairman of this panel.

The final event of the Congress will be the Youth Science Fair Awards Ceremony at the Atlantis Beach Convention Center followed by the Patrick Air Force Base Open House featuring The Thunderbirds.

The Space Congress is a non-profit symposium sponsored by the 26 member Canaveral Council of Technical Societies (CCTS), and is held annually in Cocoa Beach, Florida. For more information, write: SPACE CONGRESS, BOX 1333, Cocoa Beach, FL 32931.

SPS Talk

J. Peter Vajk will give a talk on solar power satellites 8:50 PM at the Symposium on Energy Technologies at the Radiation Research Society Meeting in Toronto, Canada May 14.

Before Creation a Presence Existed,
Self-contained, complete,
Formless, Voiceless, Mateless,
Changeless,
Which yet pervaded itself
With unending motherhood.
Though there can be no name for it,
I have called it "The Way of Life"
Perhaps I should have called it "The
Fullness of Life,"
Since fullness implies widening into
space,
Implies still further widening,
Implies widening until the circle is whole
In this sense
The way of life is fulfilled,
Heaven is fulfilled, Earth fulfilled
And a fit man also is fulfilled:
These are the four amplitudes of the
universe
And a fit man is one of them:
Man rounding the way of earth,
Earth rounding the way of heaven,
Heaven rounding the way of life
Till the circle is full

Lao Tzu (604 BC)

Inside the L-5 Society

Raleigh L-5

Raleigh L-5 opened shop on February 11, 1978 with a meeting of co-ordinating members Rupert Hazle, Larry Williams, and Tim Katterman.

Three first objectives include:

a. spreading information about space colonization and industrialization when ever and where ever possible.

b. establishing a library of technical information

c. designing fund raising projects to finance research such as Gerard O'Neill's 500g mass driver.

First projects include preparation of statistical testimony for use at the Carolina Power & Light Wake County Nuclear Power Plant Hearing and attending 'Great Decisions 78' -- a group of discussions sponsored by the Foreign Policy Association to help citizens direct U.S. Foreign Policy goals.

Interested people in the Triangle Area should write P.O. Box 5381, Raleigh, N.C. 27650 or call (919) 833-1398 for details of meetings or questions.

Norfolk, VA L-5

Those interest in forming a Norfolk, Virginia L-5 chapter should contact David Howland, 719 Graydon Ave., Norfolk, VA 23507, 622-5983.

Philadelphia L-5

The Space Futures Society here in Phila. is very alive and kicking. Since our inception on Aug. 13, 1977 we have been continually growing and reaching new plateaus of attendance. Two of our most distinguished members, Kenneth McCormick and Jon Alexander have been doing personal lobbying in Washington and corresponding for the L-5 News. A new member, Dr. Lee Valentine, is organizing a spinoff chapter within Jefferson Hospital of Phila. in which he hopes to galvanize Doctors throughout this area into a political lobbying effort. Dr. Lee Valentine has personally supervised a fund raising drive in which \$2500.00 has been raised locally for S.S.I. through his efforts. Another member Mark Hess is coordinating efforts to penetrate the war games clubs and is head of an independent committee to design a space colony survival game. Peter Kazlowski is in charge of our NASA film procurement.

Our meetings are now held monthly. We are currently at the Broad and Morris Free Library but starting in June we will meet

again at the Central Library on the Parkway. Our first meeting will be 10 a.m. June 10. From July on we will be meeting the first Sat. of every month at 10 a.m.

We had a public lecture and slide show on April 1st at 2 pm at the Marple Twp. Free Library, Springfield and Sproul Rds. Broomall, Pa. 19008. We are also taking part in the "Sun Day" Celebrations on Wed. May 3rd at 7 p.m. in the Central Library. We will also be holding a lecture and slide show on June 3, 1978 at 1 p.m. at the Frankford Y.W.C.A., 4606 Leiper St., Phila. Pa. 19124. We are hoping to have the "Libra Colony" film in time for these lectures.

Houston L-5 Meeting

Public service announcement for Houston area L-5ers: The Houston chapter of the L-5 Society will hold its April meeting on Friday, April 21, at 7:30 PM in the University Center of the University of Houston.

MASC News

The National Governor's Association held its annual meeting Feb. 26 to Feb. 28 at the Hyatt Regency Hotel in Washington D.C. In attendance were 52 of 54 Governors. The Maryland Alliance for Space Colonization (MASC) spent Sunday the 26th trying to gain the attention of the Governors so as to tell them about space solar power. The main thrust of the conference was energy production and conservation. The issues discussed by the Governors included oil and natural gas, coal, nuclear energy, outer continental shelf development, renewable resources programs and energy facility siting.

The topic of solar power energy, however, was not on the agenda. In the course of a press conference we were able to ask Governor Milliken, Chairman and Governor of Michigan, and Governor Jerry Brown of California about space solar power systems.

We asked Governor Milliken "Have you discussed solar power satellites as a permanent alternate source of energy and will you be discussing it as a possibility?" He stated that "It came up briefly and we recognize it as an important issue." but he felt there were more immediate issues to be discussed at the present conference.

Even more significant and positive were

the statements made by Governor Brown in a later press conference, which was set up at our request. Governor Brown spoke to the media and replied at great lengths to our solar power questions.

Governor Brown underscored the need for increased research on alternate energy sources and especially solar power. He stated that one space solar power station could replace the need for 50 nuclear power stations and that the geothermal energy available in California alone could replace an additional 20 nuclear power stations.

When later we were able to ask him his thoughts on House Concurrent Resolution 451 (introduced by Olin Teague of Texas), he said "Yes, we would like to see much more attention directed towards alternate energy sources." In fact in his opening statement he spoke strongly of alternate energy sources, referring to a large prominent MASC banner, which we had located nearby.

We were also able to talk briefly to Governors Exon of Nebraska and Governor Bolin of Arizona, who requested that we get Dr. O'Neill to send him information on the matter. In general, all of the Governors, members of their staffs and members of the press whom we contacted expressed positive interest, but were uninformed as to space solar power alternatives. Perhaps a matter for local L-5 chapters to pursue!

Michigan "Missal"

The Missal, the newsletter of the Michigan L-5 Society, is still going strong. Following is an excerpt from the March issue.

On January 24-26, Year of our Lord 1978, the Space Science and Applications Subcommittee of the House Science and Technology Committee convened to hold hearings for the purpose of examining our future space program.

The testimony of the first day consisted of industrialists. The most exciting proposal offered was an experimental platform in geosynchronous orbit where studies could be done to determine the feasibility of powersats (earth-based configuration) by the late 1980's. As was to occur several times in the next couple of days, the committee members appeared bored and frustrated at the lack of imagination displayed by the witnesses. This was heartening to L-5 partisans. The only memorable statement was that made by G. Harry Stine concerning cutting back the shuttle fleet from five to four. He made the comment that O.M.B. reminded him of the Senator in 1908 who asked, "Why does the Army need another airplane. They

already have one." The legislator also suggested that rather than giving the Army and Navy each an airplane, they could share one and take turns flying it.

The second day's proceedings were more interesting. The witnesses were the president of Martin-Marrietta, the head of the National Academy of Sciences, Gerard O'Neill and Barbara Hubbard. After being placed in a somnolent state by the first two witnesses, Ms. Hubbard's vibrant rhetoric brought the committee room to life. This was what the committee gallery had been waiting for and her words paved the way for Prof. O'Neill. Dr. O'Neill summarized the results of the 1977 NASA-Ames summer study which showed that there were no show-stoppers to the concept. He also showed a film of the M.I.T. mass-driver. The congressmen seemed duly impressed. In questioning afterwards, O'Neill told the committee that he would need a million dollars in the next year to continue his research. Some members expressed astonishment at the low figure. Dr. Handler, N.A.S. chairman, was asked if there were any major technical breakthroughs required for O'Neill's scheme. There was a long pause, seemingly for dramatic effect, and then a reluctant "No." Barbara Hubbard was asked why NASA was not carrying through with these plans. She replied that Dr. Frosch seemed to be committed to limits to growth. Dr. Handler interrupted and suggested that she let Dr. Frosch speak for himself. Chairman Teague concurred and said, somewhat ominously, that he would be given every chance to do so on the following day. We went to bed that night maliciously gladdened at the prospect of Frosch's roasting on a slow spit in the committee room the next morning.

Alas, it was not to be. The NASA administrator was allowed to give his testimony and get away without questioning to attend the appropriations hearing in another building. Before he left, however, he unveiled the space agency's exciting plans for the future: more earth resources satellites and a more advanced communication satellite. He also opened his testimony with the statement that his role was not that of a Columbus, but rather of one of Isabella's counselors. I'm not sure personally how to interpret this. If I recall my history correctly, Isabella hocked her jewels and funded Columbus against the advice of her counsel. In this light, Dr. Frosch sees himself as an obstructor rather than an originator or facilitator. It is obliquely comforting to see that he is at least consistent; his self-view coincides with his actions. One of the few questions he did answer concerned powersats. His answer was to the effect that while they

might be technically possible, he was not convinced or, at best, didn't know whether or not they would be economical. He claimed disbelief of the many favorable cost-benefit analyses done of the subject.

Carter's science advisor, Frank Press, was the next witness. He was destined to receive the flak that should have been reserved for Dr. Frosch. His performance was almost pathetic. Dr. Press had the misfortune of possessing the voice and total lack of inflection of the computer "HAL" from the movie *2001: A Space Odyssey*. His testimony consisted of apologies for the Administration and a feigned enthusiasm for the space program. One of his more outrageous statements, coupled with his monotone, evoked open derision and laughter from the gallery. Re: SSPS. "We simply don't know anything about them." If this is truly the case, perhaps Dr. Press should be replaced by someone who does know something about them. I find it at least disconcerting that someone endowed of such profound ignorance is advising the President.

The foregoing was only a thumbnail sketch of the proceedings in Washington one month ago. My editorializing will be forgiven, I trust, with the realization that this is not strictly a news story, but rather my own impressions and reactions to recent events to which I was a witness. To summarize: I was cheered by the fact that several members of the committee seemed almost as impatient with the Administration as we are. We have several friends in Congress and these friendships should be carefully nurtured with letters and phone calls. In particular, Rep. Scheuer of New York City should be given thanks and support. The most helpful thing that could be done with respect to him would be to write him descriptions of the ways that our program would directly benefit the inhabitants of his district. This was a query that he put to O'Neill that wasn't properly responded to. Anyone who can think of some immediate, direct benefits to the urban areas should send them directly to him or else to us to be relayed to him.

--*The Missal*, \$3.00/year, Box 126 Michigan Union, Ann Arbor, MI 48109.

The L-5 Society is attempting to build a comprehensive file of newspaper and magazine articles concerning space; particularly on space colonies, solar satellites, etc. These would be used both to keep track of media and public opinion, and to have a list of writers and publications which have taken an interest, pro or con, on the subject. Local papers and magazines are as important as national ones in this respect. L-5ers are encouraged to send all relevant articles to the National office.