

L-5 NEWS

A Newsletter from the L-5 Society
Number 8 * April * 1976

MSFC SYMPOSIUM ON SPACE INDUSTRIALIZATION

A two-day symposium on "Space Industrialization" will be held at the NASA-Marshall Space Flight Center, Alabama, May 26-27.

To be sponsored jointly by the Alabama Section of the American Institute of Aeronautics and Astronautics (AIAA) and the Marshall Center, the symposium will cover four primary topics: Space Habitation, Space Transportation, Space Processing, and Space Power.

Participation will include NASA centers and organizations, other government agencies, industry and universities. Invitations to present papers on the current status of the topic areas is expected to draw national as well as local response.

The general purpose of the symposium is to disseminate the latest information on planning of expanded space operations following the advent of the Space Shuttle to all segments of the scientific and technical community.

James A. Downey III, deputy director of MSFC's Program Development directorate, will be the chairman for the event.

The two-day event will be held in the Morris Auditorium of Marshall Center's headquarters building (Bldg. 4200). There will be no fee for attendance and registration will begin at 8 A.M. on May 26.

For more information, call Christine Duncan, 205-453-0034 or write Marshall Space Flight Center, AL 35812.

THE SCENE IN WASHINGTON

In 1972, President Nixon advised NASA officials to lie low, keep quiet, and plan on a constant level budget. They were told to expect to squeeze by on somewhere between \$3.85-3.9 billion by 1977, the year in which the Space Shuttle budget would peak.

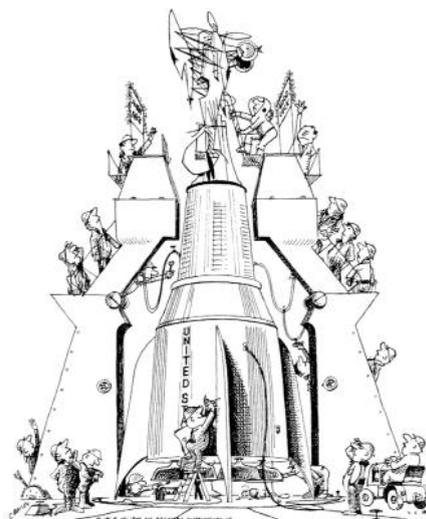
NASA has had to pull in its belt even tighter than expected. This year, NASA is getting by on \$3.562 billion, and the Office of Management and Budget (OMB) has allowed only \$3.697 billion for Fiscal Year 1977 -- an increase so small it does not compensate for inflation.

The FY '77 budget contains no funds with which to continue NASA's solar power satellite research. However, as the March L-5 News reported, the NASA Authorization Bill for FY '77, put together by the House Science and Technology Committee, added \$5 million for solar power stations. Another \$3.5 million was added for ground-based solar energy applications.

In an effort to appease the budget watchdogs, both within Congress and OMB, however, the Committee kept the overall NASA budget within the \$3.69 billion figure by dropping some other programs that OMB had allowed.

Most significant is a cut of \$8 million from Development Test and Mission Operation (DTMO). These funds are part of the Shuttle R&D budget. The Shuttle is essential for the construction of the 200-person orbiting facility, planned to be completed in 1983-85 (given appropriate funding), at which solar power satellite construction techniques will be developed. A strong case could be made that funding power satellite research by diverting Shuttle funds is counterproductive.

When the NASA Authorization Bill reaches the Appropriations Committee, it is likely that the unbudgeted solar power research funds will be rejected, considering the penny-pinching mood of Congress. What is even more likely is that the DTMO cut will also stand, even though its funds had been allowed by OMB, leaving NASA with even less money on which to operate in FY '77.



REMEMBER THE BUDGET

SPACE COLONIZATION AND THE SOVIET UNION

Phillip J. Parker

Although the Soviet Union has not categorically stated that it will undertake space colonization, there are many references in the Soviet press which imply that this may be a long term goal for them.

Russia's current program, the Salyut-Soyuz space station, is aimed at developing techniques for the operation of what Soviet scientists term "orbital stations." The Salyut space station (of which Russia has launched four in recent years) is smaller than the American Skylab but appears to be manufactured along the lines of Europe's Spacelab, i.e., on a modular production basis.

The Salyut space station has a number of interesting experiments that will have application to the so-called "Spacebases"

(space stations housing up to two hundred people) and, possibly, to space colonies.

Several Soviet scientists have stated that many of the experiments being carried out within the Salyut space station program are aimed at developing new techniques for large permanent orbital bases.

In an interview with the Soviet newspaper, *Izvestia*, August 1975, Academician V. Glushko stated that "There can be no doubt that in the future the crews of orbital stations will be international and space exploration will become a matter involving that whole planet."¹

Another statement by Academician Glushko was, in reference to the Salyut 4 space station, "Today we have an orbital station to conduct research; tomorrow it will have production purposes. Today the station is handled by two or three men; tomorrow tens or hundreds of people will work there. Today this is only a station; tomorrow it will be a satellite city with everything such as a city has on earth."²

Another leading scientist, Academician Boris Petrov, said in an interview with *Trud* that it will eventually be possible to build superlarge, multipurpose complexes designed for a crew of fifty to one hundred persons. Also he envisioned the use of standard units that could be assembled in space using space tugs. He also foresaw the need to provide artificial gravity in the large orbital stations of the future.³

The construction of large orbital stations will require cheap methods of launching payloads into near-earth orbit, which invites the use of reusable rockets like, for instance, NASA's Space Shuttle. Do the Soviets have any plans for a reusable rocket?

In an article in the Moscow journal, *Nauka i Zhizn*, cosmonaut Vladimir Shatalov said that "The development of a spaceplane is quite feasible The time is not far off when such a plane will make its first flight." He described this spaceplane and suggested that the most acceptable design was for an unpowered first stage and a piloted second stage, with as many units as possible being reusable.

Soviet space scientists are carrying out a number of important experiments that will have application in large orbital stations and, perhaps, space colonies. Many of the concepts for space colonies so far proposed have envisaged the production of "artificial" gravity. On November 25, 1975, the Soviet Union launched the Cosmos 782 biosatellite, and one of the experiments carried aboard was a small centrifuge for testing the effect of artificial gravity on small land tortoises. The results from this successful experiment should be significant for future development programs, as the earlier Cosmos 605 satellite carried land tortoises in a weightless condition and the

two sets of results can be compared and new experiments devised for further testing of ideas for artificial gravity.

Another space colony concept which the Soviet Union has taken the first steps in developing has been the growing of food for orbital base crews. During the Salyut space program, successive crews planted and grew several "crops" in the "Oasis" experiment. These included peas and onions. Of 20 peas planted in Oasis, by the first Salyut 4 crew, only four sprouted. The second crew planted 28 peas and a greater number sprouted. In another container, microscopic alga chlorella was grown.

Soviet scientist Alexander Kamin pointed out that these "cosmic factories" producing albumen and oxygen can be described as "models of the future space industry."⁴

At the Institute of Medico-Biological Problems of the USSR Ministry of Health, problems of life support during prolonged space missions are being studied, including closed ecological systems of the type that will be required for space colonies.⁵

At the Institute, vivarium experiments are being conducted using poultry. They feel that human food must include animal protein; in selecting animals for an ecological system, emphasis is being placed on species that are not fastidious about the choice of feed and are easy to care for. Other factors include caloric content and taste.

The Institute considers that soil in a space farm will be replaced by micro-organisms which will decompose solid organic substances and purify liquids. They also consider that the atmosphere will be filled with oxygen by using algae.

The Institute has conducted a successful one-month experiment in which a man, isolated in a test chamber, lived with the air being cleansed using chlorella.

In another laboratory, plantations of white cabbage and beets are growing in beds set up at table level. The sprouts of these crops are in special holders with the roots placed in baths holding nutrient solutions. The Sun is being simulated using xenon lamps. These early tests are aimed at developing a fully-closed ecological system for future orbital bases and they definitely have application to space colonies.

Besides the growing of small plants in Salyut-4, the Soviet Union also demonstrated the recycling of water in this space station. Condensate was collected and purified and used for domestic purposes. Later in the mission, the two cosmonauts used the purified water for drinking purposes.⁶

Even from the few references given here it can be seen that the Soviet Union is intent on creating large orbital bases in near-earth orbit that will house up to one hundred people, providing them with artificial gravity, a closed-system self-

supporting space farm, and having close links with the earth and other space stations through the use of spaceplanes and space tugs.

These "mini-colonies" will be the forerunners of the larger space colonies that members of the L-5 Society foresee at the liberation points.

Comments made by many of the Soviet Union's leading space system designers and administrators indicate that they wish to see the development of space to be undertaken on an international level for the benefit of humanity. This wish, which is also the hope of many people in the USA and Europe, has already begun to be realized through the joint USA-USSR Apollo-Soyuz project and the USA-Europe Shuttle-Spacelab program.

Will the next step be an orbital complex in the early 1980s involving the American Shuttle, Europe's Spacelab, and the Russian Salyut? This would be the forerunner of humanity's first international space colony!

USSR Novosti news service bulletins:

1. 16315, August 5, 1975.
2. 15759, January 14, 1975.
3. 15835, February 5, 1975.
4. 15584, November 21, 1974.
5. 16096, April 29, 1975.
6. 16315, August 5, 1975.
7. 15775, January 21, 1975.
8. 16177, June 23, 1975.

SPACE PROGRAM: BOONDOGGLE TO BOON

*Reprinted from Foreign Affairs
Newsletter, March 1, 1976.*

A number of people think that it would be both practical and desirable to establish a permanent manufacturing facility in space. . . . Government interest in high-orbital manufacturing stems in part from calculations about its economics. The task of colonies in space would be to build and operate huge power plants that would convert sunlight to low-density microwaves and beam them to earth where they would be converted to . . . ordinary electricity The levels of technology required to do all this have already been achieved. . . . A private, perhaps multinational, investment in the first colony could be returned several times over in profits.

This may read like Jules Verne. In fact, it is a *New York Times Magazine* editorial note of January 18 which accompanied Professor Gerard K. O'Neill's article, *Colonies in Space*.

All we need to turn what many have viewed as space boondoggles into practical and economic ventures on earth, it seems, is money. And money is easy to find if we and the Russian use our heads.

What is needed now is a vigorous effort to get agreement with the Russians to reverse the arms race by each reducing expenditures on military hardware-by say 5 percent a year-over the next few years and to devote those savings to

constructing space hardware in a cooperative venture. Space colonies established by such cooperation would be capable of developing solar energy and transmitting it to earth in usable and economic quantities.

Here are the arguments:

1) Arms expenditures by the U.S. and the U.S.S.R. have been escalating since the end of World War I. These nations have not been able to agree to stop the race or even to slow it perceptibly. The race could be slowed by diverting the energies of our respective military industrial complexes away from using our limited earth resources to build military hardware for destruction, and direct them instead toward producing hardware with a potential for the acquisition of energy usable on earth.

2) A joint space venture financed equally from U.S. and U.S.S.R. military budgets would not impair the respective military security of either side vis-a-vis each other.

3) A number of reputable economists believe that public economic indicators are now of such reliability that Russian cheating by secretly keeping their military expenditures high while inducing the U.S. to divert its military expenditures to joint space ventures, would easily be detectable, thus mitigating the perennial problem of verifiability in negotiating agreements with the Russians.

4) Americans and Russians already have worked together to explore the Antarctic and have cooperated in space ventures. The scientists of both societies in many spheres have subordinated their ideological differences and worked together for a recognized common good.

5) The space programs of the U.S. and the U.S.S.R., bred in a race to the moon, are now in search of missions. What better mission than a joint effort to capture the solar energy of space for use on earth where existing sources of energy are finite and where their use is too often damaging to the environment?

6) The economic impact of a shift in Government spending from military hardware components to space hardware should be minimal for each society.

Finally, after 30 years effort we seem to have exhausted all means to bring arms expenditures under control. We all recognize that excessive resources of the American and Russian societies are dedicated to creating better means to destroy life rather than to preserve it.

It should not be beyond the ingenuity of our respective governmental leaders to take first steps toward substituting cooperative space ventures for the boondoggle of military competition. Within American society we should be able to look to the Arms Control and Disarmament Agency and the National Aeronautics and Space Administration for imaginative and sustained leadership.

Carl Marcy

US-USSR L-5 VENTURE?

Carl Marcy, Legislative Counsel to the Council for a Livable World (CLW) has informed the L-5 News that they are "trying (to put the matter baldly) to do all we can to get the U.S. and U.S.S.R. to agree to cut back funds spent for military hardware and to devote them instead to such constructive projects as L-5."

Writing to James C. Fletcher, Administrator of NASA, Charles Price, Chairman of CLW and a former president of the American Chemical Society, proposed that, "I would like to see us and the Russians each reduce our military expenditures by, say, 5% or more over the next few years and devote those savings to scientifically and economically feasible cooperative space programs, such as proposed by Professor O'Neill. . . . By beginning to work together in developing solar energy in space we should be able to get away from competition in using limited Earth resources to produce weapons of destruction and move toward cooperation in the acquisition of energy usable on Earth."

Fletcher replied, saying: "We believe that a strong case can be made for a greater investment in space, and international cooperation is an important way of increasing the return on that investment. . . . Space may be an important factor in utilizing solar energy, and if we proceed with it, the possibility of working in cooperation with other nations could be considered very seriously.

"As for the Soviets, a key question is the attitude which they may take toward future space cooperation. For our part, we hope to maintain the momentum developed in the Apollo-Soyuz Test Project.

"We have sensed a similar interest on the part of the Soviets, but we are not yet able to assess its depth and scope. We do expect to meet with representatives of the Soviet Academy of Sciences in the next few months to discuss post-ASTP cooperation.

"To cooperate in the development of solar energy in space would require skills and confidence far beyond what were developed in ASTP. Therefore, assuming the most positive attitude on the part of our Soviet colleagues, we would still be some years away from so complex an undertaking."

CLW is currently awaiting a response to their request for a cooperative U.S.-U.S.S.R. L-5 venture which they made March 15, 1976, to Fred C. Ikle, Director of the Arms Control and Disarmament Agency.

SPACE COLONIZATION AT LUNAR SCIENCE CONFERENCE

T. A. Heppenheimer

The Lunar Science Conference is one of the major technical meetings involving the space sciences. It is held annually, at

the Johnson Space Center in Houston, and primarily involves discussions of current lunar studies, as well as of studies on returned lunar samples. This year, Dr. David Criswell, of the Lunar Science Institute, organized a special session. The topic was "Utilization of Lunar Materials and Expertise for Large Scale Operations in Space."

The meeting was held from 2:00 P.M. through about 6:00 P.M., March 16. The speakers had been invited to present a broad, comprehensive view of the problems and opportunities. Nearly every paper either touched directly on the matter of space colonization, or contained material pertinent to this matter.

Hubert P. Davis of JSC led off with a review of NASA's interest in, and support of, work on power satellites. The bulk of his talk concerned the approach of assembling powersats in earth orbit from material brought up from the ground. He noted that the greatest problems then would involve construction methods and productivity, and that there was in progress a study at the Martin Co. on automated assembly in orbit. He expressed the hope that there would be ten powersats by the year 2000, and 100 in 2025, each generating ten gigawatts of power.

In response to questions, he noted that the power beam density would be such as to deliver no more than 35 milliwatts per square centimeter of power, absorbed within the atmosphere. He stated this was an environmentally safe level. He also described NASA experiments in power transmission in California, and noted that "no dead birds have been found beneath the rectenna. However, this may be due to the presence of coyotes."

Gerald Driggers of Southern Research Institute noted that oxygen, available as a by-product of metal extraction processes, would greatly lower the propellant requirements for space flight. He discussed a class of launch vehicles with payload of 500,000 pounds, noting that availability of lunar oxygen would permit a fourfold reduction in the gross liftoff weight.

David Criswell reviewed O'Neill's work on lunar mass transportation, and suggested that hydrogen from the solar wind, implanted in the lunar regolith, would be a valuable resource. The concentration is 40 parts per million. In a subsequent paper, Richard J. Williams, of NASA Headquarters, made similar suggestions concerning nitrogen. He stated the nitrogen concentration is 100 parts per million and is higher in fine-grained materials.

Charles Holbrow, one of the leaders of last year's Summer Study, reviewed the work of that study and suggested that further attention be directed to colonizing the moon. In response to a question, he said the Summer Study report might be out in "two or three

months-but I've been told that for the last six months."

Richard R. Vondrak, of Stanford Research Institute, discussed the possibility of a large radio astronomy facility on the lunar farside. He stated that such a facility could involve an Arecibo-type installation: a lunar crater converted into a radiotelescope. Alternatively, it could involve a phased-array composed of a large number of smaller radiotelescopes. A prime use for such a system would be in searching for civilizations of other star systems.

There were then several papers on the availability of lunar resources.

Grant Heiken, of Los Alamos Scientific Labs, discussed the chemical composition of the lunar regolith.

James R. Arnold, of University of California at San Diego, reviewed a 1962 paper by Watson, Murray, and Brown, on the availability of water on the moon. He suggested that permanently shadowed regions near the lunar poles might act as cold traps for the trapping of water.

Charles B. Sclar, of Lehigh University, suggested that lunar iron could serve as a source of process heat for lunar operations.

Turning to environmental concerns, John W. Freeman of Rice University stated that release of 100 grams per second of gas would, over time, suffice to build a tenuous lunar atmosphere.

Robert C. Reedy, of LASL, raised the question of whether there have existed super intense solar flares, much more powerful than any observed to date. He presented isotopic evidence to show that data of the last ten years is typical of flare activity over the last million.

Krafft Ehrlicke, of Rockwell International, suggested the use of nuclear explosions for engineering purposes on the Moon. He noted that the near absence of such nuclides as strontium and iodine would ease the problem of radioactivity. He expressed confidence that the existing international treaties, which forbid such explosions, would be amended to permit them.

David Strangeway, of the University of Toronto, proposed methods for lunar prospecting. He noted that lunar soils contain 0.5% metallic iron, and suggested that one means of prospecting would involve generating a magnetic field over the surface and noting the nature of the remnant magnetism after the field is turned off. Different minerals would react in different ways. Alternately, there would be electromagnetic methods of prospecting. An electromagnetic pulse, directed into the soil, would induce eddy currents, measurement of which would permit determination of the dielectric constant. Ilmenite might be detected by its property of reflecting back a radar pulse. Strangeway stated that such prospecting could be conducted by an automated roving vehicle of the size of the Apollo lunar rover. But he warned

that rich deposits would contain only two or three times the concentrations of ordinary soils on the Moon.

Michael Gaffey of MIT then discussed the asteroids as material sources. He described the spectral features which indicate the presence of metals, noting that these features are found in the spectra of such asteroids as 3 Juno, 40 Letitia, 54 Eunomia, and a number of others. However, such features are not observed in the spectra of Apollo asteroids, such as 1976 AA, which would be the ones most easily reached from Earth.

Two short papers were given by people from JPL. James D. Burke discussed the prospects for polar lunar exploration. Roger Brouke described classes of trajectories from the Moon to the libration points.

Finally, Allan M. Russell, of Hobart College, another of the leaders of last year's Summer Study, suggested the use of a gas-gun, or modern version of Jules Verne's moon cannon, for materials transport or for use as a reaction device.

In addition to the presented papers, the session organizers received some two dozen submitted short papers which were not presented. All received papers will be published in the Proceedings of this session, which will be available in about two months from David R. Criswell, Lunar Science Institute, 3303 NASA Road 1, Houston, Texas 77058.

HABITAT CONFERENCE: L-5 SOCIETY PLANS FOR WORLDWIDE IMPACT

HABITAT, UN CONFERENCE ON HUMAN SETTLEMENTS

During the United Nations Conference on Human Environment, held in Stockholm in 1972, attention was mainly focussed on the problems of the natural environment. At that time, it was decided that a separate international meeting should deal with the man-made environment. It is at the invitation of the Government of Canada that this meeting, entitled Habitat, will take place in Vancouver from May 31 to June 11, 1976. A special section of the UN Secretariat, headed by Enrique Penalosa as Secretary General, assisted by a governmental preparatory committee of 58 delegates, has been working for over two years to prepare the Conference. In a continuous plenary session and three committees, there will be discussed:

-a draft Declaration of Principles for Human Settlements;

-Recommendations for National Action on Settlement Policies, Strategies and Planning;

-Proposals for International Action on Human Settlements.

Habitat is a conference of delegates of the 145 member governments of the United Nations. Representatives of non-governmental organizations can attend

the sessions as observers on invitation only.

THE NON-GOVERNMENTAL FORUM

For representatives of non-governmental organizations and individuals interested in human settlement issues, a complementary conference, called Habitat Forum, will be organized at Jericho Beach in Vancouver starting May 24, a few days prior to the governmental meeting. Prepared by the International NGO Committee for

Habitat, the Forum has the following objectives:

-to increase public awareness of some of the gigantic problems with which humanity is confronted; of the solutions which are available to many of these problems; and of the consequences which the solutions may have on life styles;

-to build up the popular support which governments need in order to make the far-reaching decisions and undertake the actions which are needed to cope with these problems;

-to coordinate the points of view of NGOs for presentation to the UN Conference and to make an effort to have these points of view reflected in the Conference decisions;

-to enable the UN and member governments to make use of the vast experience and expertise of professional and other organizations from developed and developing countries around the world in fields related to human settlements.

The L-5 Society is participating in the non-governmental Habitat Forum. Our team is coordinated by Peter Vajk, a physicist with Science Applications, Inc. He is the author of the ground-breaking study, "The Impact of Space Colonization on World Dynamics," in press, *Technological Forecasting and Social Change*, 1976.

Magoroh Maruyama is another team member; he is a professor of Systems Science at Portland State University. He was a speaker at the 1975 Princeton Space Manufacturing Facilities Conference and a participant in the NASA/Ames Research Center Summer Study on space colonization. His formulation of reciprocal causality (*American Scientist*, 1963) has been widely used in the analysis of ecological systems. He has been an organizer of the annual Cultural Futuristics Symposia for the American Anthropological Association since 1970.

A third member of the team is Robert Anton Wilson, a free-lance science-fiction writer (*Ulluminatus*, Dell Books, 1975) and a former editor of *Playboy*. Wilson is handling the publicity for the L-5 Habitat presentation.

As a native of Hungary, Peter Vajk speaks the language fluently; Magoroh Maruyama's native language is Japanese. They also speak, between the two of them, Swedish, Danish, French, and German.

The official languages of the Habitat Forum are French, English, and Spanish. In order to communicate with the media of all the nations represented at the conference, the team is asking any L-5 members with a scientific or technical background who are fluent in Spanish or French to please attend the conference and help translate L-5 press releases. Spanish is an especially critical language as no one of the team speaks it, and Maruyama's experience at a previous international conference is that video crews are anxious to tape interviews in their home language. (What this means is that L-5 volunteers had better not be too camera shy!) Volunteers who speak other languages, even only English, are also welcome.

Following is the official L-5 Society statement to the Habitat Forum, which will be published by the Forum in a hand-book available to all who attend.

Human Settlements in Outer Space: Energy for Earth and New Lands for Humanity

The construction of self-sufficient earth-like habitats for human settlements in outer space (in high earth orbit) has been demonstrated to be practical and economical within the next fifteen years. Such habitats (sometimes called "space communities" or "space colonies" can be as attractive as the most pleasant parts of the Earth, with abundant fresh food, energy, and room for the inhabitants, but without pollution.

This astonishing option for humanity has been under serious study since 1969 at several universities (including Princeton and M.I.T.) and by the National Aeronautics and Space Administration (NASA). Space communities have also been discussed in committees of both houses of the United States Congress and in the Outer Space Committee and the Political Committee of the United Nations General Assembly.

No technological developments more advanced than NASA's Space Shuttle are necessary for the construction of the first few such space communities. Raw materials mined on the moon would be used extensively, with energy supplied abundantly and freely by the Sun. The establishment of this first foothold in space for permanent human expansion beyond the confines of Spaceship Earth will require a significant (but not exorbitant) investment for the first ten to fifteen years. Peak annual costs would be only 0.1-0.3% -- a few thousandths -- of the combined Gross National Products of the principal industrialized nations of the world.

Beginning in about 1990, the first space communities (ten thousand or more people living in each) would build Satellite Solar Power Stations (SSPS) for Earth. Such a satellite in geosynchronous orbit, where it would appear to hover motionlessly above a fixed point on the

Earth, can collect solar energy with large mirrors (ten to fifty square kilometers in area) and convert it into short-wavelength radio beams for transmission to large receiver antennas located anywhere on the Earth. This will provide large amounts of safe, environmentally clean electrical energy twenty-four hours a day at prices lower than for fossil fuel or nuclear powerplants in the United States and Canada today, rapidly repaying the entire investment for establishing these first space communities.

In the developing countries, SSPS electricity can be used to make synthetic fuels (either gaseous or liquid) and synthetic fertilizers at costs much lower than present prices in these countries for fossil fuels or firewood and for fertilizers. This would provide meaningful assistance for economic development and agricultural productivity improvements. Moreover, the use of such synthetic fuels can halt the massive environmental damage due to the presently unavoidable excessive use of trees and animal manures for fuel. These practices, especially since the recent price increases for petroleum, contribute to erosion and flooding of agricultural lands in South America and South Asia and to the southward expansion of the Sahara Desert. Shortly after the year 2000, importing of metals (steel, aluminum, titanium, etc.) from the asteroid belt to any country on Earth is likely to become economically attractive, further assisting economic development.

Without any drain on Earth's resources, the space communities will also build additional space communities beginning in the 1990's. Available resources in just a few of the larger known asteroids are sufficient to provide at least *three thousand times* the total land area of Earth. Each physically separate space community (ranging in size from a few square kilometers to several hundred kilometers, and accommodating from ten thousand to several million people in each) can have a completely different type of climate, weather, and landscape, as well as totally distinct cultures, languages, and life-styles. The principles for human settlement in these conditions can be radically different from the principles for Earthbound settlements.

The accelerated economic development of the less affluent nations will help to lower birth rates, without coercion. This reduction in birth rates, combined with modest levels of migration to the new lands in outer space, has been projected to stabilize the Earth's population perhaps as early as 2020 or 2030.

It is clear that any discussion of human settlement policies for the next fifteen to fifty years must take cognizance of this new option for humanity, both in terms of the abundant energy and materials resources which will thus become available here on the Earth as well as in

terms of the construction of entirely new forms of human settlements in the space communities. The United Nations Conference on Human Settlements is urged to endorse further work on these new concepts, and to propose that all national governments participate in the most rapid possible development of human settlements in outer space for the benefit of all of humankind.

Peter Vajk and Robert Wilson are planning to remain at the conference for 12 days in order to be able to make a presentation to the Governmental section of Habitat after the Forum has ended. Professor Maruyama will stay only during the week of the Forum. The team's budget is as follows:

Transportation:	\$824
Telephone:	100
Literature:	400
Food :	300
Housing:	562
Misc.:	200
Total:	\$2,386

If any people can be located in Vancouver who can provide the local transportation and housing the team needs, the expenses can be cut by about \$700. That would leave a balance of \$1,686 for the projected expenses. Of that, L-5 members William O'Boyle of New York City and Norrie Huddle of San Francisco have already committed a total of \$750, leaving less than \$1,000 to be raised, assuming the team gets free housing and local transportation.

Why are we making the Habitat presentation? Jesco von Puttkamer of NASA's Office of Space Flight has urged the L-5 Society to "bring this concept to the Third World," citing the need to make the U.S. space program relevant to the problems of the entire Earth.

Peter Jankowitsch, Austrian Ambassador to the U.N. and Chairman of the U.N. Outer Space Committee has reported to us that "space colonization . . . is gaining increasing attention from a number of member countries. . . ."

Our Society has become an international organization, with members in the United States, Canada, Australia, England, and Switzerland. The time has come for us to speak out to the entire international community. Please help our team at Habitat make our voices heard around the world!

Those who can attend the conference or who have located free housing in Vancouver should contact J. Peter Vajk, 57 Oakdene Court, Walnut Creek, CA 94596.

Those who wish to contribute to the Habitat Fund should send donations to: Habitat Fund, L-5 Society, 1620 N. Park, Tucson, AZ 85719; the phone number is (602) 622-1344.

For more details on the Habitat budget, contact Carolyn Henson at the L-5 Society headquarters in Tucson.

NASA ARTIST DONATES PAINTING FOR HABITAT FUND

Andre Fontaine-Gagnon, a NASA artist and student of Jackson Pollock, has donated a concave, fluorescent, textured abstract painting to the L-5 Society.

Entitled "The Door of the Universe," the work is described by Fontaine-Gagnon in this way: "What is the door of the universe? The answer is very simple! When people learn to live in Peace and Harmony with themselves and each other the door of the universe shall be opened for them. All the wisdom and knowledge in the heavenly bodies shall be theirs."

When the 24" x 32" painting arrived, the first thing the L-5 staff did was to shine an ultraviolet light (used by Analog Precision to erase microprocessor memories) on it. We can guarantee "The Door to the Universe" will satisfy black light fans. It has the brilliance of a surrealist hummingbird.

The artist has given the L-5 Society permission to sell his painting to raise funds for the Habitat presentation. It is appraised at \$900. Slides of it are available to those who are interested. If your heart is set on owning a Fontaine-Gagnon painting, but your bank balance objects, let the L-5 staff know and perhaps we can negotiate.

Fontaine-Gagnon's next major art show, "Probing the Universe," will premiere next August in Montreal as part of the 1976 Olympic program. One of his works will be titled "The L-5 Society" and will be sent to the Society headquarters after the show.

The L-5 staff will survive parting with "The Door of the Universe" only because we know another of the artist's paintings will be coming in the future!

NO SNAKE OIL SALESMEN NEED APPLY

"A new wind is blowing," asserted Jesco von Puttkamer of NASA's Office of Space Flight.

"We expect to have our orbiting space station (planned to house two hundred workers) by 1983-1984. Notice we have moved up the date a bit since last month -that is because public attitudes are changing."

Von Puttkamer added, "We feel public participation in its planning is feasible." He said that while Skylab carried a few citizen and student experiments, the orbiting space station is planned to take advantage of large scale public participation. FASST (which now stands for Forum for the Advancement of Students in Science and Technology) is currently working closely with the Office of Space Flight to coordinate citizen input to the program.

Von Puttkamer suggested that L-5 members (whether or not they are students!) might wish to contact FASST on this project. Those interested should

write or call Leonard David, 1785 Massachusetts Ave., NW, Washington, DC 20036, or phone (202) 483-2900.

Von Puttkamer predicted that in the building and operation of this space station, which he sees as the crucial first step toward the colonization of space, "a lot of hardships should be encountered and overcome. What we don't want is for these hardships to generate a backlash. Supporters of space colonization should show a measured judgement -- no snake oil salesmen are needed!"

When asked what makes a "snake oil" salesperson, von Puttkamer replied that they were people who belittle the obstacles to be overcome by the space program, or claim that it could be done far cheaper, or in far less time, than NASA has predicted (\$100-200 billion, and no sooner than 1990).

"Now, don't misunderstand me," he added. "There are no snake oil salesmen in the L-5 Society. You are doing a good job."

NATIONWIDE LOOK AT AMERICA'S THIRD CENTURY ON HORIZONS DAY

We are on the edge of a new millenium, on the brink of a new stage of development, racing blindly in to the future. But where do we want to go?
-- Alvin Toffler

Communities and groups across the nation will meet in Future Assemblies on June 26, 1976 -- Horizons Day -- to examine goals for America's Third Century.

A local Future Assembly will involve a community cross-section of approximately fifty citizens. They will reach consensus on the best actions the United States can take to build a better future.

As Horizons Day (June 26) ends, results of Future Assemblies will be telephoned toll-free to the First International Syncon (June 23-26) at Cape Canaveral, Florida.

At the First International Syncon, an officially recognized Bicentennial project of The Committee for the Future, Inc., two hundred participants will use the Syncon conference technique to reach consensus on goals for America's Third Century. They will meet at Press Site 39, Kennedy Space Center.

The combined results of Horizons Day and the First International Syncon will be read into the Congressional Record, submitted to the President of the United States, and featured on national television.

Community leaders will be trained in a consensus-building process, "Shared Participation," to be used on Horizons Day. This process was developed by Warren Avis, founder of Avis Rent-a-Car and Avis Research Center.

The Committee for the Future, Inc., will conduct the Shared Participation training in ten locations: Chicago and

Atlanta, April 24; Washington, D.C., and Dallas, May 1; San Francisco, May 8; Seattle, Miami, and Boston, May 15; Tucson and Memphis, May 22. Horizons Day leaders trained at these sessions will also receive:

- Special worksheets, ballot boxes and forms for their Future Assembly
- *Idea Kit* containing a digest of current and advanced thinking on solutions for basic problems and techniques for implementation (including space colonization).
- *Publicity Kit* to help organize and publicize the event.
- *Public Service Announcements* for local TV and radio stations.
- *Dramatic Skit*, "Everyone," depicting humankind's search for understanding of one another.
- Suggestions for *Visual Aids* to help add a festive note to Future Assemblies.

After the Horizons Day leaders return from their training sessions, they will have two months to organize their Future Assemblies. Here is how it will be done:

- *The Participants:* The leaders will invite as many people as possible to participate. Horizons Day headquarters will provide participation profiles to guide leaders toward wider representation. Twenty to fifty people per group has been found to work best. So, if there will be more than fifty participants, additional people should be trained as Volunteer Leaders at one of the five national training centers. If needed, additional training sessions will be held.
- *The Place:* Leaders can convene their Future Assembly in a home or town hall, community center, school gym, church recreational facility, college auditorium or meeting room. Special prices are being considered by both the Holiday Inn and Sheraton Hotel chains for the Future Assemblies.
- *The Procedure:* Having completed the Horizons Day training, leaders will use the Shared Participation process to conduct the Future Assemblies. With the aid of the ballot box, special forms, and idea kit, they will facilitate agreement on new actions for a future of the community's choice. In addition, the Future Assemblies can be enhanced by other festivities and program events.
- *Horizons Day:* When the group has reached agreement, it will call in its results on a toll-free line to the First International Syncon at Cape Canaveral. There, participants will be discussing issues similar to those being discussed by Future Assemblies across the nation on Horizons Day, the last day of the First International Syncon. Both Syncon and Future Assembly results will be presented in a nationally televised program.

The First International Syncon is part of the U.S. Bicentennial Exposition on Science and Technology at Cape Canaveral from May 30 to Labor Day, September 6, 1976. President Ford recently announced the theme of the Exposition: "The prospects for a better life in 1976 and for the next one hundred years thereafter."

The Committee for the Future, Inc., the Washington-based nonprofit organization which developed the Syncon technique and is coordinating the Horizons Day program, is the only citizens group participating in the Exposition.

The Committee for the Future, Inc., is a nonprofit public foundation dedicated to bringing the options for a positive future into the public arena for decision and action. Since its inception in 1970, The Committee has produced twenty-two citizens' participatory conferences called Syncons, covering a wide range of topics: the environment, crime, technology and society, quality of life, information, politics, and many others. It has supported the development of the concept of space colonization since 1974, and has been a major ally of the L-5 Society.

Bicentennial communities and interested organizations who wish to participate in 'Horizons Day can call Horizons Day headquarters toll-free at 800-424-2488.

In order for them to do their planning effectively, they must hear from you soon!

SPACE COLONIZATION ORGANIZATIONS

Space Colonization Now!

1601 N. Main St., Suite 203
Walnut Creek, CA 94596

This is a non-profit organization with a membership of about four hundred.

"Space colonization is possible today. . . . The sad fact is, present political priorities being what they are, few of us here today will be able to participate in this grand adventure. *There is no time to delay till the next century what we can and must do today!*"

Phoenix Foundation

1021 California Ave.
Klamath Falls, OR 97601

This is a non-profit, tax-exempt religious organization. "The Foundation believes in the basic goodness of mankind. . . . Its purpose is to help mankind set and achieve the very highest of goals. . . . The best way to accomplish this task is to arrange a marriage between religion and science, or intuition and intellect. . . . Currently, the Foundation is concentrating its efforts on the promotion of Dr. O'Neill's SSPS concept."

International Society of Free Space Colonizers

P.O. Box 9743
Seattle, WA 98109

"Quest, the journal of the international Society of Free Space Colonizers, presents approaches to fighting and defeating altruist-collectivism. Quest represents the first wave of an emerging hard-core capitalist revolutionary movement which promises to reform the course of two hundred years of history and bring forth the triumphant rise of the Creator Class both on and off this planet. 12 issues, \$9."

Earth/Space
2319 Sierra
Palo Alto, CA 94303
(415) 326-3216

This organization publishes the *Earth/Space Newsletter*, \$5 per year. "Dedicated to free space enterprise," the newsletter heavily emphasizes space colonization.

The March 1976 issue carries a plan for a low earth orbit, large scale human habitat built within a surprisingly small budget. While the newsletter admits that its analysis glosses over the radiation shielding problem, the subject is in general well researched.

The Network
P.O. Box 317
Berkeley, CA 94701

A writeup on this organization can be found in *Fate*, March, 1976, pp. 49-57. The Network is interested in a gestalt of star flight, immortality research, and "higher intelligence." It is notable among space-oriented organizations in its hearty, if sometimes bizarre sense of humor. People who would like to attend a Network seminar can call (415) 841-9470 for more details.

United For Our Expanded Space Programs
P.O. Box 7807
San Diego, CA 92107

"A non-profit organization dedicated to propaganda and education for the increased exploration and exploitation of the space environment. . . . Either we will go forward to the Void or we will hold back and create the Void here on Earth. The latter is War while the former is *Space!*"

BIBLIOGRAPHY UPDATE

"Colonies in Space," Eric Burgess, *Astronomy*, January, 1976, pp. 18-25.

"Colonies in Space May Turn Out to Be Nice Places to Live," Ron Chernow, *Smithsonian*, February, 1976.

"Space Colonies: The High Frontier," Gerard K. O'Neill, *The Futurist*, February, 1976, pp. 25-33.

"Initial Space Colonization: Concepts and R&D Aims," T.A. Heppenheimer and Mark Hopkins, *Aeronautics and Aeronautics*, March, 1976, pp. 58-64, 72.

CoEvolution Quarterly, Spring, 1976. [Box 428, Sausalito, CA 94965.] Public figures such as Buckminster Fuller, Paolo Soleri, Hazel Henderson, and John Todd make public statements for the first time on space colonization. Writings from researchers in the field, such as Peter Vajk, T.A. Heppenheimer, and Eric Drexler are also included.

L-5 TAX STATUS

The L-5 Society recently received its nonprofit, tax-exempt status under section 501 (c)(3) of the Internal Revenue Code. Donors may deduct contributions to the L-5 Society as provided in section 170 of the Code. Bequests, legacies, devises, transfers, or gifts to the Society or for its use are deductible for Federal estate and gift tax purposes if they meet the applicable provisions of sections 2055, 2106, and 2522 of the Code.

Donations dating back to the beginning of the L-5 Society are also tax-deductible under the provisions of the Code.

BUMPER STICKER CONTEST

Two bumper stickers are available from other organizations. FASST has one labeled "America Needs Space to Grow," with the Earth rising over the horizon of the Moon. They are five for \$1.00, up to 25; ten cents each for 25 or more; minimum order of five. Write Leonard David, 1785 Massachusetts Ave., NW, Washington, DC 20036.

April 1976-7

United for Our Expanded Space Programs has a bumper sticker reading "Space is the Place." They can be contacted at P.O. Box 7807, San Diego, CA 92107.

Entries in the L-5 bumper sticker contest are:

- SPACE IS SURVIVAL
- L-5 A GIANT STEP FOR MANKIND
- L-5 IS FAR OUT
- WE NEED SPACE TO LIVE IN TROUBLE PARKING?
- JOIN A SPACE COLONY
- MOON YOUR FELLOW MAN - L-5
- BE A STAR - L-5
- FLY HIGHER WITH AN L-FIVER
- COME ALIVE - JOIN L-5
- BE A PERSON IN YOUR OWN MOON: L-5
- L-5 WANTS TO GET HIGH
- L-5 LET'S GET HIGH
- L-5 ON THE LAST FRONTIER
- L-5 ON THE NEW FRONTIER
- L-5 A GREAT PLACE TO LIVE
- L-5 LET'S LIVE IN SPACE TOGETHER
- L-5 IS THE PLACE TO LIVE
- L-5 FOR MORE JOBS IN SPACE
- SAFE, CLEAN ENERGY FROM SPACE
- SPACE POWER: L-5
- L-5 BY '95
- L-5: THE HIGH FRONTIER

As some of the contest entries are from members of the L-5 staff, we don't trust our objectivity. How about a vote? No fair writing in under pseudonyms, one vote per member!

I've been advocating some commercial space transportation company for ten years or so to stop the taxpayer drain.

We really can't expect a war effort to go for such national push like the Apollo job.

This should be stockholder run and dividend-paying some day.

Let us not go so far down toward socialism. We can do it with stockholders like we did with Comsat.

Maitland McLarin
Mountain Lakes, NJ

L-5 SOCIETY MEMBERSHIP FORM (please type or print)

NAME _____

COMPLETE ADDRESS: _____

AFFILIATION (OPTIONAL): _____

TITLE OR POSITION (OPTIONAL): _____

I am -- am not -- interested in being active locally.

___ Back issues of *L-5 News* available, \$1.00 each.

___ Please enroll me as an L-5 Society Member. I am enclosing a check for \$ _____ (regular membership, \$20.00; student membership, \$10.00; memberships include subscription to *L-5 News*).

___ Please enter an institutional membership to receive *L-5 News* for our organization/library as indicated above. We enclose a check for \$ _____ (institutional or library membership, \$100.00; special library subscription with one month delayed mailing, \$20.00).

Ian Richards sent me a copy of his paper (for which many thanks) and a little summary of what he's doing. Apparently, he's thinking along the lines of a system based on direct cultivation of lunar soil rather than hydroponic culture. He has therefore been using terrestrial production rather than hydroponic production figures, which are much higher. In the later stages, Model II and beyond, soil cultivation might become important, if we are going to consider landscaping of the space habitats. For agriculture, hydroponics beats soil cultivation hands down, especially with regard to the area parameter. I'm going to write Ian Richards an encouraging note, as I seem to recall a report around 1969-1970 in *Science* by someone at the University of Houston who did a cultivation experiment with lunar soil samples from one of the first Apollos (and found that the plants actually grew better in lunar soil!).

Another factor just occurred to me -- atmosphere. CO₂ content has received much attention, but I'm not sure if anyone has looked into the effect of decreasing or eliminating nitrogen. One plant group which might suffer is the legumes, since they harbor symbiotic bacteria on root nodules which fix free nitrogen from the air to supply the plant with nutrients. If we can compensate for this, we might be able to save considerable mass by using an all oxygen atmosphere.

Jim Kempf
Koror, Palau
West Caroline Islands

...I'd be interested in corresponding with anyone interested in discussing space colonization and other future prospects such as computer progress, human-machine symbiosis, and other activities in space.

Terry Nielsen
731 Bond St.
Green Bay, WI 54303

I have noticed that each time you mention Neil Ruzic in your newsletter you add that he is the author of *The Case for Going to the Moon*. You might also add that he is the author if the just as, if not more important *Where the Wind Sleeps*.

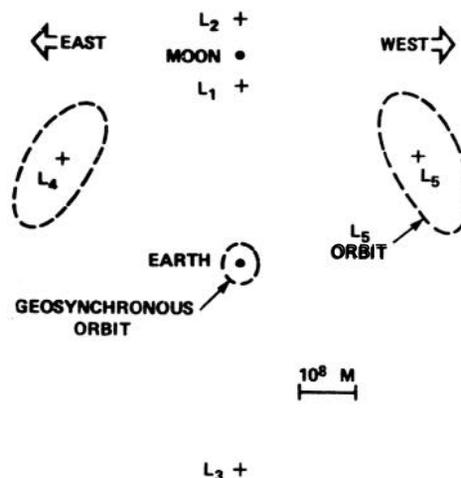
Is it possible that someday when ERDA remembers that solar energy research is *supposed* to be in *their* budget, that they might ask you for a study of SSPS construction methods and costs. Even though they say that they are considering SSPS as a possible alternative source of future energy, it appears that they are neglecting this proposal.

Keep up the good work. Thank you.

David M. Dryden
Toledo, Ohio

L-5 SOCIETY UNWHELMED

Thanks to last minute donations from members (see "Underwhelming Response, L-5 News No. 7, pg. 7). Bill Weigle of the Tucson L-5 Chapter was able to represent the L-5 Society and FASST at the April 2 convention of the National Conference on Aerospace Education. Special thanks go to Bill O'Boyle of New York, New York, and to Frederick H. Osborn of Garrison, New York, who sent in his donation with the note, "Hope this will unwhelm you!"



MIT "CAN"

A graduate level course in advanced systems engineering at the Massachusetts Institute of Technology is studying the design of a small, early industrial colony. Taught by Professor John F. McCarthy, Jr., it focuses on a structural design for 1000-2500 people, depending upon the agricultural productivity which can be achieved. The design plans to avoid major resupply problems by providing food and renewing the air with a system of farms and parks.

The design parameters are 0.75 g (7.36 m/sec²), an RPM of 2.6, an atmosphere 0.4 that of sea level, with a content of 50% oxygen and 50% nitrogen, radiation shielding of 5000 kg/ma, and a location at L-5.

The habitat is a cylinder with rounded endcaps; sunlight will be brought in through windows in the endcaps. Area is 6.28 x 10⁴ m² in the cylindrical part plus 1.26 x 10⁵ m² in the endcaps. Diameter is 100m.

Participants in the course refer to the colony as the "MIT Can."

Fourteen students and two faculty members are participating in the study. The results will be published. For copies of the report, available some months hence, write Professor John F. McCarthy, Jr., Center for Space Research, MIT, Cambridge, MA 02139.

COMING UP IN L-5 NEWS:

MILITARY ASPECTS OF SSPS POWER, Keith Henson

A-STROLLING THE ASTROTURF T. A. Heppenheimer

NEED TO EVALUATE FEASIBILITY OF SPACE-BUILT SSPS, Sklarew & Vajk

LATE DEVELOPMENTS AND MUCH MORE!

L-5 NEWS

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L-5 Society

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