

L-5 NEWS

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A Newsletter from the L-5 Society
Number 4, Dec. 1975

HUDSON INSTITUTE PREDICTS BUILDING OF SPACE COLONIES

A recent study at the Hudson Institute entitled *The Next 200 Years in Space* (NASA Bicentennial Planning) by Herman Kahn and William M. Brown, predicts the building of space communities and manufacturing facilities.

Following are excerpts from a section entitled the "Tricentennial Conference on Space:"

"That wild-eyed stock market scheme, labelled the old L-5 boondoggle, that your grandparents may have heard of from their parents, which late in the 20th century promised great riches to all who invested in preliminary plans of colonization and tourism, has actually become a bonanza. Also, as the first of the automated asteroid material deliveries begin to make its investors happy, we find over 80 percent of the operating space industries are currently on a profitable, unsubsidized basis."

(Don't laugh about that stock market bonanza; the proposed Space Research and Development Corporation in the October Newsletter inspired several readers to offer to invest.)

"It was already clear from the nature of the new projects being undertaken that the advantages of space manufacture for advanced integrated circuits and minimum energy surface honeycomb materials, as well as the proliferation of solar power plants, all implied a bright future for space industry - at least for supplying increased numbers of colonists with life support and tools. Indeed, with today's advanced space technologies of automation, cybernation, and high-strength-materials fabrication, the earth-based market beckons entrepreneurs to orbit. Certain chemical processes, utilizing pure materials available from planetary bodies, are cheaper perform in the orbiting catalytic chambers I mentioned earlier, than on earth. Moreover, this kind of technology relocation is favored by our very wealthy world for the highly polluting forms of direct nuclear industry on grounds of safety alone. Perhaps it was the consumer benefits from near earth or the great number of tourists which gave rise to the 'Greater Earth ideology.' At that time it clearly included the near-earth orbit, with its 60,000 inhabitants - but there was some debate whether 'Greater Earth' extended to the LaGrange points and the moon as well. Indeed the L-5 colonies were already growing by producing new habitats and power stations, much as seen by Professor Gerard O'Neill 80 years earlier."

Those interested in the complete report should write to:

Hudson Institute
Quaker Ridge Road, Croton-on-Hudson,
New York 10520
1 Rue du Bac, Paris 75007, France
1-11-46 Akasaka Minato-ku, Tokyo, Japan

Also available is a book by Pat Gunkel entitled *The Future of Space: An Encyclopedic Prospect*. The author tells us that "My book is intended to be something of a reference book, the basic working manual of the future of space field, and is filled with analyses, lists, glossaries, etc. in order to stimulate future thought and give rise to a serious discussion. It is meant to breathe life into what has recently seemed a fading human prospect, and to present an accurate and elaborate picture of what space can really mean."

Copies of this book may also be obtained from the Hudson Institute.

Vajk Update

"Every man takes the limits of his own vision for the limits of the world" - Schopenhauer

Since the "Limits to Growth" conference, Peter Vajk of Lawrence Livermore Laboratory has given three lectures on his world dynamics work applied to space colonies. Oct. 28 he spoke to about 50 people at the Space Sciences Division of the NASA/Ames Research Center. Most of the audience, strangely enough, were not very familiar with space colonization; they were, needless to say, quite interested. Nov. 11 Vajk spoke at the Stanford Research Institute in Menlo Park, Calif. before an audience of about 175, and Nov. 24 at the Peninsula Chapter of the Kiwanis International, with more than 70 members attending. Both audiences were very receptive, and one member of the Kiwanis requested franchise rights for the first chapter of Kiwanis at L-5 !

Vajk recommends that those interested in the motivations behind "technophobia" should read **Zen and the Art of Motorcycle Maintenance**, by Robert M. Pirsig, Bantam Books, 1974. Counterarguments to the "limits to growth" concepts can be found in **Population, Resources, and the Future: Non-Malthusian Perspectives**, edited by Howard M. Bahr, Bruce A. Chadwick and Darwin L. Thomas, Brigham Young University Press, 1972.

In Science, Nov. 7, 1975, p. 540, Nicholas Wade reports on "Limits to Growth: Texas Conference Finds None, But Didn't Look Too Hard." Wade writes, "Among the sea of whites at the Woodlands Conference were two blacks, one of whom was the local cop. That was probably a tactical error, at the least, because antigrowth arguments are vulnerable to portrayal as the rationalizations of elitists seeking to preserve their own upper middle class privileges. Any serious debate has to include the poor, both at home and abroad, because they are the first victims of any pause in growth. The price of attending the conference, about \$450 a head plus travel costs, excluded the former, and no representatives of the latter were invited, unless two delegates from Iran count as such."

Watch for a letter from the L-5 staff in the Dec. 1 issue of Newsweek on the "Limits to Growth '75" conference.

MARGARET MEAD and L-5

In an interview with the L-5 staff, Margaret Mead called for "the utilization, on a commercial scale, of the abundant solar power of space." When asked if she was interested in living at L-5, she replied, "I don't want to be an astronaut. But if they have a need for experienced people and can use me, I'll go. And I'll plan to stay there, too!" Ms. Mead told us she is currently working on a Club of Rome report.

FASST Invites L-5 Director To Dec. 2 White House Conference

Representatives of FASST (Federation of Americans Supporting Science and Technology) attended a White House conference earlier this year, making the Dec. 2 meeting the only time a student group has been invited to attend a White House conference twice in one year. The first conference had 25 attendees; the Dec. 2 meeting will number 50, and will include active FASST members and student leaders in other technical and environmental organizations.

Bill Weigle, a member of FASST and an L5 Director, will participate in the one day conference, in which the participants will discuss issues relating to science and technology.

NASA'S Fletcher on Space Colonization, Solar Power Satellites

A.P. Alibrando, Deputy Assistant Administrator for Public Affairs, sent the L-S staff the following speech by James C. Fletcher, Administrator of NASA, saying that it "addresses itself to the questions you asked concerning NASA's response to the Committee on Science and Technology, U.S. House of Representatives Report on Future Space Programs 1975." Fletcher presented this speech at the National Academy of Engineering Nov. 10, 1975.

"With uranium and fossil fuels heading towards depletion, we should be giving serious attention to solar energy as a solution to our long-range energy needs. Terrestrial solar energy will find its place in applying these needs but it could be more useful as an energy source if solar energy should be collected constantly and in large amounts. This is difficult to do on Earth because of the problems of clouds, the day-night-cycle, and the requirement of vast areas of open, uninhabited land for terrestrial solar collectors. No such restrictions are found in space. Large solar arrays could be positioned so that they are continually hovering in the sunlight above the same points on the Earth's surface. From these vantage points, they could beam solar energy in the form of microwaves to collecting stations below.

"Space systems may not be the total answer to our solar energy needs, but they certainly represent one of the directions we should be looking in. What is important is that we begin to consider other alternatives. If we had placed the same emphasis years ago on ways to utilize solar energy as we have put into the development of a nuclear generating capacity, we might already be well along the road to solving the energy shortage.

"We should not ignore new concepts such as the space colony recently proposed by Professor Gerard O'Neill. The wheel-shaped habitat would house up to 10,000 people along with shops, schools, light industry and a self-contained agriculture system. The principal industries would be the manufacture of more habitats and the construction of solar energy collectors that would be placed in orbit near the Earth to beam down cheap energy. Solar energy also would power the space colony. Heavy industry would be conducted outside the habitat to make use of the weightlessness and vacuum of space.

"After completion of the first habitat, larger colonies could be constructed, some orbiting farther from Earth. The material of the asteroids, for instance, would be sufficient for the construction of colonies with a total land area thousands of times greater than all of Earth's continents."

Dr. Fletcher discussed advanced probes in the solar system, an interstellar mission (mentioning the British Interplanetary Society) and the possibilities of interstellar communications. He poses the question, "Is NASA, itself, becoming shortsighted?"

"Isn't the Agency's pre-occupation with short-range projects a contradiction of its publicly espoused goals?"

"Granted, NASA's present actions seem to speak louder than its words. Our expenditures are weighted heavily in favor of contemporary needs. This course, however, does not presume an abandonment of tomorrow's goals or a lack of the vision and imagination that molded NASA into probably the most forward looking agency of government. Rather, it represents an accommodation with current constraints.

"Let me explain. The most difficult task facing an administrator today is to maintain a future perspective in the face of growing consumer and public demands for solutions to today's problems. In planning long-range objectives, he must take into account certain time horizons.

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L-5 Society

1620 N. Park Ave.

Tucson, AZ 85719

(602) 622-1344

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"The public is 'now' oriented. Studies - and I might add, past experience - have shown that the average person pays lip service to the kind of world he wants for his grandchildren. He is interested in what affects him now, not his descendants. He can easily translate the concept of meteorological satellites into his everyday experience. Thus, he is ready to bear the costs of developing the technology, the boosters and the satellites themselves not because he believes in space activities, but because he stands a far better chance of not having that ball game rained out when the forecast was for sunny skies. Selling him on the idea of financing a \$100 billion space colony for the 1990s must be viewed by him in the same context as convincing an Eskimo that he needs a refrigerator for his igloo."

Dr. Fletcher commented on other obstacles: short terms of elected office, the budget cycle, and limited career spans of leaders, and then went on to say,

"The restrictive elements I have just described should not be construed as excuses for NASA's lowered sights. They are causes . . . emotional, political and economic facts of life that in whole or part are holding back our outward flight into the future.

"We cannot afford to let these obstacles deter us from our ultimate goals. We must somehow keep the dreams of space exploration alive, for in the long run they will prove to be of far importance to the human race than the attainment of immediate material benefits. . . just as the effects of Copernican astronomy; or Darwin's theory of evolution far outweighed their immediate practical results.

"Space offers us an alternative for the future. Our race can squander its potential and continue our unchecked momentum down the slopes of time towards the shore of the primeval sea to join the great reptiles and nature's other unsuccessful experiments. Or we can accept the challenge of the great spaces between the worlds and establish our citadels among the stars.

"The choice, as the historian Wells once said: 'Is the universe or nothing.'"

Those who would like the entire text of the speech should write.

Miles Waggoner

Director

Public Information Division

Code FP

NASA Headquarters

Washington, D.C. 20546

FUTURE SPACE PROGRAMS 1975

Excerpts from the REPORT

Prepared For The COMMITTEE ON SCIENCE AND TECHNOLOGY U.S. HOUSE OF REPRESENTATIVES NINETY-FOURTH CONGRESS SEPTEMBER 1975

Dr. Gerard K. O'Neill. Professor of Physics, Princeton University:

Studies beginning in 1969 have so far confirmed the possibility that large-scale, earthlike human communities could be built in space. The space-colonies would orbit L-5, a location on the lunar path equidistant, gravitationally, from the earth and moon. Nearly all the materials for these communities and for their manufactured products would be transported from the low-gravity surface of the moon by an automated materials launcher. No liftocket more advanced than the space-shuttle and a simple derivative of it would be required. A space community development program could therefore begin soon, on the basis of known technology, with construction starting as early as 1981-2.

The first L-5 community could support a workforce of 10,000 people in comfort, even in some luxury, within a large enclosed volume having a climate where flowers, trees, birds and animals could flourish, and in which gravity could be provided by slow rotation.

The L-5 "Beachhead in space" appears capable of building, more economically than could be done in any other way, satellite solar power stations to supply electrical energy to the earth by low-density microwave beam transmission. Economic analysis so far indicates a benefit/cost ratio much higher than one, at a discount rate of 10 percent. The investment would be 5 percent to 15 percent of the cost estimated for Project Independence.

Eleven to fifteen years after the start of construction of the first colony, energy to the earth from space could reach and exceed the peak capacity of the Alaska pipeline. Busbar costs initially of 15 mils appear capable of reduction to 10 mils or less, opening the possibility of synthetic fuel production and of a true permanent "energy independence" without strip-mining or nuclear-power proliferation.

Dr. Isaac Asimov, author and educator proposed that the important goal for space exploration over the next century is the establishment of an ecologically independent human colony on the Moon, or on artificial space colonies that use the Moon as a quarry for raw materials. The reasons for this follow:

(1) Observatories beyond Earth's atmosphere can lead to a better knowledge of the Universe and the laws of nature governing it - with unpredictable but surely great applications to the human way of life.

(2) The presence of infinite amounts of hard vacuum, of low temperatures, of high solar radiation, should make possible industrial activities of types not practical on Earth, leading to unpredictable but surely great advances in technology.

(3) The establishment of a working colony, ecologically independent on either the Moon or in an artificial structure in space will require a society fundamentally different from our own - a society that can live in an engineered environment under conditions of strict recycling and mineral waste. Since this is precisely the sort of condition toward which Terrestrial life is tending (barring a catastrophe that destroys our technology altogether) the colonies will serve as schools to Earth, as experiments in living from which we may profit immensely.

(4) The establishment of a colony will be difficult enough and expensive enough to require a global - rather than a national - effort. The effort will be great enough to supply

mankind with a common goal and a common sense of pride that may transcend local chauvinisms, and thus encourage the growth of a global political community - and indeed serve as a substitute for the emotional catharsis of war.

(5) Lunar or space colonists, living in engineered worlds, on the inside, would be more psychologically adapted to life in a spaceship undertaking long voyages, so it will be they rather than Earthmen by whom the rest of the Solar system (and eventually the stars perhaps) will be explored.

(6) Colonies in space generally will supply a change for growth and adventure after Earth itself has, perforce, adopted a no-growth philosophy.

Dr. Robert L. Forward, Senior Scientist, Hughes Research Laboratories proposed a national space program for interstellar exploration:

A national space program for interstellar exploration is proposed. The program envisions the launch of automated interstellar probes to nearby stellar systems around the turn of the century, with manned exploration commencing twenty-five years later. The program starts with a fifteen year period of mission definition studies, automated probe payload definition studies and development efforts on critical technology areas. The funding required during this initial phase of the program would be a few million dollars a year. As the automated probe design is finalized, work on the design and feasibility testing of ultra-high velocity propulsion systems would be initiated. Five possibilities for interstellar propulsion systems are discussed that are based on 10-30 year projections of present day technology development programs in controlled nuclear fusion, elementary particle physics, high power lasers, and thermonuclear explosives. Annual funding for this phase of the program would climb to the multi-million dollar level to peak around 2000 AD with the launch of a number of automated interstellar probes to carry out an initial exploration of the nearest stellar systems. Development of man-rated propulsion systems would continue for 20 years while awaiting the return of the automated probe data. Assuming positive returns from the probes, a manned exploration starship would be launched in 2025 AD, arriving at Alpha Centauri 10-20 years later.

Dr. Larry J. Friesen, Department of Geology, University of Georgia endorses the concept proposed by Dr. O'Neill for orbital colonies designed to manufacture solar power satellites :

He outlines the requirements to avoid cost overruns in such a project. Another suggested project is a manned self-sufficient moon base. He describes the various techniques which could be used to construct and operate such a base for research. Dr. Friesen proposes planetary missions to Mars and to the asteroids. He reviews several opportunities for improved launch systems. Financial arrangements for providing educational services via satellite are described.

Dr. Peter E. Glaser, Vice President, Arthur D. Little, Inc. reviewed:

The option for using satellite solar power stations for large-scale power generation on Earth, collecting and converting solar energy into microwave energy transmitting it to the Earth's surface, and transforming it into electricity.

The current state of technology and the necessary developments for accomplishing these functions are discussed and the results of recent microwave transmission and rectification demonstration tests are mentioned. The requirements for Earth-to-orbit transportation are presented. Considerations are given to cost projections, resource use and economic comparisons. Environmental issues, including impact of waste heat release, space vehicle exhaust, noise pollution and location of antenna sites are listed. Biological effects and radio frequency interference are explored. The time frame for accomplishing the operational system is outlined.

One of the few such alternative energy sources available on a scale substantial enough to have a significant world-

wide impact is the Sun. Today, the development of solar energy applications is perceived to be a promising approach to meeting future energy demands. Solar energy is certainly abundant enough to provide a significant portion of future energy demands and clean enough to satisfy the most ardent environmentalists. The challenges lie in finding methods for efficiently and economically converting this inexhaustible source of energy into useful forms. Although solar energy falls on Earth in tremendous quantities, it is not easily convertible and certainly is not "free." In a sense, it can be considered to be a widely distributed resource, somewhat akin to low-grade mineral resources, which will require technological sophistication to "mine" economically.

There are two obvious obstacles to harnessing solar energy: one, it is not constantly available on Earth during nighttime or when local weather conditions obscure the Sun; the other, it is diffuse. Although the total amount of energy available is far beyond all conceivable future needs, the collection and conversion of solar energy into useful forms must be carried out over a large area, entailing a large capital investment for the conversion apparatus. The challenge lies in making the best use of this capital investment. Solar energy most likely will be developed not because it is cheaper than alternative energy sources, but because these alternative energy sources sooner or later will be exhausted, will become increasingly more expensive, will continue to be subject to political and economic control by the nations possessing them, and will produce undesirable and, as yet, incompletely understood environmental consequences, especially on the huge scale which will be required to meet projected demands even with controlled growth.

Dr. Arthur Kantrowitz, Chairman, Avco Everett Research Laboratory, Inc. :

A generation ago people growing up in America were imbued with the idea of progress, that mankind could continuously improve not only the material conditions of life, but mankind itself. One of the important elements of that belief is that there are no visible limits that we could not surpass. I was shocked when, in a college philosophy course, I first discovered that many philosophers called this view of life "naive optimism". Today we hear a great deal about the limitations to mankind's capabilities. It is very fashionable to make facile predictions of imminent disasters resulting from technological advances and such predictions have received wide currency even though they are frequently based on a very superficial look at the potentialities of a creative approach to our problems. I would like to call this view of mankind's future "naive pessimism". It is perfectly clear that, just as naive optimism has had an enormous impact as a self-fulfilling prophecy, naive pessimism is producing a similar impact with deadening consequences.

Naive pessimism about the role that space can play in exhibiting the possibilities for unlimited progress is in my view one of the important bases for the present move to restrict space activity. I think it is important that we emphasize that any limits that people can now set are naive. The opportunity for the growth of new worlds in space with all of the advantages that people have gained from fresh starts in creating new societies, is among the potentials of space. I submit that a space program directed toward exhibiting that there are no visible limits to man's future in the universe could be a most important help in reviving faith in the idea of progress. I can imagine nothing more relevant to our current problems.

Dr. Albert Kelley, Dean of the School of Management at Boston College, called for in-depth cost-benefit and investment analyses of Space Application Programs:

The potential benefits which spaceflight operations can provide our nation and the world are enormous. However, the resources required to obtain these benefits are large and must be committed far in advance of reaping the rewards.

The size of the resource commitments require that full justification of space applications be based on the national conviction that the potential returns from space warrant the heavy investment needed to expand the frontiers of knowledge.

An underlying thesis of Kelley's paper is that phased, increasingly rigorous investment and cost-benefit analyses are not only possible but beneficial before committing to full-up operational systems. Space applications are now at the point of maturity where more conventional private sector-type investment techniques can be employed, but must be employed judiciously. Analytical approaches are proposed which draw on conclusions reached by the Cost and Benefits Panel of the 1974 Summer Study on Practical Application of Space Systems sponsored by the National Research Council. The author served as Chairman of the Cost and Benefit Panel.

Dr. Robert C. Seamans, Administrator of the Energy Research and Development Administration (ERDA), discussed the importance of past work done by NASA in providing useful technologies and a current capability which will provide valuable support to ERDA in its efforts toward achieving the Nation's energy research and development goals. ERDA also is conducting advanced technology programs that will be essential to the future NASA and Department of Defense (DOD) space programs in their efforts to make full beneficial use of space.

Space as a possible location of nuclear power generating stations to help solve the long-term energy requirements on earth or for ultimately disposing of radioactive wastes from nuclear electric generating plants is also discussed by Seamans.

The paper concludes by focusing on "the importance of reversing the declining national trend in support of basic research and technology which is of vital importance to the long-term economic health and security of the Nation." A vigorous and well-focused future space program will be highly beneficial to man in many ways, including helping solve energy supply problems, improved communications, long-range weather forecasting, and improved management of earth's natural and agricultural resources as well as also advancing man's basic and continuing quest for knowledge of the earth and solar systems.

RECOMMENDATIONS

Based on the foregoing conclusions, the following recommendations are made:

A. The Subcommittee believes that NASA should demonstrate a sense of urgency in its future program planning and development. The Subcommittee further believes it is absolutely essential to the continued vitality of the space program and consequently to its potential for increased contributions to the welfare of society that the nation and NASA focus on an overarching concept. This concept should represent one or more mind-expanding endeavors which would challenge the imagination and capability of the country. The key element of such a program should be substantial return on past and current investments in space through clear and immediate benefits to the society on earth in the form of greatly expanded services and direct contributions to solution of earth-found problems.

B. New opportunities in national and international space programs should be examined by the Executive and introduced into the budget cycle including comprehensive planning and implementation of a five year program to provide space systems for educational and medical satellite services and earth resource surveys - maritime, agriculture, geological, and demographic.

C. To aid in assuring a breadth of vision while maintaining a vital shorter term space program, NASA should strengthen its annual future program planning effort and on a periodic basis (every 3-4 years) initiate an ad hoc review

of its planning process and future programs, drawing upon both national and international expertise from a broad cross-section of society. This ad hoc examination should review projected space activity 20-30 years in the future to determine to the extent possible:

1. How well does the short range (0-10 year) planning mid-range (10-20 year) planning coincide with the current assessment of the longer range future?
 2. What planning and resources allocation adjustments, in the short and mid-range, should be made to accommodate the latest thinking on long term opportunities?
 3. What new research and development initiatives are necessary to support long term opportunities?
- D. In determination of space program composition over the next decade adequate weight needs to be given to the widest possible range of longer term opportunities to assure that the scientific and technological basis has been developed to support them. These longer term programs include:
1. Lunar scientific and manufacturing bases;
 2. Orbital colonies;
 3. Extra-terrestrial communication systems;
 4. Satellite solar power;
 5. Planetary and interstellar exploration; and
 6. Disposal of high risk waste materials.
- E. Because of the technology available for earth resource (land, sea, air) and other satellite applications and their demonstrated value, increased emphasis must be placed on Improving organizational and management arrangements within and external to the Federal Government to assure technology transfer to the private sector and the development of operational systems
- F. Re-evaluation of the organizational and management arrangements, relative emphasis and program content for space processing and manufacturing should be made within the next year with the intent of assuring that options for commercial utilization of space are developed.
- G. NASA should embark on an expanded program of fundamental research and exploratory development in new propulsion concepts.
- H. In withdrawal from an area of Federal space research and development, a formal procedure similar to that for initiating new programs should be adopted to assure that the effect of such withdrawal of effort will be positive. For example, NASA should assure that the necessary advanced satellite communication technology is being developed to assure continued U.S. leadership before withdrawal from the area.
- I. NASA should develop and implement a comprehensive cost benefit analysis for each major program which will include the relative social and economic benefits as well as the potential for public support and international cooperation.
- J. Based on the foregoing conclusions and recommendations on space program opportunities, and the high positive economic multiplier associated with space related research and development programs, NASA should assemble and propose to the President, and ultimately to the Congress, an expanded space program in FY 1977-1978 at least 25% greater than current funding to undertake new space initiatives.

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Elitism

By Keith and Carolyn Henson

In discussing the L-S concept with literally thousands of people in schools, churches, meetings, legislative hearings, etc., we have found that most of the negative reactions to space colonization fall into two categories. The first, exemplified in Fletcher's speech in this issue, could be paraphrased as, "It's a marvelous and worthwhile project, but the people will never buy it." Some people feel that political support for projects with long payoff times is almost impossible to obtain because the average person is too short sighted. Those who espouse this form of elitism do not exactly oppose us. They are not far from being active supporters, as they already approve of the project, and most of them, like Fletcher, would really like to be proven wrong.

There is a long list of historical precedents for popular support of large, long term projects, dating back at least to the cathedrals of Europe. More recent examples are the building of the Panama Canal, dams, railroads, and even the Apollo project. This last was without clear economic payoff. Also, as the L-S News has been reporting, space colonization sparks a very favorable public and media reaction. The critical difference between this and the other NASA projects is the chance that virtually anyone who wants to can take part in the adventure, not as a spectator, but as a colonist. Those who don't want to go like the idea of getting rid of those who do. The spirit of '76 is not dead in this country; it just needs a direction.

NASA's reaction to space colonies is understandable. It is an organism in shock, that hardly dares to hope.

The second negative attitude is: "We have sinned by overpopulating and exploiting the world and deserve to suffer for our sins." These people view space colonization as cheating fate. We would respect their attitude more if they would restate the above to, "I have sinned . . . and I must suffer for my sins." But when closely questioned, they expect most of the suffering to be done by the next generation or out of their social class. Their idea of sacrifice is to give up a second (or third) car. Few, if any of these people look like they have missed a meal lately. From experience, arguing with these Neo-Calvinist types is a waste of time. Fortunately, this view is not very popular, except among the more extreme of "limits to growth" cultists.

Surprisingly, objections to the cost of the project are not very common, and, in our experience, objections based on technical reasons are rare. Please let us know if your experiences differ widely from ours, or if you hear any novel objections.

L-5 AND NEW YORK POLYTECHNIC

by Dan McHugh

Major interest in the L-5 project was first aroused at Polytechnic last March when the Institute's Astronomical Society and the Mellon Fund invited Dr. O'Neill to speak to faculty and students. The lecture was videotaped and was extremely well attended and received. The Astronomical Society followed up this success with an article devoted to the subject in its special astronomy issue last spring of **The Engineer**, the undergraduate technical journal.

At the urging of the Astronomical Society and Dr. Martin H. Bloom of Aerospace Engineering, Polytechnic representatives Dr. Stanley Gross and students Loren Abdulezer, Warren Ziegler, Mark Mandell and myself attended the May 7-9 Princeton conference on space colonization. As with the March lecture, Polytechnic videotapes were made at the conference.

The four hours of summary lectures have already been run on cable TV in Manhattan and requests for showing have been received from a number of other colleges. At Polytechnic, the tapes will be used for several courses this year.

Professor Bloom, coordinator of Polytechnic's extensive new energy program, is acting this year as preceptor for an environmental design study of space habitat and/or SSPS concept under the Societal Systems design course, SA 456-51. And Professor Romualdas Sviedrys has introduced successfully this concept into his popular Technological Forecasting course.

Plan Spring Course

Sponsored by the Mellon Foundation, an interdisciplinary senior seminar course is planned for next spring, covering the broad aspects of the concept. It is hoped that many of the students taking the course will go on to apply for NSF and NASA grants for further study of specific problems related to their field of study.

Dr. Richard McNulty and Warren Ziegler of the Meteorology and Oceanography department are preparing grant proposals to study "weather" models for the giant colonies. A structural analysis of the space habitats, prepared by Loren Abdulezer, is being used by scientists inside and outside Polytechnic as the basis for further research.

Dr. George Bugliarello, Polytechnic's president, has taken a strong positive and supportive interest in the concept as a good multidisciplinary and Bicentennial activity for Polytechnic. Dr. O'Neill is now referring inquiries about the project to Polytechnic, which is recognized as one of the major academic Institutions with active programs in this area.

Most recently, the media, such as WBAI radio, WNET television, KCTV and Dr. Frank Fields of NBC, have requested information on space habitats from Polytechnic.

Polytechnic's position as a leader in the field of space development for human needs promises to keep the Institute at the cutting edge of the technical disciplines and societal decision making processes.

ORGANIZATIONAL MEETING OF THE NEW YORK CHAPTER

An organizational meeting for the New York Chapter of the L-5 Society took place at the Rockefeller University on December 5, 1975. The meeting was called by Dan McHugh of the New York Polytechnic Institute and Michael Mautner of The Rockefeller University. Twenty-five L-5 members and interested individuals attended the meeting in which proposed activities in the New York area were discussed. Activities mentioned were contact with an appropriate scientific body of the United Nations, establishing a local information center and information dissemination in local colleges.

Dr. Jerry Grey reported on space colonization related activities and plans at the AIAA, and Ambassador Edward Finch spoke of some legal aspects. A further meeting of a smaller core group is planned to discuss specific programs in the New York area. A half-day symposium on space colonization, to be presented at the National Design Engineers Show in Chicago in April 1976 is also being prepared by some members from the New York area.

L-5 Chapter Formed in U.K.

Philip J. Parker, a science writer and lecturer in England, has formed our first overseas branch. He is in contact with a number of people who have been working on space communities/industrialization. Parker will be sending the L-S News articles on space agriculture and the lunar mass driver concept in the near future. He is the author of "Lagrange Point Space Colonies" in the July 1975 issue of Spaceflight (see bibliography below) and reports that it "has started the ball rolling here in the U.K., as far as serious students of the subject are concerned."

Space Colonization at the University of North Florida

Professor O'Neill's article in Physics Today appeared during the first offering of THE SPACE VENTURE, an enrichment course taken primarily by non-science major juniors and seniors at the University of North Florida. Professor Jay S. Huebner offers this course twice a year. It has been so popular with the students that at each subsequent offering the enrollment has been closed to maintain a reasonable class size. Space colonization is studied after examining the results of the Skylab and Apollo programs. Since successful space colonization will require an interaction of knowledge from disciplines ranging from astronomy, physics, engineering and economics to agriculture, ecology, medicine, psychology, and the political and social sciences, most students relate it directly to their own prospective fields. This makes the topic of space colonization pedagogically productive, it motivates the students to learn science, to understand the power and utility, as well as the limits of modern science, and to examine how scientific ideas influence human activities. So far, 150 students have studied space colonization at UNF.

Dr. Huebner has also found the Jacksonville public to be eager to learn of this new frontier. In the month of November, he presented space colony talks to two groups of gifted elementary school children, to the religious education program at the local Unitarian church, had an interview published in UNF's student newspaper, and has been on a local TV (WJKS, channel 17) talk show. He had a letter about space colonization and the L-S society (including mailing address) accepted for publication in The Physics Teacher, and sent similar letters to Physics Today, IEEE Spectrum, and Chemical and Engineering News. Dr. Huebner wishes to encourage other L-S News readers to seek other means of spreading the work about space colonization and our society, and to report successful efforts in L-S News.

L-5 Allies

A number of organizations are actively cooperating with the L-S Society. The first to do so was the Federation of Americans Supporting Science and Technology (FASST). August 12-17 it held a conference on "Energy, the Environment, and Societal Needs" at which University student and L-5 Director Bill Weigle spoke on "O'Neill's Space Colony - Energy Considerations." Their October/November FASST News carried an article on the L-5 Society. See below for further information on joint FASST - L-S activities.

The Committee for the Future, especially through the aid of Barbara Marx Hubbard is a major ally. (Our thanks to Shirley Varughese who initiated the L-5 Society's correspondence with Barbara). Aside from our cooperation on the Horizons Day planning, Barbara came to our rescue by agreeing to cover the deficit on the December Newsletter. The Committee for the Future funded Eric Drexler (see "Vapor Deposition of Massive Structures" L-S News, November, 1975) in the summer of 1974 to work as an assistant to Professor Gerard K. O'Neill. See below for further joint CFF - L-5 activities.

Mercury, a publication of the Astronomical Society of the Pacific, carried "The Colonization of Space" in the July/August 1974 issue (see bibliography in the September 1975 L-5 News). This was the first publication of Dr.

O'Neill's space colonization concept to appear in a technical journal. Richard Reis of the Mercury staff is currently giving lectures on space communities/industrialization and is distributing copies of the L-5 News to those who are interested.

The Earth/Space Newsletter, 2319 Palo Alto, CA 94303, in its first issue, November 1975, carried an article on space colonization and the L-S News. The Earth/Space Newsletter carries information and comment on private enterprize space ventures.

Three people on the staff of the National Geographic have become L-5 Society members. The L-S Staff has been told to expect an article on space communities in the future. We can hardly wait to see some of Don Davis' beautiful space colony paintings printed in the incomparable quality the National Geographic regularly produces.

Several L-5 members have complained about the total dearth of space colony information in the science fiction magazines. However, at least one "fanzine," those semi-amature low circulation publications' where many SF writers get their start, has published an article on the L-S Society. Those readers who have heard about that elusive creature known as the "fanzine" but have never seen one can satisfy their curiosity by writing to:

"The Brotherhood of Evil Mutants"
c/o David Merkel
College Station
Williamsburg, VA 23186
Copies of "The Mutant" are 25¢ each.

BICENTENNIAL CONFERENCE TO PRESENT SPACE COMMUNITIES

Barbara Marx Hubbard and John Whiteside of the Washington, D.C. based Committee for the Future discussed the development of a "Citizens' Platform for the Future" at a meeting with the L-5 staff in Tucson. The Committee for the Future is a non-profit organization to bring new options for the future into the public arena for citizen action. They have now received approval from the National Office of the American Revolution Bicentennial Administration for an international conference to explore new horizons at Cape Canaveral June 23-26. (This event is mentioned in the Sept. Newsletter.)

The Committee for the Future has consistently advocated the colonization of space and was among the first to support Gerard K. O'Neill's work. They will continue this support with the conference

The "Citizens' Platform for the Future" will be developed in the ensuing months and will be introduced nationally at the Cape Canaveral Conference in June.

Those interested in participating should write to:

"Citizens' Platform for the Future"
Committee for the Future
2325 Porter St., NW
Washington, D.C. 20008

To cover information distribution expenses, \$2.00 is requested when inquiring.

November 16th, after discussing these concepts with a number of people and organizations, Barbara Marx Hubbard reported:

"Some interesting developments are occurring concerning the International SYNCON at the Cape. It has been informally suggested by one person at the Bicentennial Administration that July 5th, which is the first day of our Third Century, be Horizons Day, and that the Committee for the Future's effort to involve many people

in looking together at this next evolutionary step be made the centerpiece of the July 5th event. We are going to work on this idea with our television producer. Maybe it could become a high level consciousness-raising day.

"We feel that, after this June - July time frame, the concepts of the Citizens' Platform. for the Future and whatever transpolitical activity emerge will be clearer. We discussed this idea with many people after talking with you and found interest everywhere, in both the platform and in some method of making it realistic and active in the world."

Inside the L-5 Society

Following is a description of the operations to date of the L-S Society:

Date of incorporation: Aug. 4, 1975.
First newsletter published: Aug. 24, 1975.
Total paying members as of Nov. 26: 129.

The clearly stated purpose of the L-5 Society is to disband in a mass meeting at L-5.

The most vivid short term goal, however, is to manage to pay the bills! The Society operates on volunteer labor, working in donated office space. Expenses are as follows:

News-gathering. The major expense in this area is the telephone bill. It ran \$253.87 in Aug.; \$363.70 in Sept.; \$466.73 in October and \$286.12 in Nov.

The quantity of news printed does not reflect the phone bill very closely. In Sept., there were 37 column inches; Oct. 42 column inches; Nov., 82 column inches; and in this issue, 200-250 column inches. The reader will note that, while the phone bill has started to decrease, the news gathered has increased. The L-5 staff would like to ascribe this to their "learning curve".

For accurate and responsible news reporting we use the following procedure:

1) An L-5 staff member calls "a reliable source" in the organization in question. The verbal information received would be considered to be suitable for publication by many major news magazines as coming from "a reliable source"; the L-5 News classifies it as "rumor".

2) An L-5 staffer will attempt to acquire written material that confirms or pertains to the "rumor". If the deadline is near at hand, sometimes the source will read the written materials over the phone, which is then transcribed. This was the way, for example, that the L-5 News got the text of Rep. Don Fuqua's press release in time for the Nov. newsletter.

3) On occasion, there is a question as to whether written material the staff receives was meant to see the light of day in a publication. In case of doubt, the staff asks the source for permission.

4) A large body of "rumor" type data, as well as some written materials, is held for future use. The data that remains unconfirmed or that our sources ask the L-5 News to withhold indefinitely would make good material for a novel, titled something like; "Weird Tales of Intrigue in Science, Industry and Government".

An example of a story yet to be published that is eating up a good deal of the phone bills is a followup on Morris Udall's letter to Robert Seamans, Administrator of ERDA (Sept. 1975 L-5 News). The L-5 News has not yet carried any information on ERDA's response to Udall's request that \$1,000,000 be budgeted in fiscal '76 for space solar energy and colonization research. Within the next two months this newsletter should be able to report on definite actions by ERDA, or on the reason for their inaction!

The L-5 News has a special interest in this story because two of its staffers set up the meeting between Udall and O'Neill that resulted in Udall's strong and continuing interest in the subject. (They were the "Tucson constituents" mentioned in his letter). That meeting was the culmination of two months of discussions with, and providing written information to, Udall's advisors. The decision to support O'Neill's work was based on an in-depth understanding of the concepts by these people.

Providing information. The four major expenses in this area are newsletter printing, xeroxing, postage and slide reproduction. The L-5 Society has provided several dozen members with slides and information for use in lectures. Nearly half the members have obtained articles from the L-S Society which were not available to the general public. The most popular articles have been: "Economic Considerations of Initial Space Colonization," by Mark Hopkins of Harvard; "Space Production of Solar Power Stations," by William Agosto of Microwave Semiconductor Corp.; O'Neill's testimony before Congress (now available to the public; see bibliography below); and the "Preliminary Report of the Summer Study on Space Colonization".

Total information distribution expenses for the month of Nov. were \$740.79. A large number of our members are giving lectures or writing articles for professional or general interest publications. Their work greatly increases the effectiveness of the information distribution.

Sources of funds. Only about half of the news gathering and information distribution expenses are being covered by membership fees. The rest is made up from contributions and patient creditors. We have no aerospace industry support - although we would accept money from any source. **Even the Mob?**

The expenses for distributing slides and unpublished papers are proportional to the membership. Newsletter printing is only partially proportional, and news gathering expenses are independent of membership. The L-5 Society must increase its membership significantly in order to continue the present scale of its operations. Special thanks go to the organizations (see the article, "L-5 Allies") and Gerard O'Neill, which have been aiding the Society in gaining new members.

Special projects. Presenting Peter Vajk's work was the first special project. The funds for the presentation at the "Limits to Growth '75" conference were covered entirely by the L-5 members who participated, and special contributions. The Society is on the lookout for new projects and the funds to support them.

Who are the L-5 Staff? Not only do we work for free - we oftentimes pay for the privilege! The major workers are Richard Greenwell, Associate Editor, Office of Arid Lands Studies, The University of Arizona; Keith and Carolyn Henson, Analog Precision, Inc.; and T.A. Heppenheimer, who the reader will remember as the coauthor of "R & D Requirements for Initial Space Colonization" (Nov. 1975 L-S News.) Heppenheimer will be putting in a major portion of the work in the next month.

Members who would like to visit the balmy winter resort of Tucson and volunteer to work in the L-S office will be offered free room and board by the Hensons. The staff welcomes unsolicited articles and news items.

We need feedback. Copies of the temporary bylaws are available to members. They are referred to as temporary because we expect feedback. We would also welcome suggestions on how operations could be improved and the membership expanded; on services we should initiate, expand or terminate; and on how we could cut costs or raise money.

BIBLIOGRAPHY UPDATE

Our thanks to Bill Bush, David Calkins, Raymond Ewing, Gerald Driggers and Ray Sperber for the bibliography!

Power Satellites

NASA CR-2357 "Feasibility Study of a Satellite Solar Power Station," Feb. 1974. Available from the U.S. Government Printing Office, Washington, D.C. 20402. "Derivation of A Total Satellite Energy System"; G.R. Woodcock & D.L. Gregory, AIAA Paper 75-640, 4/24/75.

"Overcoming Two Significant Hurdles to Space Power Generation: Transportation and Assembly," R. Kline and C.A. Nathan, AIAA paper 75-641. From the AIAA/AAS Solar Energy for Earth conference, Los Angeles, CA April 21-24, 1975.

"Satellite Power Stations: A New Source of Energy?" IEEE Spectrum, March 1973, p. 38.

"Space Based Solar Power Conversion and Delivery Systems - Engineering Analysis," C.A. Nathan, NAS8-31308, GAC No. NSS-P-75-001 Aug. 6, 1975. Available from the U.S. Government Printing Office, Washington, D.C. 20402.

"Space Based Power Conversion and Power Relay Systems," D.L. Gregory, NAS8-31628 October, 1975.

This is the most recent study we have located. It can be obtained by writing:

Daniel L. Gregory
MS-HC32
Boeing Aerospace
P.O. Box 3999
Seattle, Wash. 98124

Space Communities

"The High Frontier"; Dr. Gerard O'Neill

"Space Colonization And Energy Supply To The Earth"; Testimony of Dr. Gerard K. O'Neill before The Sub-Committee On Space Science And Applications Committee On Science And Technology, U.S. House of Representatives, July 23, 1975.

"Is The Surface of A Planet Really The Right Place For An Expanding Technological Civilization?"; an interview with Gerard O'Neill.

The above are all in the Fall, 1975 issue of the Co Evolution Quarterly, Box 428, Sausalito, CA 94965

"Space Colonization Now?" by Robert Salkeld. *Aeronautics and Astronautics*, Vol. 13. Sept. 1973. pp. 30-34.

"Lagrange Point Space Colonies" by P. J. Parker. *Spaceflight*, Vol. 7 July 1973. pp. 269-273.

General Interest

"Future Space Programs 1975: Report of the Subcommittee on Space Science and Applications" Sept. 1975.

"Hearings Before the Subcommittee on Space Science and Applications" July 22, 23, 24, 29 and 30, 1975.

"Future Space Programs 1975: A Compilation of Papers Prepared for the Subcommittee on Space Science and Applications," Sept. 1975.

The above three reports are available from:
Superintendent of Documents
U.S. Government Printing Office
Washington, D.C. 20402

They cost 95¢ \$3.20 and \$7.60 respectively.

Living in Outer Space, George S. Robinson, Public Affairs Press, Washington, D.C., 1975.

Moon Colonies and Industry

Colonization Of the Moon, D.S. Halacy, Jr., D. Van Nostrand Company, Inc., 1969.

The Case for Going to the Moon, Neil P. Ruzic, G.P. Putnam's Sons.

"Counterpoint: A Lunar Colony", J.R. Dossey, G.L. Trotti, Spaceflight, Vol. 7, July 1975, pp. 258-268.

Readers will want to see "Two Tracks to New Worlds" by Michael A.G. Michaud in the January issue of Spaceflight. The article concerns space communities.

COMING NEXT ISSUE:

Text of a statement by the Austrian Ambassador to the United Nations, Peter Jankowitsch, Chairman of the U.N. Outer Space Committee, to the Political Committee of the General Assembly on space colonization. The L-5 news will carry articles on the economic, legal and political aspects of international cooperation on this project.

Details on the Jet Propulsion Laboratory's Goldstone Tracking Station experiments with the transmission of microwave power.

LETTERS

DENNIS MEADOWS ON "LIMITS TO GROWTH"

I see that a number of great difficulties will come to a head here on earth well before any space program can have any impact. That is no reason for everyone to abandon interest in space vehicles. but it is reason enough for me and my group to concentrate our energy on the problems before us.

Dennis Meadows
Dartmouth College
Hanover. N. H.

HUDSON INSTITUTE ON "LIMITS TO GROWTH"

Most of us at the Hudson Institute, Herman Kahn and I in particular, regard the Limits of Growth case as feeble and the position as wrong. In particular, I see the scientific revolution as something yet to occur, a feature of the next 75-125 years. Thus the real returns have also yet to appear, and gloom about resources and side effects of science are simply premature

Sincerely,
Pat Gunkel
Hudson Institute
Croton-on-Hudson. N. Y.

SENATE HEARINGS PLANNED

Thank you for sending along the ideas of Dr. Gerard K. O'Neill. There have been suggestions before about colonies in space, and I believe these ideas have merit. In the not-too-distant future the Aeronautical and Space Sciences Committee of the Senate will be looking into this matter. When that happens, I believe Dr. O'Neill should testify. We have no firm dates as yet.

Sincerely,
Barry Goldwater

FASST AND L-5

Being director of aerospace programs for FASST, I look upon the development of the L-5 society as an important indicator of interest in the utilization of outer space. I would like to offer my support for its concept and would like to extend any help that you may think I can supply.

As you may know, NASA is on the verge of announcing a request for proposals to study the feasibility of large space stations-up to 1 km. in diameter-for development in the mid-to-late 1980's.

Beginning next year, FASST. in cooperation with the student programs of the American Institute of Aeronautics and Astronautics (AIAA) as well as the American Astronautical Society (AAS), will develop college and university forums on the utilizations of space and future exploration programs. I would like to include members of the L-5 group to assist and take part in such programs.

Sincerely,
Leonard David, Director
Aerospace Student Programs
FASST
Washington, D. C.

(Members interested in working with Leonard David on this project can reach him at 1785 Massachusetts Ave. NW, Washington. D. C. 20088, phone 202-483-2900.)

L-5 SOCIETY MEMBERSHIP FORM (PLEASE TYPE OR PRINT)

NAME: _____

COMPLETE ADDRESS: _____

AFFILIATION (OPTIONAL):- _____

TITLE or POSITION (OPTIONAL): _____

I am - - a m n o t - - interested in being active locally.

___Check here if membership is to start with issue one.

Please enroll me as an L-5 Society Member. I am enclosing a check for \$ _____ (regular membership \$20.00: student membership \$10.00).

Please enter an institutional membership to receive the "L-5 News" for our organization/library as indicated above. We enclose a check for \$ _____ (institutional or library membership \$100; special library subscription with one month delayed mailing \$20).

COMMENTS AND REQUESTS _____

DOING YOUR OWN THING IN SPACE

Space not only makes a much better place for living, as Dr. O'Neill has shown, but it also offers us a much better laboratory for cryobiological and suspended animation research: We can control gravity (or lack thereof), pressure (or lack thereof), and heat (or lack thereof) very easily and inexpensively in space.

In the year 2000, anyone with the equivalent of (what is now, 1975) \$10,000 will be able to move to live in this space utopia. Each space city might "do its own thing." One such ethically important thing to do is to build more and better space cities so that all (not just some) humans can live in utopia by 2050. A city for cryobiological research and development, is also ethically important.

Dr. O'Neill is already informally recruiting for his first space colony of only 10,000 people, to be in place by 1990. We should begin recruiting for his 1990 beachhead and our 2000 city now.

If interested, contact me.

Charles "Ed" Tandy
 PROMETHEUS SOCIETY
 102 Morris Drive
 Laurel, Maryland 20910

L-5 NEWS

HUDSON INSTITUTE ON SPACE COLONIES
 EXCERPTS FROM HOUSE REPORT -
 KANTROWITZ ON "NAIVE PESSIMISM"
 NASA RESPONDS TO HOUSE REPORT
 MORE BIBLIOGRAPHY - LATEST ON POWER SATELLITES

L-5 Society
 1620 N. Park
 Tucson, AZ. 85719

