

L-5 NEWS

A Newsletter from the L-5 Society

Number 3, Nov. 1975

HOUSE SUBCOMMITTEE CALLS FOR SPACE COLONIZATION

(Text of a news release dated Nov. 4th)

"We are literally on the threshold of a major scientific frontier." Congressman Don Fuqua. (D. Florida) Chairman of the House Space Science and Applications Subcommittee said today. "Our achievements in space exploration as remarkable as they are, are only the beginning." Fuqua's remarks came in the wake of his committee's report to Congress calling for an expanded space program, both in practical applications and future space initiatives. In releasing the 3 volume report on future space programs. Fuqua, a ranking member of the Science and Technology committee chaired by Congressman Olin Teague, Democrat of Texas stressed the importance of what he termed "down to earth" or practical benefits of space exploration. "From the work of the earliest astronomers mankind has obtained tangible benefits from space exploration, in virtually all areas of human endeavors." he said. "And today with our advanced state of technology and manifest needs, the potential for such benefits is greater than ever before." The Congressman cited examples such as helping to solve the energy crisis, advances in medicine, communication, weather and crop forecasting. "However," Fuqua said, "the principal impact of space exploration will occur in the future. Important as the practical benefits are, bold new space programs, such as the possibility of space colonization, based on realistic appraisals of potential space progress deserves serious consideration. It is apparent that the imagination, skill and technology exists to expand the utilization and exploration of space. The costs and benefits of such a program are certainly compelling. Like our forefathers, we need to challenge new frontiers, to explore the unknown, to occupy it, to conquer it and develop it. It might sound like something from the script of Star Trek' but let me hasten to say although it sounds futuristic, which it is, it is, more important, realistic. For in these areas, unexplored, unknown and unconquered, not only are there significant contributions to the future needs of our terrestrial world and its people, but therein also lies the very survival of our celestial existence." In conclusion, Fuqua praised the members of his subcommittee and staff for their diligence and labor in many hours of hearings and meetings which culminated in the report.

The L-5 Editors also wish to compliment the committee and staff for the very rapid release of this report. This report, released in less than half the time ordinarily required, includes the text of Dr. O'Neill's testimony before the committee. Those with a need for this report should write to:

Don Fuqua
2266 Rayburn House Office Bldg.
Washington, D.C. 20515

The UPI story (below) on the Subcommittee press conference was carried in a number of major newspapers:

A House space subcommittee has called for an expanded space program to help solve down-to-earth problems. . . while laying the foundation for advanced projects such as moon bases and orbital colonies.

To pay for such a program, the panel recommended that the space agency propose a 25% budget increase for the next fiscal year. The space agency's budget for fiscal 1976 is \$3.5 billion.

The committee report said the first priority for space activity in the near future "should be directed toward providing clear and immediate benefits to society." It mentioned new educational and medical satellite services and expanded earth resources surveys.

"LIMITS TO GROWTH '75"

Six L-S members: Peter Vajk, Mark Hopkins, Bill Weigle, Cheryl Peltz, and Keith and Carolyn Henson attended the "Limits to Growth '75" conference in Houston, Oct. 19-21. We would like to give special thanks to those who helped us get there: Jack Babcock, Stephen Cheston, Gerald Driggers, Gordon Woodcock, Afco Family Mart, T.F. Walker Co. and Union Bank.

The conference staff was most helpful in arranging accommodations at the last minute for a seminar, "The impact of Space Colonization on World Dynamics," presented by Peter Vajk and Mark Hopkins.

The L-5 Society was well received at the Conference; by the last day it was difficult for us to even eat because of people questioning us in relays. Our efforts were mentioned in the Nov. 3 Newsweek report on the Conference. We are receiving mail and phone calls as the result of our participation in the Conference and hope soon to be able to report interesting developments.

We were not the only people to present concepts that indicate that growth (at least in certain directions) is both possible and desirable. Alvin F. Hildebrandt of the University of Houston presented an earth based solar power system that may hold promise for power generation in arid low latitude regions of the Earth, such as the Southwestern part of the United States.

Professor Hans Linneman of the Netherlands presented data from Club of Rome sponsored research showing that a doubling of world food production is possible. He suggested that we keep in mind a quote from M.K. Gandhi: "To the poor man God dare not appear except in the form of bread and promise of work."

Fletcher L. Byrom, Chairman of the Board of Koppers Corp. spoke in plenary session on the role that his international corporation is playing in improving the quality of life around the world through a combination of investment (carefully considered for social and environmental impact) and corporate sponsorship of groups working to improve the lot of humankind. In reference to the "limits to growth" ethic, Byrom stated, "I have heard this proposition - mostly from people in rather comfortable circumstances - and I always respond with a standing offer. I say that I will invite them to visit a crossroads in Bangladesh, a slum in South America, a village in Africa. All they have to do is announce: 'Good news, friends! We've just decided on a policy of zero economic growth that will freeze everything just where it is!' For my part of the bargain, I will notify their next of kin."

"Those who attack growth are likely also to attack the technology that makes it possible. [See Jay Forrester's statement below! Ed.] I remember a story set down by the late Paul Goodman. 'Just the other day; he said, I listened to a young fellow sing a very passionate song about how technology is killing us and all that . . . But before he started, he bent down and plugged his electric guitar into the wall socket.' "

An unexpected degree of opposition was encountered from Jay Forrester of Massachusetts Institute of Technology. In his talk in plenary session, "New Perspectives for Growth Over the Next Thirty Years," he stated, "Much of the limits-to-growth debate has focused too narrowly on physical constraints. Restricting debate to physical limits invites the rejoinder that technology can circumvent such limits. Indeed technology might do so for some time. But any belief that shortages of energy and food can be overcome will be used by people and governments as an excuse to avoid facing the issues posed by growth of population and consumption."

Forrester's solution to the world's population growth was "Some social threats, some energy and materials shortages, some inadequacy of food, and some pollution . . ." He also called for an end to world trade, calling it an invitation to war.

In contrast to this view, Herman Kahn of the Hudson Institute, speaking in plenary session, pointed out that an increased material standard of living has preceded the demographic transition to steady state in over twenty nations. He held out the well justified hope that increased material standards of living around world will lead the rest of the world's population to steady state.

The one continuing disappointment of the conference was that no one in the world dynamics field that we met was willing to evaluate the implications of space industrialization in relation to world dynamics or even comment on Dr. Vajk's additions to the world dynamics model. This is particularly galling in view of the comments made by the authors of *Limits to Growth* in their response to Sussex. They state,

"Any long-term model that is being used to aid the policy making process must therefore be updated constantly to incorporate surprising discoveries as they occur, and to assess how they may change the options of human society."

Also Professor Forrester stated in *World Dynamics*.

"It is hoped that those who believe they already have some different model that is more valid will present it in the same explicit detail, so that its assumptions and consequences can be examined and compared. To reject this model because of its shortcomings without offering concrete and tangible alternatives would be equivalent to asking that time be stopped."

There are two primary problems with space colonization. The first is can we do it? Scientists, engineers, and economists can answer this one. So far, the answer seems to be yes. The other is more basic. In view of the long term effects on the world, should we do it? If world dynamics is to live up to its promise of guiding the future, this is a question that needs to be addressed.

Peter Vajk is currently giving seminars on his world dynamics work. Those interested should write to him at:
57 Oakdene Court
Walnut Creek, CA 94596

Dr. Vajk's primary interest at this time is to form a world wide study group to prepare a world impact statement on space communities and industrialization.

**IS A HIGH TECHNOLOGY SOCIETY
MORE VULNERABLE THAN A LOW
TECHNOLOGY SOCIETY?**

Professor Forrester raised an issue at the "Limits to Growth '75" conference that will be of importance to the space communities and industrialization project. Forrester said, "A complex technological society is at the same time harder to understand, more difficult to accept, and easier to disrupt. Complexity increases frustration and disenchantment while also increasing vulnerability to either individual or organized interference."

L-5 NEWS

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This highly anti-technological statement, characteristic of the opinions of a large segment of academia, needs to be carefully considered in view of space communities as they will be a most "complex technological society."

Data on life expectancies shows that highly technological societies around the world, in spite of their "vulnerability," are consistently safer places than low technology areas. Compare, for example, the life expectancies of people in New York City or Northern Ireland with those of Bangladesh. We also suspect that one's chances of surviving a modern airline hijacking are better than in an old fashioned stagecoach robbery.

On the other hand, events of the last decade: violent antiwar protests in the U.S., the Irish Republican Army in Ireland and England and the Palestinian terrorists, for example, have shown that large scale social injustice is dangerous to maintain in a technological society. However, for those who consider social justice to be a worthy goal, this could be considered an advantage. (And would Nixon have been deposed without the tapes?)

As this issue bears heavily on space communities we would like to hear more on this pro and con with concrete examples from our readers.

**VAPOR DEPOSITION OF
MASSIVE STRUCTURES**

Work done this summer suggests the possibility of fabricating space structures directly from vaporized metals. If proven out by further design work and by vacuum chamber experiments, it promises to provide a textbook example of the use of space conditions in processing, and may cut the cost of a colonization program by some tens of billions of dollars.

Fabrication of seamless hulls or hull segments would be a simple and useful application. The solar energy flux, vacuum, and lack of gravity in space make it easy to vaporize metal and direct it as a conical beam; metal plate of the desired strength and thickness can then be built up on a balloon-like form made of plastic film.

This technology seems applicable to both aluminum and steel alloys, to structures many kilometers in diameter, and to structures more complex than smooth halls. Because it requires little equipment and negligible labor, it promises to reduce the cost of some space structures to little more than the cost of raw material. It seems a fruitful area for further research.

Eric Drexler

SPACE COLONIZATION AT MIT

Organized interest in space colonization at the Massachusetts Institute of Technology has been rapidly expanding since last January. January 1975 saw an informal, student-sponsored seminar. Spring and Fall terms have seen a continuing undergraduate seminar sponsored by the Department of Earth and Planetary Sciences, and the establishment of a permanent study group. Fall term has seen the Department of Aeronautics and Astronautics sponsor an undergraduate course in space systems engineering, centered around space colonization: a graduate level design course is planned for next spring.

Members of the MIT study group are concerned with topics ranging from sociology to metallurgy to agriculture; several participated in the NASA/Ames Summer Study. Papers are under preparation on extra-terrestrial resources for terrestrial use, vacuum vapor fabrication, and the overall economics of space colonization; Inquiries may be addressed to:

Eric Drexler
Rm 201 4 Ames St.
Cambridge, MA 02139
(617) 253-1000 Ex-56105

SPACE COLONIZATION AT PORTLAND STATE UNIVERSITY

A course, on Extraterrestrial Community Systems, will be offered at Portland State University by Professor Magoroh Maruyama. The course will address the "new cultural options" of an extraterrestrial community, and will analyze the psychological, and social problems which will be reduced and those new ones that might arise. The course will also examine various physical, architectural, environmental, and social designs.

Next month we will carry articles on the space community courses being offered at New York Polytechnic and Northern Florida University.

L-5 R & D REQUIREMENTS OUTLINED

T.A. Heppenheimer, of the California Institute of Technology (CalTech), and Mark Hopkins of Harvard University, describe the research and development requirements for an initial L-S habitat in a paper to be published in the near future in *Astronautics and Aeronautics*, journal of the American Institute of Aeronautics and Astronautics (contribution No. 2664 of CalTech's Division of Geological and Planetary Sciences).

The initial requirement would be a "construction shed" in low Earth orbit, manned by about 2,000 workers, and a mining and transport facility on the Moon, which would accelerate packages of lunar rock by means of a "mass launcher"* to the translunar libration point L-2, where they would be caught by a "mass catcher" and sent on to L-5 by a space bulk carrier. "Despite the grand scale of the concept," the authors state, "it (L-5) appears to be achievable with technology currently in hand. It may be at least as feasible to propose a colonization effort today, as it was for John Kennedy to propose the Apollo program in 1961."

Although 10,000 tons may have to be lifted annually to low Earth orbit for L-S or lunar station purposes, all the lift requirements could be met "with derivatives of the space shuttle and of other existing lift vehicles." The authors propose construction of a Heavy Lift Launch Vehicle (HLLV), outlined recently by Boeing Aerospace Company, which could be developed for less than \$0.5 billion, and could be operational in the early 1980's.

The Lunar mass launcher would propel 106 tons of raw Moon material annually, at 2.4 km/sec. (or lunar escape velocity). A track would be laid along a relatively rough 10

km. stretch, on which payloads could be accelerated at 300 meter/sec.² A fine-aligned section of track would then provide fine velocity adjustment. After Lunar escape, the payloads would arrive at L-2 with a probable error of 100 meters, to be intercepted by a catcher (two systems are proposed) and shipped on to L-5.

The authors predict that the unselected material arriving at L-S would petrographically consist of plagioclases, ilmenites, pyroxenes, and anorthosites (by weight, 20-30% metals, 20% silicon, and 40% oxygen), and they describe the probable L-S production methods of aluminum, titanium, glass, and oxygen. They then discuss habitat construction methods, and pay considerable attention to radiation problems and shielding methods for both "outside" workers and "inside" residents.

They also discuss the closed-cycle ecosystem of the community: "The colony must function as a closed ecosystem and must be self-sufficient, requiring no routine resupply from Earth. . . A space farm offers the opportunity for high intensity agriculture in an optimized environment. Temperatures and lighting cycles can be controlled; insects and pests can be excluded. Hydroponic methods can be utilized. In particular, plants can be grown without soil. They may be supported by Styrofoam boards, with a nutrient solution sprayed on the roots which hang below the boards." Heppenheimer and Hopkins mention a productivity of 125 grams of fruits and vegetables per square meter of growing area per day, and due to the controlled environment, "growing seasons" would be continuous.

Rabbits would be the main source of animal protein, and ruminants would convert stems, leaves, and roots into milk; the preferred ruminant is the goat ("by excluding billy goats and using artificial insemination when new goats are wanted, the odor and flavor of goat's milk can be as acceptable as that of cow's milk"). Chickens would be raised for egg production "using wastes from kitchens." The space farm would provide 3,000 calories and 150 grams of protein per person/day.

In discussing the proposed satellite solar power stations (SSPS's), the authors state they could "be produced in numbers adequate to meet the nation's energy needs and thus repay the initial investment in the colony." In conclusion, they describe the concept of space communities as one of the most important in recent years:

"important because it offers a new, feasible means of meeting our energy needs, without nuclear plant proliferation or environmental despoliation. But even more importantly, it gives at least a partial refutation to the concept of limits of growth. When mankind's world extends beyond the Earth, one need not regard the human future as bound by the limitations of Earth. And in opening up a new frontier for large-scale settlement, space colonization can be a major stimulus to hope."

FEDERAL BAR COUNCIL BULLETIN OF REPORTS CONCERNING LEGISLATION LEGAL STRUCTURE FOR SPACE EXPLORATION

Humankind's pursuit of exploration in space can have great new results on earth if the legal structure for this great effort is further refined.

The task of securing humankind's future by exploring the secrets of the universe is so vast that it can tap spiritual and material resources now unused and thus help to provide the will needed to overcome age old problems on this planet. Thus, Earl Hubbard, author of a new work on the implications of this effort¹ stated:

"It is not a question of either solving the problems of earth or going into space. It is a question of both.

"We have the means to end poverty. What we lack is the will. Morality means a concern for the future of mankind. Without faith in that future, there will be no morality.

"The tradition of all life is the decision to transcend - to overcome every obstacle to life, to explore every new frontier. The basic option for survival is now and always has been the acceptance that man serves some greater purpose than the care and feeling of his own body."²

This great effort should exclude no group of our citizens, accidentally or otherwise. And participation in industries involved has in fact begun in our inner cities on a small scale.³ A specific office should be created by law with the particular function of seeing to it that this is rapidly expanded, and that on-the-job training is offered without barriers to advancement based on conventional academic requirements for jobs. As this is done, it will become more evident as Mr. Hubbard has stated that "It is not a question of either solving the problems of earth or going into space. It is a question of both." The birth of new industries gives us the opportunity to bypass old barriers.

Likewise, this Committee has unanimously approved resolutions seeking a convention to explore possibilities of closer union of free peoples. As a grand gesture looking toward such unity, citizens of such nations could be enabled to compete in our space efforts, and the possibilities of sharing the benefits and burdens of the program as a whole with such nations could be explored. In addition, co-operation in space with all nations is potentially unrestricted.

We hope that our contribution as lawyers to broadening the foundations on earth for this great effort may assist in some small measure in furthering its high goals.

The premise underlying the reports in this bulletin is that these questions can be approached in ways which will redound to the benefit of all. Without decent neighborhoods for all Americans there will be none for any. Similarly, both fairness and effectiveness in law enforcement are essential, and neither can exist without the other. We believe that increased attention to the common interests of all will result in measures which will protect the interests of all groups in our society.

Respectfully submitted,

COMMITTEE ON LEGISLATION*

Richard A. Givens, *Chairman*

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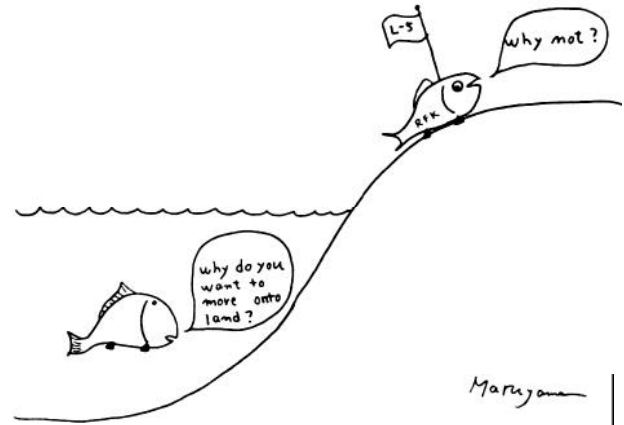
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¹ Hubbard, *The Search Is On* (1969).

² *Pace* magazine, Vol. 5, No. 8 p. 22 (Aug. 1969) (omissions made without indication by permission).

³ Sullivan, *Build Brother Build* (1969); *Pace*, Vol. 5, No. 8, p. 50.



L-5 SOCIETY PRESENTS TESTIMONY AT ERDA MEETING

Gerald Driggers of the Southern Research Institute represented the L-5 Society at a public meeting Oct. 20 in Atlanta, Georgia sponsored by the Energy Research and Development Administration. Driggers explained the potential of orbiting power satellites (Powersats) manufactured at L-5 with lunar resources to provide cheap, renewable and non-polluting power to the Earth.

BICENTENNIAL ACTIVITIES

Ms. Norie Huddle, author of *Island of Dreams*, a book about the environmental crisis in Japan (Autumn Press, Inc., 1975) is interested in organizing a cross country tour as a Bicentennial Horizons project. On this tour Norie plans to discuss future alternatives with gatherings of citizens; she plans to present space communities and solar satellite power stations as an alternative that deserves serious consideration. Those who want to learn more about her project and interested in participating may write to her:

C/O Ecology Center
13 Columbus
San Francisco, CA 94111

HORIZONS DAY PLANNING SESSION

Nov. 8th Barbara Marx Hubbard and John Whiteside of the Committee for the Future met with the L-S Staff in Tucson to discuss joint sponsorship of their June 26, 1976 Horizons Day and associated events. Barbara Hubbard was one of Dr. O'Neill's earliest financial supporters and plans to continue her organization's work in space communities and industrialization. Further details may be obtained from:

Barbara Marx Hubbard
Committee for the Future
2325 Porter St., NW
Washington, D.C. 20008

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

O'NEILL LECTURE SCHEDULE

Gerard K. O'Neill, of Princeton University's Physics Department, has been one of the leading proponents of space communities, and lectures extensively on the subject. His lecture schedule for the next few months is as follows:

Thursday, December 4: National Meeting, Deans of Engineering Schools, Chicago, Illinois. (American Society of Engineering Education j

Friday, January 30: American Institute of Aeronautics and Astronautics, Annual Meeting, Washington, D.C. Keynote Speech, Session 9. Session title: "Transition to the Future"

Persons living in these areas may wish to attend Dr. O'Neill's presentations.

VIEWS ON AMERICA'S FUTURE TO RECEIVE BICENTENNIAL AWARDS

The Wells Fargo Bank, in cooperation with the Smithsonian Institution, will be sponsoring "Toward Our Third Century," bicentennial awards program which will judge entries on "critical issues facing our nation in its third century." and which "express thoroughly and creatively . . . ideas and recommendations for shaping an even better future." The themes, which may be presented in written form, or film, or on tape, are: 1) individual freedoms in U.S. society; 2) American arts and culture; 3) science, technology, energy and the environment; 4) family life, work, and leisure; and 5) the U.S. and the world.

Written essays must be no more than 3,500 words, and films and tapes no more than 15 minutes. Entries must be postmarked no later than January 31, 1976, and submitted to "Toward Our Third Century," P.O. Box 44076, San Francisco, Cal. 94144. Entries will be categorized by 1) essays by those under 18 years of age; 2) essays by all those over 18; and 3) Films or tapes by person of any age. All categories will receive \$10,000, \$5,000, and \$3,000 as first prizes. A total of \$100,000 will be awarded. Final judging will be made by a panel of nine distinguished Americans selected by Smithsonian Institution, and winners will be announced on July 4, 1976.

CoEvolution Quarterly

The fall issue of the CoEvolution Quarterly contains the text of O'Neill's testimony before Congress, O'Neill's article, "The High Frontier," an interview with - you guessed it - O'Neill, and Eric Drexler's "Deep Space Materials Sources." Box 428, Sausalito, California 94965

SATELLITE/TERRESTRIAL POWER COMPARISONS

Under subcontract to Econ, Inc., on behalf of NASA, Arthur D. Little, Inc., is working with Grumman and Raytheon to develop technical and economic comparisons of satellite and terrestrial power generation and transmission systems. According to Dr. Bette M. Winer, of Arthur D. Little, the Econ project should place these alternatives in proper perspective. Source: Arthur D. Little, Inc.

INFORMING YOUR COMMUNITY

Austin L-S member Gayle Hudgins Watson sent us a copy of a front page article on space colonization run in the Daily Texan 9/5/75. Gayle told us, "It was easy to get the coverage. I just gave a reporter the September Newsletter and a copy of O'Neill's testimony before Congress."

While Ms. Watson doesn't promise that all home town newspapers will respond as well, she certainly feels that local publicity is not hard to obtain.

In Tucson we have been listed by our public library as a source organization for information on solar satellite power stations and space communities. Three local members are giving lectures for schools and civic groups. Most other communities would be likely to give L-S Society people a warm welcome, as well.

ERRATUM

In the October newsletter it was stated that in the year 2020, "1/3 of 10% of SSPS energy production" would go to transporting Earth emigrants and their baggage. It should have read, "1/3 of 1%".

LETTERS

COMMENT ON SPACE RESEARCH AND DEVELOPMENT BILL

The general concept of a bill to establish a Space Research and Development Corporation strikes one as an idea whose time has come. The various possibilities for profitable investment in space at the present have in most cases the characteristics of long payback periods and many side benefits to society which could not be captured by a private enterprise government participation* Ventures with these characteristics have had a long and fruitful history

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.

_____ 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 _____

within the United States. From the earliest days of our nationhood the government participated in one form or another in investments canals, turnpikes and later, railroads. In the early 1800's these investments amounted to a far larger percent of government expenditures than they do for similar projects today. This was because we had a frontier to open up. Today we see before us another frontier, the high frontier, whose economic potential may dwarf the frontier which lay to the west of the original thirteen states. It seems quite appropriate for America, as the bicentennial approaches, to take serious steps towards the economic development of the high frontier. After all, more than half our history has been intimately associated with a frontier and besides, it is getting boring down here.

Mark Hopkins
Harvard University

MORE COMMENT

I have a major bone to pick with this bill. Even if you don't realize it now, you will soon find that some of your strongest support could come from ecology oriented groups. Clean Energy and a Clean Environment go hand in

hand. A efficient source of solar energy is the Ecologist's dream. I *strongly* urge that the wording of Section 24, part (b) relating to the Corporation being exempted from filing an environmental impact statement be changed to read that you must file an environmental impact statement, but that you may proceed with the project while the statement is being studied. Besides, there is the outside chance that the corporation might miss something in its "considerations" and damage the ecology in some way. So why take chances? Why mess up a powerful lobby just so the Corporation is spared a little paper work?

I also am a bit disturbed that the Board of Directors is going to be appointed to office by the President. Where are the Standards of the Quality of these people? This is going to be a job for a real Scientist-Businessperson. How do we know Ford (Or who ever) is going to be able to handle the selection? (By the by . . . I noticed that the Bill uses all masculine pronouns? I hope that you can have the wording altered so that 52% of the population is not left out by the sin of semantic omission!)

Shirley Ann Varughese
North Plainfield, N.J.

L-5 NEWS

**HOUSE SUBCOMMITTEE CALLS FOR "ORBITAL COLONIES"
REPORT ON "LIMITS TO GROWTH '75" CONFERENCE
SPACE COLONIZATION AT MIT**

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