L5 NEWS

AUGUST 1977 VOL. 2, NUMBER 8

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Published monthly by L-5 Society, Inc., at 1620 N. Park Ave., Tucson, AZ 85719. Subscription price: L-5 Society members, $3.00 per year, included in dues ($20.00 per year, students $10.00 per year). Subscription price to non-members available on request. Single copies, when available, $1.00 each. Send Form 3579, ADDRESS CHANGES AND SUBSCRIPTION ORDERS to L-5 SOCIETY, 1620 N. PARK AVE., TUCSON, AZ 85719. Application to mail at second-class postage rates is pending at Tucson, Arizona.

HOUSE OK'S JOP

Washington, D.C.'s July weather isn't the only featureof the U.S. Capital that resembles a pressure cooker. Summer is also a season in which Congress puts the pressure on supporters of Federal programs to justify their funding requests.

Planetary scientists, elated at the unexpected inclusion of the Large Space Telescope in both the House and Senate NASA Appropriations Bills, were hopeful that the Jupiter Orbiter Probe (JOP) would also get the nod from Congress. JOP sailed through the Senate Commerce Committee and House Science and Technology committee, but the next step, approval by the House and Senate Appropriations Committees, looked less easy. Perennial NASA bogeyman Senator William Proxmire (D-Wis.) had made unfriendly noises about both the Large Space Telescope and JOP. But his committee allowed the two programs to stand, while, over in the House, supporters were caught off guard when Edward Boland (D-Mass.) nixed JOP.

Because the House and Senate versions of the NASA Appropriations Bill differed after Boland's JOP deletion, a joint Senate/House conference committee was formed to iron out their differences before reporting the bill to the floors of the two chambers for a vote. (A yes vote from Congress on such committee-approved funds is virtually automatic.) But this time the committee reached an impass. Boland refused to back down on JOP, asserting that "NASA always gets what it wants," while NASA's Office of Congressional Liason complained that "We've hardly ever had a project come off on time in the last several years because they cut back our money and we end up having to juggle things around."

Wednesday, July 13, the committee was hopelessly deadlocked. Near midnight, in a surprise move, Boland called for a vote of the full House on his JOP deletion move. The vote was scheduled a scant two days later: Friday, July 15.

JOP supporters were stunned. As a worried NASA official recalled, "I've been in Congressional Liason for at least 14 years, and a House Committee's recommendation on a NASA appropriation has *never* been overturned on the floor." And, as asteroid expert Clark Chapman was pointing out, "Only 35 or so out of the 435 members of the House have even heard of JOP."

It looked like the end of an era. Planetary flight mission funding had been declining precipitously for years. The demise of JOP would have meant that the early development team at the Jet Propulsion Laboratory in Pasadena, which lays the foundations of all planetary missions, would be disbanded.

Planetary scientists are normally an apolitical lot. In the past, their projects were quietly snuffed out in committee. But the completely unexpected opportunity to battle it out on the House floor goaded them into action.

"We've got to take it to the people-the folks who are standing in line to see Star Wars," declared San Diego scientist Jim Arnold. Thursday, with no more than 36 hours to go before the scheduled vote, the Division of Planetary Sciences of the American Astronomical Society sent telegrams to all planetary scientists.

Across the nation planetary scientists read their telegrams and grabbed the phone, calling the local news media and alerting friends. A long distance "telephone tree" was set up to reach as many people as possible. "If you call 7 people and tell them about JOP and get each of them to call another 7, and so on, we've got it made."

Telegrams and phone calls began arriving at Congress; by Friday the phone at NASA's office of Congressional Liason was ringing off the hook. "There were literally hundreds of House staffers calling," a NASA official reported. "They'd say, 'Hey, we've heard JOP is in trouble. What's JOP?'"

In the meantime, unexpectedly long House debates on other bills made it clear that the JOP vote would be delayed at least until Monday. Word flashed over the hastily organized phone network: "We've got a chance!"

Even so, time seemed hopelessly short. One Republican staffer who had first heard of JOP's problems around midnight Thursday complained, "After spending all day going around to other Representative's offices, when I went home Friday night I felt like beating my wife! Getting those people aware of what's happening to JOP is like trying to nail jello to the wall."

Monday morning Washington residents, as is their custom, read the Washington Post over breakfast. Inside they found an editorial supporting JOP. Over on Capital Hill, California governor Jerry Brown, Morris Udall (D-Arizona) and Carter Science Advisor Frank Press were using their not inconsiderable influence to woo Democratic votes for JOP. On the Republican side, Minority Leader John Rhodes and John Ashbrook (R-Ohio), among others, were also lining up votes for JOP. The political pros now were giving it a 50/50 chance.

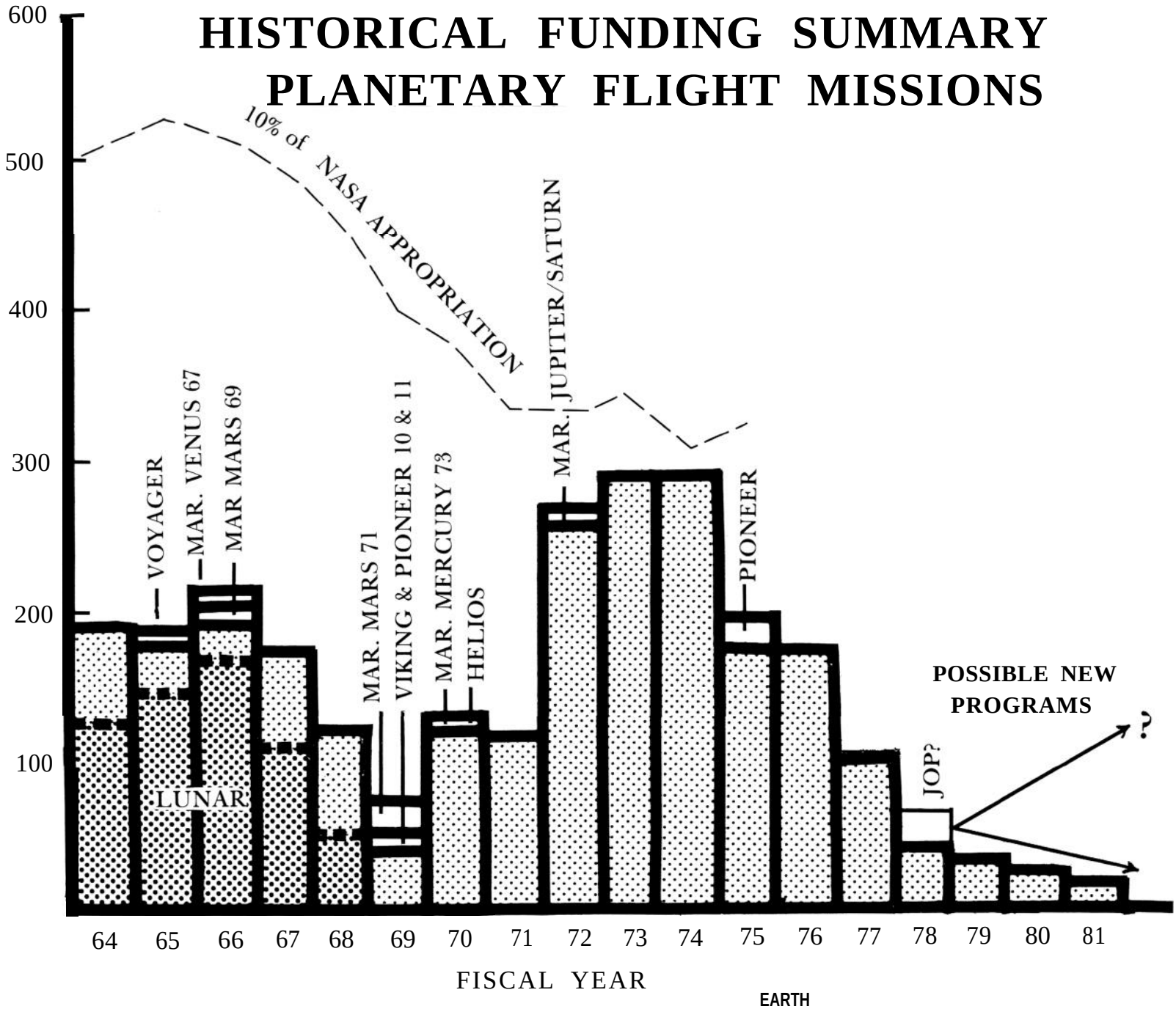
Tuesday, July 19, rolled in wet and hot. Inside the chamber of the House of Representatives the air conditioning was doing its job, but planetary scientists in the visitors' gallery were sweating. JOP, given a reprieve until now, was about to be voted on.

The hour of scheduled debate opened with Edward P. Boland. He held the floor for nearly half an hour, defending his committee's cut of JOP funds. Then JOP supporters got the floor. The first to speak was House Minority Leader John Rhodes (R-Arizona) (see related story). He was followed by Barbara Mikulski (D-Maryland), who wisecracked, "I hate to have to agree with the Minority Leader, but . . ." And one after another, some 30 Republicans and Democrates from all over the country got up behind the podium and defended JOP.

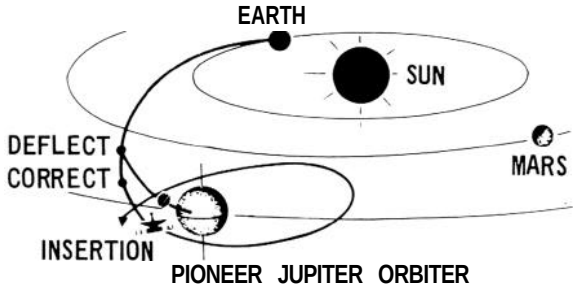
However, the real action was not on the floor, where only some 60 out of the 435 members of the House were present. JOP supporters were concerned about rumors that Speaker of the House and close Boland associate Tip O'Neill was out gathering votes to kill JOP.

(Continued page 4)

HISTORICAL FUNDING SUMMARY
PLANETARY FLIGHT MISSIONS



JUPITER PROBE
REFERENCE DESIGN MISSION



LAUNCH DATE: 21 **DEC 81**
ARRIVAL DATE: 24 NOV 84

Probe release from the bus occurs at 500 Jupiter radii from the planet in a plane slightly tilted to the equatorial plane. The targeted entry point is 3.15 degrees North latitude and 28 degrees before the evening terminator. Entry is at -7.5 degrees at 450 kilometers (km) above Jupiter's theoretical one bar pressure level and at a relative velocity of 47.4 kilometers per second. When the probe senses deceleration, it initiates warmup and prepares to start its scientific measurements. After a peak deceleration of about 300 g's, the deceleration level drops off, and at about -3g's the probe will be in a subsonic flight condition. Sensors are then deployed, data is formatted, and real-time and stored data are interleaved onto the RF telemetry link to the spacecraft bus. The telemetry carrier wave is used for acquisition purposes and to provide range rate data by Doppler techniques, and for reconstruction of an atmospheric model of Jupiter.

RHODES LEADS SUCCESSFUL EFFORT TO PRESERVE JOP

Congressman and House Minority Leader John J. Rhodes (R-Ariz.) spearheaded a successful effort in the House of Representatives to preserve funds for the Jupiter Orbiter Probe despite attempts to abolish the program. After debate during which both Republican and Democratic members spoke in favor of the probe, the House voted to appropriate money for the program.

An amendment to the National Aeronautics and Space Administration appropriations bill sought to delete funding for the Jupiter Orbiter Probe Program for Fiscal Year 1978. After debate during which Rhodes led efforts to strike down the amendment, it was defeated 280 to 131.

In remarks from the House Floor, Rhodes told his colleagues, "I believe that deletion of the funds for this program would seriously set back our balanced space efforts."

"The Jupiter Probe provides the first in-depth opportunity for exploration of the planet's atmosphere and is expected to advance our knowledge of atmospheric processes," Rhodes said. "I hope that my colleagues would want to take advantage of this opportunity to maintain U.S. leadership in space exploration."

"In addition, the program is a key link in maintaining our leadership in planetary exploration and dedication to expanding knowledge of the universe. As had been pointed out by other Members (of the House of Representatives), the program is now designed to take advantage of the optimum launch date in 1982. The next optimum launch time will not come until 1987, and any interim effort would require a greater launch energy."

"Any delay in the funding of the program would not only delay our space efforts but would cause the disruption of this highly coordinated effort and could result in the loss of very specialized personnel," Rhodes said.

House Minority Leader John Rhodes

House OK's JOP *(Continued from page 2)*

At the end of the speeches a voice vote was called. Those who backed Boland's JOP cut called out "aye." Then the "nay's" rang out, far louder. But Boland, expecting that the absent Representatives would back him, called for a quorum.

A buzzer rang throughout the buildings of the House of Representatives. In offices, hearing rooms, corridors and cafeterias, the Representatives got the message: fifteen minutes to get to the floor and vote. The rush was on.

Those already on the floor filed over to the forty voting terminals. One by one they inserted their plastic identification cards and pushed a button to indicate a yes or no vote. An electronic scoreboard then flashed his or her name and vote, and talleyed up the score.

As expected, the early count from those who had given the voice vote ran 2 to 1 against Boland's measure. But they were only a small fraction of the total. Then the rest of the Representatives began crowding in. Hundreds of them. In the gallery, the scientist's eyes were riveted on the scoreboard as the votes piled up. The 2 to 1 margin was holding-Tip O'Neill had decided to remain on the sidelines, and Boland was on his own.

The timer counted down to the end of the fifteen minutes. The vote was in: 280 opposed the JOP cut, and only 131 supported it.

In the gallery, the scientists were jubilant. Across the nation the phone network went into action once again, carrying congratulations to the citizens who had joined hands in the JOP rescue operation.

Asteroid expert Clark Chapman, on behalf of the planetary sciences community, extends thanks to L-5 members, who with their money and action helped to save JOP. -Carolyn Henson

SPS, SPACE INDUSTRY FUNDS CUT

July 13 a House-Senate conference committee finalized all NASA appropriations except for JOP (see lead story this issue.) The Large Space Telescope was awarded $36 million, and the cut in Shuttle funds made by Rep. Boland's subcommittee was restored, with the proviso that certain program milestones should be met.

However, several NASA requests were cut. Among them were a $5 million reduction for space industrialization studies and a $2 million cut in solar power satellite funds (hey, folks, that's us!) Also cut was $3 million for Viking follow-on studies. A $2 million ozone depletion study was dropped entirely.

FROSH STEPS UP TO NASA POST

Dr. Robert A. Frosch, 49, has become Administrator of the National Aeronautics and Space Administration. Frosch was Associate Director for Applied Oceanography at the Woods Hole Oceanographic Institution on Cape Cod, Mass.

Frosch succeeds Dr. James C. Fletcher, who resigned May 1, after six years service as NASA's Administrator.

From 1973 to 1975, Frosch was Assistant Executive Director of the United Nations Environment Programme, holding the rank of Assistant Secretary General of the United Nations. Previously, from 1966 to 1973, he was Assistant Secretary of the Navy for Research and Development.

Frosch's professional career began in 1951 with the Hudson Laboratories of Columbia University, where he worked on Naval research projects. There he progressed from Research Scientist to Director of the Laboratories, becoming Director in 1956 and remaining in that post until 1963.

Frosch, a native New Yorker, earned his A.B., A.M. and Ph.D. degrees at Columbia University. He is a member of Phi Beta Kappa and Sigma Xi. He received the Arthur S. Flemming Award in 1966 and the Navy Distinguished Public Service Award in 1969. Frosch is a member of some nine scientific professional societies and the author of numerous scientific publications.

Dr. Robert A. Frosh

IT'S EYES DOWNWARD

by Leonard Dauid

On June 23rd NASA's fifth Administrator in its 19 year history met the Washington press corps at what was billed as a "get-acquainted" news conference.

New NASA Administrator Dr. Robert Frosch, in his opening remarks, sprinkled holy water on a wide variety of current and future NASA activities, but underscored his discussions with the attitude of "getting the NASA house in order." Demonstrating a "first things first" attitude, Frosch emphasized the need to complete the development of the Shuttle and prepare a foundation for even more elaborate applications of our space capabilities.

It is clear that the new NASA Administrator has a keen eye on applications programs and in increasing public awareness of NASA's entire stable of application satellite concepts. But with this increased capability, Frosch strongly feels that management of those systems is paramount. "As the Shuttle comes into being, we are going to be doing things in the application direction that are going to be entirely new in the way we put together systems and manage them. I think that is going to take a considerable major new effort," stated Frosch.

When questioned about the space settlement concept, Frosch reacted. by saying "I want to understand better than I do now why we want to colonize space and what it is that will be gained by doing that. In any case, I don't think we will understand how to do it and why until we have some experience with routine use of the Shuttle."

Continuing Frosch emphasized that, in the case of space settlements, "we have just begun to get our imaginations and our thoughts fired up. In every major technological development that I know of." said Frosch, "the import uses were not the ones that you were able to think about in advance, but the ones that came upon you when you actually had the tools."

According to Frosch, even near term space station development looks a little far off. Frosch believes that the technology isn't at hand to build a large permanent space station, or "even a long-term colony with a lot of people. I have not seen any reasons that have convinced me that *now* is the time to make a major attempt to do such a thing. I don't know when the time will be to do that," observed Frosch.

However, Frosch considers NASA as the "logical" agency to develop the Solar Power Satellite concept, with the space agency engaging in small-scale experiments to test the feasibility of an SSPS system via the Shuttle.

Summing up, it appears that Dr. Frosch has taken up T.V. star Leonard Nimoy's (alias Dr. Spock) quest of "In Search of . . ."

You advocates of large space stations, SSPS, space settlements, and possible resumption of expeditions to the moon and planets, will have to wait. It's eyes downward, and more earth-assisting satellite applications. Luckily the Universe will be patient!

SPS DISTANT, SAYS FROSH

A satellite solar-power system "appears to be technologically feasible," but its development and use are "between 25 and 100 years" away. Robert A. Frosch told a Senate committee in June hearings to confirm his nomination as head of the National Aeronautics and Space Administration. Supposing thermal energy were collected by large space-based solar-cell arrays, "we have only the sketchiest ideas of the costs" of converting that energy into electricity and transmitting it to earth for distribution by microwaves or other means, Frosch said.

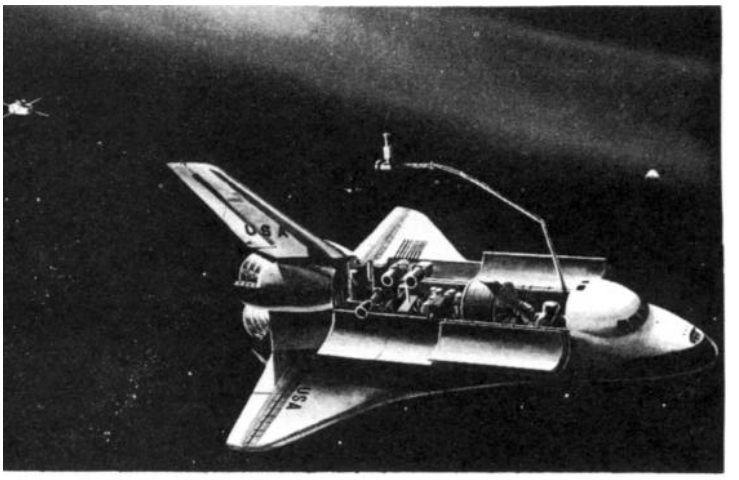
But NASA will get a better handle on satellite solar-power economics -- including the cost of erecting large space structures-when it begins using the Space Shuttle, Frosch believes. The transmission problem "will have to be attacked on its own merits," but only after "we have a better capability for the appropriate structures and experiments in space."

MILITARY SHUTTLE FLIGHTS PLANNED

When the space shuttle starts flying in 1979, the U.S. military will for the first time be in charge of piloted missions beyond the atmosphere. Current estimates are that one third of the projected 725 shuttle flights in the 80's will be under military sponsorship.

Plans are to use the shuttle for satellite deployment and repair. The military has also offered to develop a "space tug" for NASA which will boost payloads from the shuttle's 100-500 mile high orbit range to 20,000 miles and higher.

What do these plans mean for the space warfare debate? Mr. Currie, Director of Research and Development for the Department of Defense, says, "Over the next 10 or 15 years, space is not going to remain the unmolested territory, the sanctuary, that it is today. This issue must be addressed explicitly."



NEWS FROM ERDA

ERDA/NASA POWERSAT CONCORD

A series of meetings between NASA Deputy Administrator Alan Lovelace and acting ERDA Administrator Robert Fri has culminated in a joint NASA/ERDA solar power satellite (SPS) research program. The proposed SPS program calls for expenditures of a total of $19.5 million over the 4 years from 1977 through 1980.

It provides for an outlay in the current fiscal year (1977) of $2.5 million within NASA and $700,000 within ERDA. In fiscal year 1978 NASA is slated to spend $3.5 million and ERDA $2.6 million. This compares with the $4 million Congress has already approved for NASA SPS work in FY '78 and $3 million which is currently under consideration in a joint House/Senate conference committee for ERDA in FY '78.

The SPS energy program has been sent to energy czar Schlesinger where it awaits his approval and incorporation into Carter's energy plan. And while enthusiasts may complain that the SPS program is not yet a booming business, at least power satellites are gaining a place in the sun within the Carter administration.

ENERGY SOCIAL ISSUES STUDY

Researchers at Yale University will attempt to determine the social consequences of some of the Nation's key energy options under a new program funded by the Energy Research and Development Administration (ERDA).

The research will be carried out by Yale's Institution for Social and Policy Studies. It will involve a multi-disciplinary group of Yale faculty and ERDA scientists.

Professor Charles Walker and Dr. Leroy Could of the Institution will be in charge of the program. ERDA funding for the first year of the project is $155,000.

"There already has been a great deal of social science research done on certain types of energy development projects," said Dr. James A. Liver-man, ERDA's Assistant Administrator for Environment and Safety. "Unfortunately this research is duplicative and merely describes the problems. In this program, we intend to evaluate the existing social science research on energy so that our future efforts can provide more concrete approaches to solving some of the problems that have already been identified."

The team will examine the social consequences of energy options under development by ERDA, including such issues as employment, community growth, transportation, government regulation, and public participation in decision-making.

Initially, they will concentrate on the social consequences of increased use of coal and nuclear power, application of various conservation approaches, arid the use of solar energy.

The Yale team also will assist ERDA in identifying social science research issues which should receive increased attention in energy technology planning and development. This "Mapping Project on Energy and the Social Sciences" will also help ERDA to plan future social science research projects.

ERDA ISSUES NATIONAL ENERGY R & D PLAN

The Energy Research and Development Administration (ERDA) has issued its annual plan for research, development and demonstration efforts in support of the President's National Energy Plan.

Acting ERDA Administrator Robert W. Fri noted in a transmittal letter to Congress and the President that "the President's overall energy plan provides the neededcontext for the national energy RD&D effort and includes specific sections on energy RD&D."

Single copies may be obtained by writing to ERDA, Technical Information Center, P.O. Box 62, Oak Ridge, Tennessee 37830.

BOOK REVIEWS

Colonies in Space
by T.A. Heppenheimer, Stackpole, 1977. Reviewed by K. Eric Drexler for AIAA Student Journal and the L-5 News.

Colonies and the future of humanity in space make a complex topic. To do it justice is difficult, but Dr. Heppenheimer's book has succeeded quite well, combining background information, dreams, graphics, and engineering numbers with lively writing to produce a pleasing package.

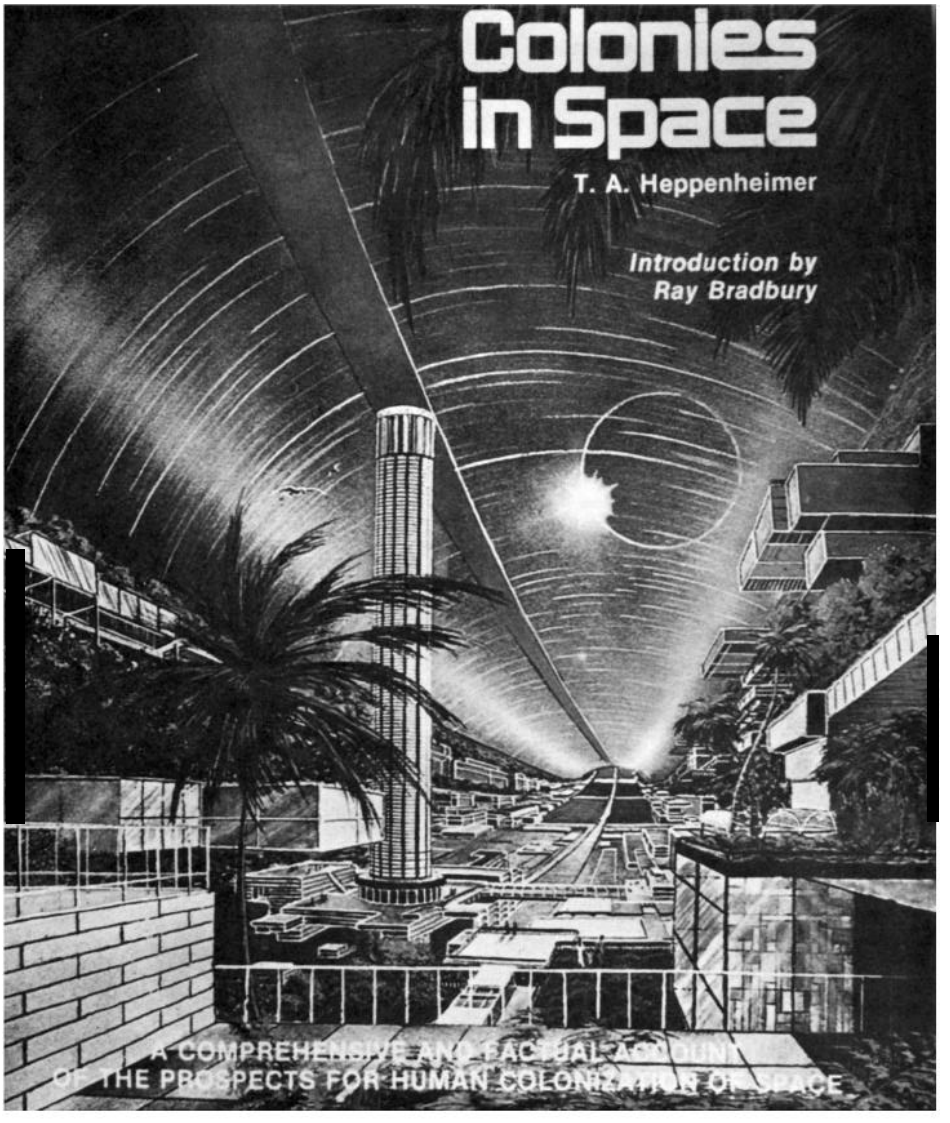
Topics discussed include the solar system as a place for life, the history of the space colony idea, power satellites, the potential impact of colonies and power satellites in the next several decades, the space shuttle and advanced lift vehicles, lunar resources and their exploitation, the mass driver, establishment of early industrial facilities in orbit, specific space colony design ideas, agriculture in space, construction of colonies research and industry in space, the potential of the asteroid belt for human settlement, and the eventual prospects for interstellar expansion. Heppenheimer builds on the solid base of his background as an aerospace engineer, planetary scientist, and participant in the major conferences and studies dealing with space colonization.

The concept of colonies as an integral part of large scale industrial activities in space has become gradually more influential. The early visions of mammoth "new Earths" in 2050 have gradually gained roots which twine comfortably with Shuttle-era programs of the 1980's. The early justification of exporting population to ease pressure on Earth a half century from now has given way to the idea of using non-terrestrial resources as a short-cut to economical power satellite construction in the 1990's. Changes of concept and mission continue today, but the underlying theme of a beach-head in space using non-terrestrial resources remains, and appears to be gaining strength under scrutiny.

Portraying such a shifting topic presents problems. Deciding what audience to write for presents further problems. In "The High Frontier," one of the other recent books on this topic, Dr. O'Neill writes to an audience that is humanistic, skeptical, and needs to be convinced of the practicality and relevance of space. His book, therefore, is cautious in tone and is careful to build a strong case for "why" before attacking "what," "how," and "what next?" It deals with the changing topic by concentrating on what are hoped to be solid general concepts, rather than on details of scenarios and systems. In "Colonies in Space," Dr. Heppenheimer writes to an audience assumed to be receptive but not necessarily enthusiastic. His book, therefore supplies the "why" and the "how" as it goes along, without exercising itself to prove at the outset that space is relevant and that living in space is not science fiction.

"Colonies in space" shows an unusual concern for both entertaining and informing the reader. The writing is clear and lively, sometimes crossing the line from exposition to drama. Ideas are not presented as results of science, but as results of individual's work and of earlier ideas. Background material (which pulls its own weight in reader interest) appears throughout the book. This ranges from a capsule description of the solar system (rather than simply alluding to "asteroids," etc. with which some readers will be unfamiliar) to a history of the political and economic factors that led to today's Space Shuttle.

As a book to lend a friend, "Colonies in Space" is an eye-catcher. Most pages are broken by diagrams, illustrations, photographs, or paintings (some reproduced in color). It is the sort of book whose title gets it picked up off the coffee table, whose graphics and layout earn it an interested thumbing-through, and whose text gets it read.



PRINCETON CONFERENCE BOOK IN WORKS

Both those who made it there and those who didn't but wish they did will be pleased to learn that the proceedings of the 1977 Princeton Space Manufacturing Facilities Conference will be available in hard cover book form Oct. 1. Transcripts of the discussions which followed each paper are included, as well as the summary session in which MIT professor Rene Miller, Princeton professors James Arnold and Gerard O'Neill, the AIAA's Jerry Grey and Georgetown University Associate Dean Stephen Cheston pick out the highlights and heroes of the conference.

The '77 Conference wasn't just a nuts and bolts affair. Stephen Cheston reports that it was "especially valuable in highlighting key issues in orbital psychology and international affairs. The Conference was a major step in organizing a coherent body of knowledge in the social sciences which should run in parallel with space manufacturing facilities technical developments. Anyone interested in social science aspects should consult the conference proceedings book."

Those who want to receive the book can order it from:

Jerry Grey
AIAA
1290 Avenue of the Americas
NY, NY 10019

Grey projects the book's price at $8-12.

The papers reviewed below are from Grey's upcoming book on the '77 Princeton Conference.

"Vapor-Phase Fabrication of Massive Structures in Space"
H.K. Henson, K.E. Drexler

"Vapor deposition may be an economical approach to processing and fabricating metals (especially aluminum) in space. This method, which uses to advantage sunlight, vacuum, and zero gravity conditions of space, is found to have advantages when considered from metallurgical, physical and cost viewpoints. A design for a large scale (250 ton) solar powered deposition apparatus with a throughput rate of 10 kg/second and the associated physical and chemical material problems are described in detail." Using the described vapor fabrication system, "a plastic balloon of the proper size and shape would be inflated and metal deposited until the walls were strongenough to fill it with air and put up the real estate signs."

"Trajectory Dynamics In The Earth-Moon System"
T.A. Heppenheimer

"A comprehensive overview of the main features of the dynamical problems associated with transport of lunar mass to a space colony via a catcher near the L2 libration point. A theoretical treatment is given for achromatic trajectories (those for which the arrival point is insensitive to launch errors) . . ." "Catching strategies are considered, and equations are given for minimum-energy catcher maneuvering. The problem of optimal colony location is treated. . ." "It is concluded that a 2:1 or 5:2 resonant orbit is preferable over alternatives of 3:1 or 7:3 resonances, and is markedly superior to L-5."

"Mass-Driver Reaction Engine as Shuttle Upper-Stage," Gerard K. O'Neill.

Describes an optimized design of a Mass Driver Reaction Engine (MDRE). It is designed to use Shuttle tankage as reaction mass to move payloads from low orbit to geosynchronous (or higher) orbit. It accelerates 14 gram reaction mass segments (which may be powdered for safety reasons) at 500 g's. The MDRE is found to reduce geosynchronous freight transport costs by approximately a factor of 3 and overall costs by a factor of 2. As a result "it appears that economic payoff does not require the development of space-farming." The program he outlines "appears highly profitable even if operated open-cycle." "Similarly, the development of large 'space colony' habitats does not appear to be a precondition for space manufacturing."

"Basic Coaxial Mass Driver Construction and Testing,"
Kevin Fine

This paper was written before the mass driver was operational; however, it was ready in time for the conference and . . . it worked! This design (described in the preceeding paper) was created during the fall and winter of 1976 by Profs. Henry Kolm and Gerard O'Neill. It was constructed by a student team at MIT.

"Assessment of Satellite Power Stations"
Robert A. Summers, H. Richard Blieden, Charles E. Bloomquist

"This paper reviews the [earth launched] SPS concept, summarizes the recommendations of the [ERDA] task group [on satellite power stations], and briefly discusses the joint ERDA-NASA program plan for future SPS activities." It is ominous to note that ERDA is going to "clearly identify barriers to SPS that suggest that all significant R&D investment in SPS be halted." This is earth launched SPS as compared to SMF SPS -- so if you should hear that SPS has been shown to be unviable, be sure to clearly distinguish between these two approaches!

VAJK WINS CONTEST

Joe Haldeman's contest (see May '77 L-5 News) to name his upcoming book on space settlements and industries (St. Martin's Press; illustrated by Analog cover artist Rich Sternback) was won by physicist J. Peter Vajk of Walnut Creek, California.

The title? *The Endless Horizon*

As Haldeman says, 'Classy, eh?"

Colonies in Space, Frederic Golden, Harcourt Brace Jovanovich, 1977.
by Conrad Schneiker

The worst thing I can say about this book is that its title is identical to that of T.A. Heppenheimer's recent book. So beware of this problem when ordering books.

This book is classified as juvenile literature and as such is excellent. It introduces Gerard K. O'Neill's approach to space colonization. The author, by his own admission, is something of a professional skeptic. As a result he has sidestepped the "gee whiz" trap without losing theexciting flavor of this venture. "My approach has been chronological. After the opening chapter's letter from the future, I go back in time to tell how O'Neill's proposal evolved and how he had been preceded by other farsighted writers and scientists. In the course of these reflections, I have also touched briefly on some of the high points of the United States space program, notably the extraordinary flight of Skylab-whose full significance as a landmark for living in space has yet to be fully appreciated by a now blase public. I next explain, step by step, how the first colonies might be built and what life on them might be like." This book is well written, well illustrated, and includes a useful glossary. Ideal for a young L-5er.

WHAT TO REMEMBER WHEN READING A STUDY REPORT

Much of the informative literature on spacecolonization is study writeups of group research. Just as the camel is a horse designed by a committee, so the group report is a paper written by several chimpanzees with malfunctioning typewriters, and suffers from lack of communication among its parts.

1) Responsible authorship tends to be inversely proportional to the number of authors, i.e., when there are ten to twenty authors, irresponsible statements tend to creep in such as "As X has said in the section on framistan maintenance," when in fact X never said that, wrote the portion on dingbat replacement, and has been arguing the opposite since the first time framistans were mentioned at the inception of the project. This happens because the final editing and rewriting is usually done at the last possible minute by one solitary group member with a hypertrophied sense of responsibility after the other group members have gone home to pass out in utter exhaustion. Their decision to let George do it ignores the fact that George too is close to terminal fatigue and is therefore unaware that he has erroneous and incomplete data. He writes what he thinks the others meant, but often it is neither what they actually did say nor what they meant to say.

2) Reading between the lines negatively is probably realistic; reading between the lines positively is usually unrealistic. This is because, given a confusing set of incomplete data, the solitary editor tends to make optimistic assumptions about the contents of missing pages, coffee-obliterated graphs, and vanished charts. Since Tom, Dick, and Harry decided to let George do it, they are not available to correct this unwarranted optimism and quite often would like to think the data did show that a reciprocating framistan would cut a minimum of six months off the time schedule while saving half a megabuck per unit. Sperber's Law should be kept in mind, "People tend to stretch the truth in an optimistic direction."

3) The results presented in the writeup are not necessarily arrived at during the study. In fact, any resemblance may well be coincidental. When the Horrid Realization that the final draft is due in two weeks finally penetrates the overburdened attention of the project manager, he says, "George, the results are this, that and the other-you might as well get started." George spends three or four days producing a masterful outline, an elegant opening statement, and a cogent closing paragraph. Then (surprise, surprise) he gets the hard data. At this point, he has the problem of a cat trying to bury something on a glass coffee table. The more he digs through the data, the more obvious it becomes that something is rotten. Reluctant to scrap the work done so far with a mere week to thedeadline, he takes the cosmetic approach.

4) Check the references. "Internal" references such as Private Company Memo No. 123 may be impossible to get and of dubious real value. A reference to something is not meant to be a way of ducking responsibility for doubtful data, but rather a guide for further in-depth study. However, in a moment of cosmetic despair, George may well decide to prepare Internal Memo No. 3.1416 and hide inconvenient data in it (beware of irrationally numbered footnotes), hoping no one will ask. Entirely too often, it works.

Many studies are produced by conscientious, well-rested Georges given considerable time and assistance by their colleagues. However, it many cases, the writeup is seen as the least important part of the project and gets only the scraps of time, energy and ability left after the Real Work At Hand has been completed. A word to the wise is scrutinized.

(Written by a study team which wishes to remain anonymous)

CONFERENCES

THE INDUSTRIALIZATION OF SPACE

Fees for "The Industrialization of Space," the 23rd annual Meeting of the American Astronautical Society, are as follows:

	Member	Non Member	Student
3 days incl. banquet	$50	70	20
3 days w/o banquet	40	60	10
Per day	20	25	5
Banquet only	15	15	10

The only anticipated change would come in the banquet fee, if there is a "big name" speaker who charged a large speaker's fee. This would likely drive all the prices up by $5 or so.

"Member" includes members of any sponsoring organization, of which L-5 Society is one. (So hang on to your membership card!)

The conference is to be held Oct. 18, 19 and 20 in San Francisco. For further information, contact Paul Siegler, 415/969-0785, P.O. Box 7205, Menlo Park, CA 94025.

28TH INTERNATIONAL ASTRONAUTICAL CONGRESS

The 28th IAF Congress is to be held in Czechoslovakia this year and members are reminded that it will be held at the Hotel International, Prague 6, Czechoslovakia from the 26th September to 1st October 1977. The congress is being organised for the International Astronautical Federation (IAF) by the Organising Committee under the leadership of Professor Rudolf Pesek (Chairman, Czechoslovak Commission on Astronautics). Full details of the Congress can be obtained by writing to the IAF Secretariat, 250 Rue Saint Jacques, 75005 Paris, France. The theme of the Congress will be "Using Space, Today and Tomorrow." Brief details can be obtained from the L-5 WE Branch Director, Phill Parker, at 40 Lamb St., Kidsgrove, Stoke-on-Trent, ST7 4AL, United Kingdom.

SATELLITE FUSION POWER ?

On June 23-24 the Fusion Energy Foundation sponsored a conference at the Conrad Hilton Hotel in Chicago. It focused on plasma physics as a solution to the energy crisis. The conference was attended by about 40 people, mostly from the Chicago area and the surrounding Midwest region.

In the session devoted to the frontiers of science and technology Vid Beldavs of Cummins Engine Company proposed that fusion reactors be placed in geosynchronous orbit as proposed by Krafft Ehricke for nuclear reactors, explaining that this would reduce the need for vacuum pumps, ensure alignment and stability of magnetic fields and reduce construction cost in general.

WORLD FUTURE SOCIETY CONFERENCE

In keeping with general policy guidelines set forth at the first Southeastern Regional Conference of the World Future Society in Atlanta, Georgia, November, 1976, the Huntsville Chapter plans to host a regional conference in Huntsville, Alabama January 27-29, 1978. This conference will be a major part of a city-wide celebration of the 20th anniversary of the launching of the United State's first satellite, Explorer I.

The conference will feature speakers from major governmental and private organizations relating to the applications of space technology to human problems. The conference will also emphasize future directions in space technology.

All interested parties are encouraged to submit topics for discussion at the conference. The limited number of panels at the conference will have participants presenting papers, but because of the small number of sessions, these papers will be by invitation only. We are, however, arranging for a number of two-hour round-table discussions. If you are interested in organizing and leading such a discussion group, please let us know. Discussion leaders would be responsible for identifying and informing conference personnel of parties that might be interested in participating in the session.

Listed below you will see a number of suggested space-related topics for possible discussion. The topic you choose to present, however, does not have to be space-related. We encourage you to suggest discussion topics on any subject of general interest to the futurist community.

Energy from space
Biomedical research in space
Communications satellites
History of space activities
Materials processing in space
The future of space industrialization
Large-scale space habitation
(L-5 type space colonies)
Sociological impacts of space technology
Environmental monitoring from space
Space-based astronomy
Space and the limits-to-growth hypothesis
The search for extraterrestrial life
Space and national defense
Global education through satellites
Philosophical and theological implications of expanded awareness from space exploration

All those wishing to organize discussion groups should let their interest be known by August 31, 1977. Please direct all correspondence to:

Dr. Donald E. Tarter
Department of Sociology
The University of Alabama in Huntsville
Huntsville, AL 35807

TOM HEPPENHEIMER VIEWS THE PRINCETON CONFERENCE

T.A. Heppenheimer

I was asked by Carolyn Henson to write down my impressions of the May 1977 Princeton Conference; that is, to be somewhat like Norman Mailer in drag. So this will not be a true and correct historical account of those four days. But it may *give* something of their flavor.

At the Princeton Conference, except for an unusual May snow flurry one noontime, the days were warm and clear. The campus was sunny and green, and the walkways were full of young girls on their bicycles.

My overwhelming impression was one of ceaseless activity, long night sessions with colleagues, and fascinating conference sessions by day-punctuated with occasional cheers from the conference hall lobby as the MIT Demonstration Mass-Driver once again worked. It was all very intense. In particular, it was a poor place to meet girls.

At the Conference, Gerry O'Neill was once again the genial host, the respected chairman, the master of ceremonies. The most impressvie single individual there, if indeed one may be singled out, was usually found engaged in adjustments to his beloved mass-driver. This was Henry Kolm of MIT. He radiated friendliness, openness, competence; these all were as obviously a part of him as were the pens in his shirt pocket.

He had accomplished the remarkable feat, in three months and for only $2,000, of leading a student group at MIT which had built a working model of a mass-driver. They had finished it only the day before the conference, then trucked it down by U-Haul. It was not in its full-blown lunar glory, of course; that would have been too much. But it did accelerate payload carriers, in single-shot demonstrations, at up to 33 g's. (O'Neill's 1974 *Physics Today* article had proposed that the lunar mass-driver, in its best performance, would give 29 g's.) Naturally, such tests were over very quickly, which made the coffee breaks ideal for the demonstrations. Following the announcement of an impending test, crowds would gather in the lobby while Kolm and his associates prepared for the test. Then the countdown, "three, two, one;" a spark, a report-and the payload carrier would suddenly appear at the far end of the track, where it had not been previously. After several days of this, one speaker, remembering the doubts as to whether mass-drivers could be made to work, noted ironically that the last announcement had been "as usual, the mass-driver will be demonstrated during the coffee break."

Several of the presented papers were taken from the 1976 Summer Study at Ames, or from follow-on work. Among these were papers by Frank Chilton and Gerry Driggers on chemical processing of lunar material-the processing equipment was packaged into a structure of Drigger's favorite diameter, 15 meters. I had the particular pleasure of reporting new work on the dynamical problems of lunar material transfer, giving results which the AIAA's Jerry Grey later described as "elegant." There were new and encouraging economic results from Mark Hopkins, as well as results on space construction by vapor-phase deposition, from Keith Henson and from the redoubtable Eric Drexler. Eric Drexler.

At that Conference, O'Neill and O'Leary spoke of such novel concepts as massdriver tugs and of asteroidal retrieval. O'Neill had fitted a low-thrust trajectory integration program into the 49 registers of an HP-25 hand-held calculator. With typical transfer times of some 150 days, the program ran in something like 0.01 of real time. But Henry Kolm was impatient, and wanted a bigger computer, so he was very happy when he got his wish -- an HP-67.

Available at the conference-at last-were copies of the 1975 Summer Study report, NASA SP-413. Enough of that Study's participants were there to make it worthwhile for all to exchange signatures, so that their copies soon resembled high school yearbooks.

Not all the news was cheery. In the midst of the sessions, we were told that a House Appropriations subcommittee had cut out funding for Lunar Polar Orbiter. And while they were at it, they'd also cut Jupiter Orbiter Probe.

For all this, there was on straw in the wind which went unremarked. A few years ago, aerospace professionals were attacked as "irrelevant," urged to "retrain" for work in urban housing, or transportation. Indeed, in those days Henry Kolm was working on novel forms of high-speed ground transport. But now he is working on . . .mass-drivers. And where he has led, others may follow.

T.A. Heppenheimer is the author of "Colonies in Space," Stackpole Books, 1977 (available from the L-5 Society).

Colorful Personalities

by Magoroh Maruyama

As members of L-5 Society get to know one another at various conferences and meetings, it has become clear that L-5 Society has a colorful assortment of different personalities. It is an eye-opening experience to meet them, stimulating and thought-provoking:

Carolyn Henson. This CH compound is a very sweet sugar, and as carbohydrate can be found in many other forms of organic materials. It has a property of dissolving and absorbing other chemicals. But as CMH -- Carolyn Meinel Hensen which she insists to be sometimes -- it is inorganic and is only an airline code for Columbus, Ohio.

Tom Heppenheimer is unforgettable for his very unique personality. If his uniqueness is used as a unit of measurement called "hep," ordinary persons would range in the micro-micro hep regions.

Magoroh Maruyama. When asked what he is, he says he is a Rorschach inkblot; different people see different structures in him. In any case, in terms of "mag" as a unit of measurement, most people are found in the meg-mag region.

Inside the L-5 Society

LOCAL CHAPTERS

What's there to do in a local L-5 group?

The Northwest L-5 Society, for example, is producing a monthly newsletter. Following are some choice excerpts from the June '77 newsletter:

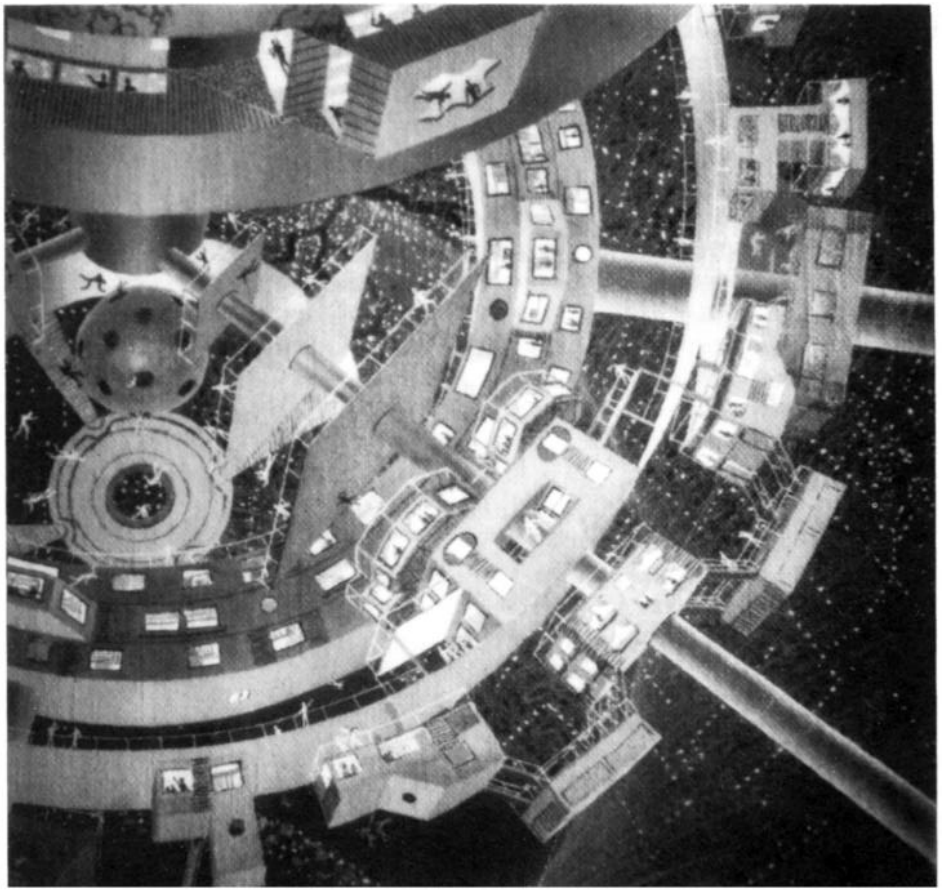
EVERETT MALL ENERGY FAIR

The Northwest L-5 Society will have a continuous presentation during the fair for informing the public about space colonies. Coordinator for this exhibition is Bill Hadley, phone 363-0911. Bill is embarking on his fledgling journey as an L-5 lecturer, and so will welcome any help that members and friends want to offer

Vancouver, B.C., July l-4, 1977: The panel on space colonies at the Western Regional Science Fiction Convention, Westercon 30, will include famous science fiction authors Larry Niven and Jerry Pournelle, and possibly Frank Herbert, in addition to NWL-5 Society president Greg Bennett (eek!).

What does it take to get things rolling? For tidbits of advice, try writing Northwest L-5 president (and Boeing aerospace engineer in his copious free time) Greg Bennett, at:

The Northwest L-5 Society
13001 79th Place NE
Kirkland, WA 98033



Inside L-5: the recreational area of a Bernal Sphere space habitat. (Courtesy Don Davis)

INSIDE THE OFFICE

Volunteers over the last 6 weeks included Deborah Slavin and Trip Lazarus of Austin, Texas; Stella Calvert of Ann Arbor, Michigan; Jim Parker of Covina, California, and Tucsonans Danny Lee, Conrad Schneiker, Dennis Riggin, Rob Loss, Jim Anderson, the Yakowitz family, Maureen Hazlett, Benita Ebach, Kelly McLear, Windy and Gale Henson, Michael Thomas, Eileen Nunn, Mara Anzuini, and Elizabeth Martin.

The L-5 Society is under new management. Along with the change in management has come a change in our administrative office location. We are just 2 doors over, 1060 E. Elm, from the old office-and just down the block from our trusty mail address, 1620 N. Park. The Elm St. office is open 8 AM to 5 PM weekdays, and often someone is available at other times, also, to help you. Visitors are encouraged to spend time in the L-5 reading room, where an enormous volume of books, papers and the famed L-5 correspondence files are open to all. However, you should be warned that people who wander in off the street are in danger of being conscripted into the volunteer labor gang.

If you have ordered anything from the Society over five weeks ago and it hasn't arrived yet, or if you have missed an issue of the L-5 News (you should receive one every month) or have failed to receive a membership card, please write and tell us your problem.

One of the major ways you can miss the L-5 News is when you change your address. If the News goes to your old address, the Post Office cuts your old address out of the magazine, puts your new address on the scrap, mails it to us, (charging us 25¢) and throws away the News.

Need something in a hurry? Shipping Hot Line, 602-622-6351 is a red telephone by a big chalk board where rush orders are recorded, there to glower at us until dumped in the mail. Doris Cooper, the Hot Line Lady, is available from 8 to 5; in emergencies, Carolyn Henson, the intrepid L-5 editor, can usually help you out evenings and weekends either at the Hot Line or at home, 602-622-8520.

IRS report time is rolling around once again. By mid Sept. we need reports from the treasurers of all L-5 chapters in the United States on expenditures during the fiscal year ending June 30, 1977.

Chapters which demonstrate that they are alive and kicking by sending in the treasurer's report will receive an L-5 care package from headquarters. Con tents are: several dozen L-5 buttons, brochures describing the Society, Bernal Sphere posters to use in displays, and a copy of the L-5 bylaws.

TO LOBBY OR NOT TO LOBBY?

A recent issue of Astronautics and Aeronautics *announced that President Carter is opposed to any new initiatives, including the Lunar Polar Orbiter, Mariner Jupiter-Saturn, Jupiter Orbiter and atmospheric probe, and others. He is presently favoring such marketable items as communications and land use satellites. I have written to both President Carter and various members of Congress about this and other relevant topics, with little success. Perhaps a nationwide letter-writing campaign could influence matters (such as restoration of SSPS funding, etc.) Remember, Carter said many times that he wants input from "the people."*

Richard Schultz
Little Falls, New Jersey

The LPO has direct application to space habitats, it might find badly needed water at the lunar poles. With the JOP success, NASA might try for the LPO next year.--K.H.

In recent months quite a few people have written in about lobbying. What is lobbying? It is to work to get a specific bill passed by a legislative body. This should be distinguished from providing information. When the government requests input, such as inviting people and organizations to testify at hearings, or in cases such as energy czar Schlesinger's request for citizen input this spring, those who respond are not lobbying. But when offering unsolicited advice on legislation, or in urging others to offer this advice ("Write your Congressperson today about the dread Framistan Bill!") one becomes a lobbyist.

The L-5 News has at times wandered close to that fuzzy borderline between providing information and lobbying. The News has never urged readers to write their Congressional delegations. However, oblique statements such as "Our Wisconsin readers are reminded that Senator Proxmire is from your state" come darn close.

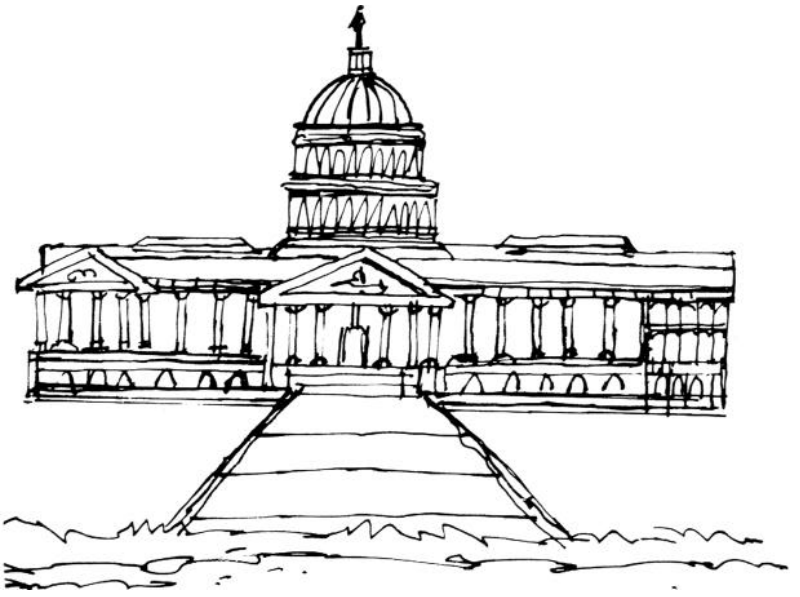
New legislation has made it possible for tax exempt organizations such as L-5 to spend up to 20% of their income on lobbying. But our newly gained freedom could be a mixed blessing.

First, if we choose to lobby, we must take sides. What happens to members who may disagree with the policy of the L-5 Board of Directors? Should the Society have the power to spend their money to lobby for bills they may oppose?

Second, lobbying requires a great deal of skill. A clumsy job can alienate potential supporters-look at the press South Korea is getting lately!

However, many L-5 members have personally engaged in lobbying, representing only themselves, rather than as spokespeople for the Society. They read the news and move into action. And they get mostly good results. Why?

One of Morris Udall's staffers tells us that most folks in Congress are leary of organized pressure groups. "If we get in a hundred letters in one week that all read the same we discount them," he says, but adds that "It's when we get a steady input of individual views that we know our constituents really care about something."



Following is a letter written by an L-5 member to Senator Proxmire. It is an eloquent, effective example of a citizen's lobbying. But if 100 form letters had been mailed instead, perhaps Proxmire's subcommittee, dismissing them as the work of cranks, might have given JOP the thumbs down and this month's cover story would never have been written.

Dear Mr. Proxmire:

As Chairman of the Senate Appropriations Committee, the 1978 budget of the National Aeronautical and Space Administration will soon be before you.

NASA is funded at a pitiably low level. I would accept a tax increase if it meant that the proceeds were going to our most productive and cost-effective agency. Technology is the only real product America has to sell, and NASA's positive record in medical, communications, and consumer spin-offs make it the best investment in town. With Federal and State governments soaking up virtually all venture capital in the United States, our Scientists and Engineers are entitled to Federal support of their research efforts. Space research is an investment in tomorrow, which we owe our children, since we have mortgaged them up to their trusting blue eyeballs to pay for our social comforts today. I would like to hope I could leave my children a legacy of hope, not of a stripped world and broken promises.

Specifically, I am concerned over public statements you have made against the Space Shuttle and the Space Telescope projects. In tandem with Representative Boland, you are in a position to do considerable harm to the lean and efficient industry/government space flight team. The investigation and ultimate mastery of Space is our opportunity to replenish earth's resources, and gather unlimited energy to feed and house the hungry of the world. Let us be the leaders in this noble cause. Let us be proud again.

"Give me a fish, and I eat for a day --
Teach me to fish, and I eat for a lifetime."

Thank you,
Ralph E. Evans
Mequon, Wisconsin

Letters

There seems to me to be a lack of something thus far in the activities espousing and facilitating L-5 inhabitation, orbital industry and all outer space endeavors.

What I'm trying to say is that the inevitable human conflicts of space exploration are not being as adequately foreseen and dealt with deliberately and intelligently as are the concrete technological problems and implications.

Observe the largely undeveloped equatorial nations' bid for their outer space "natural resource": controlling rights to equatorial geosynchronous orbits. Do I smell the beastie who would say to them: "It ain't yours if you can't get to it!" or "Try and stop me, sucker! "

Really, had no one foreseen such a confrontation? And what will be done in the UN to deal with it? Are we to be subjected again to the hideous continuing spectacle of arrogant ravaging (outer space) imperialism?

Joan Woods
Chicago, Illinois

You are a keen predictor of human reactions-see the next letter.--K.H.

On *the topic* of the equatorial nations claiming orbit space above their countries; sell them power at reduced rates or ignore them since they lack the equipment and expertise to do anything about it, equip SPS with short range defensive lasers.

Michael C. Strong
Swartz Creek, Michigan

Many people writing in the *L-5 News* have stated that the move from Earth to space is an evolutionary one. To this I can only recoil in horror. The characteristics of evolution are that it takes tremendous amounts of time, is conducted by a trial and error process, and is beset by an innumerable number of failures. If the movement from Europe to the New World had been an evolutionary process, Jamestown might just have been founded, with the Plymouth Colony a prospect for the early 21st century.

Space Industrialization and Habitation, clearly, cannot afford to be trial and error. An adaptation of one of Robert Freitag's recent statements could be that if we had killed the first and second man in orbit, this might be the Continental Shelf Society. That the move to space will occur I have no doubt, but I fear it will come too late for many of us around today. The best thing that could happen would be for the Saudi Arabians to announce they were contracting to build satellite solar power stations.

John Sotos
Hanover, New Hampshire

Where do we sign up for Arabic lessons?--K.H.

Capital! Capital! I refer of course to the May issue.

In seeking to define a suitable international regime for space colonization, it is useful to address the specific interest of the nations involved, and to consider analogies in current practice.

Thus, it is not necessary that the colony inhabitants be of diverse nations, or that the lunar workers resemble the crew of a Liberian-registry freighter. But the world's nations will be strongly interested in internationally-enforceable assurances that the power satellites will be available at predictable and controlled rates, and for as long as is required.

A similar situation exists in international aviation. Outside the Soviet Union, most aircraft are bought from Boeing or McDonnell Douglas or Lockheed. Yet it is in no way regarded as necessary that these companies' facilities be internationally owned or controlled, or that the work forces be multinational in origin.

On the other hand, international fares, and other conditions of operation, are under the control of agencies such as IATA (the International Air Transport Association), and are subject to such treaties as the Bermuda Convention and the Chicago Convention.

Similarly, one can envision an international rate-making body, akin to Intelsat, which would determine the fees and conditions for use of power satellites, in the export market. The U.S. would be a party to this, though the influence of other nations might result in rates and regulations which the U.S. would regard as unfavorable. Even so, there would still be the domestic U.S. market for powersats, which would not be under international regulation any more than our domestic airlines are under IATA.

Tom Heppenheimer
Heidelburg, Germany

As a geology student, I would like to comment on Joe Haldeman's letter in the April, 1977 issue. Carbonaceous chondrites are extremely fragile meteorites, and as such are very rate on the earth because re-entry heating easily destroys them. Impact on the moon is much more violent, due to the large terminal velocity (30 to 40 meters per second vs. roughly 5 m/s at earth surface). Impact at such speeds creates a crater 100 to 200 times the diameter of the meteorite, which is vaporized. The carbon implanted in this manner is extremely diluted and largely irretrievable in large quantities.

Richard Schultz
Little Falls, New Jersey

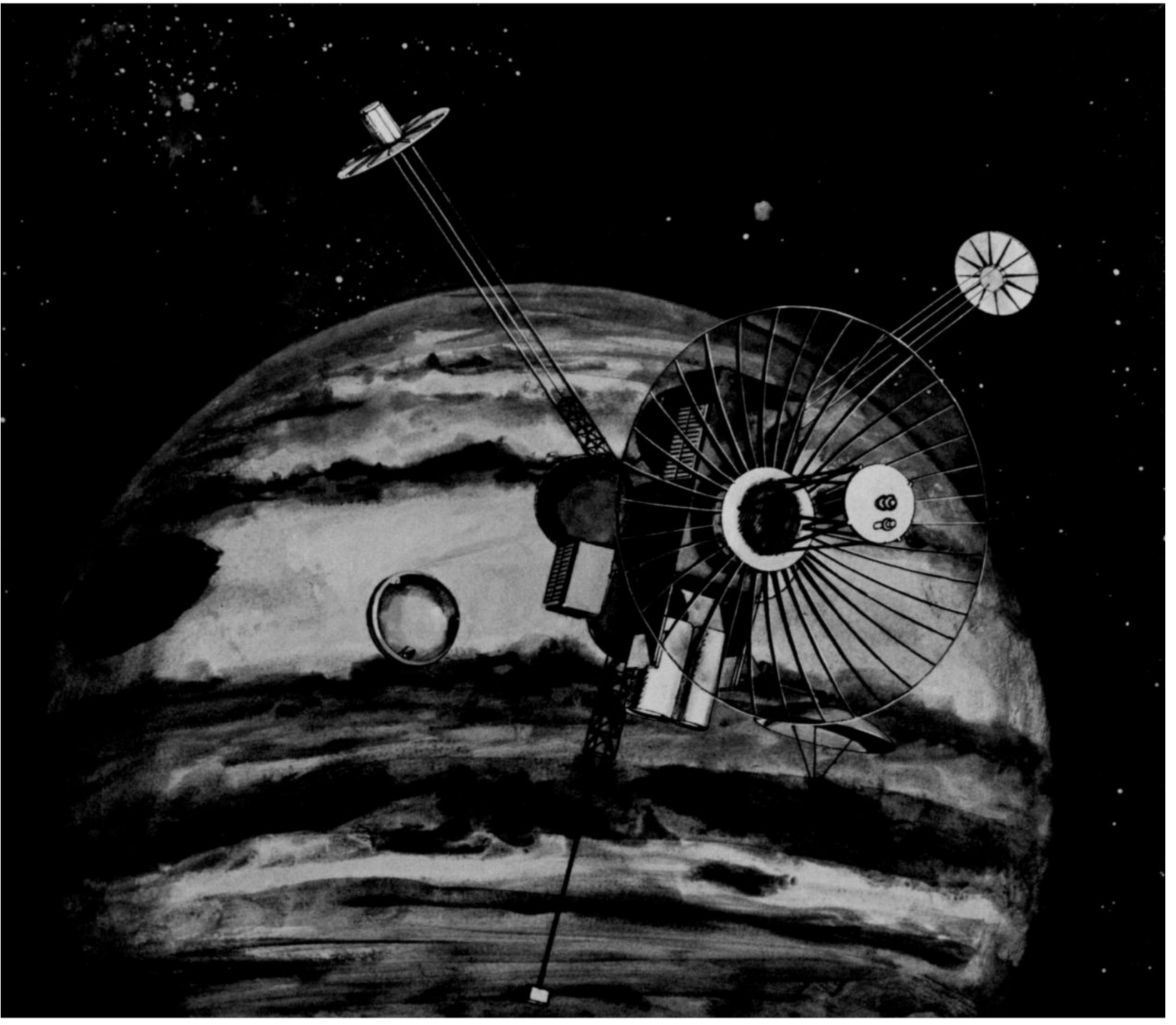
I am getting pretty sick of how our modem education is treating our science books, by not being very up to date but 5 years behind our times.

In my 6th grade science books they think that colonizing the moon is good but the people need laws there forcing them to exercise! (far-fetched isn't it!!)

The Libraries of America need some updating too! The one in Petoskey says that buying T.A. Heppenheimer's book is too costly, and that getting O'Neill's book isn't.

But the only thing I got our class and I to realize about colonizing space is building a model of a colony, the cylinder type! It measured "4" inches by "20" inches, "16" inches in place, and every inch represents a mile! It was named L-5, Island Three, Alpha O'Neill.

Troy Frantz
Petoskey, Michigan



HEADING FOR JUPITER -- The probe portion of the Jupiter Orbiter Probe spacecraft is launched toward Jupiter in this painting of a highlight of the planned flight. In the mission proposed by Galtech's Jet Propulsion Laboratory, a combination orbiter-probe spacecraft would be launched to Jupiter in January 1982. Flight time would be 1,000 days. Fifty-six days before reaching Jupiter, the orbiter would release the probe so that it would enter the planet's atmosphere on the sunlit side, taking measurements of Jupiter's atmosphere during the SO-minute-long descent. The orbiter would then go on to circle Jupiter for at least 20 months, studying the planet, its largest satellites, and the entire Jovian environment.