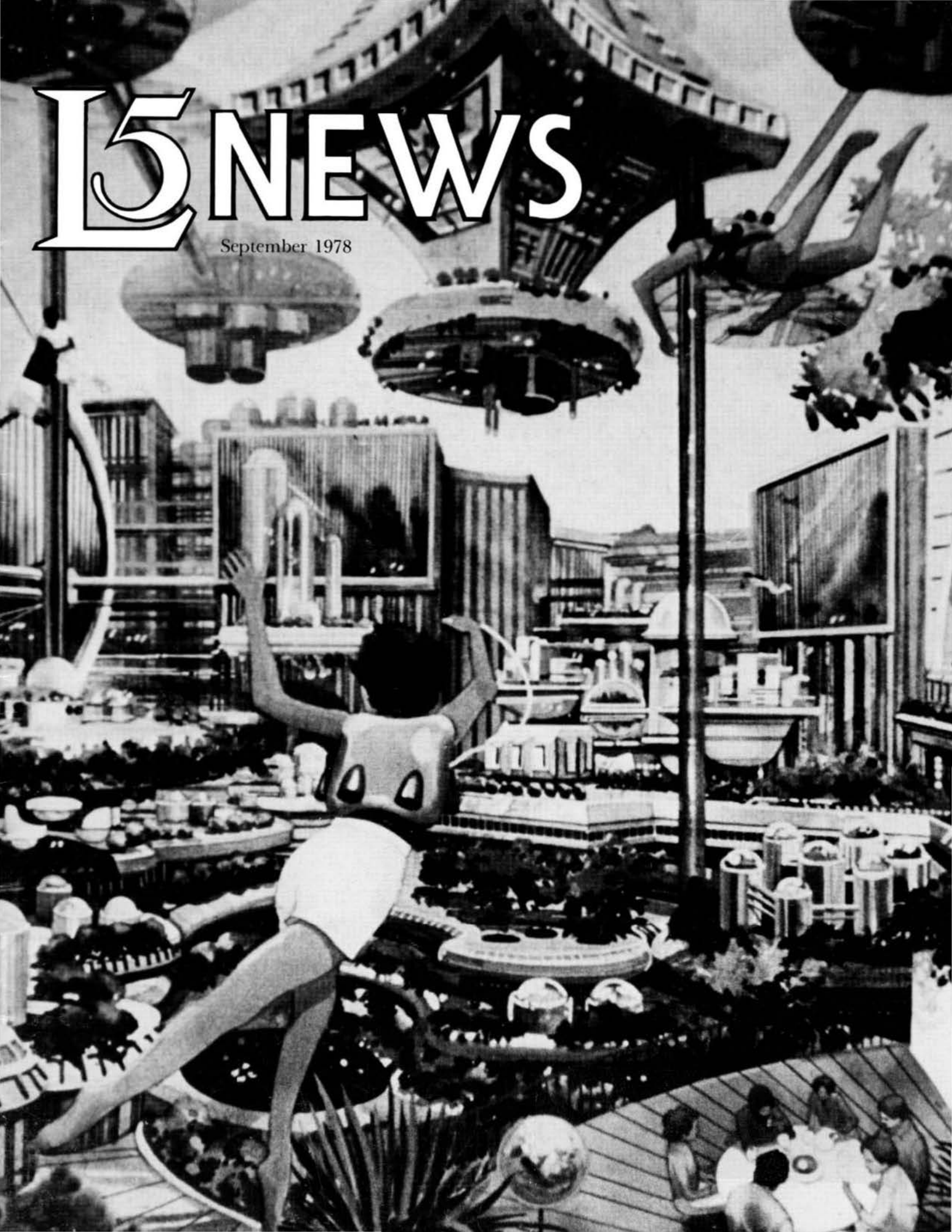


# L5 NEWS

September 1978



# L-5 NEWS

A PUBLICATION OF THE L-5 SOCIETY

VOL. 3 NUMBER 9 SEPTEMBER 1978

## In this issue:

*Carolyn Henson, Editor*

*Membership Services:*

*Janet E. Tarney*

*Linda Salisbury*

*William Weigle,*

*Administrative Services*

*Board of Directors:*

*Isaac Asimov*

*Barry Goldwater, Sr.*

*Robert A. Heinlein*

*Barbara Marx Hubbard*

*Gordon R. Woodcock*

*Philip K. Chapman*

*Arthur Kantrowitz*

*Konrad K. Dannenberg*

*Edward R. Finch, Jr.*

*J. Peter Vajk*

*Jack D. Salmon*

*Harlan Smith*

*Norie Huddle*

*Mark Hopkins*

*H. Keith Henson*

*Carolyn Meinel Henson*

*William Weigle*

*Phillip Parker*

**1 SPS Hearings** *Ken McCormick reports.*

**3 LDEF Input**

**4 Energy and Alternative Futures** *Solar power satellite researcher Gordon Woodcock explores some of the implications of "soft" vs. "hard" technology.*

**5 L-5 Society Slide Show**

**14 FASST to Study Student Input on SPS**

**15 Inside the L-5 Society**

**18 Letters**

*Publication office: the L-5 Society,*

*1060 E. Elm, Tucson, Arizona*

*85719. Published monthly.*

*Subscription: \$12.00 per year,*

*included in dues (\$20.00 per year,*

*students \$15.00 per year). Second*

*class postage paid at Tucson,*

*Arizona and additional offices.*

*Copyright ©1978 by the L-5*

*Society. No part of this periodical*

*may be reproduced without*

*written consent of the L-5 Society.*

*The opinions expressed by the*

*authors do not necessarily reflect*

*the policy of the L-5 Society.*

*Membership Services: L-5 Society,*

*1620 N. Park Avenue, Tucson,*

*Arizona 85719. Telephone:*

*602/622-6351.*

*Change of address notices, undeliverable*

*copies, orders for subscriptions, and*

*other mail items are to be sent to:*

**L-5 Society**

**Membership Services**

**1620 N. Park**

**Tucson, AZ 85719**

**Cover:** A zero-g space habitat (*courtesy Ames Research Center*).

# SPS Hearings

by Ken McCormick

*"SPS would be enormously expensive. . . with program costs estimated at \$1.5 trillion by the turn of the century. . . . When cost overruns are included, we may well be stuck with an enormous investment in an uneconomical project — a Vietnam of the sky." — Sen. James Abourezk*

*"To say that the SPS program will cost trillions of dollars is unfounded, unfair, misleading, and downright ludicrous." — Rep. Ronnie Flippo.*

On August 14, the Senate Subcommittee on Energy Research and Development held hearings on S. 2860. It is the Senate equivalent of H.R. 12505, which was introduced into Congress last January by Representative Ronnie G. Flippo of Alabama. The program called for by these solar power satellite (SPS) bills would supersede the current DOE/NASA "SPS Development and Concept Evaluation Program", and increase funding for SPS to \$25 million for fiscal year 1979.

Subcommittee member Sen. James Abourezk (D-SD) opened the hearings with an anti-SPS broadside: "With respect to S. 2860 . . . I'd like to say that I've long been a supporter of solar energy, and sponsored a great deal of legislation to encourage its use. Nonetheless, the harnessing of the sun through the deployment of the solar power satellite seems to me to be a singularly ill-advised and wasteful approach. Solar power satellites would be enormously expensive, and the money that would be spent on their development would be much more efficiently spent on developing smaller scale or more diversified solar approaches. With total program costs estimated at \$1.5 trillion by the turn of the century, I fear that this bill will only serve to further concentrate economic and consequently, political power in the hands of a few corporate giants, while freezing out the innovative smaller businesses, who could, with much less public money, provide this country with a truly solar economy.

"Moreover, solar power satellites present enormous environmental hazards in the form of microwave radiation, a subject we are only beginning to understand. It also raises serious military questions with which we simply do not have the institutions to deal. Frankly, I fear that this

bill sets the stage for a boondoggle of unprecedented proportions, that will be of benefit only to the aerospace industry . . . This kind of wasteful, uninformed government spending, largely at the behest of industry, is hardly consistent with the mood of the taxpayer or the fiscal needs of the country.

"Presumably, proponents of 2860 assume that there is already enough information to go on to development and demonstration. Studies have been cited that ultimate costs per kilowatt-hour will be no more than those for power generated by nuclear plants. These same studies, however, are based on such contradictory and speculative assumptions that we can hardly use them as the basis for a commitment as large as this bill contemplates. To give but one example, the capital costs of the receiving antenna were estimated at 17% by project proponent Peter Glaser, 42% by the Johnson Space Center, and 8% by the Marshall Space Center.

"We also do not know enough about the effects of microwaves, which have been shown to cause central nervous system problems, cataracts and genetic changes, and possibly are carcinogenic and involved in sudden infant death.

"The ongoing Department of Energy/NASA study addresses such cost and environmental problems as these. I see no reason to proceed until we have the answers that study will provide.

"Even if it does turn out that there is some potential, here, I think that there is more to fear if the solar power satellite succeeds than if it fails. The promoters of the solar power satellite have formed a group called 'Sunsat' to push the idea. Sunsat's major members are General Electric, McDonnell Douglas, Grumman,

Boeing, RCA, Westinghouse, Lockheed and Martin Marietta, plus various engineering firms and public utilities. If we go ahead and spend hundreds of billions or even trillions of dollars on this project, we will be creating a massive energy complex controlled by these industrial giants . . . Massive government regulation would be necessary to protect the consumer.

"Moreover, as the system is being developed, it will, I fear, freeze out more responsible solar development.

"Proponents argue that this bill only commits \$25 million, and less than \$200 million will be spent over the next five years. Boeing, however, is proposing a minimum of 3 billion over the next five years as the amount needed to proceed to development by the turn of the century.

"Whatever the amount, I think we should be guided by the familiar and apt aphorism that 'In Washington, projects have only two stages—too early to tell, and too late to do anything about.' As appropriations for this project mount, year after year, it will be harder and harder to forsake the previous accumulated expenditures, even if we find that the project is no longer as practical as it seemed.

"Cost projections now state that full research and development will cost 40 to 80 billion dollars, with each satellite to cost 25 billion dollars. These estimates are from the aerospace industry which is notorious for underestimating costs.

"Nonetheless, even at these optimistic projections, the cost per kilowatt-hour is expected to compare only to nuclear costs. When cost overruns are included, we may well be stuck with an enormous investment in an uneconomical project—a Vietnam of the sky."

Representative Flippo was soon on the witness stand with a rebuttal to Abourezk's attack: "The SPS concept has been under consideration for ten years . . . Despite all the evidence amassed in support of this program, it has been treated in the past with benign neglect by responsible agencies. They say the SPS program is needed and shows great promise, but request little or no funding for it, which in turn stifles development.

"At the present time, the Department of Energy and NASA are conducting a joint three-year SPS study. Their objective is to develop an understanding of the technical requirements, economic practicality, and social and environmental acceptability of the SPS concept . . .

"The DOE/NASA program is a good start. However, the program only entails an expenditure of 15.6 million dollars over the three year period. These funds will provide for paper studies which will focus on systems definitions, environmental issues, and economic considerations. These are issues that have been under study for the past ten years.

"Testimony presented during hearings in the House have confirmed that the technical, environmental, economic, and other related issues cannot be resolved without an adequate technology verification program . . .

"Senate Bill 2860 will complement the existing program by providing for the necessary technical verification program. It would strengthen the existing program by bridging the gap between paper studies and hardware verification.

"Sometime in 1980, DOE and NASA will be making a decision to continue or stop the SPS program. Congress, in turn, will have to confirm or reverse this decision. This responsibility suggests that Congress would be prudent to begin now to thoroughly examine the technical, economic, and environmental issues, and to generate the experimental issues and the experimental data necessary to make a sound go-no-go decision on the SPS program . . .

"The SPS concept holds great promise as a viable long-run energy source. Yet when placed in the context of the other long-run non-depletable baseload energy options, solar power satellite research is being short-changed. Fusion research receives Congressional support of more than 400 million dollars per year; nuclear fission receives more than one billion dollars per year. We need to pursue all these energy options, and each option should be given a balanced examination commensurate with its potential.

"In the course of the House hearings a number of criticisms were leveled against



*Rep. Ronnie Flippo, originator of the SPS bill, testifying at the Senate hearings. (Photo courtesy Charles Divine.)*

the bill. For the most part, the objections to the bill were valid and legitimate, representing some of the same questions in my mind when I first explored this concept. These objections and criticisms were very much in mind when witnesses were developed for the House hearings on the SPS legislation.

"In view of the testimony presented in these hearings, the content of the House report of H.R. 95-1120, and the considerable publicity provided by the bill, I believe the objections have been laid to rest. In case they have not, I would like to review some of the major criticisms.

"First of all, the cost. Criticisms of the SPS bill on the basis of cost have been most perplexing. To say that the SPS program will cost trillions of dollars is unfounded, unfair, misleading, and downright ludicrous. To say that the legislation under consideration here today will authorize a multibillion-dollar space program is untrue and irresponsible. Senate Bill 2860 does not provide for or authorize a multibillion dollar space program. The bill does not commit the nation or the Congress to commercial-sized satellites . . .

"Initially, the Space Shuttle would serve as the development vehicle. There is no requirement that we develop heavy-lift launch vehicles at this time, or an orbital construction base, or solar cell production facilities . . . The SPS is generally viewed as an incrementally funded program taking approximately 15 years to fully implement.

"In regard to the environmental concerns, the bill does not attempt to hide,

disguise, ignore or minimize the environmental issues associated with the SPS concept. On the contrary, the members of the House subcommittee on energy and space programs made every possible effort to identify and assess the environmental issues.

"Distinguished scientists from academic institutions and private research laboratories and federal agencies were invited to participate in hearings on this bill held this year. These learned scientists clearly identified all the environmental issues associated with the SPS concept for the members of the subcommittees. They provided information about the status of ongoing research efforts to analyze and solve these environmental questions, and they outlined research programs that would seek to resolve these environmental issues by a combination of analysis, systems studies, and experiments on Earth and in space. For those who want to know more about the committee approach, I would recommend a careful reading of the committee report of H.R. 12505." (For a copy, write to Science and Technology Committee, U.S. House of Representatives, Washington, DC 20515.)

"In addition to thoroughly reviewing the environmental issues, the report contains what I believe to be an innovative, unique approach to addressing the environmental concerns. The report recommends the establishment, within the overall SPS program plan, of a mechanism that will allow for independent review and consultation on the environmental, biological, and ecological issues. This



Left to right: James J. Kramer, John Deutch and Fred Koomanoff, testifying in opposition to the bill. (Photo courtesy Charles Divine.)

independent review mechanism would isolate the environmental judgments from the program management, and from the program proponents.

"Based on currently available data, adverse environmental effects are not anticipated because of the relatively low level of transmitted microwave energy being considered. The SPS can be designed to operate effectively and efficiently within the existing microwave exposure standards in this country and elsewhere. However, all possible effects of microwave transmission must be reevaluated in the context of the SPS design to resolve outstanding environmental questions.

"Additional research is certainly necessary, and this is the purpose of the SPS legislative program. If effects are discovered, the SPS system design can probably be modified to alleviate the effects. If the appropriate design changes cannot be made, then we will have to pursue other energy alternatives.

"The environmental research initiative provided in S. 2860 will supplement and complement existing research efforts to assess the biological effects of this radiation. At the present time, the federal government is spending approximately 9.3 million on this form of research.

"The research and development of the SPS will require an increase. . . . The SPS legislation may be the driving force in solving the mysteries of microwave radiation."

Mr. Flippo agreed that it is worthwhile to invest in the development of decentralized solar power, but added that

SPS would be a "complete solution that will turn the engines of society," and would "place a cap on energy costs."

Senator Floyd Haskell of Colorado questioned Mr. Flippo on the SPS program: "It is my understanding. . . that both DOE and NASA are already making feasibility studies to answer some of the questions that you've raised. If that is the case, . . . what does this bill do that the feasibility study wouldn't do?"

"The main thing that it would do would (be to) move us into a technology verification phase. The status of DOE/NASA activities were confined primarily to paper studies prior to the introduction of this bill. We cannot base a program. . . on paper studies or surveying current literature, alone. We must prove the foundations or the assumptions on which these paper studies have been based, and that's what this bill intends to do. . ."

DOE and NASA spokesmen appeared before the subcommittee to reiterate the position that the current SPS evaluation program is sufficient. In the words of DOE Energy Research director, John M. Deutch: "Based upon our present knowledge and understanding of the SPS systems concept, we feel that it is premature to proceed with any orbital demonstration or SPS hardware systems development. We, therefore, recommend against the Senate Bill #2860 being considered by your subcommittee."

Senator Haskell questioned Dr. Deutch about the cost of SPS: "The figures that are available to me - I'd like to know how accurate they are - (indicate) that one of

these satellites might cost \$25 billion."

Dr. Deutch replied: "I would guess that with the first satellite—that might be true. I wouldn't come back to you on a precise number, there."

In response to questioning by Sen. Melcher, Dr. Deutch explained that \$3.4 million is now budgeted for the SPS evaluation in the fiscal year 1980, but that he regarded that amount of money to be insufficient to carry out research activity which will take place at that time. Under strong pressure from Senators Haskell and Melcher, Dr. Deutch revealed that he thought he might request that the budget be increased to somewhere in the neighborhood of \$8 million for FY 1980. (Continued next month.)

## LDEF Input

The NASA Office of Aeronautics and Space Technology (OAST) is actively planning future utilization of the Space Transportation System for technology and other experiments in space. The development of the Long Duration Exposure Facility (LDEF) and the development of experiments for the first LDEF mission to be flown in early 1980 are a part of the OAST approved shuttle utilization plans.

The initial LDEF is a reusable, shuttle-transported, free-flying carrier for recoverable experiments requiring a 6- to 12-month stay in space. In the solicitation of experiments for the first LDEF mission, many respondents also identified a need for LDEF-type missions of 5 years' duration or longer. The facility required for such a mission may be significantly different from the initial LDEF. Accordingly, the OAST has approved a study to further investigate the needs and specific requirements for an extended-duration LDEF-type mission and to develop the facility and mission concept.

If you would like to have input in LDEF planning, address responses and/or questions to:

Dr. C. Howard Robins, Jr.  
 Manager, LDEF Program  
 Code RS-7  
 NASA Headquarters  
 Washington, DC 20546

Telephone: Area code 202/755-8504

# Energy and Alternative Futures

by Gordon R. Woodcock

*When I was a boy of ten, growing up in a small town in Oregon, the people I knew didn't think about the future very much. When they did, it was mostly about returning to normalcy after the war was over. Any speculation about future novelties I had seen or heard dealt mostly with the idea of a private plane in everyone's garage. But hidden things were happening in 1943. In secret cities in the United States, fever-pitch work was going on, to transform the recent discovery of uranium fission into a war weapon of unheard-of destructiveness. In Germany, the research laboratories at Peenemunde were making equally amazing progress in the adaptation of a curious "toy," the liquid-propellant rocket, to the modern military purpose of long-range bombardment. Under the pressures of the war efforts, the tempo of technological progress was highly accelerated. Humanity emerged from the crucible of World War II with the essentials of a technology capable of the destruction of civilization, if not of all life on Earth, and also capable of approaching the frontiers of space. "Normalcy" has neither been seen nor heard of since.*

Until 1938 the energies of the atom's nucleus were believed by scientists to be forever beyond the reach of mankind. Experiments bombarding uranium with neutrons were conducted as early as 1934, but the idea that a nucleus could fission, permitting a chain reaction to release the powerful nuclear force, was thought contrary to physical law. The accumulation of evidence finally overcame pre-conceived notions, and the discovery of fission was quickly followed by recognition of the possibility of a self-sustaining chain reaction. The race to harness nuclear power was on.

Almost since the beginnings of nuclear energy research, there has been controversy over what could, should, or would be done with the nuclear genie released from the bottle of science and technology. Along with pessimism and concern about nuclear weapons, there has been a great deal of optimism regarding the

benefits of nuclear energy for the future of mankind.

Ordinary fuels derive energy from the electromagnetic force that binds atoms together into molecules. Nuclear fuels release the nuclear force that binds atomic nuclei together, a force that is millions of times more energetic than electromagnetic forces; nuclear fuels are consumed only very slowly while releasing great amounts of energy. Because of this, it was once believed (at least by some physicists) that electricity produced by nuclear reactors would someday be so cheap that power meters would be unnecessary.

Only much later did the realities of nuclear power emerge. Fission fuels are scarce elements; even their prodigious ability to produce energy does not remove them from the list of finite resources. Nuclear electricity is not unimaginably cheap, although it is today cheaper than fossil-fuel-generated electricity. Fears about the drawbacks of nuclear power, notably its radioactive wastes and the relationships between reactors and weapons, have spawned an occasionally irrational and highly vocal anti-nuclear "movement." The objective of this movement is to reverse the now perceptible beginnings of a world transition in energy sources, a transition from oil to nuclear power.

In general, the anti-nuclear movement offers no comparable alternative, apparently believing that its case against nuclear power is so strong that no comparable alternative need be offered. A non-comparable alternative is frequently offered: "soft technology," or make do with less. (The public, based on polls and on results of votes on anti-nuclear initiatives in several states, seems unconvinced by this movement.) The roots of the soft technology philosophy run far deeper than just an anti-nuclear movement.<sup>1</sup> Its proponents think of it as a new economics, and often as a new social order. They do not, at least in any of the literature I have read, [e.g. 3,4] offer any quantitative economics analyses to support their

philosophy. (In my view, basing an economic system solely on philosophical arguments is like trying to balance your checkbook without doing arithmetic.) The origins of this philosophy can be found in energy issues.

In previous articles we noted that there are several viewpoints on energy supplies, and that questions on energy policy are thoroughly entangled with the business of economics. Despite widespread discussion of the so-called energy crisis, there is still a belief in many quarters that if left alone, the energy situation will take care of itself. This viewpoint generally argues that if the government would stop regulating energy prices, market economics would provide adequate supplies for everyone.

It is indeed reasonable to presume that market economics would strike a balance between supply and demand, but with a finite and diminishing resource, the characteristics of market economics could easily result in a crisis situation with timescales short by comparison to the time required to develop alternative energy solutions. The finite resource economics model displayed in the prior article, [June L-5 News] although simple and primarily illustrative, suggested that in the early phases of finite resource economics, under the law of supply and demand, the consumption rate appears to follow exponential growth with relatively little signal that anything is fundamentally wrong except for persistent increases in price. Later, as supplies continue to diminish, rapidly escalating prices cause a turndown in consumption, presumably accompanied by severe economic dislocations.

In 1973, even before the widespread recognition of the energy crisis, Klaus Heiss described the results of a study of resources in the Congress [5] "In a recent report on various forecasting techniques and in the analysis presented in this section, we could not find any single material resource which decisively influences the economic and military power

*(Continued page 13)*

# 15 SOCIETY SLIDE SHOW

## Space Stations



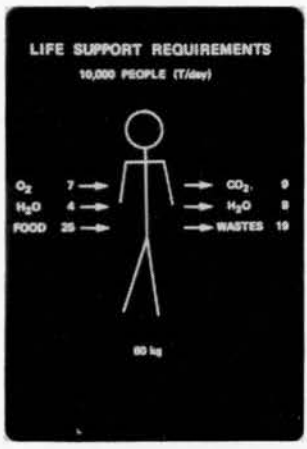
A01 A modular space station. Each module is carried up by the space shuttle.



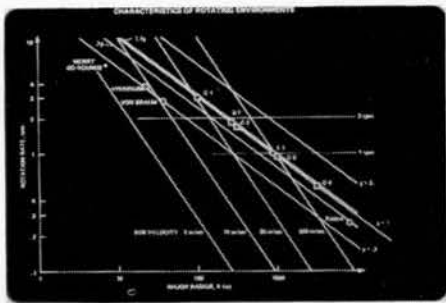
A02 An apartment inside a shuttle main tank which has been converted to a space station.

## Space Habitats

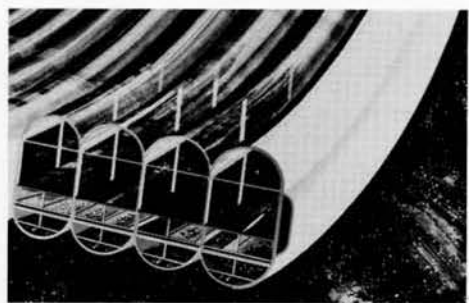
## Life Support



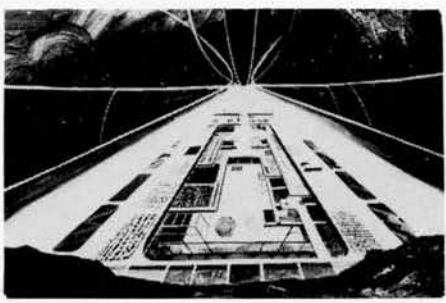
A11 Life support requirements, taken from the Stanford Torus study.



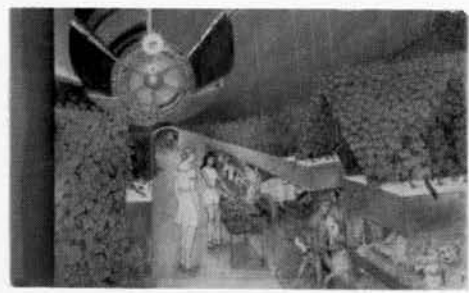
A12 Design considerations for rotating space habitats.



A13 Agricultural area of a Bernal Sphere habitat.



A14 Agricultural area of the Stanford Torus

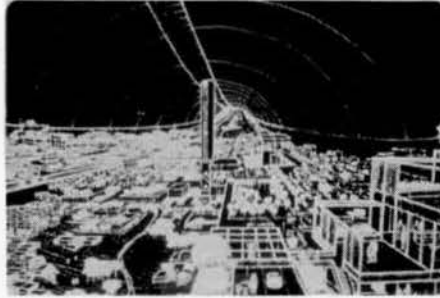


A15 "Construction shack" habitat space farm.

## Stanford Torus



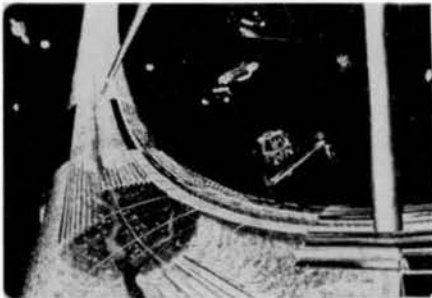
A21 A completed colony (toroid design by 1975 NASA/Ames Summer Study).



A22 Interior of a colony (toroid design by 1975 NASA/Ames Summer Study).



A23 Cross-section of a model of the Stanford Torus, showing habitat, and other areas.

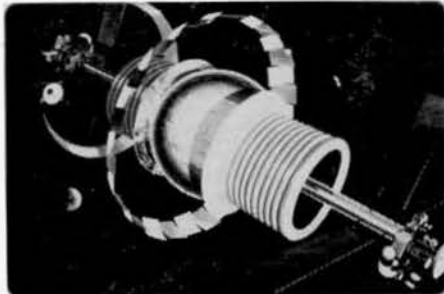


A24 Construction in space of a space colony (toroid design).



A25 A village in the Stanford Torus.

## Bernal Sphere



A31 "Bernal Sphere" design for an early space habitat—accommodating about 10,000 people.



A32 A view through the window area of the Bernal Sphere.



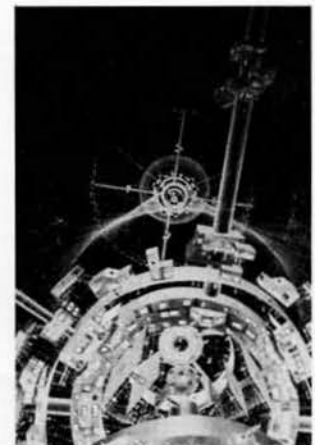
A33 Construction of the Bernal Sphere.



A34 Interior of a "Bernal Sphere" space colony.



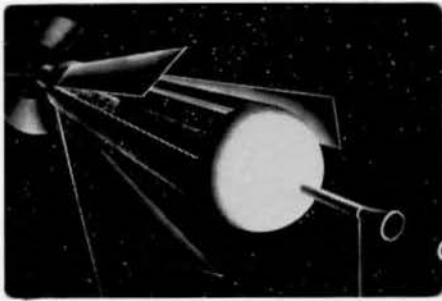
A35 A 1 gravity recreation area.



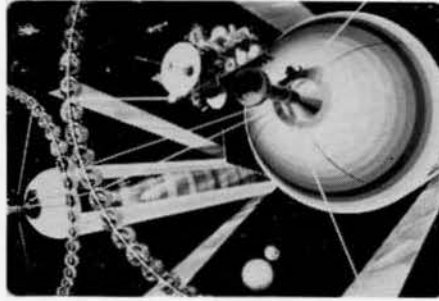
A36 The zero gravity recreation areas at the Bernal Sphere hubs at night



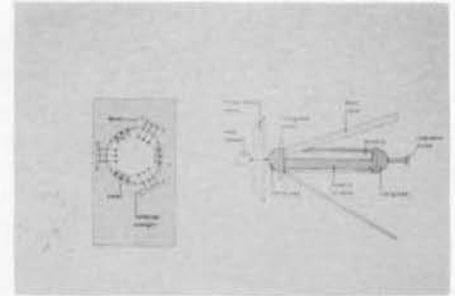
## O'Neill Cylinder



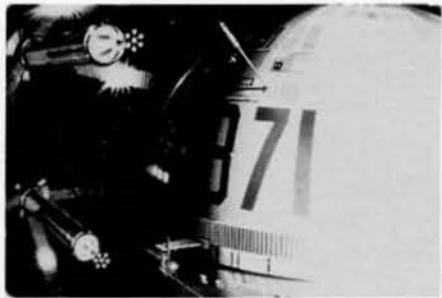
A41 First painting of a space habitat—four by twenty miles in size (cover of *Physics Today*, September 1974).



A42 An advanced colony. Two cylinders in tandem, each with a four-mile diameter and twenty-mile length.



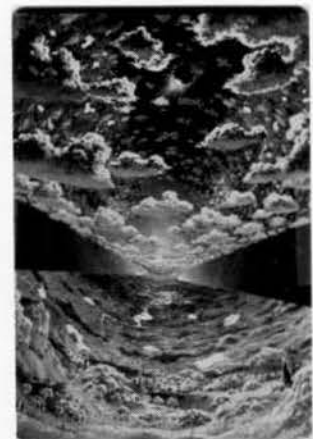
A43 Diagram of Model 1 space habitat indicating living areas, valleys, and energy source.



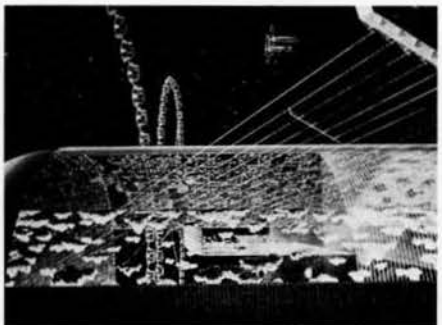
A44 The spaceliner *Robert H. Goddard* brings in a new group of immigrants (Courtesy *Science Year*).



A45 Interior design of a colony founded by a group of expatriate San Franciscans.



A46 Solar eclipse in a colony. Cylinder interior is viewed along its axis.



A47 A side view of the O'Neill cylinders.



A51 A zero gravity habitat.

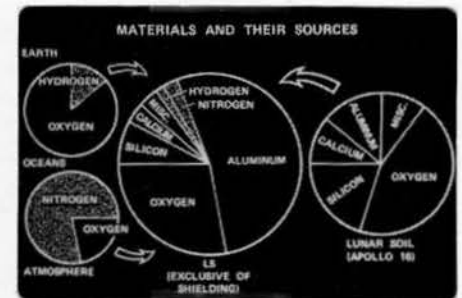
## Extraterrestrial Resources



B01 The Moon, source of most of the materials for space colonization.



B02 Apollo 8 view of the Earth seen from the Moon (NASA photo).



B03 Summer study slide showing that almost all of the materials can come from the Moon.



B04 Lunar mine to obtain materials for construction in space (Field Enterprises).



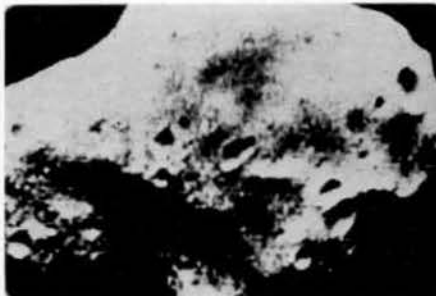
B05 The lunar mass driver.



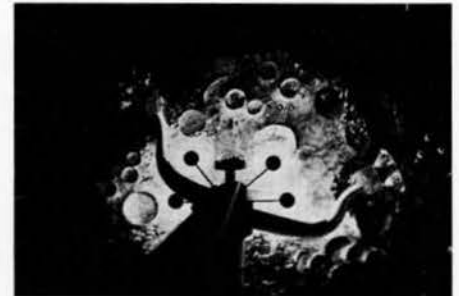
B06 A closeup of the end of the lunar mass driver, where ore is being shot into an escape trajectory.



B07 Control center for the lunar mining base.



B11 Phobos—asteroids are believed to look like this.



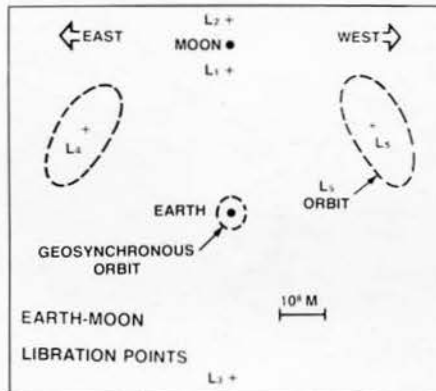
B12 An asteroid mining operation.

## Space Transportation

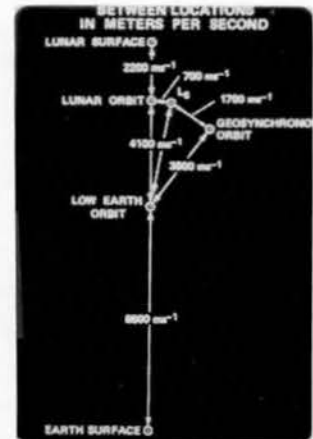


C00 A century's progress in transportation.

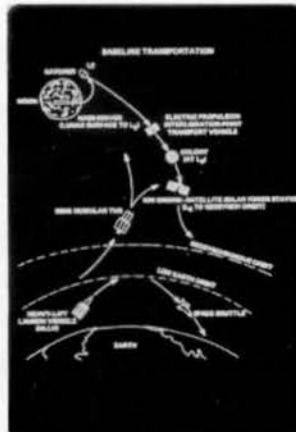
## Orbits and Orbital Transfers



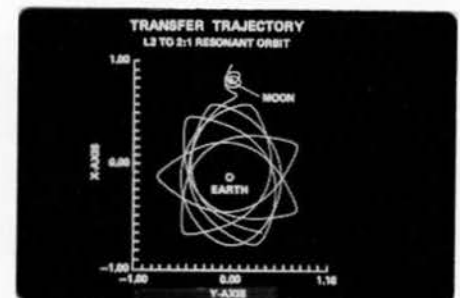
C01 Lagrangian libration points.



C02 Distance between significant points in meters per second.

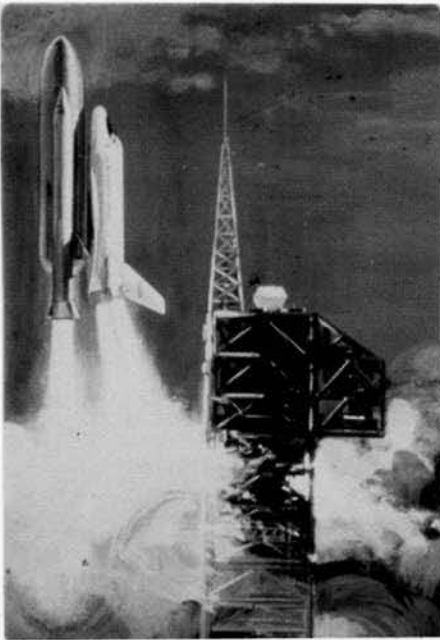


C03 Baseline transportation diagram: Earth, Moon, colony at L-5.



C04 Transfer trajectory from L-2 to 2:1 resonant orbit.

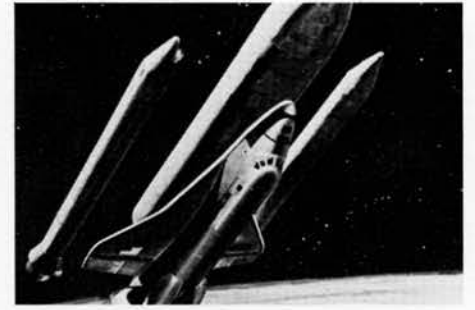
## Space Shuttle



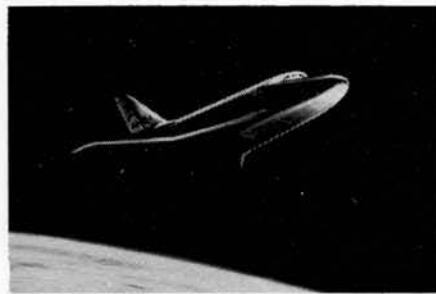
C11 Takeoff.



C10



C12 The reusable solid fuel boosters separating from the orbiter. They will fall into the ocean, suspended from parachutes. The main fuel tank, still attached, will be discarded later, either to burn up as it falls to Earth, or to be kept in orbit for use in space station construction.

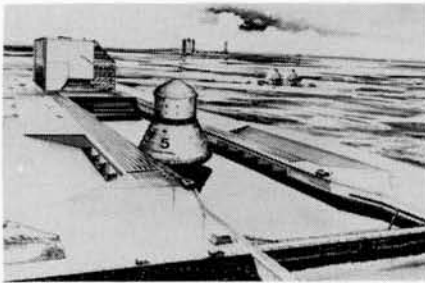


C13 Shuttle orbiter reentering the atmosphere.



C14 Orbiter landing at Vandenberg AFB.

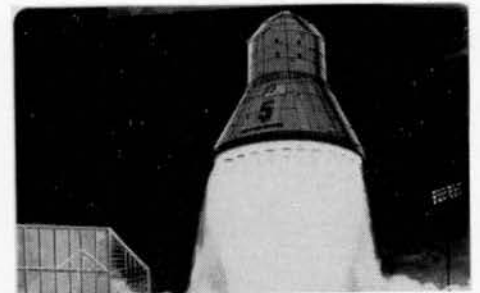
## Heavy Lift Launch Vehicles



C31 Heavy lift rocket docked and ready for next trip to construction site (Boeing).



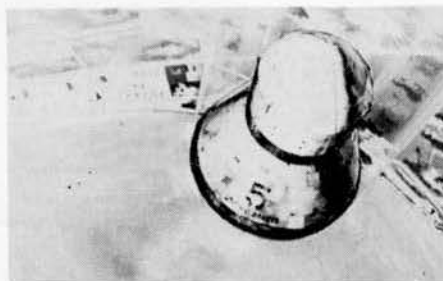
C32 Cape Canaveral in the future, with landing basin and power receiving antenna (Boeing).



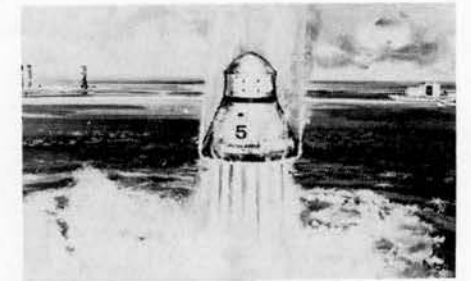
C33 Heavy lift rocket takes Earth materials for construction to satellite solar power station (Boeing).



C34 A slightly different heavy lift vehicle just after the lower stage has separated. (Boeing)

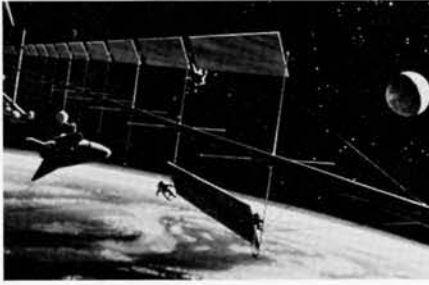


C35 Heavy lift rocket re-entering and heading for landing basin (Boeing).

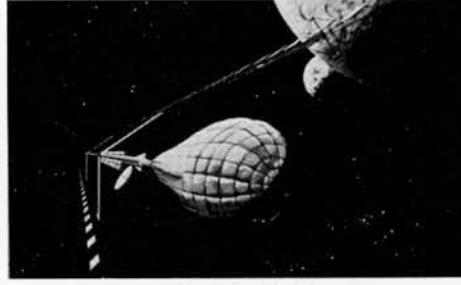


C36 Heavy lift rocket landing after delivering Earth materials to construction site (Boeing).

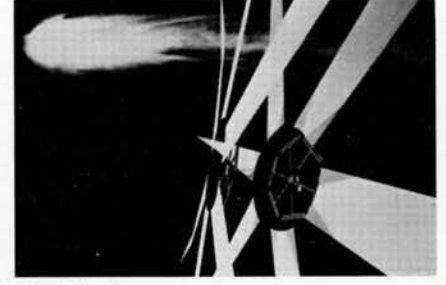
## Advanced Propulsion



C41 Shuttle orbiter docking with a transport linear accelerator (TLA) which is under construction. The TLA uses a solar powered linear electric motor to throw mass out the end, which propels it forward. It is very similar to the lunar mass driver.



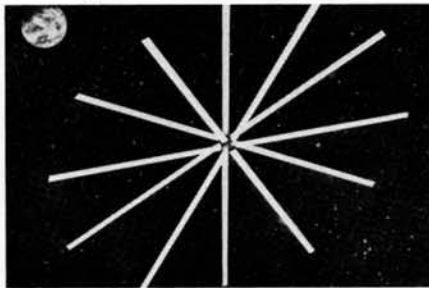
C42 A TLA carrying a load of lunar ore to a space processing facility.



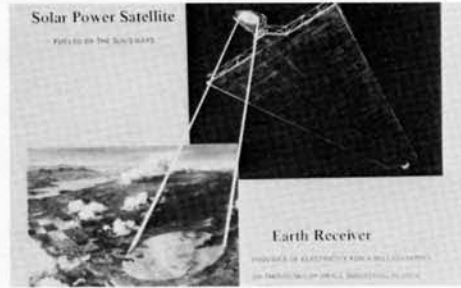
C43 A heliogyro solar sail approaches a comet. It is propelled by the thrust given when light bounces off its sails. Rotation stiffens the sails.

## Solar Power Satellites

### SPS Concept



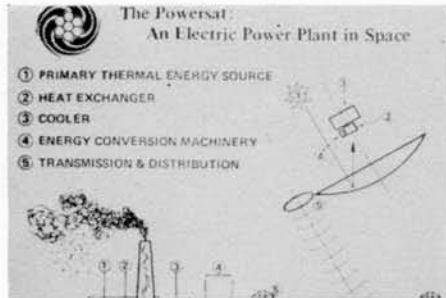
C44 Another view of the heliogyro.



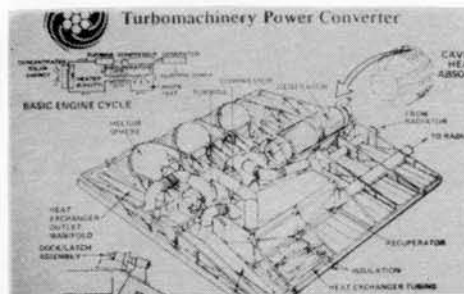
D01



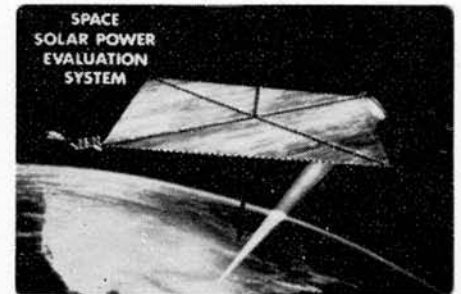
D02 A view of the Middle East, present focus of energy discussions.



D03 The Powersat: An Electric Power Plant in Space (Boeing design).



D04 Design for Turbomachinery Power Converter.

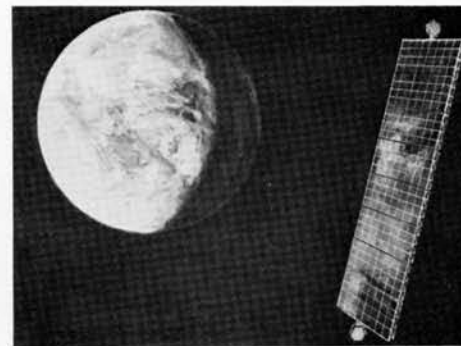


D05 A small SPS demonstration model necessary to test the concept.

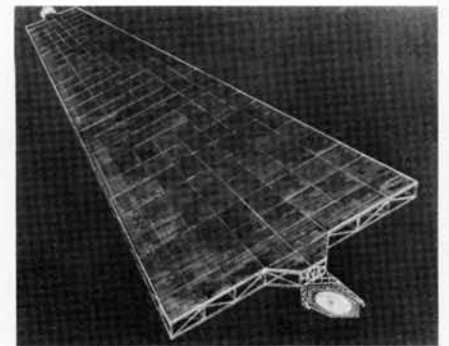
## The Space Collector



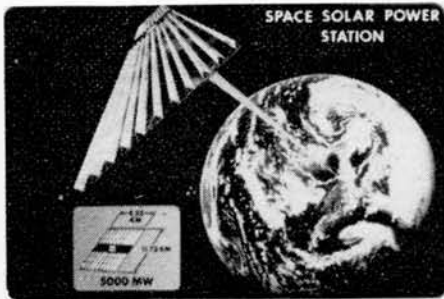
D11 Power satellite of the photovoltaic type (Arthur D. Little).



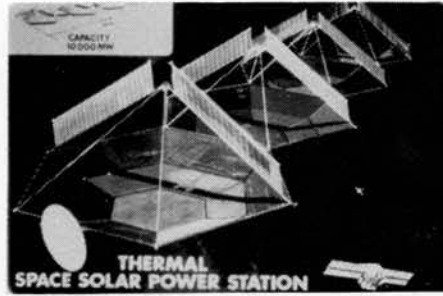
D12 Another photovoltaic SPS. The hexagons at the ends are microwave transmitters.



D13 Another view of the SPS.

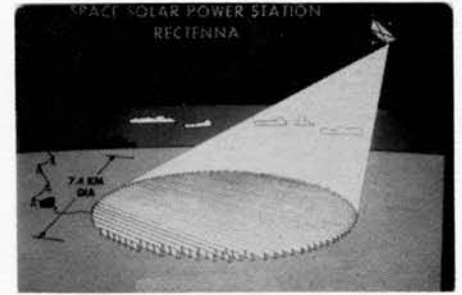


D14 A photovoltaic SPS, with the dimensions shown.

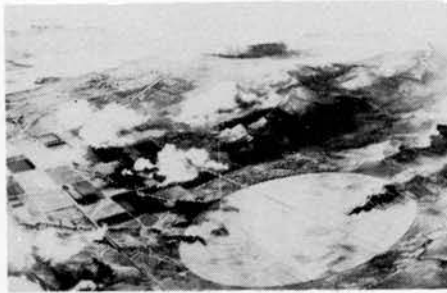


D15 A thermal SPS.

## Power Transmission



D21 The SPS beams energy via microwaves to an Earth rectifying antenna farm where it is converted to DC electricity.



D22 Rectenna array over farmland for receiving microwave transmission from SPS.

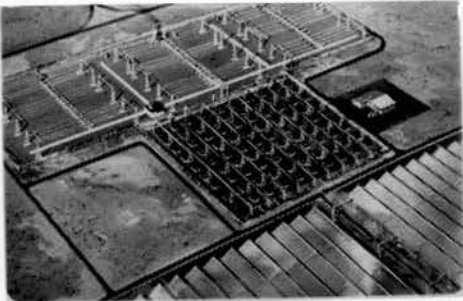


D23 Microwave power transmission test (summer of 1975).

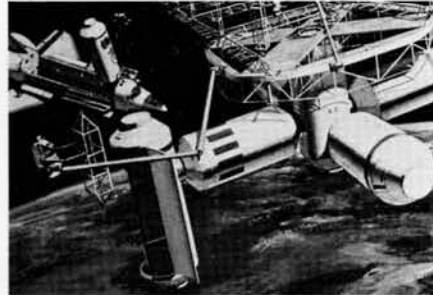


D24 Microwave power transmission test (summer of 1975).

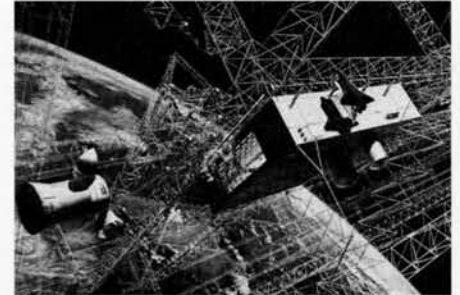
## SPS Construction



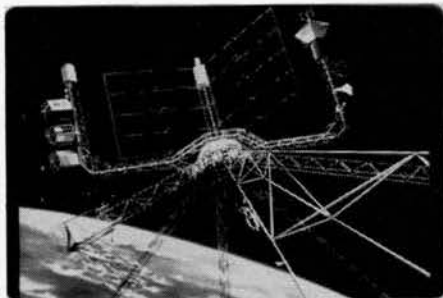
D25 Inverters and standard power grid at the edge of the rectenna array over farmland.



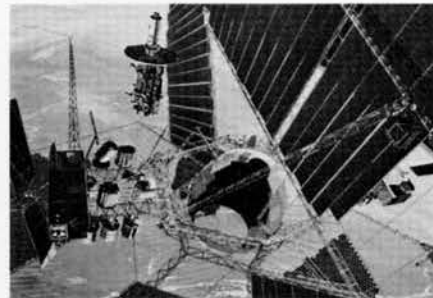
D31 Shuttle orbiter is docking at the SPS construction workers' living facility. (Rockwell)



D32 A large hangar where construction workers are building SPS components. The heavy lift launch vehicle brings up materials; the shuttle orbiter carries workers. (Boeing)



D33 The heat cavity of a thermal SPS. (Boeing)



D34 The heat cavity under construction. (Boeing)

# Spread the News

Your local schools, churches, civic groups and clubs are looking for lecturers. As an L-5 member, you can probably fill the bill. Are you nervous in front of an audience? Try your lecture on some friends in your living room. Move on to scout troops and grade school classes, and before you know it you'll be regaling the Rotary Club and appearing on your local TV show without flinching. Developing public presence is only part of the job. You must be knowledgeable, accurate, able to present complex ideas in a clear and straight forward manner, and entertaining (or at least undull). In dealing with questions, be willing (if necessary) to admit that you don't know the answer. Treat your critics with respect, even if they don't respond in kind.

## Getting Speaking Engagements

How do you get invited to speak? To get started lecturing to schools and scout troops, begin with your children or friends' children—they'll introduce you to teachers and group leaders. If you are a church-going type, your minister can introduce you to the people who schedule entertainment at church-sponsored pot luck dinners, couples' clubs, etc. The Chamber of Commerce will give you a list of the names and addresses of local civic groups.

The "big time" is your local radio and television stations and newspapers. If you can pull off a major public event: an energy fair, a big L-5 meeting with an interesting program, etc. you may be able to attract a newspaper reporter or camera crew. Be sure your event doesn't flop, or your name is mud!

## News Releases

How are you going to grab the attention of the media? One way is the news release. The ABC's of news releases are as follows:

- a) Identify your group in the upper left hand corner.
- b) In the upper right corner give the date and the time at which the news is to be released below it. (Most press releases say "for immediate release".)
- c) Use wide margins and double spacing.
- d) Include all the facts and be accurate. Check and double check times, dates and the spelling of names. Be brief: if you can't fit all the material on one page it's probably too long.
- e) At the end give a name and number where more information can be obtained. Make certain that phone is covered at all times.
- f) Timing is important. Learn when the deadlines-for you local media are and get the news releases to them well in advance. For best results, deliver them in person. Appearances count: look sharp, and be extra polite. Learn the names of all the people who handle your news, and address news releases to them personally, or ask for them when you hand deliver it.
- g) When you do get coverage, always thank the reporters responsible, even if you feel they did a poor job. Remember, no matter how bad the publicity is, they can always do worse. (Fortunately, nearly all reporters seem to be biased in favor of our work; our files at the L-5 office are packed with friendly news clippings.)



Send orders to: **L-5 Society**  
**1620 North Park Avenue**  
**Tucson, AZ 85719**

## Public Service Announcements

Do you want a crowd to show up for your lecture or L-5 chapter meeting? If it is held by a non-profit group (such as L-5) you can get *free* public service announcements on your local TV and radio stations. Here are the ABC's of public service announcements:

- a) Identify your group in the upper left hand corner.
- b) Use a small index card. Type with all capital letters, triple spaced.
- c) Tell what's happening, when and where. The address isn't enough; give the location ("corner of Main and 3rd", "west side of campus", etc.). Then tag it, twice, if possible, with a phone number for further information—a phone that will be covered day and night!
- d) Time the announcement for 10 or 30 seconds, no longer.
- e) Deliver your PSA at least 2 weeks in advance. Mail is OK, but hand delivery is better. As with press releases, look and act your best when calling on a station.

The slides in this catalog were provided by NASA, Boeing, Rockwell, and Arthur D. Little, Inc.. They are the same slides that top space researchers have used in presentations at conferences, Congressional hearings and television appearances. Have a good time as you join them in spreading the good news!

## Clearance Sale

We have discontinued 27 slides from the old L-5 slide catalog: 108, 117, 201, 203, 204, 205, 206, 217, 218, 219, 220, 221, 222, 224, 225, 226, 227, 228, 312, 408, 410, 411, 412, 413, 414, 416, 417. These slides are on sale at 25¢ each while they last. A copy of the old slide catalog is available upon request.

### THE L-5 SOCIETY SLIDE SHOW Order Form

- |                              |                              |                              |                              |                              |                              |                              |                              |                              |                              |                              |                              |
|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|
| <input type="checkbox"/> A01 | <input type="checkbox"/> A13 | <input type="checkbox"/> A22 | <input type="checkbox"/> A31 | <input type="checkbox"/> A35 | <input type="checkbox"/> A47 | <input type="checkbox"/> B07 | <input type="checkbox"/> C10 | <input type="checkbox"/> C34 | <input type="checkbox"/> C44 | <input type="checkbox"/> D11 | <input type="checkbox"/> D23 |
| <input type="checkbox"/> A02 | <input type="checkbox"/> A14 | <input type="checkbox"/> A23 | <input type="checkbox"/> A32 | <input type="checkbox"/> A36 | <input type="checkbox"/> A51 | <input type="checkbox"/> B11 | <input type="checkbox"/> C11 | <input type="checkbox"/> C35 | <input type="checkbox"/> D01 | <input type="checkbox"/> D12 | <input type="checkbox"/> D24 |
| <input type="checkbox"/> A11 | <input type="checkbox"/> A15 | <input type="checkbox"/> A24 | <input type="checkbox"/> A33 | <input type="checkbox"/> A41 | <input type="checkbox"/> B01 | <input type="checkbox"/> B12 | <input type="checkbox"/> C12 | <input type="checkbox"/> C36 | <input type="checkbox"/> D02 | <input type="checkbox"/> D13 | <input type="checkbox"/> D25 |
| <input type="checkbox"/> A12 | <input type="checkbox"/> A21 | <input type="checkbox"/> A25 | <input type="checkbox"/> A34 | <input type="checkbox"/> A42 | <input type="checkbox"/> B02 | <input type="checkbox"/> C00 | <input type="checkbox"/> C13 | <input type="checkbox"/> C41 | <input type="checkbox"/> D03 | <input type="checkbox"/> D14 | <input type="checkbox"/> D31 |
|                              |                              |                              |                              | <input type="checkbox"/> A43 | <input type="checkbox"/> B03 | <input type="checkbox"/> C01 | <input type="checkbox"/> C14 | <input type="checkbox"/> C42 | <input type="checkbox"/> D04 | <input type="checkbox"/> D15 | <input type="checkbox"/> D32 |
|                              |                              |                              |                              | <input type="checkbox"/> A44 | <input type="checkbox"/> B04 | <input type="checkbox"/> C02 | <input type="checkbox"/> C31 | <input type="checkbox"/> C43 | <input type="checkbox"/> D05 | <input type="checkbox"/> D21 | <input type="checkbox"/> D33 |
|                              |                              |                              |                              | <input type="checkbox"/> A45 | <input type="checkbox"/> B05 | <input type="checkbox"/> C03 | <input type="checkbox"/> C32 |                              |                              | <input type="checkbox"/> D22 | <input type="checkbox"/> D34 |
|                              |                              |                              |                              | <input type="checkbox"/> A46 | <input type="checkbox"/> B06 | <input type="checkbox"/> C04 | <input type="checkbox"/> C33 |                              |                              |                              |                              |

Total number of slides  
 @ \$1.00 each \_\_\_\_\_

TOTAL, enclosed \_\_\_\_\_

- Space Habitats (26 slides A series) \$26
- Extraterrestrial Resources (9 slides B series) \$9
- Space Transportation (20 slides C series) \$20
- Solar Power Satellites (19 slides D series) \$19
- All 74 slides \$74

Note: if you receive slides of poor quality, please send them back for replacements.

This order from:

Name \_\_\_\_\_

Address \_\_\_\_\_

City, State, Zip \_\_\_\_\_

Continued from page 4

of any one nation or region, with one critical exception: energy."

Many economic studies have examined the strong correlation between energy consumption and economic strength. A strong correlation indeed exists. One can argue from this either that (1) abundant low cost energy is essential to economic well-being, or (2) a strong economy will consume a lot of energy if energy is abundant and cheap.

There are measures of truth in both views. The way the U.S. gross national product tracked the dip in energy consumption in 1973-4, that in turn resulted from the sudden increase in the price of foreign oil, tends to support the former view. The widespread use of large "gas-guzzling" cars in the U.S. is an obvious example of the latter view.

Patterns of energy use tend to be institutionalized in many ways. In response to a sudden increase in energy cost (or decrease in supply), one could:

- Turn down the thermostat: no capital cost, perhaps a little discomfort
- Carpool: no capital cost, some inconvenience
- Put more insulation in the house: small capital cost
- Buy a small car: large capital cost unless one was going to buy a car anyway

And so on. Similarly, industry can equip with more efficient machines, etc. But most conservation measures take time and cost money—capital that is siphoned away from investments that would result in growth.<sup>2</sup>

The degree to which conservation can limit our energy consumption without a major dislocation such as a severe economic downturn with massive unemployment and other problems is unknown, but certainly limited. Policies that emphasize conservation are likely to

- (1) Some enthusiasts for solar power satellites have had the idea that the anti-nuclear movement would support SPS. Predictably, it does not [1,2].
- (2) An energy-economics model should recognize the time lag and cost factors of conservation. We will try such a model in a future article.
- (3) One of the difficulties is that all of the analysts are probably depending to some degree on the oil companies as the ultimate source of data on reserves. There are evident reasons why the oil companies would wish to underestimate their reserves.

disproportionately burden those that are now economically disadvantaged. Last winter, the NAACP issued a report on its considerations of energy policy [6] that clearly recognized this fact. A representative quote: "—We cannot accept the notion that our people are best served by a policy based on the inevitability of energy shortage and the need for government to allocate an ever diminishing supply among competing interests." Well said.

The most widely used energy resources today are oil and natural gas. It is generally recognized now that oil is a critical resource. Substantial controversy exists regarding the exact degree of scarcity<sup>3</sup> but most of the controversy seems to be centered around whether a supply crisis will occur before 1985 or somewhat later, after 1990. Neither of these is a particularly attractive prospect. 1990 is only 12 years away. History indicates that the time required to develop and introduce a new energy source and bring it into principal use is 50 to 60 years. In other words, if we started today to convert to a major new energy source we could hope to have a transition more or less complete by the year 2030.

The use of coal has been viewed in some quarters as a panacea, a sufficient answer to our energy needs. The impression has been created that supplies of coal are either infinite or at least so very large as to represent a long-term supply. Quantities sufficient for hundreds of years have been discussed. This figure, however, applies to the United States only and to current levels of coal consumption. A study by Hubbert [7] however, indicated that world coal reserves could be relatively quickly consumed if the world turned to this source as a primary resolution of the energy problem. And the reserves may not be as large as once thought. Quoting a UPI/AP news item in the Seattle Times of January 29, "The General Accounting Office said only half of the nation's estimated coal reserves may be recoverable."

The widespread use of coal is also not without environmental impact. Strip mining and air pollution are often cited; more significantly, climatologists have expressed concern that the use of coal as a primary energy source for the next 50 to 100 years could cause worldwide climatic changes. George Woodwell writes [8] "Mankind therefore faces a historic dilemma. The human activities that are increasing the carbon dioxide content of the atmosphere promise to bring a general warming of the climate over the next several decades. —the results—will almost certainly be destabilizing." (Woodwell considers deforestation as well as fossil fuel consumption to be significant causes of carbon dioxide increase.)

Climatic changes would affect world food production, probably negatively, and suffi-

cient warming could begin melting the great arctic and antarctic ice caps, resulting in a general rise in sea level by possibly as much as 100 meters. The economic and social consequences would be devastating.

We are indeed faced with a profound dilemma. Although the energy problem is at the heart and the focus of this dilemma, the dilemma is broader in scope than just energy. Until very recently in history, say until 1900, mankind was an incidental tenant of the Earth's ecosystem. We didn't consume very much or create much disturbance. We have now, however, become a planetary force. Our activities threaten to poison the oceans, foul the atmosphere, destroy the forests primeval, and pave the fruited plains with concrete. Uncontrolled growth is abhorrent to many people and would probably be ultimately disastrous. The problem of exponential growth was originally voiced by Malthus as long ago as 1798. It has recently stimulated the doomsday philosophies of the limits-to-growth studies, and the less draconian concept of "alternatives to growth." The prescription provided by "alternatives to growth" generally requires limitation of population growth, recycling of raw materials, and confinement of energy consumption to renewable resources such as solar energy, wind energy, biomass and so forth. This prescription often contains an ideological distrust of big government, big institutions, and big business. Its current buzzwords are "soft technology" and "decentralized energy." A utopian vision is often hinted at, a vision of peaceful small communities living a happy pastoral, self-sufficient, hand-crafted existence with roof top solar collectors and family farms. The "soft technologies" of solar and wind energy are, however, neither soft nor low in cost [9].

If uncontrolled growth may be disastrous, I don't think the soft technology road is much better. I discussed my views of hazards of limiting growth in an economic sense in my previous article. I don't believe there are any satisfactory alternatives to growth! The entire fabric of recorded history attests to the fact that when growth is constrained, the strong prosper at the expense of the weak. (They tend to do so even when growth is not constrained). The various social and political experiments that have been carried out in the world have not changed this fact; they have merely altered the rules that determine who shall be strong.

*My vision of the soft technology road is one of pervasive control by rigid government bureaucracies charged with administering the allocations of scarcities, of severely restricted personal freedoms; of widespread poverty and unemployment; of urban jungles written off to decay and violence, or cleared by what might be called the "Cambodian solution."*

Industrialized society is approaching a level of overall productivity that can afford to support all its members at a level above mere subsistence, and provide something near an adequate level of medical care to everyone. One success of this society is indicated by the continuing increases in life expectancy on the part of its members. But the economics of this society is based on growth.

So we have our profound dilemma. Should we continue with a social order that accommodates our human nature of aggressiveness, expansiveness, growth, and improvement with possible eventual consequence of catastrophe, or should we transform ourselves into a kind of recycling-limited treadmill society, including whatever social changes e.g. establishment of a totalitarian state, may be necessary?

We have talked of two philosophies regarding the limits to growth. One philosophy is to ignore the limits, the second one is to observe them slavishly. There is a third philosophy, one that asks, "why not remove the limits?"

If we are to essay such a philosophy, our most immediate concerns are supplies of energy and food. Small may very well be beautiful, but it is not sufficient. Development of abundant new energy resources would help to alleviate the food problem, since high-productivity agriculture is energy-intensive.

There are three new energy options that offer some promise of being able to support continued economic growth. These are the breeder reactor, which would increase fission fuel resources roughly 100-fold, the thermonuclear (fusion) reactor, for which limitations in availability of the (exotic) construction materials are more limiting than the availability of fuels, and the solar power satellite, for which no meaningful limits on eventual energy abundance are evident.

These options all have potential limitations or problems. A sensible energy policy will pursue all three with equal vigor<sup>4</sup>, as well as other options such as decentralized solar and bio-

(4) The breeder reactor is the only one of these options that presently has demonstrated capability. The position of the current administration as regards the breeder has been observed to be rather curious [10]. Ostensibly for reasons of retarding nuclear (weapons) proliferation, a "go slow" posture has been adopted. For Western Europe, Japan, and many nations aspiring to industrialize, since no adequate alternative is offered, the reluctance of the United States to vigorously curb fossil fuel consumption and pursue new energy initiatives, leaves little recourse except increased emphasis on nuclear power, especially breeder reactors.

mass, these latter likely to be much more important in the future than they have been in the past. The mechanics of transition from our present temporary energy sources, to the permanent ones of the future, are not presently very clear, but the ultimate need is compelling.

*Development of adequate undepletable energy supplies will not remove limits to growth; it only can move the crisis horizon from about 10 to 25 years away to about 50 to 100 years. In the longer run, we are driven to what Krafft Ehrlicke has called the "extraterrestrial imperative." All of the space pioneers—Tsiolkovsky, Oberth, von Braun, Goddard, Ehrlicke, recently O'Neill, as well as others, have in some way recognized this. But philosophy alone no more suffices as a justification for going into space in a big way than it does for soft technology. Hard economics must rule. (The job of building solar power satellites simply does not, in economic terms, demand colonization of space.) So which way does the road in space lead? This is a difficult question we will explore in future articles.*

#### References

- (1) Hochschild, A., "Shuttling Manhattans to the Sky," *Mother Jones*, May 1978
- (2) "Sizing Up Solar Satellites," *People & Energy*, May 1978
- (3) Schumacher, E. F., Small is Beautiful, Harper & Row, 1973
- (4) Lovius, A. B., and Price, J. H., Non-Nuclear Futures: The Case for an Ethical Energy Strategy, Friends of the Earth International, 1975
- (5) Heiss, K. P., "The Energy Problem: The Need to Develop Policy Options," Statement for Record, Hearings Before the Subcommittee on Space Science and Applications and Subcommittee on Energy of the Committee on Science and Astronautics, U.S. House of Representatives, Hon. Olin E. Teague, Chairman, 1973
- (6) "Energy, Jobs, and Black America," *Wall Street Journal*, January 12, 1978
- (7) Hubbert, M. K., "Energy Resources," Environment: Resources, Pollution, and Society, Sinauer Assoc., 1972
- (8) Woodwell, G. M., "The Carbon Dioxide Question," *Scientific American*, January 1978
- (9) Murray, B., "Solar Energy: True God or False Prophet," *Engineering & Science*, March-April 1978

- (10) Rose, David J. and Lester, R. K., "Nuclear Power, Nuclear Weapons, and International Stability," *Scientific American*, April 1978

## FASST to Study Student Input on SPS

Methods to solicit student input and to disseminate information on the topic of solar power satellites (SPS) are being examined by the Forum for the Advancement of Students in Science and Technology (FASST), under a planning contract awarded by the PRC Systems Sciences Company.

Notification of the contract award was recently announced by Charles E. Bloomquist, Project Officer for PRC, which is currently engaged in a three-year study for the Department of Energy to develop an initial understanding of the technical feasibility, economic practicality, and social and environmental acceptability of the SPS concept.

The PRC Systems Sciences Company is the world's largest diversified, professional services organization. It serves government, business, and industry, primarily in areas of planning, engineering, architecture, information sciences, and management consulting.

Results of the FASST, three-month, \$9,500 planning contract will provide a better understanding of how to communicate SPS information to the college community, in order to encourage students to think in a realistic way about the development of this technology as a potential energy source.

During the study, FASST will identify methods that have proven successful in disseminating information addressing other contemporary issues, and methods to encourage students to become active participants in the discussion of these issues. The study will also examine models for conflict management which can be applied when presenting students with the wide range of opinions and attitudes that currently revolve around the SPS concept.

In commenting on the award of the contract, Alan Ladwig, President of FASST stated, "We are looking forward to this opportunity to improve student participation in the discussion of energy options for the country. We commend the foresight of the PRC Systems Sciences Company and the Department of Energy in recognizing the importance of having student participation in the SPS discussion. This is especially important since students will inherit the management responsibility of future energy systems being decided upon today."

According to Leonard David, Program



Director of FASST and Principal Investigator for this contract, "While this study concerns the communication of information relevant to a specific type of technology, the methods to increase student participation that will be identified may be suitable for application to other FASST science education programs."

The scope of this study project compliments the on-going efforts of FASST to develop new opportunities for student participation in the discussion of science issues, and to develop new approaches to resolve conflicting opinions on the direction of science projects.

"During a time," Ladwig concluded, "when numerous groups, from both the business and non-profit sectors, are advocating cut and dried solutions to complex science problems, FASST must increase its efforts to develop new forums for these problems to be worked out and discussed."

In addition to Ladwig and David, the FASST study team will include Tom Schwab of Cornell University. Tom is currently participating in the FASST Summer Intern Program.

For more information, contact Leonard David, FASST, 2030 M St., Washington, D.C. 20036, 202/466-3860.

## Omission

The article, "Space Habitats by Accident" in the July L-5 News was written by Leonard David of FASST.

## "Living and Working in Space" Panel

The opening session of the 11th annual National Association of Industrial Technology Convention at the Jacksonville Beach Sheraton Hotel, Jacksonville, Florida will be "Living and Working in Space". This panel discussion session, from 8:45 to 10:30 AM, Thursday Oct. 19, 1978, will be chaired by Earl G. Mills of Hughes Aircraft Co., El Suguendo, CA, and will include presentations by panelists; Jerold Farrell, Hughes Aircraft Co., Los Angeles, CA, Charles L. Gould, Rockwell International, Downey, CA, and Jay Huebner, University of North Florida, Jacksonville, FL.

Individuals may attend without charge. It is hoped that groups planning on attending will communicate the number expected to be in attendance to Dr. Adam Darm, Division of Industrial Technology, University of North Florida, Jacksonville, FL 32216, so adequate space can be assured.



## Bylaws Votes

There were 504 ballots cast in the annual election. Bylaws changes require 2/3 of the votes cast to pass — in this case, 336. One bylaw change flunked: the amendment to Article XI, Part A reading "Approval by majority vote of a quorum of the Directors at any meeting of the Board of Directors". It only received 321 votes.

If you would like a copy of the new, improved bylaws, write L-5 headquarters at 1620 N. Park, Tucson, AZ 85719 and we will mail you a copy.

## New L-5 Chapters

Ashland L-5  
Box 1420  
Randolph-Macon College  
Ashland, VA 23005

Reno L-5  
c/o Ray Bryan  
1071 Glen Meadow Dr.  
Sparks, NV 89431

Jacksonville L-5  
c/o Penny Stombock  
Star Route 1, Box 1208  
Yulee, FL 32097

(Note: the organizational meeting will be held Friday, September 22, 1978 at 8 PM in the Jacksonville Museum of Arts and Sciences, 1025 Gulf Life Dr.)

## Mankato News

The Mankato Space Society was formed in April of 1978 by members of the L-5 Society, the National Space Institute, the National Association of Rocketry, the American Astronomical and Astronautical Societies, The American Institute of Aeronautics and Astronautics, and other organizations, with the intent, because of our non-central location, of bringing those with the common interest in the utilization of outer space under the umbrella of a local, stronger, and more influential organization.

The purpose of the Society is to inform and educate the Society membership and the general public of the history, present condition, and proposed and possible future developments in all aspects of the utilization of outer space and related fields, and to conduct research in areas of interest to the membership.

The Society is sponsoring an Aerospace Week in Mankato during Sept. 22-27, 1978. Displays will be presented in two of the shopping malls and on the campus of Mankato State University (MSU) on such various aerospace topics as: Astronomy, Space Settlements and Industrialization, Civil Air Patrol Aerospace Education, Model Rocketry, Remote Controlled Model Airplanes, and the National Aeronautics and Space Administration. There will be speakers in MSU Centennial Student Union in addition to the displays, and a two hour Society program will be given the evening of Wednesday, Sept. 27.

The Mankato Space Society has been organized as a MSU recognized campus organization with membership open to anyone in our region. Anyone who is interested in participating in the Society's L-5 Concept project team or one of the other project teams to help produce and give public education presentations may contact the Society for more information at: Box 58 Activities Office, Mankato State University, Mankato MN 56001; or Dan Lundquist at 507/345-3624 or Brady at 507/388-6090.

## O'Neill Lecture

The Chicago Society for Space Settlement will present Dr. Gerard O'Neill on Friday, October 20, at 7:30 P.M. in the Navy Pier Auditorium on Chicago's Lakefront. This show is open to the public without any admission charge. Mayor Bilandic has provided the Society with the use of the Navy Pier Auditorium as well as the parking facilities located on the pier itself.

BUT—to carry off the O'Neill lecture, the Society needs to raise \$2,500.00 by October 1st. As of August, current pledges total \$600.00.

In order to make contributions to this program tax-deductible, the National Space Institute has agreed to act as a "grant sponsor" for the lecture. This means that a donor who makes his check payable to the NSI and sends it to the Chicago Society for Space Settlement may write off the gift and the NSI will give the donation to the Society for the project. Donations can be mailed anytime to The Chicago Society for Space Settlement, 4 N. 186 Walter Drive, Addison, Illinois 60101.

The September meeting of the Chicago Society for Space Settlement will be held September 17, 1:00 P.M., the Midlevel lecture hall of the Adler Planetarium. The public is invited, and there is no admission charge. The Adler Planetarium is located at: 1300 S. Lake Shore Drive, Chicago, IL.

## Tulsa L-5

The Tulsa L-5 Society conducted a panel discussion at Okon '78, held July 22-23 in Tulsa. SF writer Joe Haldeman and Tom Huffman, president of the Tulsa chapter, discussed the High Frontier concept and the L-5 Society, its history and current activities.

Haldeman mentioned the possibility of an auction at Worldcon (Phoenix, Aug. 30-Sept. 4) to benefit G.K. O'Neill's Space Studies Institute. Joe thinks some SF writers would be willing to donate manuscripts to be auctioned off; he'd be the auctioneer.

Quite a few people stopped by our table in the hucksters' room; more than 40 of them signed their names to a list indicating an interest becoming members of Tulsa L-5. Other chapters may gain members from the out-of-towners who expressed interest in joining; some new chapters may even be formed.

With the people we picked up at the "con", added to our small core group, we should have enough people for an active chapter. We're already planning a careers in space symposium and a poll of local

interest in an expanded space program.

If anyone in an established chapter is interested in giving advice to a fledgling group, write to: Tom Huffman, pres., Tulsa L-5 Society, 3424 E. 41st, Tulsa OK 74135 or phone 918/743-4942.

## VA Tech L-5

New officers have been elected to direct activities of the Virginia Tech Chapter of the L-5 Society this coming school year.

President is Cindy Hartman, a public administration major from Springfield, VA. Vice President is Billy O'Donovan, majoring in engineering; secretary is Mark Turner, a public administration major; and Allen Jones, an engineering major is the new treasurer.

Miss Hartman explained the goals of the chapter as being one of spreading the ideas and benefits of space colonization.

"We will be preparing audio-visual presentations on a wide variety of subjects for use in high school and junior high science classes," she said.

Miss Hartman described the presentations as covering subjects from

space habitat design to applications of spin-off technology.

"The variety of subjects available will present challenging areas related to space colonization for all chapter members to research and participate with," she added. "This should keep our chapter busy for years to come."

## Sounds of Earth

The 120 minutes of the "Sounds of Earth" recording installed on Jupiter-bound Voyager-1 and Voyager-2 may be sold commercially to coincide with probe Jupiter encounters in March & July 1979. The record consists of 22 minutes of sounds and 98 minutes of music.

The record was put together by CBS records in New York, which owns all rights. NASA has tapes which can be used for news and information purposes. Contact Jim Kukowski, Audio-Visual Office, NASA Headquarters, Washington, D.C. 20546.

# The Future United States Space Program Conference

October 30 through November 2 the top space researchers in the U.S. will gather in Houston to chart out future efforts. This gathering will cover everything from space science to nuts and bolts space engineering to "people problems".

If you want a crash course on the options

opening up in the U.S. space program; if you want to meet and talk with the top space researchers in the nation; if you want to be one of the several hundred people who know and care the most about our future in space, then you'll want to make it

to this conference.

The "Future United States Space Program" conference is cosponsored by the American Astronautical Society and the L-5 Society, among others. Hope to see you there!—Carolyn Henson

## Advance Conference Registration

TO: The American Astronautical Society  
1830 NASA Road 1 LEC Mail Code D-01  
Houston, Texas 77058

*Don't forget to take your L-5 members' discount when filling out your application.*

### ADVANCE REGISTRATION:

(Members)	<input type="checkbox"/>	\$20.00 one day	(Student)	<input type="checkbox"/>	\$ 5.00 one day
	<input type="checkbox"/>	\$50.00 four days		<input type="checkbox"/>	\$10.00 four days
(Non-members)	<input type="checkbox"/>	\$25.00 one day	(Banquet)	<input type="checkbox"/>	\$15.00
	<input type="checkbox"/>	\$70.00 four days	(Awards Luncheon)	<input type="checkbox"/>	\$10.00

NAME \_\_\_\_\_ POSITION \_\_\_\_\_ DEPT. \_\_\_\_\_

COMPANY \_\_\_\_\_

ADDRESS \_\_\_\_\_

(Street)

(City)

(State-Zip)

## Fresno L-5

We wish to thank you very much for sending us the L-5 reprints which we passed out at our booth at the Diablo Canyon Rally and Alternative Energy Fair.

Our display generated a lot of interest and the reactions were varied. About ten percent of the people were openly hostile. A typical comment was: "Oh no! This is totally out of place here." Another fifteen percent were openly supportive. You can expect a few new memberships. The rest ran the whole spectrum in between; skeptical, puzzled, curious, and interested. Nearly everyone asked, "What about the microwaves?". Others said, "We can never afford that." I found it helpful to tick off a point by point comparison of the SSPS and nuclear power plants and to mention the cost of foreign oil. This leaves SSPS smelling like a rose and caused even tough skeptics to ask for more information.

At the rally and during the preparation prior to it, I made friends with several people from the Abalone Alliance and our local anti-nuke activist group, People for Safe Energy. Most of these people are committed to, as they put it, replacement of "hard" technology by "soft" technology. They tend to initially view space industrialization as "just more of the same", meaning control and manipulation by the major power companies. They seem to be grasping for something elusive, however, since I think that most of them realize that the conversion to soft technology would lead to economic stagnation and a largely uncertain future. When I mention the possibility of utilizing extraterrestrial resources to put the lie to the concept of limits to growth some of them become enthusiastic almost, it seems, in spite of themselves since this is near heresy to the ideals of decentralization. I think that, if approached in the right way, these types of



Fresno L-5 booth at the Alternative Energy Fair. Seated on the right are Lynne Percy and Eric Forster. (Photo courtesy Gale Smith.)

activist groups could yield some very intelligent dedicated space supporters.

Gale M. Smith

## Hubbard to Appear in LA

October 17 at 8 PM the Theatre for the Future will present "Previews of Coming Attractions", starring Barbara Marx Hubbard. Ms. Hubbard, an L-5 Society director and noted space activist, has been showing her audiences that our expansion into space is an evolutionary imperative.

The show is cosponsored by the World Future Society and American Institute of Aeronautics and Astronautics. Location is the Union Oil Auditorium, 461 S. Boylston St. (west of the Harbor Freeway). Admission is \$2.50.

## Final Frontier

Two new programs, now available in 16mm and videocassette, have been added to Time-Life Multimedia's critically-acclaimed NOVA series. The new releases, which were produced by WGBH and originally aired on the PBS network, are: "One Small Step" and "The Final Frontier."

With "One Small Step", NOVA marks the 20th anniversary of the first American venture into space. It examines the history of space exploration and the technical—as well as political—considerations that influenced it through July, 1975, when the first Soviet Soyuz and the American Apollo rendezvoused in space and the space race officially ended.

"The Final Frontier" investigates the

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

NAME: \_\_\_\_\_

ADDRESS: \_\_\_\_\_

CITY/STATE/ZIP: \_\_\_\_\_

AFFILIATION/TITLE OR POSITION \_\_\_\_\_  
(OPTIONAL)

I am \_\_\_\_\_ am not \_\_\_\_\_ interested in being active locally. Phone (optional) \_\_\_\_\_

\_\_\_\_\_ Please enroll me as a member of L-5 Society (\$20 per year regular, \$15 per year for students). A check or money order is enclosed. (Membership includes the **L-5 News**, the monthly magazine of the L-5 Society. Subscription of \$12/year included in membership dues).

L-5 Society members who sign up for the Space Legislation Hot Line option receive frequent first class mailings on the actions of Congress and the President which affect the space shuttle, space colonies, solar power satellites, space exploration and other space projects.

\_\_\_\_\_ Sign me up for the Space Legislation Hot Line.

premise and promise of space colonization: regularly scheduled space shuttles, extra-terrestrial manufacturing and agriculture, and untapped and perhaps unlimited sources of raw materials and energy. Already NASA is testing "Getaway Specials" to outer space and mounting a marketing campaign to convince American industry that space is the place to be, and scientists predict that by the year 2177 more people will live in space than on Earth.

For more information on obtaining tapes of these programs, write to WGBH Educational Foundation, 125 Western Avenue, Boston, MA 02134, phone 617-492-2777.

## Letters

This question may only reflect my ignorance of "the market", but I'd rather be laughed at by you than by a stockholder! In reading the **Laser Propulsion** article in the July, 1978 **L-5 News** (which I received 3 August, about usual), I got the flash - 'why not invest money in one of these brilliant, new, little, space-oriented companies, like AVCO Everett Research Laboratory, a la Xerox when it was young?' I am convinced that the utilization of Space lies in humanity's future—so let's get going! Right now my largest asset is the cash value of my life insurance policy, which, at my age of 26 - and considering I seriously intend to live another six score years - seems a pretty silly use of my resources. Now the question: where does one get the names and profiles of such budding companies? Does a list exist, or are there brokers who specialize in this interest, or is this something the **L-5 News** can help put together?

Thanks for your help.

Aloha,  
Ron Lichtwardt  
Honolulu, HI

*Details on companies which interest you can be located in **Moody's Industrial Manual**, available in any good library—CH*

Why should we spend \$20.5 million for the Teleoperator Retrieval System? From what I read in Henry S.F. Cooper's **A House in Space**, the problems and living conditions of Skylab warrant a totally new system. An updated version of Skylab could be a predecessor to Space mini-colonies. Would this not be a more fruitful course to follow? Let the old system come tumbling down, but not on me, and use the money for R&D into a new and different

"Skylab". Unless the Teleoperator Retrieval System has other important uses, I cannot lobby for it as part of a NASA budget. I feel that Skylab won't be there to save and will be stuck with a \$20.5 million Teleoperated Anemic Pachyderm. The same seems applicable to Spacelab II. In the absence of a better argument, I must lobby against these items in the NASA appropriations bill.

Live long and Economically!

Keith Kuhn  
Lewistown, Pa.

I propose that we make up our own award to be called the golden turkey consisting of a statue of a turkey with its head on the chopping block. The first person to receive one should be none other than Senator Proxmire for making a fuss over the SETI appropriation. The \$2 million requested this year when compared to the national debt of 675 billion amounts to a savings of 3 ten thousandths of one per cent ( $3 \times 10^{-6}$ ). Never has one done so much to hinder the expansion of human knowledge at so little savings. In fact, the \$2 million would only be 2% of the cost of the new Senate office building. As for being against the tele-operator system, I hope Skylab comes down in his back yard.

Michael C. Strong  
Swartz Creek, MI

I am opposed to developing solar energy stations in space because it is not cost effective and, further, will not produce significant energy potential. Rather, I fully support the development of fusion energy.

At this time, the U.S. does not have a comprehensive energy program. The Soviet Union, in conjunction with the Socialist bloc does it the following way: massive financial, economic and scientific development of fusion energy and space exploration. While we reinvent the wheel (solar energy), they will leave us far behind. Unfortunately, it will take a new "Sputnik" to change the prevailing intellectual climate.

Thomas Scanlon  
Brooklyn, NY

On page 20 of the January 1978 **L-5 News** is a letter: "L-5's Achilles Heel?" I cannot agree with Mr. R.G. Lovell's opinion. The solar power satellites are stations which can be moved all around our planet at any place where energy is needed. The deep well geothermal plants imply a very strong study of new materials resisting the high temperatures of magma and lava, and the creation of a liquid resisting these

temperatures. The problem of solar-energy transmission by microwaves seems to me to have been studied much more profoundly and therefore much more advanced in its creation.

On page 21, Mr. Michael Mautner, Ph.D. discusses "Corrosion Questions". Still it seems to me premature to examine space colonies' structural materials. I will only mention an article indicating the tremendous quantity of nickel to be collected from an asteroid, which means that large quantities of oxidation and/or acid proof sheets can be laminated for space-purposes. Another solution may possibly be the vitrification at low cost of usual sheets.

But, as I mentioned before, I consider the creation of space colonies as a second step. The main purpose of L-5 ought to be the creation of the SPS and the large income which will result from the supply of the cost free solar-energy which will pay the investment made and then build up the funds necessary to proceed to the second step: space-colonies.

Stefan Cantacuzino  
Master of Technology  
Huddinge, Sweden

Eric Drexler's article "The New Space Program" was very interesting, and very true. If we (members of the NSP) don't come together on our goals, we will never be able to get anything put up in space, much less any form of space habitat. NASA already has congressmen and Senators tearing its budget apart left and right. It certainly doesn't need to have civilians tearing down every idea they put up because it opposes their pet project.

Jonathan Henderson  
Hodgenville, KY

Words of wisdom from Dr. Frosch: "The system has now sharpened its pencils in a way that discourages changes that are major. We have been so busy with other things that we may have inadvertently told the people who think up ideas to go away." (Vanishing Innovation, **Business Week**, July 3, 1978, p. 46-54, specifically page 49) Aargh!!!

Charles J. Divine  
Trenton, NJ

Congratulations on the L-5 editor's new daughter. I suggest that you train her as a pipe-fitter/metal worker, with 1995 in mind. Looks like about the best way to get off the world then: a useful skill plus EEOC pressure, there being few female pipe-fitters.

Jack Salmon  
Pensacola, FL