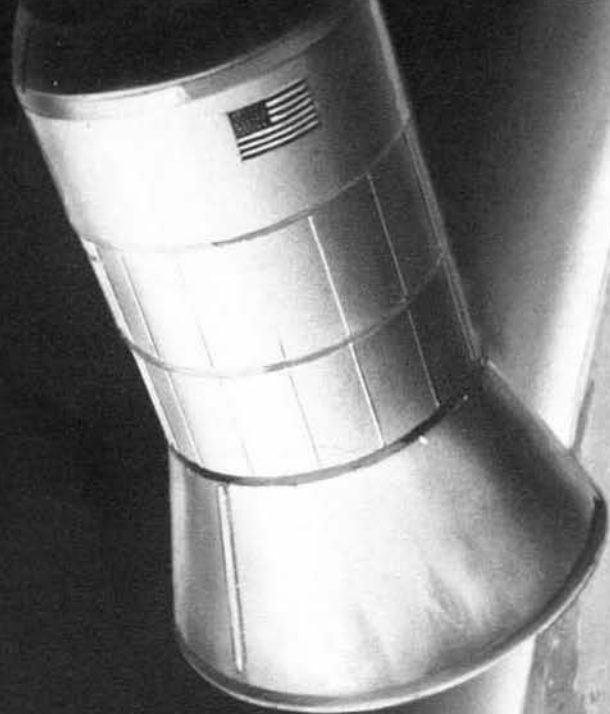


# 15 NEWS

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# L-5 NEWS

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**Cover:** A proposed heavy lift launch vehicle, a space freighter which could lower launch costs to \$15/lb within this century. (Artwork courtesy Boeing.)

# Congress Pushes SPS

by Carolyn Henson

Complaining that NASA and DOE's solar power satellite (SPS) research is on a "going out of business curve", twelve members of the House of Representatives have introduced a bill which would fund SPS research in fiscal year '79 with \$25 million.

The bill, HR10601, entitled the Solar Power Satellite Research, Development and Demonstration Act, was introduced by Rep. Ronnie G. Flippo (D-AL). Cosponsors are Representatives Olin Teague (D-TX), Don Fuqua (D-FL), Walter Flowers (D-AL), Mike McCormack (D-WA), Larry Winn (R-KS), Bob Gammage (D-TX), Louis Frey (R-FL), Jim Lloyd (D-CA), James Blanchard (D-MI) and Dale Milford (D-TX). The bill calls for a new SPS development plan to be drawn up by Sept. 30. The plan would supercede the SPS Concept Development and Evaluation Program plan which has planned expenditures of only \$19.5

million from 1977 through 1980. The current plan allows no further hardware development, concentrating on evaluation of research already done in the field. SPS researchers have been concerned over the plan's "go-no go" decision date in 1980, complaining that, without further hardware development and research, the only possible decision would be that SPS cannot be demonstrated to be economically feasible. Researchers have also objected to the Administration's refusal to include some of the more promising SPS designs in the study. The space manufacturing facilities approach is one which has been excluded. Observers accuse DOE of choosing "straw man" SPS designs for further evaluation, making it easier to "prove" that they are economically unfeasible.

As things now stand, the SPS project appears slated for extinction by 1980. Will Congress change the direction of Carter's energy policy with HR 10601?

If you want to be a player in the drama unfolding in Congress this year, you can get wired into the hot line by joining L-5's "So You Want to Lobby" information service.

If you wish to receive up-to-date news via first class mail and, in emergencies, via phone, please send in the following information:

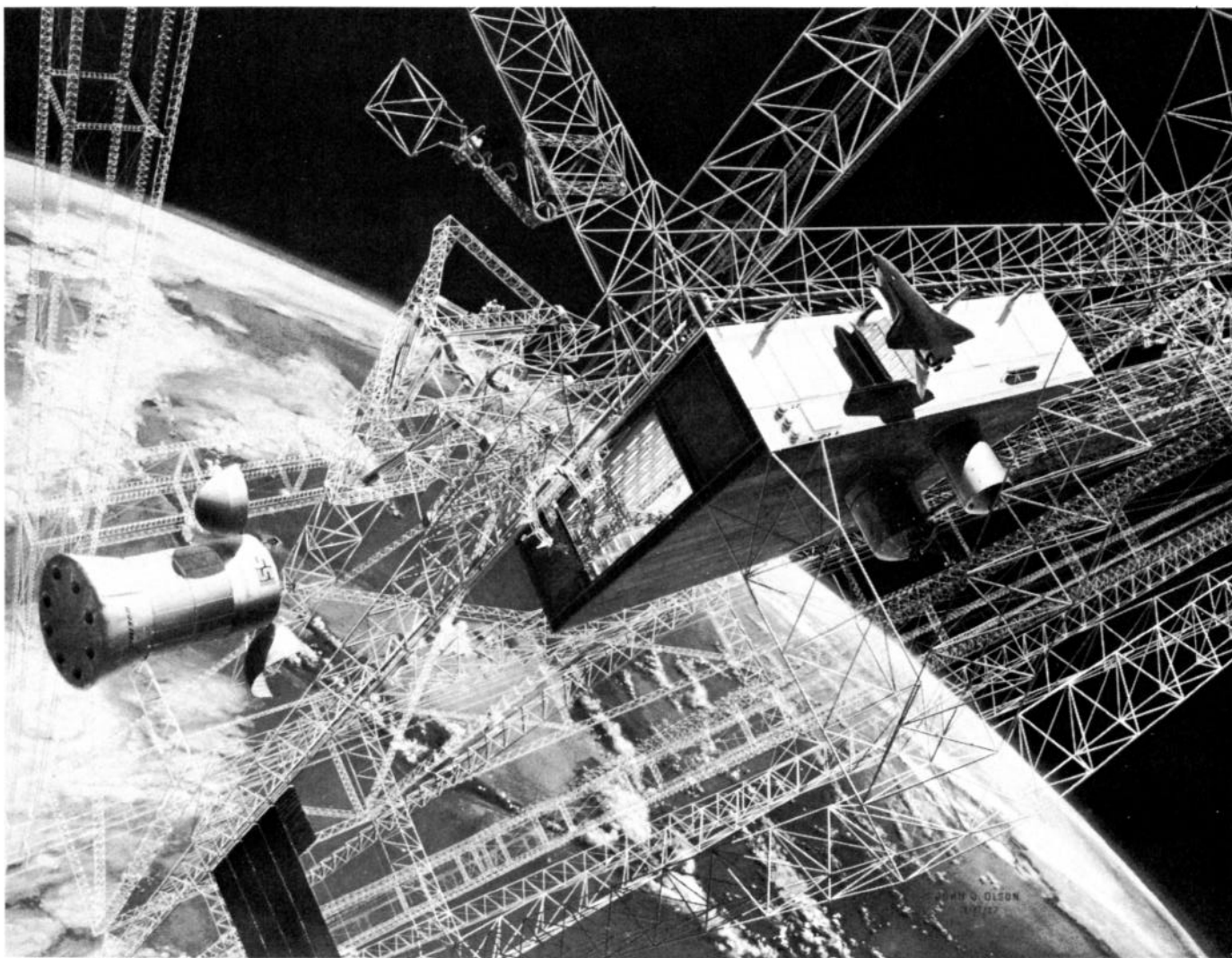
Your address, and, if you are willing to accept a collect phone call from the Society, your phone number.

A brief essay on your background and how you plan to take political action.

Whether you can drop everything and go to Washington to attend hearings and meet with your Congresspeople.

Whether you will need a place to stay when in Washington (area members please notify us if you can put up out of town visitors).

Whether the Society has permission to pass your name and address along to responsible space oriented lobby groups.



A solar power satellite in construction in low Earth orbit. A shuttle is docking at a "hangar" in which space construction workers operate; at the left is a freighter rocket which brings up parts. (Illustration courtesy Boeing.)

# “Congress Has to Set Priorities”

by Carolyn Henson

A sizeable contingent of L-5 members showed up in Washington for the Future Space Program hearings Jan. 24-26. The hearing room was jammed; at times people were standing in the back and the aisles. Many of the L-5 people met with their Representatives and staffers while in Washington delivering well thought out written statements and encouraging them to attend the hearings.

Interest in them was high. Normally only members of the Space Science and Applications Subcommittee (which sponsored the hearings) attend their hearings. But this time members of several other Science and Technology subcommittees attended as well as some Representatives who were not even on the Science and Technology Committee. The Subcommittee chairman, Don Fuqua, allowed all the Representatives in attendance to question the witnesses. Staffers for dozens of Representatives were in the audience.

Four of the thirteen witnesses testified in favor of space settlements. They were G. Harry Stine, author of the *Third Industrial Revolution*; Charles Sheffield, Vice President, Earth Satellite Corporation; Barbara Marx Hubbard, author of *The Hunger of Eve*; Gerard K. O'Neill, Princeton physics professor, and Lawrence Adams, President, Martin Marietta Aerospace. The Representatives were quite cordial and openly helpful to these witnesses.

Dr. Phillip Handler, National Academy of Sciences; Frank Press, Carter's Science advisor; and Robert Frosch, Administrator of NASA got up on the witness stand to explain why space industries, settlements and solar power satellites should have the low priority given them by the Carter Administration. The Representatives were surprisingly hostile to them. Barbara Mikulski (D-MD) told Handler, "Congress has to set priorities, not you,"

and demanded that he submit the criteria on which he based his evaluation of the space program. Louis Frey (R-FL) complained that "I don't see the sense of urgency, commitment -- we've been talking long enough."

Under questioning Handler, Press and Frosch all admitted that solar power satellites (SPS) were technically feasible. Press, when told by James Scheuer (D-NY) that "when you do nothing you make policy" and "I don't get a feeling of zeal," replied that "there's no question we've got to get there; the problem is to explore possibilities." Scheuer responded that "you learn by doing" and proposed that a prototype SPS be built immediately. Press countered by saying that "we have to get \$16 million behind us before we can make a prudent decision." Ronnie Flippo (D-AL) objected that it would take three years at current SPS funding rates to make a decision.



Barbara Mikulski telling Phillip Handler "Congress has to set priorities, not you." (Photo courtesy Charles Divine.)

Larry Winn (R-KS) pretty well summed up the Representatives' frustrations with the Carter SPS policy, saying "I don't mean to sound rude -- but we've been listening to you (Press and Frosch) for one hour and we're not hearing a damn thing that's new . . . if this is what we've got for energy, we'd better sell the Saudis our F-15's."

Four days after the administration's testimony, an alternative SPS bill was introduced by Ronnie Flippo (D-AL) and cosponsored by 11 other disgruntled Science and Technology Committee members, including the chairman of the Fossil and Nuclear Energy Research, Development and Demonstration Subcommittee, Walter Flowers (D-AL); the chairman of the Transportation, Aviation and Weather Subcommittee, Dale Milford (D-TX); the chairman of the Advanced Energy Technologies and Energy Conservation, Development and Demonstration Subcommittee, Mike McCormack (D-WA); the chairman of the Space Sciences and Applications Subcommittee, Don Fuqua (D-FL); and the chairman of the Science and Technology Committee, Olin Teague (D-TX). For details on this bill, HR 10601, "Solar Power Satellite Research, Development and Demonstration Act" see the related article, "Congress Pushes SPS" in this issue of the L-S News.



*NASA Administrator Robert Frosch faces Congress.*



*Gerard O'Neill testifying at the Future Space Program hearings.*

# A Crassly Expedient Act

*From the center - T.A. Heppenheimer*

The proposed 1979 Federal budget, the first to fully reflect the views of the Carter Administration, must certainly be a shock to all who advocate an expanded space program. President Carter has struck at the very heart of the mainstay of any such expanded efforts -- the Space Shuttle. This comes through his recommendation to delete funding for the fifth Shuttle Orbiter, reducing the Shuttle fleet to four in number, instead of the planned five.

The proposed five-orbiter fleet reflects anticipated traffic, as developed through careful NASA and contractor studies, and represents a fleet size calculated to permit most effective use of this new space transportation system. Thus this Carter Administration decision must be taken as earnest of an intention to reduce our already inadequate space efforts by another 20% -- if not by more.

Such an action would hardly be out of keeping with the viewpoint of an Administration which has given high responsibility to Walter Mondale. During his Senate days, Mondale stood high among the inveterate foes of the space program. In 1970, with Space Shuttle funding set at only \$12 million in the budget, Mondale sought to strangle the program at its birth by moving to delete this item. In 1971, 1972, and 1973, Mondale again and again sought to delete Shuttle funding, abandoning his efforts only when it became obvious that the program enjoyed overwhelming support.

Fortunately, there is ample opportunity to move to restore funding for the fifth Orbiter. The budget must be passed by Congress, and friends of the Shuttle can introduce amendments. But to aid in this, it will be important to muster public support.

Such support can only be enhanced by the fact that the Orbiter craft to be scrapped is, indeed, the famous *Enterprise*. That craft received that name through the efforts of a hundred thousand Star Trek fans. Such support, if mobilized and focused, will prove more than enough to send a warning to Carter: Hands off our space program!

Such organizations as FASST, the AIAA, and the L-S Society can play a vital role in energizing and directing this support. There's a lot to do. Let's get to work. Let's show this Administration that our space program is not for cutting.



Dr. Thomas A. Heppenheimer was born in 1947. In 1971 he co-founded FASST (Forum for Advancement of Students in Science and Technology), and served as its Vice-President/Technical. In 1974 he was named to a temporary appointment to the faculty of California Institute of Technology. In 1976 he was named Alexander von Humboldt Research Fellow, in the Max Planck Institut für Kernphysik, Heidelberg, West Germany.

His principal research areas include planetary science, aerospace engineering, and celestial mechanics. His 1976 discovery of achromatic trajectories has since

led to major advances in the understanding of the problem of transport of lunar resources, for use in space industrialization. More recently, he has given new solutions in dynamics which point the way to a complete understanding of the early history of the asteroids.

He is the author of *Colonies in Space* (Stackpole, 1977), widely regarded as the definitive work on space colonization. It has been selected by the Book-of-the-Month Club, and by five other book clubs.

He is listed in *Who's Who in Aviation* and in *Who's Who in the West*.

# OTRAG: BOLD PIONEER FACES HOSTILE WORLD

by Conrad Schneiker

## INTRODUCTION

In past issues of the L-5 News, articles of interest to our readers have been reviewed individually. The large volume of articles on OTRAG has made such a treatment a formidable task. The large degree of overlapping reports would make the task very monotonous as well. For these reasons this article was written to summarize some recent articles on OTRAG. They are listed in the bibliography for interested readers.

## OTRAG -- THE COMPANY

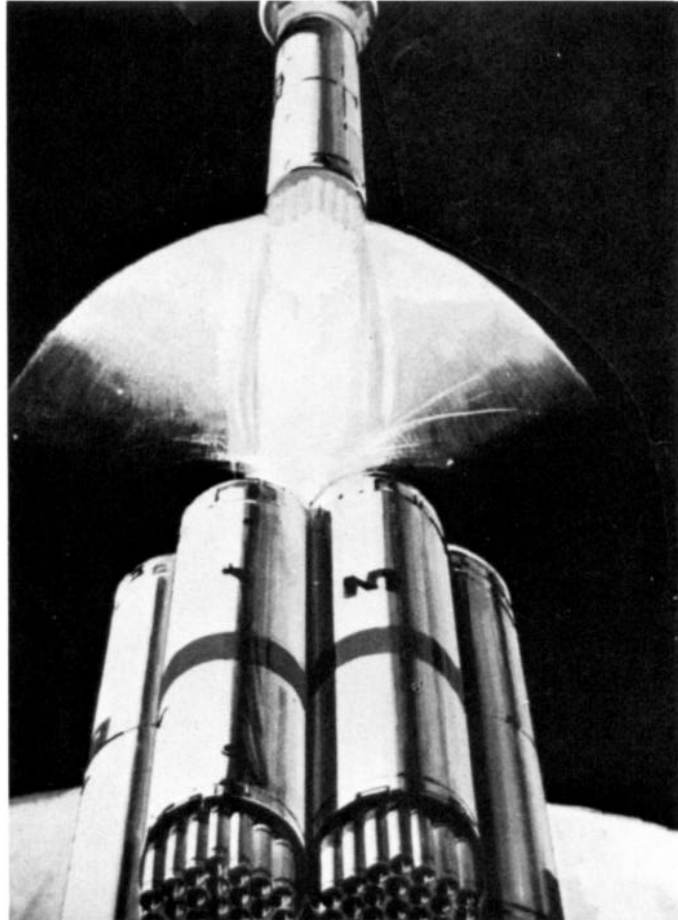
OTRAG's goal is to slash the high cost of rocket launch vehicles to half the cost of existing or planned launch vehicles. OTRAG (Orbital Transport und Raketer Aktiengesellschaft) is a West German firm, headed by 38 year old Dr. Lutz T. Kayser. He has made 31 inventions in rocket technology to date [7]. Chairman of the Board of Directors, Kurt Debus, was director of the NASA Kennedy Space Flight Center. He directed the world's first tests of large rockets at Peenemuende [2]. He worked with the late Werner Von Braun. Kurt Debus describes the OTRAG rocket as "brilliantly simple [12]."

OTRAG's starting capital was only \$425,000. Money has been invested by "a score of West Germany's big earners who can write off their investment through tax deductions." Now it is financed entirely by some 600 private investors. It has contracted with Zaire for a launch area. The contract is through the year 2000, with payments deferred until 1980, at which time Zaire will receive 5% of the sales revenues.

OTRAG has spent about \$30 million on the development of its launcher, using a small team of about 40 engineers. It has already flown its first test vehicle. On the other hand, "the German-French project -- ARIANE -- has not yet yielded any results despite the huge amount of money (\$400 million) put into its development [8]." This last amount is what OTRAG figures it will spend by the time it starts regular operations in 1980-1981. It also figures that its prices will undercut ARIANE's.

## OTRAG -- THE ROCKET

The "low-cost rocket" is based on clustering many standard tank and engine modules. The number of modules used varies with the weight of the payload



Artist's conception of the OTRAG multistage rocket, planned for launch in late 1979. (Photo courtesy Theo Pirard.)

to be launched [15]. As many mass-produced, off-the-shelf components are being used as possible. Every attempt is being made to simplify the overall system. For instance, compressed air is used to move fuel instead of turbopumps. The inexpensive and plentiful fuels, kerosene and nitric acid, replace the expensive and hard to obtain UDMH fuel. Thrust chambers are ablatively cooled, a technique usually reserved for solid fuel rockets. Automobile windshield wiper motors actuate fuel valves (which are used by the chemical industry).

The largest OTRAG rocket configuration is sized to place about 1/3 as much payload weight in low earth orbit as the Shuttle. However the diameter of its payload bay is 8m compared to 5m for the Shuttle. In addition, ". . . payloads for the Shuttle will be very expensive because they

must be man rated, which will not be the case for the OTRAG launcher. . . . Shuttle payloads will have to be qualified to much higher noise-fatigue levels because they will be so much closer to the engines . . . during launch."

The first test flight reached an altitude of about 20km. Another test flight is scheduled for early 1979 and the first orbital insertion is planned for later that year.

## OTRAG: AFRICA'S CAPE CANAVERAL

"Until now Africa's participation in the application of space technology for the economic and social development of the continent had been limited to the use of INTELSAT communication satellites. This has considerably improved Africa's communication with the outside world but not the links between one African

country and another [6].” With the arrival of OTRAG, this may soon change. For “the role of satellites is gradually shifting from international to national systems. The trend is clearly towards separate domestic satellite systems which make it possible for a developing country to determine its use for its domestic instead of depending on the INTELSAT system which is entirely outside the control of governments using it.”

OTRAG is prepared to launch spy satellites for African nations (or anyone else). As a result “no major military move, such as a concentration of troops, activities on military bases, airfields and even roads can escape the watchful eye of the satellite cameras. The recent detection of the South African nuclear testing ground in the Kalahari Desert is a good example.” Lutz Kayser takes the view that “until recently much of this spectacular achievement was cloaked in unnecessary military secrecy . . . [7].”

Compare this with an earlier dialogue in the U.S. “As we go into the future,” says Director, Defense Research and Engineering, Malcolm Currie, “we may have to establish resolution limits on various kinds of sensors used in unclassified programs [16].” For instance, “DOD and NASA have ‘intensely’ discussed NASA’s development of the thematic mapper which will provide resolution of 30m (compared to the 80m now available on Landsat with the multispectral scanner).” Once OTRAG’s rockets are operational, such considerations will be passe. For OTRAG can fly satellites with “wide angle, high precision cameras that can register an object on the ground the size of an automobile.” This is (very roughly) a factor of ten improvement over a resolution of 30m. And with modern equipment, one can do much better.

Apparently the DOD has company in its worries: “Others, however, have linked the publicity given to the [Pravda] press report with Soviet efforts to amend the Space Treaty limiting the launching of reconnaissance satellites to the Soviet Union and the United States [7].” OTRAG considers launching spy satellites a positive activity as “. . . consequently, any contemplated armed aggression can be discovered in time to allow the Security Council of the United Nations to intervene and prevent the conflict.” These launches may be big business. “. . . 80 per cent of the satellites in orbit, that is almost 2000, were launched exclusively by the two superpowers -- the United States and the Soviet Union -- for military reconnaissance purposes [6].” How many more satellites will be launched when (say) 10, 20 or 30 more countries get into the act?

## OTRAG -- THE CONTROVERSY

“... OTRAG’s launching site in Zaire has given rise to international controversy with cold war flavour [6].” First we consider the accusation leveled at OTRAG. This controversy followed the announcement of OTRAG’s leasing agreement with Zaire by the Paris-based Afrique-Asie [11]. “. . . the editor of Afrique-Asie -- Simon Malley -- had obtained details of an agreement signed between OTRAG and Mobutu in Kinshasa on March 26, 1976. Central figure in the revelation is Nathaniel M’Bumba, shadowy commander of the abortive Shaba ‘invasion’ earlier this year [1977] whose ‘guerilla informants’ discovered the ‘secret documents’ detailing the deal.” The alleged “cost to the Germans is a monumental \$29.95 million a year. . .” In addition, “the socialist states regard the leased area as a ‘military base.’” The Soviet paper Pravda followed up by repeatedly damning OTRAG’s operations militaristic [4, 7, 10]. Soviet President Leonid I. Brezhnev “condemned the West for establishing ‘military strongholds’ in Africa . . . [12].” At this point a column appeared in U.S. newspapers noting the “. . . most curious aspect of the entire fascinating matter is the thunderous silence of the whole American media [10].” Perhaps taking a hint, Penthouse magazine made public an article scheduled for publication in March 1978. It charges “West Germany has taken over a Colorado-sized chunk of Zaire where it is secretly producing and testing cruise and intermediate range ballistic missiles with U.S. approval . . . [14].” Furthermore “prototypes of four or five cruise missiles, designed to carry nuclear warheads, have already flown over the 100,000 square mile area.” The article quotes the lease rate at \$50 million per year. As usual, the CIA is involved.

Now, the defense. According to OTRAG spokesman Frank Wukasch, “what we originally started as a scientific project has suddenly, for unknown reasons been blown up into a politico-strategic fairy tale [11].” Why such tight security? “Such a costly project is closely guarded as it would anywhere else in the world. But our work is in no way a state secret. The launching of the first rocket was covered by a German TV team and has been shown in Germany.” In fact, “when he blasted off his first rocket last May 17, he hired a public relations firm to publicize the successful launch [12].” What about huge payments for the lease? “A farce [11].” What about the hostile Soviet reaction? A news article notes: “It is hard to believe that West Germany is really and truly installing a base for nuclear missiles in the heart of

southern Africa. The Soviet Union knows exactly how to play on Western fears of a revived German militarism, and such a maneuver would give them a superb propaganda weapon [10].” Why lease such a large territory? “. . . to ensure that burnt-out parts of our [OTRAG’s] launchers shall not cause any damage. . . . Otrag is liable for any damages to life, the health of the people in the area and their property. . . .” “OTRAG will not agree to any cooperation with the Republic of South Africa as long as its government pursues a policy that is condemned both by the Organization of African Unity and the United Nations.” What about the launching of nuclear warheads? “We shall provide the launching services only after we are satisfied that such a satellite is for peaceful purposes only as they are defined by the [UN] Space Treaty.” What about Brezhnev’s claims? “He ought to be better informed about the project. We frequently see Soviet MIG-23 reconnaissance jets over our testing grounds [12].”

The Penthouse article deserves special mention. The actual area of the lease is 38,000 square miles, not 100,000 as claimed in the article. This is about 100,000 square kilometers; perhaps the units were switched? As for the “Colorado-sized chunk of Zaire,” the author may be interested to learn that Colorado is roughly 270% larger than the area in question. The author claims the article was based on “private discussions with highly reliable sources who have access to most of the relevant knowledge . . . [17].” Hard facts & actual names of these sources are lacking however. West Germany’s reaction: “Pure nonsense [13].” OTRAG’s reaction: “This report is complete nonsense.” The U.S. State Department’s reaction: it has no evidence that cruise missiles are being tested in Zaire. The sleazy reporting in this pretentious screed prompts one to dismiss its claims as *prima facie* absurd.

## CONCLUSION

What to make of all this? We are witnessing a shift away from *de facto* government monopolies toward free enterprise in space operations. We are witnessing the end of the US-USSR monopoly on spy satellites. We are witnessing an end to the idea that experts in the world’s space agencies were always right when “they said it couldn’t be done.” We are witnessing an end to the idea that space operations will unfold according to the imposed plans of a few national agencies while they retain the upper hand. And looking back on all this, we see that it’s just as well.

Many Third World nations look quite favorably at the prospect of achieving a measure of independence from the super-



powers in their space activities [6,9]. New possibilities are opening up for these nations. They will be able to make their own choices instead of being limited to such activities as the world's "Big Brothers" deem acceptable. This doesn't sit well with those in positions of power and control. Hence the reactions of uneasiness, suspiciousness, and outright hostility directed at OTRAG. But no matter. OTRAG's perseverance, ingenuity and boldness have carried it this far -- success now appears within its grasp.

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#### SOYUZ-26 MISSION

by Phill Parker

On the 10th of December, 1977, the USSR launched the Soyuz-26 spacecraft using a standard 'Soyuz' launcher to undertake rendezvous and docking with the orbiting Salyut-6 space station on the 11th December 1977. The crew for this mission is flight commander Yuri Romanenko and flight engineer Georgi Grechko. It is interesting to note that Grechko was also flight engineer for the earlier Soyuz-17 mission which docked with Salyut-4 space station in 1975. The latest launch comes only two months after the failure of Soyuz-25 to carry out docking with Salyut-6 in October 1977. It appears that the USSR used the crew of Soyuz-25 to take photographs of the damaged docking port of Salyut-6, after their failure to link-up with it, and to undertake ground simulation and dummy crew operations on a ground simulator before launching Soyuz-26 on a 'rescue mission'. The USSR announced that Grechko has been responsible "... in testing and designing new space technology." According to Vladimir Shatalov the Soyuz-26 crew will be responsible for the testing and checking of the damaged docking port in the transfer compartment of Salyut-6. The Soyuz-26 spacecraft docked with a second docking port on Salyut-6 on the instrument section.

Besides testing the damaged docking port, other events planned for the Soyuz-26 crew are the study of physical processes of outer space, the exploration of earth's resources, medical and biological investigations and carrying out technical experiments. It is expected that the crew will attempt to exceed the long-duration record of the USA's Skylab-4 crew, which was 84 days in space. The Soviet Union has been more forthcoming with this mission than

many others and showed television pictures of the launch, rendezvous and docking (via a remote camera onboard Salyut-6), interior transfer of crew from Soyuz to Salyut and, at a later date, the crew at work and explaining various units within Salyut. From these television pictures, it appears that the space station is more 'electronically sophisticated' than its forebears and there seems to be more computerized equipment. The live pictures were, also, in color, which also seems to be step forward and would rank the Salyut-6 space station on par with Skylab. Another interesting point about Salyut-6 is that water condensates are recycled, removing the need for the large water tanks which Skylab used. Another point is that the USSR is using its large 'Mission Control Center' at Yevpatoria for this flight and is equivalent to Houston in its apparent sophistication with electronic flight plans and computerized displays.

#### SPACELAB PROGRESS

by Phill Parker

Europe's first manned spacecraft, Spacelab, being developed by the European Space Agency (ESA) is progressing according to schedule with various models having been developed for testing and development. Various hardware items for the 'Engineering Model' are undergoing assembly at the prime contractors site at Bremen in West Germany. The next critical stage is the so-called Critical Design Review (CDR) in February 1978 at which the compatibility of subsystem interfaces and of actual design with the design requirements will be established over 40 major firms in 10 European countries are helping in the construction of Spacelab.

The first launch of the European Spacelab has been delayed, however, until December 1980 due to a delay in launching the Tracking and Data Relay Satellites by NASA for use with the Space Transportation System. NASA has now decided to launch the TDRSs by the shuttle, rather than by expendable launcher. Also leading towards this first flight was a Crew Station Review was recently undertaken by staff from ESA, NASA and the prime contractor, ERNO but resulted in few suggestions for hardware changes -- a good sign! The software aspects, however, were highlighted and remedial action is taking place. A Spacelab simulation, using the NASA Galileo aircraft, was undertaken in the ASSESS-II mission between 16-25 May 1977. The simulation demonstrated that a multiple payload experiment can be operated successfully by a small number of payload specialists.

# Space Industrialization : Whence Cometh Confusion

by Gerry Driggers

What's in a name? A great deal actually, since names represent mental images and evoke emotional attitudes. The actions (or inactions) spurred by the receiver's perceptions are the effects; the names and labels are the cause.

There are presently many concepts and images associated with the terminology when reference is made to "space industrialization." With some the vision conjured up is one of large space colonies housing thousands of people building or making something. Others see big structures being built in space for whatever purpose from the bay of the Shuttle. Another fairly common image involves space stations and construction bases in Earth orbit. Many people see relatively specific activities such as space processing of materials, product manufacture or solar power satellites as the essence of space industrialization.

Whence cometh confusion? A multiplicity of images and perceptions fostered by one thing: a lack of commonly accepted, coherent definitions.

Two study teams (funded by NASA/MSFC), one at Rockwell International and one managed by Science Applications, Incorporated have been involved during the past eighteen months in defining space industrialization, delineating the characteristics of its elements and postulating its possible future developments and the related benefits. Final reports from these studies will be published in March, 1978. One result of these studies has been a set of definitions. Simply stated, space industrialization is industry and government working for profit and pragmatic benefit utilizing space. Understanding the total content of this statement requires some elaboration.

First, space industrialization (SI) is not a "program." It is at the least a collection of programs, some private, some government and involving many nations. It may also be said that space industrialization is not an activity but a collection of activities. SI today involves communications, navigation, remote sensing and launch services at about one billion dollars in annual revenue. About 146 nations are involved in SI related activities and six of these have launcher status. In the near future (early to mid-eighties) will come products from

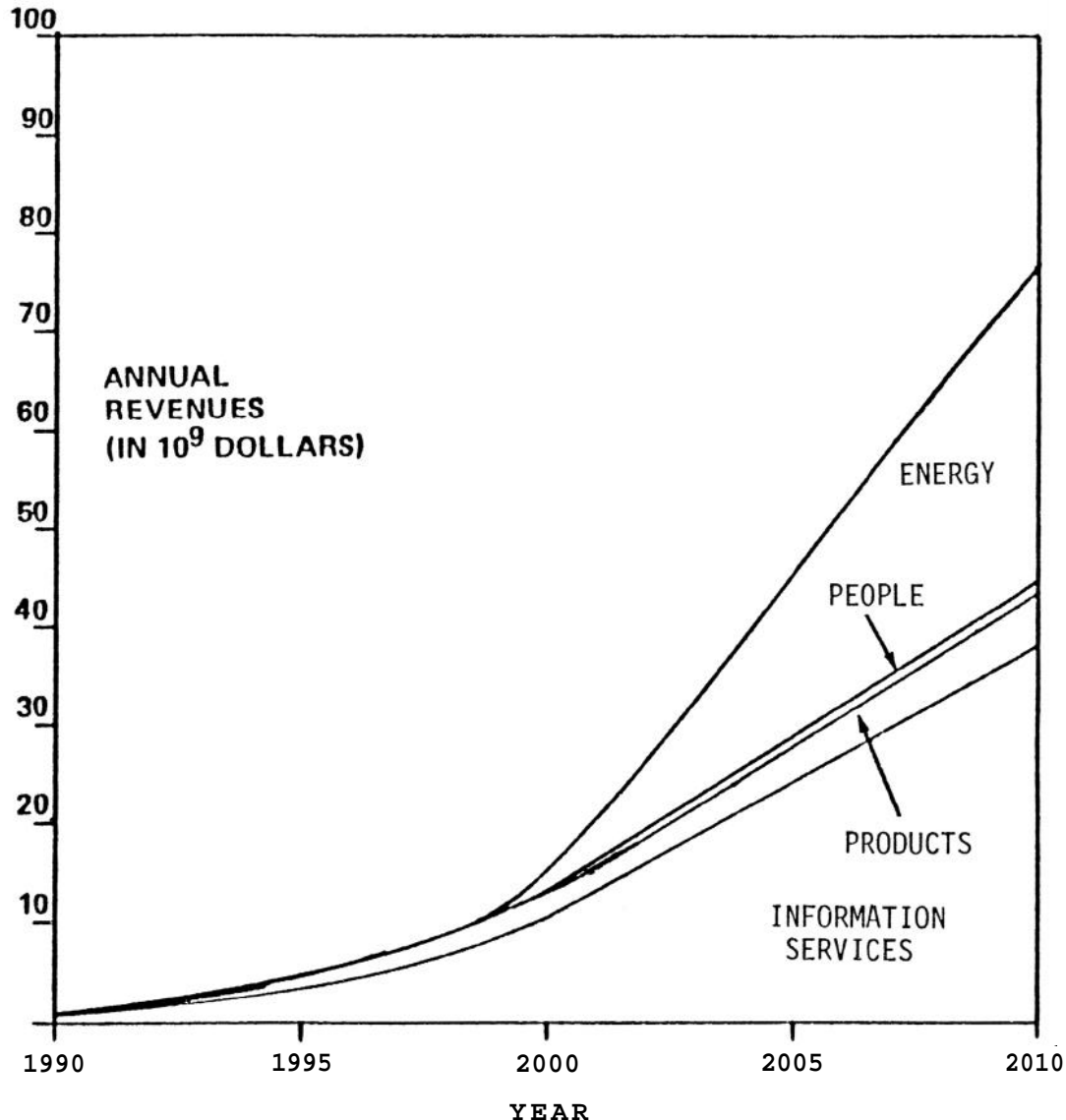
space followed in the nineties by power initiatives such as the solar power satellite. People in space as an industry then becomes a reality around the year 2000.

Thus SI activities can be generally categorized over the next thirty years under four headings: Information Services, Products, Energy and People in Space.

The size of these various activities can be characterized several ways but the most convenient has been a projection of potential annual dollar revenues. An estimate of gross revenues based on market

surveys made during the SI Study are shown in the accompanying figure. These revenues are based on a relatively conservative future projection of U.S. market potential and penetration rate. A few industry and government initiatives in earlier time frames could easily accelerate the scale by five years.

The point of the figure is made regardless of the time scale, however. The composition, relative timing and relative scale of impacts on Earth for space industrialization are illustrated.



A Projection of Future U.S. Space Industrialization Activities Based on Conservative Market Penetration Rates

# SPS: Near Future Energy Source?

## Introduction:

We live in an age in which we are rapidly diminishing our supply of Earth's resources. Global population and standard of living is increasing and as a result we are experiencing rapidly increasing rates of consumption of available fossil and nuclear fuel stores. As a consequence, we may expect existing global energy sources to last only to the following approximate dates: oil, 1995 to 2005; coal, 2030 to 2080; and uranium (without breeder reactors), 2020 to 2050.

As our available energy resources are consumed, secondary factors emerge. First, as remaining quantities become more difficult to obtain, the cost will increase. Locating and drilling for oil, for example, is a very expensive and time consuming process. Much of this cost is absorbed by the consumer. The second factor is that the consumption of available energy sources results in additional pollutants to the biosphere. The CO<sub>2</sub> removed from the atmosphere over thousands of years by plants, which formed coal, is now being returned. Third, since energy sources tend to be geographically concentrated, with most coal reserves in the United States and the Middle East possessing most of the oil resources, a potential for international tension may be created as reserves dwindle. Fourth, nuclear fission involves byproduct materials that could be dangerous in the wrong hands.

## The Alternative:

Recently the potential of solar energy to meet future needs has been re-examined. The sun radiates vast quantities of energy that are far in excess of needs in the foreseeable future. The principle way in which solar power could be put to use on Earth is by turning it directly into electricity through the use of solar cell arrays or "farms." Solar plants on Earth, however, suffer from the fact that the sun's energy reaches Earth in a very dilute form due to the diffuse nature of solar radiation, clouds, haze, etc. The most severe setback to the use of Earth-based solar systems, of course, is nightfall.

## The Answer:

One way to harness solar energy effectively would be to move the solar "farms" off the surface of the Earth and place them in orbit away from the Earth's active environment and erosive forces. A space system would receive 6 to 15 times more energy per year than the same sized

system located on Earth. In addition, a power plant located in space can receive nearly direct, unfiltered sunlight almost without interruption. These benefits were what prompted the concept of the Solar Power Satellite (SPS).

The design concept of the SPS consists of a satellite maintained in a geosynchronous orbit around the Earth. This means that the satellite would remain in a fixed position in relation to a point on the surface of the Earth. On the satellite, two symmetrically arranged solar collectors convert solar energy directly into electricity by the photovoltaic (solar cell) process. The electricity is fed to microwave generators built into a transmitting antenna located between the two solar collectors. The antenna directs the microwave beam to a receiving antenna on Earth where the microwave energy is efficiently and safely converted back to electricity. Power could be delivered to most geographic locations with the receiving antenna placed either on land or on platforms over water.

## Benefits:

The foremost benefit produced by the SPS is that it utilizes a virtually inexhaustible source of energy. There is no possibility of running out of energy from the sun in the foreseeable future. As mentioned previously, the SPS would receive from 6 to 15 times more energy than the same system on Earth, and would receive it virtually continuously.

The SPS system appears truly environmentally safe. It would produce no pollutants to the air or water and would not rely in any way on the dwindling energy resources. The materials required for construction and implementation of the SPS are abundant and the SPS would pay for itself in only two years in terms of the energy required to make it operational. This includes the raw materials, manufacturing processes, component assembly, space transportation and ground support facilities.

Open land under the receiving antenna could still be put to productive use. All incoming microwaves would be either absorbed by the antenna or reflected back into space, but 80% of the sunlight can still pass through. Thus, the land beneath the antenna would not be "dead space" since it could be put to agricultural or other uses.

## Safety Features:

The SPS does not possess the potential

for dangerous side-effects as with nuclear power plants. It is important to note that because of the inherent nature of the microwave transmitting system, it is impossible to direct the beam to any point on Earth other than the properly configured receiving antenna. This is due to the fact that the microwave beam is only attracted to the receiving antenna, and in fact, only remains a beam if pointed at the antenna. Otherwise, the microwaves transmit out from the satellite in a fine "spray" in all directions and are as harmless as a radio signal.

Because a microwave beam is non-ionizing, it does not affect biological materials in the way that ultraviolet, X-ray or nuclear radiation does. Its major effect on living tissue is heating. Microwaves do not produce ionization or chemical changes because the energy level is much too low. Precautions will be taken at the microwave receiving station to insure that the levels of microwave intensities to which employees are exposed are well below government standards for safety.

Since heating is the only effect microwaves have on biological tissue there would be no cumulative effect after repeated exposures. It works on the same principle as home microwave ovens except on an extremely small scale. If a sandwich is put into the oven to be warmed, it can be removed and allowed to cool and then returned to the oven for re-heating. This can be repeated again and again with complete safety because there are no harmful rays which are collected or stored.

There would be no danger to aircraft passengers flying through the beam because they would be shielded by the metal body of the aircraft. The time required for an airplane to fly through a microwave beam would not be long enough to harm even an unshielded person.

## Conclusion:

Solar power satellites may be the answer to our energy shortage in the near future. Research is being carefully conducted to insure that this system would be totally safe from every standpoint. There is good reason to believe that the SPS will be as safe and beneficial as the communications satellites in use at this moment. These are the satellites which provide the public with live football programming, less expensive world-wide telephone service, educational programs and so many other improvements in communications.

It is important, of course, to examine all energy alternatives carefully and weigh the benefits and drawbacks of each. The solar power satellite is one alternative, and hopefully, the answer.

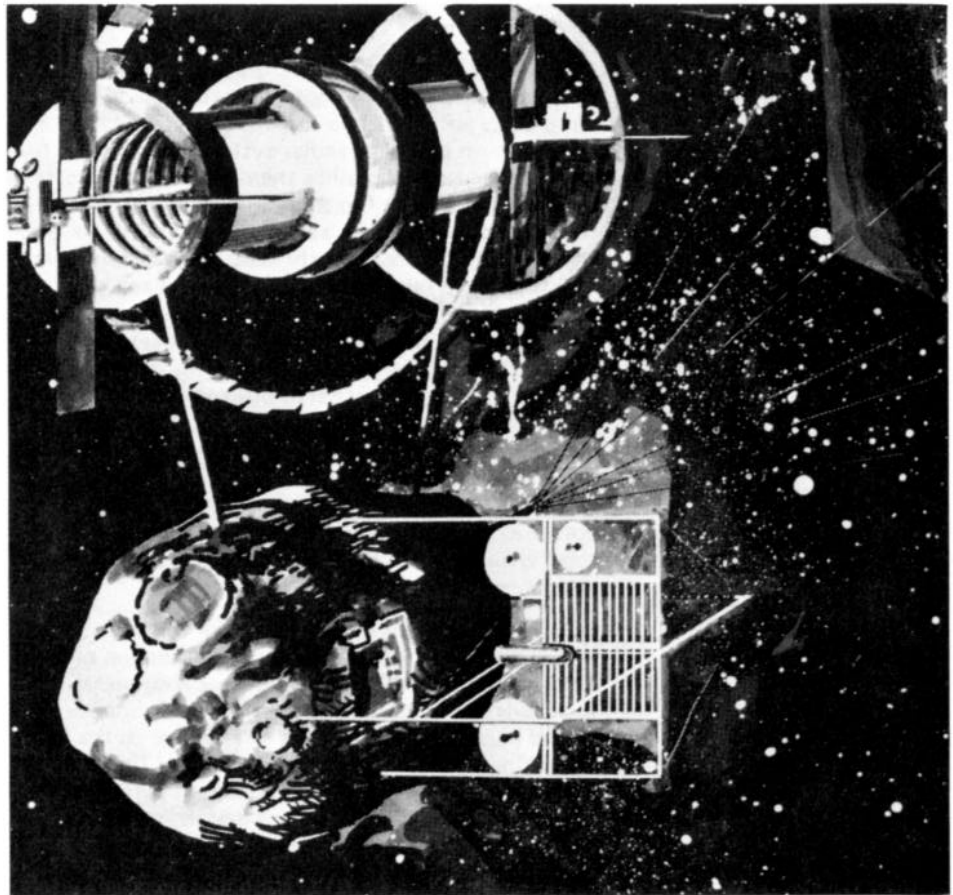
# Space Colonies

Edited by Stewart Brand  
 Review by Conrad Schneiker

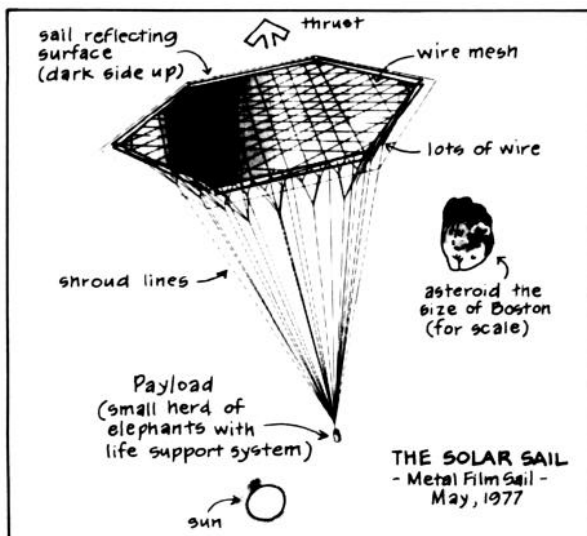
The book consists mainly of reprints from past issues of *The CoEvolution Quarterly*. This includes the pro & con debates, several interviews each with physicist Gerard O'Neill and astronaut Rusty Schweickart (including the famous "There Ain't No Graceful Way [in zero-g]" interview), many *WHOLE EARTH CATALOG* style book and periodical reviews, many pictures, drawings, diagrams, and much more.

There is some new material, most notably two articles by Eric Drexler: "The Space Colonies Idea 1969-1977" & "Solar Sailing." The first article (in spite of its title) presents several interesting scenarios for the future development of space colonization. Then follows the best answer to "BUT CAN IT BE DONE?" that I have seen yet. After disposing with technological critics, the ideological critics are attacked with a vengeance -- again, with the best replies I've seen to date. This article is a model defense of space colonization, giving concise arguments that clearly expose the (often ugly) roots of the opposition's stand. The defense stands on its own merits; there's no glossing over the issues, changing the subject, or wishy-washy apologetic mumbling about extraterrestrial imperatives and the ilk here.

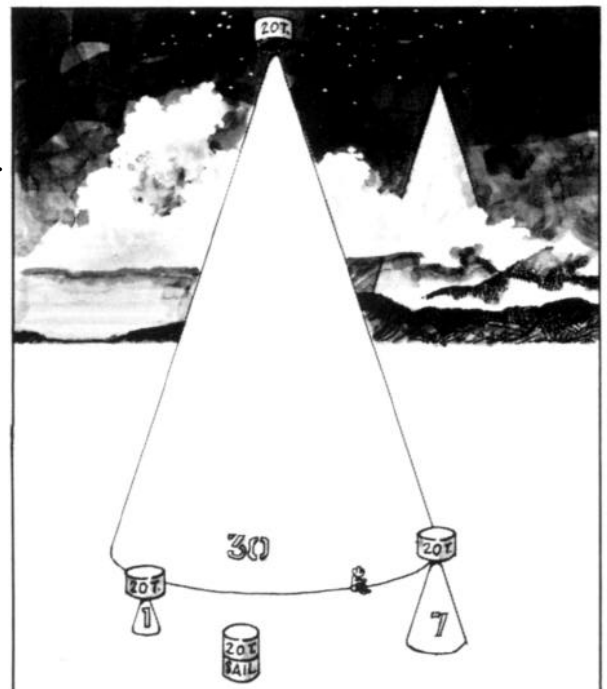
The second article discusses a new type of solar sail design, 40 times lighter and 40 times faster than previous designs. This spectacular advance results from construction of these sails in space instead of on earth. An important consequence: the possibility of \$.10/lb costs for transportation around the solar system (assuming a 10% real rate of interest on capital). Questions on the feasibility of such sails are listed and answered. Read the article for the interesting details.



Asteroid mining facility with moored sail. Top, right: solar sail (10 km diameter). Top, left: Bernal Sphere colony (½ km diameter). Bottom, left: asteroid (1 km diameter). Bottom, center: industrial complex. Behind asteroid: mooring tower with shroud lines extending to sail in the distance. The pit on the right side of the asteroid has supplied enough material to build this colony, the industrial complex. 50 power satellites, and many, many sails like the one shown. The solar system contains thousands of similar asteroids.



Illustrations shown here are reprinted from *Space Colonies*.



Solar sails and chemical rockets. Rocket mass increases exponentially with the velocity to be reached. In the foreground is a 20 ton payload sitting on a representation of a 20 ton solar sail. To its left is a similar payload resting on a cone (labeled "1") representing the mass of the chemical rocket needed to reach the velocity that the sail could reach after a day's acceleration. On the right, the cone labeled "7" represents the mass of a rocket to equal the velocity given by the sail in 7 days. Similarly with the cone labeled "30" (note man napping at base). In the background, behind Mt. Everest, is a 50-mile tall cone representing the mass of the rocket needed to equal the velocity with which the sail can throw 20 tons out of the solar system. An electric rocket would be considerably smaller.

# Inside the L-5 Society

An L-S meeting was held Jan. 28 at the Huntsville, Alabama conference celebrating the 20th anniversary of the launch of the United States' first satellite, Explorer. The participants, many of whom had also attended the Future Space Programs hearings in Washington, D.C., Jan. 24-26, requested that their names and addresses be published.

Harriett Hays -- 205/776-3940  
Brock Rd.  
Brownsboro, AL 35741

Tim Katterman -- 919/833-1398  
P.O. Box 5381  
Raleigh, NC 27607

Bret Hooper -- 615/383-4680  
921 Kirkwood Lane  
Nashville, TN 37204

Bill Gardiner  
1269 Mecaslin St. N.W.  
Atlanta, GA 30337

Mike Hogue  
Box 265  
Corinth, MS 38834

Linda Jordan  
101-A Jardane Rd.  
Pensacola, FL 32507

H. David Futch  
Box 554  
Conyers, GA 30207

David Wood  
Box 1921  
Birmingham, AL 35201

Frank Love  
1217 Cheister St.  
Birmingham, AL 35226

Kenneth McCormick -- 215/469-6513  
Birchrunville, PA 19421

Eric Laursen -- 215/662-1668  
217 S. 46th St.  
Philadelphia, PA 19139

Wm. Scott Rone -- 601/232-8244  
Box 1280  
University, MS 38677

Richard E. Yinger -- 305/968-8478  
6120 Ranches Rd.  
Lake Worth, FL 33464

Neil and Ursula Freer -- 914/679-8519  
or 679-7137  
Box 297  
Rt. 2  
W. Hurley, NY 12491

Robin Snelson  
144 West 80th St., #3  
New York, NY 10024

H. Daniel Futch -- 404/922-5699  
Box 554  
Conyers, GA 30207

Gary Noyes -- 904/378-4362  
289-5 Corry Village  
Gainesville, FL 32603

Chris Pollari  
Box 37151  
Georgia Tech  
Atlanta, GA 30332

Chuck Domm  
4113 Grenton Ave.  
Baltimore, MD 21206

Guy Pignolet  
P.O. Box 844  
97477 St. Denis Ceder  
Reunion Island, Indian Ocean

Roy S. Furst  
1866 Fargo St.  
Baldwin, NY 11510

James T. Anderson  
736 N. Euclid Ave.  
Tucson, AZ 85719

Marc Boone  
1620 N. Park  
Tucson, AZ 85719

Chris Basler  
New York City

R.R. Basler  
Menlo Park, CA

Warren Merkey  
University of Florida

Alan R. Hildebrand  
1419 43rd St. N.E.  
Calgary, Alberta Canada, T2A3L5

Jim Norwood  
1112 Irving Rd.  
Birmingham, AL 32509

L-5 Ole Miss:  
Micky McWilliams, Howard Taylor,  
Tracey Flanagan, Scott Rone, Rance  
Fortenberry  
Box 5563  
University, MS 38677

Klaus Heimburg  
2507-36SW 16th Pl.  
Gainesville, FL 32608

George Koopman  
Huntington Beach, CA

Carolyn Henson  
1134 E. Lester  
Tucson, AZ 85719

A directory of all L-5 members who wish to be active locally is available upon request from the L-5 office. Be sure to specify whether you wish only a list of those in your locality, or a complete world-wide printout.

## Inside the L-5 Office

As those who have worked as volunteers in the L-5 office can testify, running the Society is 90% elbow grease: stuffing envelopes, checking the mailing list to make sure address changes were made correctly, filing invoices, sorting

mail, packaging orders, keeping cash receipts up to date, vacuuming the floor, changing light bulbs, etc. It's not very dramatic -- but office work is darn essential.

It's been awhile since we've given credits to our many volunteers who have toiled so hard in the office. They include Jay Vivian, Cambridge, MA; Terry Cooper, Tucson, AZ; anonymous lady, Ann Arbor, MI; Bev Isbell, Chico, CA; Ron Nickel, Odessa, TX; Roger Gregory, Ann Arbor, MI; Jim Bennett, Santa Cruz, CA; Debbie Haney, Kokomo, IN; and John and Paul Fortier of Detroit, MI.

If you would like to participate in the most unglamorous side of Society activities, we will provide room and board in exchange for 12 hours a day of office drudgery. As we have a limited amount of space available, please write in and tell us when you would like to visit and wait for someone in the office to give you the OK before packing up and coming on out.



*Bryna Block -- she coordinates the mail order business and runs "Bryna's Bread" on the side.*



*Ron Nickle -- volunteer.*



*Elinore Hanes -- the L-5 bookkeeper. She keeps us honest.*

## Donations

In the last six months nearly one fourth of the Society's income has come from donations ranging from one dollar to \$5000. Counting in the impact of volunteer labor as well, the Society has been able to provide nearly twice the dollar value of services as would be possible if we had to rely solely on membership fees. People who have donated money in the last half year include Barbara Marx Hubbard, Bill O'Boyle, Timothy Leary, Marjorie Stuart, Dr. and Mrs. Erik P. Paterson, Jerry D. Lentz, James Kempf, G.M. Wannamaker, Cole Lovett, John K. Clark, Michael Davis, Ralph C. Merkle, Scott Royce, Wm. C. Tetley, E.F. Bagley, Heidy Lukas, Richard A. Sexton, Paul Reynolds, Bruce R. Harlan, Thomas O. Paine, James Seevers, Cole Lovett, Peter Zavon, Gary Lackowski, David Gale, Jeffrey Pimick, Gerald Krauleidis, anonymous, S. Friedman, Barry Cole, Stanley Grenstein, David Spiek, Leroy Lauer, John Paul Sissa, James A. Shumaker, Malcolm Walker, and Fred Manzo.

## Local Chapters

Are you still alive? We want to know which local chapters are still functioning. Write in this month and tell us what's going on and we will send you a "CARE" package of bumper stickers, lapel buttons, promotional pens, and brochures. Please -- this is important. We are updating the directory of local chapters and will only list those who Prove they are alive by writing in!

## Errata

The designer of the Austin L-5 T-shirt was incorrectly identified as John Delano. The artist is Joe Visserr.

In the Dec. '77 issue the article "Do You Sincerely Want to Become Rich?" states "Imagine a corporate animal designed to raise and send \$100 billion." That should have been "spend," not "send"!

## Mass Driver Help Needed

Any help in locating non-electrolytic capacitors with a rating between 10 and 500 microfarads and a voltage rating of more than 600 volts would be appreciated. They are needed for the construction of the second mass driver which is being built at Princeton this spring. It is planned to accelerate a small payload up to about 1000 g's. (That's zero to 350 miles per hour over a distance of four feet.) If you locate some of the capacitors, please contact Bill Snow, SSI, P.O. Box 82, Princeton, NJ 08540.

## Space Studies Institute Off to Big Start

Prof. Gerard K. O'Neill's Space Studies Institute has received over \$100,000 in donations. The fact that his support is currently coming almost entirely from individuals rather than corporations or the government is indicative of the grass roots support undergirding his space settlements research.

If you would like to join the Space Studies Institute, you can subscribe for \$10 (although more is appreciated!) Your tax deductible gift will go towards supporting one year's equipment purchases and administrative work at SSI. Please send it to:

Space Studies Institute  
P.O. Box 82  
Princeton, NJ 08540

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Jim Loudon, a well known space and astronomy popularizer in the midwest, is available for speaking engagements anywhere, on astronomical topics such as space colonization and industrialization, the Viking missions, the history of the space program, and more. The cost is \$200 plus expenses (see if your school or church won't pick up the tab). Write to James A. Loudon/1109 Geddes Ave./Ann Arbor, Michigan 48109. Jim is the author of the Viking Notes.

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The Austin Chapter of the L-5 Society has been quite active at the University of Texas in the past year. We meet on the second Wednesday of each month at 7 P.M., usually at the Texas Union. Meetings include an L-5/space oriented presentation or discussion session, a news

update and general business period. There is also a social gathering/discussion group which meets on the fourth Thursday of each month at 7 P.M. in the Texas Tavern on campus. Club activities over the past year have included a trip to San Marcos to hear Gerard O'Neill, a trip to the Johnson Space Center, a reception for T.A. Heppenheimer and a slide and lecture presentation by Harlan Smith (Chairman of the U. T. Astronomy Dept. and McDonald Observatory and member of the L-5 Board of Directors.)

Membership has grown to about 50 active members and some meetings have drawn over 150 Folks!

Another major program of the Chapter is a Public Outreach group which has given slide and information programs to many local public schools, civic groups and university organizations. Response has been excellent!

I encourage interested persons to write or call us and attend the meetings, if possible. Also, we can help other groups with organizational problems and provide access to information. (We have a quickly growing library.)

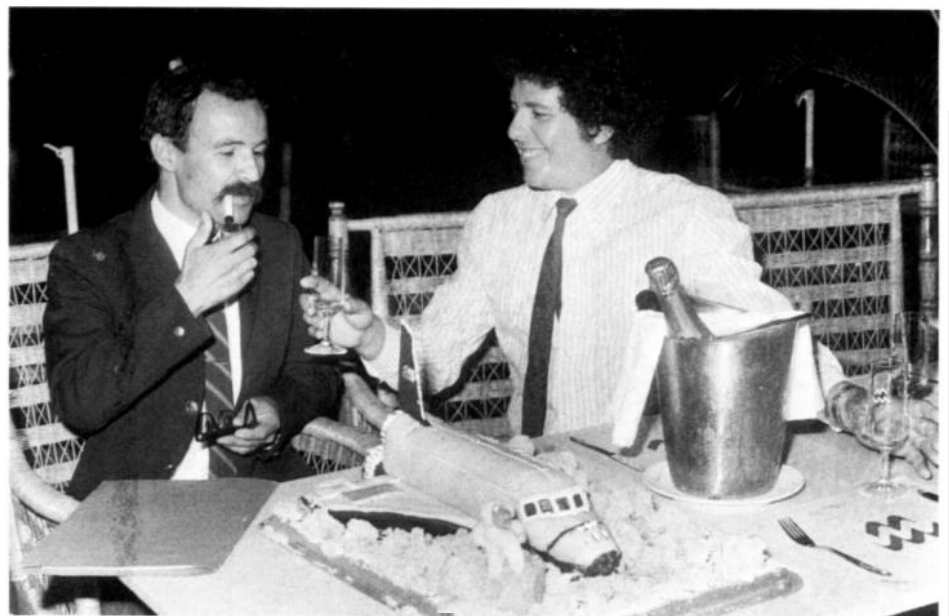
We'd like to hear from you.

Write:

The L-5 Society  
University of Texas, Austin  
P.O. Box 8213  
Austin, TX 78712

Or call:

Debbie Byrd  
c/o the U.T. Astronomy Dept.  
Austin, Texas 78754



L-5 member Guy Pignolet, pictured here on the right (with Jean Francois Riviere on the left) is celebrating a "Bonne Anee Spatiale" New Year's Eve at the Meridien Hotel on

Reunion Island in the Indian Ocean. That's right, they are about to eat a cake shaped like a space shuttle and astronaut.

An exploration of the  
prospect of prolonging youth,  
vigor, and lifespan in humans

**Alcor LIFE EXTENSION Conference**

**Los Angeles International Hyatt House  
-- March 11-12, 1978**

**Program**

On the first day of the Life Extension Conference, prominent research scientists will present a comprehensive picture of the current state of the life extension sciences. During this session, the field of biomedical gerontology -- the study of the aging process -- will receive major attention. Other fields covered will include suspended animation, resuscitation, transplantation, prosthetics, and identity reconstruction.

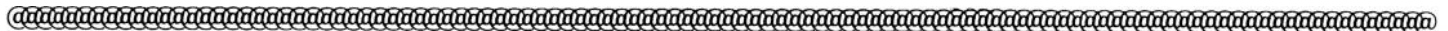
Some of the scientists who have agreed to participate in this session are:

- Leonard Hayflick, Ph.D., Children's Hospital Center of Northern California, Oakland
- Richard Cutler, Ph.D., Gerontology Research Center, National Institute on Aging, NIH, Baltimore
- Paul Segall, Ph.D., Dept. of Physiology-Anatomy, Univ. of California, Berkeley
- Gerard Hirsch, Ph.D., Staff Biologist, Oak Ridge National Laboratory, Oak Ridge, Tenn.
- Bernard Strehler, Ph.D., Biology Dept., Univ. of Southern California, Los Angeles
- Roy L. Walford, M.D., Dept. of Pathology, UCLA Medical Center, Los Angeles
- Peter Gouras, M.D., National Eye Institute, NIH, Bethesda, Md.
- T. Makinodan, Ph.D., Wadsworth V.A. Hospital, UCLA Medical Center, Los Angeles
- Jerry Leaf, Dept. of Surgery, UCLA Medical Center, Los Angeles
- Allan L. Goldstein, Ph.D., Chief of Biochemistry at the Univ. of Texas at Galveston
- Robert W. Prehoda, author of *Extended Youth: The Promise of Gerontology and Suspended Animation*

On the second day of the Life Extension Conference, there will be sessions on anti-aging therapies, cryonic suspension, and the implications of life extension. Some of the individuals who have agreed to participate in these sessions are:

- C.A. Everone, Foundation for Infinite Survival, Inc., Berkeley, California
- Richard Huchschild, Ph.D., Univ. of California, Irvine
- Benjamin Frank, M.D., author of *Nucleic Acid Therapy in Aging and Degenerative Disease*
- Fred Chamberlain, Alcor Society for Life Extension, Los Angeles
- Arthur Quaife, M.A., President, Trans Time, Inc.
- Herb Gerjouy, Ph.D., The Futures Group, Glastonbury, Conn.
- Timothy Leary, Ph.D., author, lecturer, psychologist
- F.M. Esfandiary, philosopher, teacher, author of *Upwingers*
- Alan Harrington, author of *The Immortalist* and the forthcoming *Paradise I*
- A. Stuart Otto, Chairman, The Committee for Elimination of Death
- Barbara Marx Hubbard, The Committee for the Future, Futures Network, Wash. D.C., author, *The Hunger of Eve*, lecturer
- Robert Anton Wilson, co-author of *Illuminatus* and the forthcoming, *Cosmic Trigger: The Final Secret of the Illuminati*, lecturer
- Saul Kent, author, *Future Sex* and the forthcoming *Life Extension Handbook*, lecturer, consultant
- Keith Henson, L-5 Society

Registration is \$30 at the door and \$25 for those who register by mail prior to the conference.  
Student registration is \$15.



**Registration form**

NAME \_\_\_\_\_ AFFILIATION \_\_\_\_\_

ADDRESS \_\_\_\_\_

CITY, STATE, ZIP \_\_\_\_\_

I enclose registration fee of \$25 for admission to the Life Extension Conference and a one year subscription to LIFE EXTENSION Magazine. Students: \$15, including special offer. I further enclose \$\_\_ to cover registration fees for the following people [include names and addresses].

Please make checks payable to --  
ALCOR SOCIETY FOR LIFE EXTENSION, P.O. Box 812, Garden Grove, Ca. 92842. (213) 768-0414

# Industrialization of Space Conference

*Held Oct. 18, 19 & 20, 1977, the conference was sponsored by the American Astronautical Society, American Institute of Aeronautics and Astronautics, American Society for Quality Control, British Interplanetary Society, Institute of Electrical and Electronics Engineers, International Institute of Space Law, L-5 Society, National Space Institute, and SRI International.*

The following papers have been selected by the L-5 Society as representing the best of the conference. If you can't wait for publication of the complete proceedings by the AAS, or if you are only interested in certain of the topics carried by the conference, the papers reviewed below (by Conrad Schneiker) can be purchased from the L-5 Society. The AAS will receive 50¢ per paper sold to help them continue their pioneering work.

## Space Habitats

### **A Preliminary Investigation of Space Habitat Atmosphere**

AAS 77-284

Warren Ziegler

\$1.67

Reports results of author's theoretical "study of space habitat atmosphere, dynamics, hydrostatics, particulate and cloud physics."

### **Aesthetic Implications Of The Crystal Palace Space Habitat**

AAS 77-285

Marjorie L. Stewart

\$3.21

"The goal of this study is to discover the maximum aesthetic conditions possible in [the crystal palace] . . . and to formulate suggestions for enhancing the habitat from a standpoint of human liveability and aesthetic factors."

## Space Manufacturing

### **A Baseline Of Logistic And Power Requirements For Full-scale Manufacturing Of Metallic Materials**

AAS 77-237

H. L. Bloom

\$2.37

Data from preliminary surveys on space processed materials are presented and "developed into a representative baseline of the logistic and power requirements of a future mature space manufacturing program." An interesting point is raised: "Requirements for disposition of wastes have been a 'sleeper' in studies of materials processing in space."

## Power from Space

### **Freedoms And Constraints In Solar Power Satellite Design**

AAS 77-200

Ray Sperber, Harley Zipursky

\$2.30

A surprising number of new SPS configurations are being developed. This paper surveys some of these designs. "Aspects of geometric, structural, electrical, optical, orbital assembly and implementation systems design are discussed in terms of freedom and constraint as they affect power satellite design."

### **Satellite Mirror Systems For Providing Terrestrial Power: System Concept**

AAS 77-240

Kenneth W. Billman, William P.

Gilbreath, Stuart W. Bowen

\$3.14

Half the cost of a conventional solar farm is due to storage equipment. A satellite mirror system providing continuous, slightly increased insolation is proposed. The storage system can be eliminated and the solar farm land area can be reduced in size by a factor of 5. The system "appears to be economically superior to other advanced, and even conventional, energy systems . . ."

### **In Orbit Manufacture Of Solar Reflector Satellites**

AAS 77-241

Ronald M. Muller

\$2.02

Presents design and construction scenario for gigantic orbital mirrors for use with terrestrial solar farms. The major components of these mirror satellites are described.

## Social Implications

### **Energy Crisis: A History Lesson**

AAS 77-212

Romualdas Sviedrys

\$1.60

Past energy crises are reviewed and their recurring features noted. None of the many dire, doom-filled predictions made during these crises materialized. In each case technology saves the day. It is shown that "with each energy crisis there was a jump to greater wealth."

### **The Military Uses of Outer Space**

AAS 77-251

Leonard David

\$2.37

"Space has become an extension of Earth-bound military land, air and sea warfare." We are told how this came to be and what future developments may be expected. Also discussed: how new technologies are nullifying past legal commitments (even as argument over their interpretation continues), the justifications for military activity in space, denial of space access, U.S. anti-satellite programs, military man in space, and factors affecting public support of military and peaceful space operations. Hopeful space colonists note: "the military space-industrialization complex will challenge the peaceful uses of outer space . . ."

### **Space Industrialization And The Long-term Prospects For Terrestrial Civilization**

AAS 77-226

Peter Vajk

\$2.16

Analyzes the "limits of growth" motivation for space industrialization, system-



atically examines the evidence for it, and finds it invalid. Apparently, with advancing technology, the resources of earth are adequate, both now and far into the future. Valid motivations (from the author's point of view) are then considered. They center around space industrialization for fun and profit, leading to many new commercial ventures.

## Private Enterprise in Space

### Frontiers Of Free Trade

AAS 77-268

Mark Frazier

\$1.88

Presents a proposal for the creation of "free zones for space, beginning with an international launch area near the equator." After examining existing legal and political hurdles to space industrialization, it is shown that free zones can circumvent them "... by establishing a useful political framework for the peaceful development of space" while having the beneficial side effect of encouraging "free trade and investment on Earth." These conclusions are based on historical evidence of "remarkably successful" free zone predecessors.

### Drafting A Constitution For ORBIS -- Entrepreneurial Opportunity In The Provision Of Community Service In Space

AAS 77-286

Spencer H. MacCallum

\$2.72

Opens with the thesis of the correlation of "despotism with hydraulic societies -- societies which were dependent for their existence upon complex, government-controlled irrigation works which constituted life-support systems not unlike, in principle, those which are now projected for space." The rationale for a proprietary space community "in which all things would be contractually administered through the customary usages of the marketplace without recourse to the political relationship of sovereign and subject -- a community without taxation or legislated laws" is presented. Historical precursors are noted. Included is "a draft of a master lease for the hypothetical space colony of ORBIS" that functions as "a constitution for a proprietary community in space."

### Space Industrialization, The Challenge To Private Enterprise Capitalism

AAS 77-290

Christian O. Basler

\$2.10

"No existing private enterprise business structure is suited to the task of raising and

managing the capital necessary for full-scale space industrialization. Existing companies cannot undertake the necessary research and development because of the effect it would have on their present earnings and because of antitrust problems, and a new conventionally organized company would be unable to raise the necessary capital. This paper analyzes these problems and proposes a new type of business structure, called a 'staging company,' as a solution." The effects of a private community planning are also discussed.

### Marketing Techniques And Space Industrialization

AAS 77-232

G. Harry Stine

\$1.67

This paper presents answers to "why industrial firms are so apathetic about jumping on this wonderful new bandwagon . . ." An explanation of how "we must, in essence, market the concept of space industrialization" follows. A set of guidelines for marketing methodology applied to R & D is given.

## Advanced Transportation

### Advanced Launch Vehicle Systems And Technology

AAS 77-217

M.W. Jack Bell

\$2.37

The potential exists for "enormous economic benefit if space cargo delivery costs can be reduced by an order of magnitude over those of the current Space Shuttle Vehicle." Many vehicle designs aimed at this end are examined. The conclusion is that "the basic capability exists today to initiate developments of an advanced launch system of greatly improved efficiency."

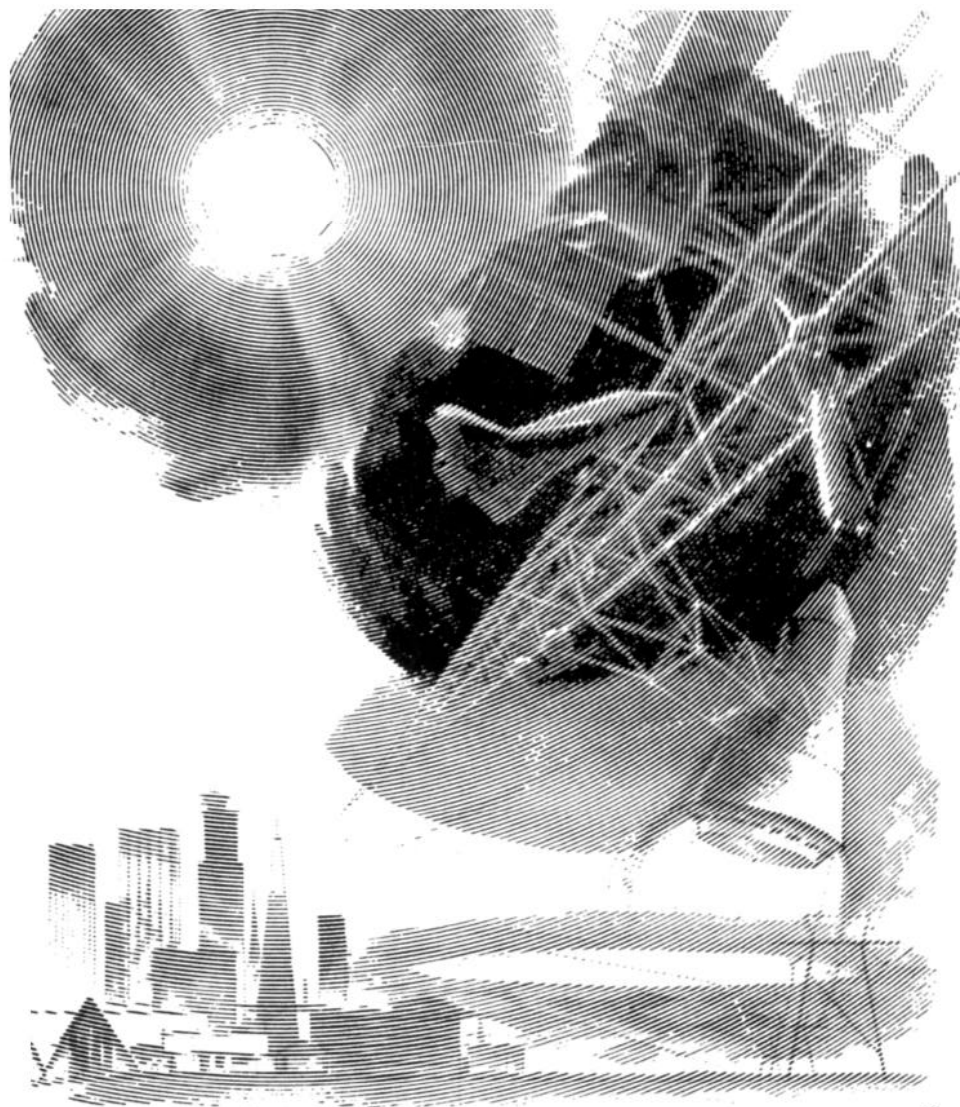
### A Non-synchronous Orbital Skyhook

AAS 77-223

Hans Moravec

\$2.02

A rotating satellite in a stable, low earth orbit about the equator, with 2 identical long filaments extending in opposite directions acts like "two spokes of a giant wheel rolling around the equator . . . canceling horizontal orbital motion during the contacts."



# What's Available from the L-5 Society?

## Books:

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<i>The High Frontier: Human Colonies in Space,</i> Gerard K. O'Neill William Morrow & Co., Hardbound. 1977 <i>Paperback, Bantam Book.</i>	B2 PB2	\$ 8.00 2.95	(.10) (.10)
<i>Colonies in Space, T.A. Heppenheimer</i> Stackpole Books, Hardbound. 1977	B3	\$12.00	(.10)
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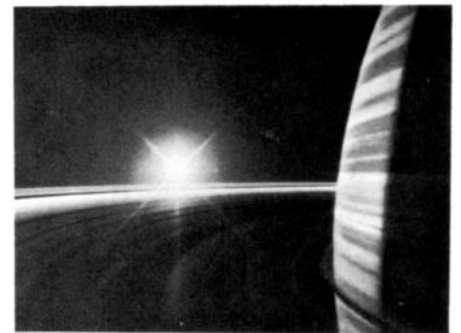
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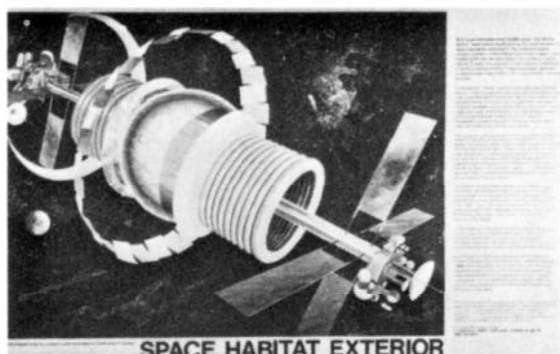
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