



L5 NEWS

VOLUME 2, NUMBER 7

A NEWSLETTER FROM THE L-5 SOCIETY

JULY, 1977

Sailing the Silent Main

SOLAR SAIL PROGRAM UNDERWAY

Six design contracts for material and booms for a 169 acre Sun sail recently were awarded by NASA's Jet Propulsion Laboratory as a move toward the production of large sailing ships in space. The awards total \$800,000.

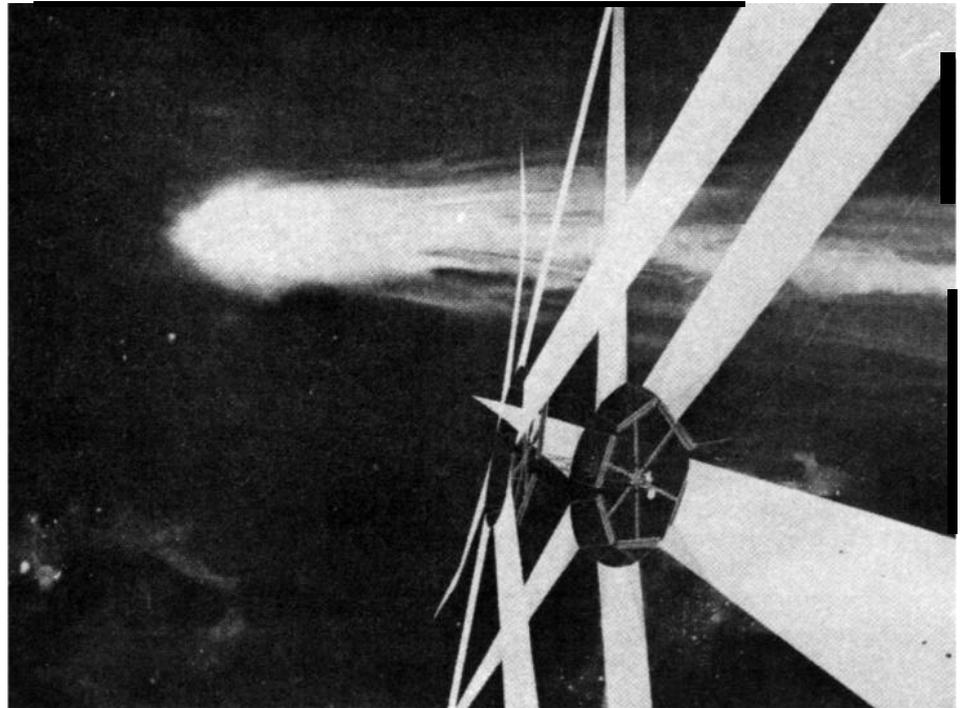
The solar "sailer" would use the momentum transferred by photons bouncing off a mirror-like aluminized plastic surface to propel vehicles among planets as wind propels Earthbound sailboats.

Recipients of the contracts are:

E.I. DuPont Co. of Wilmington, Delaware, \$250,000 for fabrication of one kind of candidate sail material; MacNeal-Schwendler, Los Angeles, \$350,000 for helio-gyro design; International Latex Corp. of Dover, Delaware, \$50,000 and Sheldahl Corp., Northfield, Minnesota, \$50,000 and Astroresearch Corp., of Able Engineering, Goleta, California, \$50,000 and Astroresearch Corp., of Carpinteria, California, \$50,000 for design of booms.

If the immense new vehicle becomes a reality, NASA will schedule demonstrations of its operation by carrying the solar sailer into space in the Space Shuttle orbital transport in 1981 or 1982 to be in position to intercept Halley's Comet in 1986. That feat would require a "sailing" velocity of 135,000 m.p.h. For the definitive first flight, the furlled sail would be taken into orbit by the Shuttle and boosted into solar orbit, unfurling automatically.

Paul Holloway, deputy associate administrator for aeronautics and space technology at NASA, said the thinnest commercial plastic film now produced is at least ten times thicker than NASA needs for the sail, adding that industrial



"Heli-gyro" solar sail concept (Courtesy JPL)

chemicals probably can reduce the material to the desired thinness. Development program chief at JPL, Howard H. Haglund and his assistant, Louis D. Friedman, say their design plan calls for an 800-meter-square (2400-foot-square) plastic film sheet only 2.5 microns (one ten-thousandth of an inch) thick, and ultra-lightweight extensible booms for the spar and masts.

NASA expects to be able to assess the merit of the solar sailer concept by this August.

NASA WEIGHS FLIGHT TO COMET

A new space mission is on the drawing boards at NASA. The target: Halley's Comet.

"We would launch our spaceship from the Space Shuttle in late 1981 or early 1982 and rendezvous in 1986 with the comet as it approaches," says Norman R. Haynes, manager of space programs development at the Jet Propulsion Laboratory in Pasadena. He added, "The

TELEVISION CELEBRITY HELPS NASA RECRUIT ASTRONAUTS

A contract recently awarded by NASA to the Women in Motion Production Co., of Los Angeles, is for services associated with acquainting potential minority applicants with opportunities available to them in the Shuttle Astronaut Recruitment Program.

Under terms of the contract, Nichelle Nichols, one of the stars (Lt. Uhura) of the NBC television series "Star Trek," will be available for contacting community organizations, colleges, institutions and individuals to familiarize them with the requirements for qualifying as Space Shuttle astronauts.

Nichols is the executive vice president of the contracting firm. Her duties under terms of the agreement will include contacting students at minority and non-minority schools at the college and university level. In addition she will seek appearances on major programs broadcast by major television networks.

"We want to make sure that the recruitment is brought to the attention of minorities and that the word gets around that NASA really wants to get applications from qualified minorities and women," an agency official explained. "We believe Ms. Nichols is uniquely qualified to do this."

Nichols will establish personal contact with NASA officials charged with astronaut recruitment so she will be familiar in detail with the status of the applications, and will have a firm understanding of the functions and duties of Shuttle crew members.

Her activities under the contract will be concentrated in the months before June 30 this year, the last date for filing applications in the current Shuttle crew recruitment program.

Nichols is a member of the board of directors of the National Space Institute, Arlington, Va.



Nichelle Nichols was briefed by astronaut Alan Bean at the Johnson Space Center before she began a nationwide tour for NASA. Her new company seeks to acquaint potential minority and women applicants with the Space Shuttle program.



Courtesy Don Davis

MORE ON PRINCETON CONFERENCE

O'Neill Top Priority Studies

Princeton Professor Gerard K. O'Neill, speaking on May 12 in the summary session of the 1977 Princeton Space Manufacturing Facilities Conference, outlined what he believes are the most important studies for the development of solar power satellites constructed from extraterrestrial materials. These studies are:

- solar power satellite construction from lunar materials,
- solar cell fabrication from lunar materials,
- mass driver development,
- bench-top-scale chemical processing of lunar materials and scaling to plant-size production,
- work force production rates,
- modular habitat design,
- environmental impacts of microwaves on the ionosphere and launch vehicle emissions,
- a radar search for L-4 and L-5 region materials (this will cost almost nothing, according to O'Neill, who added, "If we find resources there, we may have L-5 colonies yet, and the L-5 Society won't need to change its name. . . ."),
- a search for Apollo-Amor asteroids using an eighteen-inch Schmidt telescope mounted to the Long Duration Exposure Facility (cost is \$1 million),
- the Lunar Polar Orbiter, which would scout out possible ice and frozen gas deposits at the Moon's poles (cost would be \$100 million),
- substitution of silicon, oxygen and metals for plastics,
- silicon/aluminum composite work,
- a metal evaporation experiment on the Long Duration Exposure Facility (already proposed),
- life support and controlled environment agriculture.

O'Neill apologized for this list's undramatic nature, saying that he was getting so wrapped up in the nuts and bolts of building a space civilization from scratch that "My friends at NASA are reminding me not to lose sight of the beauty of the project."

(Continued from page 1)

project has not received final approval but we are about twelve months from that point and NASA is funding our project studies and technical work for two propulsion systems."

The two systems under study are ion engine and solar sails. The ion engine has the advantage that it is a "mature" propulsion system, whereas solar sail work is in its infancy.

Laurel L. Wilkening, one of the twenty-eight scientists in the Comet Halley Science Working Group, reports that they are interested in comets because "we can get an idea from them of the stuff from which the solar system condensed."

What is Halley's Comet like? "It's probably a dirty snowball; we assume a solid nucleus several kilometers in diameter," says Wilkening. "The icy constituent is probably water. But so little is known-no one has seen the nucleus."

The kinds of measurements the Comet Halley Science Working Group hopes to make include a mass spectrometer analysis of the tail, global geophysics measurements to determine if it has a solid core, and possibly a kamikaze dive of an instrumented package into the core area. Violent atmosphere, dust and the possibility that there may not be a solid core may prevent a landing on Halley's Comet.

Wilkening says that the Working Group will make a decision this August whether to recommend the use of an ion drive or a solar sail for the mission.

SHUTTLE TANK SEEN AS BASIS FOR ONGOING SPACE PLATFORM

Leonard David

James Kingsbury, director of the Science and Engineering Directorate at NASA's Marshall Space Flight Center in Alabama, says that a major space platform could be placed in Earth orbit in less time than earlier believed, using the Space Shuttle's external fuel tank.

The new concept, developed between both Marshall and the Grumman Aerospace Corporation, utilizes the only expendable element of the Space Transportation System (STS), the external tank, as the nucleus of a permanent space platform. "From this permanent space platform," Kingsbury said, "the real business of space utilization can begin."

Although far from being an "on-going" concept, as a target, the current studies are directed to an initial launch in calendar years 1983 or 1984. This first launch would have the Shuttle carry its external tank into orbit and park it in a predetermined location. This tank would provide some 2,000 cubic feet of space that would be equipped to handle a small crew for ninety days of habitation in orbit.

A second Shuttle launch would carry into orbit both an Airlock Module and Multiple Docking Adapter, complete with solar electric conversion wing. All elements would be docked and clustered to the external tank. The crew would also be brought to the platform by the second Shuttle. The assignment of the first crew would involve construction of additional crew quarters in the empty space of the

liquid oxygen propellant tank.

Expansion of this basic tank design could include additional external tanks, Spacelab modules, or even both, extending the station's capabilities. A reboost capability would add to its usefulness and length of time in orbit.

Kingsbury stated that studies indicate that a permanent space platform, using the external tank method, could be in Earth orbit at a fraction of the cost now estimated for a new developmental program, and in an earlier time frame than once thought.

WHITE HOUSE ADVISORS SHOW INTEREST IN POWER SATELLITE STUDIES

The Executive Office of the President, Energy Policy and Planning, has drawn up *The National Energy Plan*. Jimmy Carter introduces it, saying:

In each period of our history, the nation has responded to challenges which have demanded the best in all of us.

This is one of those times.

Our energy crisis is an invisible crisis, which grows steadily worse-even when it is not in the news. It has taken decades to develop, as our demand for energy has grown much faster than our supply. It will take decades to solve. But we still have time to find answers in a planned, orderly way-if we define the changes we must make and if we begin now.

This report explains why we have to act, and gives you the details of our Plan. The Plan is complicated. I am sure that many people will find some feature of 'it they will dislike along with features they can support. But it is a carefully balanced Plan, which depends for its effectiveness on all of its major parts. . . .

We can rediscover the ingenuity and the efficiency which have made our nation prosper, rather than deepening our dependence on insecure imports and increasingly expensive

conventional energy supplies. We can rediscover small-scale, more creative ways of satisfying our needs. If we are successful, we can protect jobs, the environment, and the basic American standard of living, not only for ourselves but also for our children and grandchildren.

I know that, if we work together as a united people, we will succeed.

The plan states that "Collection of solar energy by space satellites has been proposed, and the concept deserves further study." Perhaps our readers who wrote to Dr. Schlesinger have had some effect.

Copies of *The National Energy Plan* are available from: Superintendent of Publications, Washington, DC 20402.

UNITED STATES ASSOCIATION FOR THE CLUB OF ROME

Statement of Purpose: The U.S. Association for the Club of Rome has been formed in the belief that humanity is at a turning point. The wellbeing of present and future generations depends as never before on the adaptability, creativity, and vision of concerned citizens and leaders in every nation. The United States, because of its wealth and power, has a special responsibility and opportunity for leadership. . . .

Founded in Philadelphia in 1976, the U.S. Association for the Club of Rome is a small group of individuals who represent a wide variety of personal views and backgrounds, but who are united in the belief that-both nationally and internationally-we can and must do a better job than we are now doing to prepare for the future.

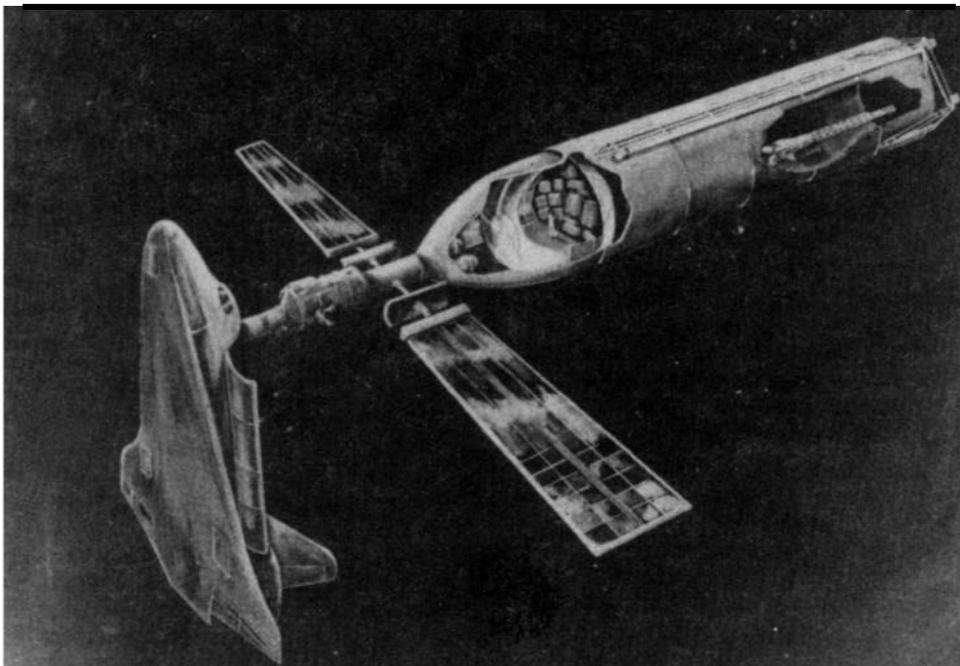
Its national membership, initially limited to 100, includes persons engaged in business, labor, research, writing, teaching, religious and voluntary activities, government at all levels, and public information, among others. Candidates for the U.S. Association are reviewed by a membership committee; members are elected by the board of directors in a nonpartisan manner without discrimination as to race, national origin, sex, or religious belief.

They welcome soundly based differences of view and personal conviction, and do not attempt to impose any form of orthodoxy on their members beyond general adherence to the Statement of Purpose.

The U.S. Association is a tax-exempt organization under Section 501 (c)(3) of the Internal Revenue Code, and is dependent on grants, gifts, bequests, and fees for its continued operation.

Write: United States Association for the Club of Rome, 1707 L Street, NW, Washington, DC 20036. Telephone: (202) 833-1640. Cable Address: USACOR.

L-5 Society members are urged to communicate with the U.S. Association for the Club of Rome to share their views on space colonization and industrialization.



SPACE PLATFORM -- An artist's drawing shows the Space Shuttle's external tank in Earth orbit as the first step of a space platform. A crew of three would inhabit the forward area and construct additional living and working space in the remaining volume (17,500 cubic feet) of the liquid oxygen propellant tank.

bibliography

SOVIET PAPERS

"Topics in Space Medicine Are Part of Lecture Series" F. Kosmolinskiy, Candidate of Medical Sciences, chairman of the section on space medicine and biology in the Tsiolkovskiy Lecture Series. Primary source: *Meditinskaya Gazeta*, October 6, 1976, No. 80 (3591), p. 3, col. 8.

Extract: At the eleventh meeting of the Tsiolkovskiy Lecture Series in Kaluga, a section was devoted to "Problems of Space Medicine and Biology." More than thirty papers were presented. Special attention was devoted to problems of biomechanics in space flight. Prof. I. Khazen presented a paper which showed that the content of biologically active substances in tissues, especially the heart muscle, undergoes a change under the effect of acceleration, vibration, hypokinesia and extreme physical stress.

Participants of the section also discussed methods for helping to endure hypodynamic conditions in space flight. For cosmonauts to maintain a good functional capability, Prof. A. Korobkov proposed a unique combination of work activity, rational diet, and use of biologically active substances and technical aids for controlling metabolism.

Prof I. Arshavskiy stated the opinion that adaptation to the long-term effect of weightlessness is impossible, and therefore it is important to seek implementation in practice of K. E. Tsiolkovskiy's idea of creating artificial gravity in flight.

Discussion was also devoted to the most important psychological and physiological problems of cosmonautics. Papers were presented by engineers who are working in cooperation with biologists on problems of biocybernetics.

"Experiment with Closed Ecological System for Space Travel" N. Mishina. Primary source: *Pravda*, March 18, 1977, No. 77 (21412). p. 6, cols. 2-7.

Abstract: The author describes a visit to the USSR Ministry of Public Health's Institute of Medical-Biological Problems, where an experiment was being completed to test a prototype of a closed ecological system. Work on the development of this system has been in progress for two years under the direction of Doctor of Medical Sciences Yevgeniy Yakovlevich Shepelev. The prototype represents a small-scale version of a future space colony designed for life support of space travellers.

The prototype of the colony, which is also called a micro-ecosystem, is a hermetically sealed enclosure with

viewing windows. Two test subjects were living in it at the time of the author's visit. One had been in the enclosure for more than forty days, and the other had spent fifteen days in it. The colony has a greenhouse where wheat and vegetables are grown as a source of food (the test subjects also had a ration of canned meat). The higher plants also were capable of regenerating the atmosphere in the enclosure for one person during the experiment. When the second test subject entered the enclosure, an installation called "Siren," which is filled with chlorella, was added to provide more air. No physical-chemical methods of air purification were employed. Water was provided by a regeneration system and by the dessication of plants. During their stay in the enclosure, the test subjects wore special belts containing monitors to record their pulse and respiration, and encephalographs and electrocardiographs were used to examine their condition.

It is noted that future models of space colonies will be even more complex and will include some small animals for food.

"Research on Closed Biological Systems," I. Terskov, corresponding member of the USSR Academy of Sciences, associate of the Siberian Branch of the Academy. Primary source: *Nedelya*, March 21-27, 1977, No. 12 (888), p. 5, cols. 1-2.

Extract: Today, when ecological problems occupy the attention of all mankind, I would like to look back to a time fifteen years ago when Sergey Pavlovich Korolev gave us his blessing for a prolonged and complicated experiment to model the biosphere. One of the integral parts of this experiment was the development of closed life-support systems.

Information has already been published about experiments in the space habitat in Krasnoyarsk Kray where for half a year microscopic chlorella algae, wheat, vegetables and people lived in harmonious accord, obtaining water, oxygen and plant nutrition on board. I am recalling this in order to talk about the "Earth" results of this research.

Recently the laboratory of controlled biosynthesis at our institute was living in rhythm with the Moon. For fourteen earth days wheat passed through one "moon" day under the light of powerful xenon "suns." For the next fourteen days night reigned in the chambers containing the wheat-dark, but significantly less cold than on the Moon. And so on for more than 100 days in a row.



A group of astronauts and cosmonauts stroll through Red Square.

The "moon" wheat has helped researchers to understand some very important theoretical questions.

"Solving Water Supply Problems of Spacecraft," I. Popov, Candidate of Medical Sciences. Primary source: *Meditinskaya Gazeta*, March 4, 1977, No. 18 (3633). p. 3, cols. 4-8.

Abstract: The article reviews the development of technical solutions to problems of supply, storage and regeneration of water on board Soviet spacecraft.

Beginning with the flights on the "Salyut" orbiting stations, it became necessary to increase the standard daily water ration per man to 2.2 liters. On the "Salyut-3" mission, the cosmonauts themselves for the first time became the source of drinking water. As their bodies gave off water into the atmosphere inside the station, the water was condensed and then regenerated in special installations.

It is said that some researchers believe that regeneration of water should be employed in flights lasting more than twenty days. The author points out, however, that the Soviet Union and USA are both still supplying flights of this duration and even longer primarily with water brought from the Earth. The reasons for this, says the author, are technical problems with the development of small, efficient and reliable regeneration devices which do not require great amounts of energy.

At present the standard for the quality of water used on board spacecraft is based on Moscow's public water supply. But it is said that the problems of treating water for space purposes remain pressing ones and are awaiting further solutions. The results of the "Salyut-5" flight will clarify many important questions in this regard.

BOOK REVIEW

Conrad Schneider

A House in Space, Henry S.F. Cooper, Jr., Holt, Rinehard and Winston, New York, 1976.

This book chronicles the experiences of the three astronaut crews as they lived and worked in Skylab. The text is supplemented with many photographs giving the reader a feel for the actual living conditions in Skylab. The activities and personalities of the individual Skylab crew members are highlighted throughout the book. Especially fascinating is the candid presentation of problems (and successes) faced by the third crew. The problems include hassles of uninterrupted zero-g living and working, conflicts with mission control, the confinement and lack of privacy in Skylab, visual disorientation and nausea. Experience with Skylab has provided most of the information needed to resolve these problems in the future. This experiment has shown the soundness of O'Neill's emphasis on making colonies and colony life both pleasant and Earthlike. Another interesting feature of the book is the description of the zero-g acrobatics and games that the astronauts entertained themselves with. Although nontechnical, this book is a valuable source of important "real-life" facts concerning many subtle psychological and physiological factors that mold the experience of those who live and work in space. It is "must" reading for those who desire to humanize the design of space habitats.



AAS CONFERENCE SEEKS SPACE ART

The American Astronautical Society Conference on the Industrialization of Space will have a display area for artists to exhibit and sell their works. The art displayed will focus on a space theme, and may include paintings, sculpture, mobiles, photographs, etc.

Running from October 18-20 at the San Francisco Airport Hilton, the conference is expected to attract people from all parts of the country. It will be a major event for the San Francisco Bay Area media. Sessions will focus on the broad theme around space industrialization, including technical aspects of making it work, economic realities, legal issues, and space settlements with their attendant psycho-social/biological concerns.

Artists interested in displaying and selling at the conference should contact Paul Siegler (General Chairman, AAS Conference), Earth/Space, Inc., 4151 Middlefield, Palo Alto, CA 94303, (415) 494-8339.

INTERSECT

International Student Exchanges for Cooperation in Technology

As students and young professionals the world over ponder the scientific and technological challenges that lie ahead of them in creating a more peaceful and balanced world, there has been lacking a real means for them to get to understand each other, or to work together to map out mutual concerns, goals, and technological priorities. Now a group of concerned young scientists and technologists from all continents, both student and professional, have begun working to change this.

Their new organization is INTERSECT, short for International Student Exchanges for Cooperation in Technology. This non-profit, non-partisan technology education effort is bringing students and young professionals from many scientific disciplines and from many nations together to learn, research, debate, cooperate, and get an early start on meeting the enormous challenges that face them as the practitioners of tomorrow's technological progress.

INTERSECT founder and executive director, Roger Guisinger, emphasizes the organization's philosophy that "technology forecasting, assessment and planning should be international and should afford easy access by the students and other successors to today's technology policy makers.

"The technological and other industrial activities of one nation," he points out, "often injure the interests of other nations or of the international community through a lack of communication, cooperation, or basic understanding of each other. We can see examples in ocean pollution, atmospheric nuclear weapons tests, the misuse and poor distribution of natural resources, and the so-called "brain-drain."

"Involving young people early can improve the future quality of international decisions, simply because our future leaders will know more about such problems, and will understand each other better. There is growing need for technology to be transferred, not only from West to East, or from 'advanced' to 'primitive' nations, but also in other directions, to blend the concepts and techniques of both old and new. Questions of technological advancement, of energy, space industrialization, controls on genetics and weather, and resource development should be addressed by all nations, and by both this and the next generation of their leaders."

One current problem for young professionals and students lies in the costs of travel to participate in

technology symposia abroad. Another concern is the frequent absence of student programs, aside from a few purely technical seminars, in which young people concerned with the future policies of technological use may involve themselves. Most professional societies and other non-profit technology organizations in the U.S. can rarely afford to use their domestic program funds to develop and maintain international activities, and INTERSECT wants to help change this.

"As seasoned scientists from all nations cooperate to determine what is possible," Guisinger asks, "why not also their successors, to cooperate and discuss what is desirable? As students of arts, languages, and culture exchange between nations, why not also their counterparts in the university science labs and engineering departments, or in agricultural test fields?"

As one solution, INTERSECT is seeking the affiliation of a variety of organizations involved with science and technology, with students, and with international affairs. These groups will pool small amounts of financial and administrative resources to add the international technological dimension to their domestic, or non-science membership services. INTERSECT's fund raising activities are expected to provide the bulk of administration, between these groups and others, through INTERSECT branches around the world.

INTERSECT exchanges, in the form of study tours, research projects, or studies of a particular region or technological problem, are flexible in terms of duration, size of delegation, and type of delegates. This can result in a small task group exchanged between the U.S. and East Africa, for example, or between the U.S. and U.S.S.R., to work on food and water resource projects. Large delegations, internally diverse, but matched between nations may exchange between the U.S. and Latin American nations for a summer, and break into groups to cover a variety of problem areas. Papers, joint design projects, and other proceedings may be published, with recommendations presented to leaders of governments, industries, or educational leaders world-wide.

In the works for 1977 and 1978 are exchanges concerned with agriculture technology, energy management, and spaceflight cooperation between the U.S. and U.S.S.R.; with energy resources and population between the U.S. and India; and with Pacific Ocean resources between the U.S., Japan, Colombia, and other nations bordering the Pacific.

For further information, contact INTERSECT, 1717 P Street NW, Washington, DC 20036.



space warfare

replies

Military aspects of space seem to be the Society's most consistent source of controversy. Those looking for a detailed and still up-to-date treatment of the subject are advised to read War and Space by Robert Salkeld, a prominent aerospace engineer. If your library doesn't have it, unbound copies are available from the Society for \$7.00 plus \$1.00 handling.

In response to "Space Research and the Military" (February L-5 News), I feel you have done your readers, Mr. Holt, and *Skeptic* magazine (dedicated to "provide opportunities for the free expression of controversial and divergent points of view . . ."--precept) a disservice by the oblique abridgement of Mr. Holt's *Skeptic* article, "Looking for Life, Neglecting the Living." Several further points need to be made.

First, you failed to provide some important information about the article, the author and the forum originally presented. The article dealt with far more than military exploitation of space (important as *that* question is). As John Holt (who has written numerous articles on education and social issues, and is the author of numerous books--a fact which some of our more enucleated members might be unaware) stated at the beginning of the articles, he is ". . . not saying that *nothing* can be learned in space, or that nothing we might learn in space might

help us in any way to solve man's problems on Earth. . . ." The main thrust of the article is to address the appropriateness of investing in space colonization at a time when many basic and vital problems of humanity have yet to be solved, or even to be studied. His is a justifiable concern that limited resources might be misdirected to near-Earth orbit and lunar soil from where it is so needed here on Earth. You also failed to mention that Holt's article was preceded in the magazine by a slightly vapid but lucid article by "The Good Doctor" Isaac Asimov: "The Payoff in Outer Space," and a balancing introduction by editorial chairperson, Henry B. Burnett, Jr.

Second, you failed to mention that Holt discussed some of the very "study topics"--practical problems of space industrialization and habitats -- mentioned in the NASA idea source (also in the February issue) that are vital matters, complex and of life/death importance.

Third, he points out that "Space Salesmen" seem very much the harbingers of a new religion. A religion promising to wipe away the problems of ". . . war and peace, of population, of nuclear war and

wastes, of diminishing resources, of the loss of more and more of our soil, the polluting and poisoning of our air and water . . ." if only "they" will give us billions of dollars, ergs, and human-hours to play with and send into space. And he quotes Buzz Aldrin in his statement (originally in *The Observer* of London, October 10, 1976), "We didn't go to the Moon to get rocks. We didn't go to the Moon to get scientific information. We didn't go to improve electronic techniques. We went there simply to beat the Russians." And as far as Holt extends his perceptions, he is much more right than wrong.

Now before I'm dismissed myself as another anti-space/science crankpot [*sic*] (and the "New Kiddies of Space" lay curses down on my head), I must point out that I'm a long-time space advocate and futurist and am not an enemy but a friendly critic. I am as aware as any of your readers of the positive benefits of space exploitation. But, as a realist, a pragmatic democratic-socialist, skeptical viewer of human affairs, and one who has the physical and psychic lumps to show my lifetime dedication to truth, reason and understanding the diversities of existence; I feel that, as a friend, I must agree with many of John Holt's arguments and feel all deserve further and full discussion.

As often before, I now find myself between polarized ideologies, and expect to be attacked by ideologues who diametrically split the complex into antipodes, rather than use what reason and wisdom they have yet obtained. This is the very force that has been my truest foe for these many years. This is why the editor felt justified in bastardizing Holt's arguments and which may lead to the destruction of any progress toward *space exploration in our lifetimes*.

Is it tangential to ask whether the immense amount of funds and energy (physical and mental) necessary for space colonization within the next twenty years is truly justifiable, considering the tremendous sociopolitical and environmental reforms so vitally needed by so, so many? Is it unfair to point out that most of the humans on Earth--today--lack decent food, adequate shelter, sufficient firewood (which, while we blissfully discuss SSPS, fusion, etc., is still the sole source of heat and energy for the majority of persons alive today), clean water, obtainable health care, basic education, and, alas, etc., etc.? Am I an enemy or foe to ask whether your members are as fully aware of the critical situation of most of Earth's own life systems while they study satellite ecosystems (since if they rely on mass electronic media, *Time/Newsweek*, or certain newspapers of record they are basely ignorant)?

I'm being so severely critical of what I am afraid is developing into a pseudo-evangelical/fundamental editorial viewpoint. Like Heppenheimer (letters

section of the February issue), I'd like to see the L-5 News develop into a polemic and balanced magazine, and to be as socially conscientious as the *Bulletin of the Atomic Scientists* or, for that matter, *Skeptic*. But by not ignoring, side-stepping, or pooh-poohing differing or personally distasteful viewpoints, I think that in time, you will find these goals are complementary to the actuation and betterment of the human race as a whole. And isn't that what we are seeking? If it isn't, damn you.

Gary Goodman
Hardinsburg, Kentucky

On the subject of where to put resources in the next twenty years, \$25 billion might get us a space industry leading to a low cost, permanent energy source! Or the same money could give the poorest billion people twenty-five gallons of kerosene each. How long would that last? --KH

It is unreasonable for Holt ("Space Research and the Military" by John Holt, *L-5 News*, February 1977) to expect us to restrict space research to keep the military from exploiting it. Defense is one of the most important and constitutionally-valid functions of the federal government. Space research and especially space industrialization and colonization can be our most effective defense:

1. Holt lists several military advantages of space.

2. Extraterrestrial resources will decrease the "need" of industrial nations to exploit underdeveloped countries for their resources.

3. Colonies at L-5, the Moon, Mars, the asteroid belt and other orbits will be the ultimate bomb shelters. They will make it virtually impossible for any non-space-going nation to conquer a space-going nation.

4. Eventually it will be possible for pacifists to always move on and find new resources outside the solar system instead of fighting over established resources.

5. Earth-based weapons such as nuclear missiles, chemical, biological,

meteorological, and geological weapons will continue to be developed with or without NASA's help. Life will get more and more precarious as we fill our cradle (Earth) with more guns, explosives, poisons and people.

Terry Nielsen
Green Bay, Wisconsin

It isn't clear that space habitats can be made any more resistant to bombs than Earth communities (see following letter). --CH

In reference to the article by Mr. Holt in the February issue, I feel compelled to point out that by his logic a case can be made not to do anything in any scientific or technological field because the military might find something attractive about it. After all, advances in the biological sciences and the threat of germ warfare have close ties, but who suggests that humanity should not pursue the conquering of disease? Secondly, if there is such an overwhelming military advantage to be had in space, some country with the technical capabilities, will eventually make use of it. As unsavory as a balance of terror in space would be, it is infinitely better than the one-sided active terror that would result from a single country blackmailing the rest of the world into submission. Lastly, given the powerful laser weapons that Mr. Holt describes, it is very doubtful that this great military advantage in space could exist at all. There is no place to hide in space. Construction of these weapons in space would certainly be easily detectable by the rest of the world. In addition, there is nothing to prevent the rest of the world from building an Earth-based weapon of the same sort. Mr. Holt says, "Who, without going underground, could escape such a finger of God?" This is exactly the point. A weapon of this sort on Earth could be hidden, could be put underground, could be protected, while the one in space is wide open and unprotected from the same sort of attack it is trying to utilize.

Roy T. Craig
Gainesville, Florida

WHAT'S AVAILABLE FROM THE L-5 SOCIETY?

- Xerographic reproductions of articles from other publications (please ask for list).
 - *The Hunger of Eve: A Woman's Odyssey Toward the Future*, Barbara Marx Hubbard, Stackpole Books, 1976. \$8.00.
 - *The High Frontier: Human Colonies in Space*, Gerard K. O'Neill, Wm. Morrow and Co., 1977. \$8.00.
 - *The Fourth Kingdom*, William J. Sauber, Aquari Corp., 1975. \$6.
 - *Colonies in Space*, T.A. Heppenheimer, Stackpole Books, \$12.
 - *War and Space*, Robert Salkeld, Prentice Hall, Inc., *unbound*, \$7.
 - *L-5 News*, back issues \$1 each (Vol. 1:1-16, Vol. 2:1-4).
 - *Space Settlement*, special edition of *L-5 News* (Vol. 2:5), \$2.
- Pioneer XI in the Rings of Saturn 17" x 22" color poster, \$3 each.
- Bernal Sphere color postcards (interior, exterior). 15¢ each; 50 of one kind, \$3.
 - Bernal Sphere 14" x 17" color posters (interior, exterior). \$2 each.
 - Introduction to the L-5 Concept, 18 slides, \$9.
 - Space Industrialization, 28 slides, \$14.
 - Satellite Solar Power Stations, 12 slides, \$6.
 - Space Habitats, 18 slides, \$9.
 - The L-5 Society Slide Show, all 76 slides, \$38.

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Letters

I have seen nothing in the L-5 News or O'Neill's book about the weather in a large habitat. It occurs to me that rising warm air and the conservation of angular momentum could lead to violent weather towards the axis. Consider how influential the Earth's much smaller angular speed is on our weather. Has anyone determined what the winds will be in space?

Kenneth Brakke
West Lafayette, Indiana

Rising air will be deflected by coriolis force, but generally the air will rotate with the habitat. It takes a mighty big building to have weather inside. Still, modeling work needs to be done. - K H

Dr. Gerard O'Neill spoke at NASA's Ames Research Center, Moffett Field, California, on April 1, 1977. It was the first time I had had an opportunity to see and hear him. He is an affable and dynamic individual who projects an air of confidence. Since we are both sailplane pilots, I felt an additional empathy for him. His talk was spiced with occasional flashes of humor.

He began his talk by saying that his aim was to get space manufacturing to reach the "ignition point." Then he went on to discuss electromagnetic rocketry. The mass driver seems to be his special technical interest. As he pointed out in his recent popular book, *The High Frontier*, not only can it be used to launch material from the surface of the Moon, but it can also be employed as a reaction device for propelling space vehicles. As a guest professor at MIT, he supervised the construction of a demonstration unit by a group of student volunteers.

He ended his lecture by giving some cost and weight figures for the establishment of the L-5 settlement and the lunar and cis-lunar processing plants. He remarked that the electric power industry was becoming interested in power satellites.

More encouraging yet was that the financial establishment was also showing signs of interest.

Someone asked about a remark he had made on a TV program earlier in the day to the effect that the Soviets might be developing a space shuttle. He labeled it as purely rumor but added that it might inspire NASA to accelerate development of the space shuttle in order to stay ahead of the Russians. He added a wry remark that we always do the right things for the wrong reasons. Dr. Hans Mark, Director of Ames, said he had not heard that rumor. If anything, he said that the "vibes" he got out of Washington would indicate the opposite.

Incidentally, Dr. O'Neill wrote an interesting article on "flying" the space shuttle simulator at the Johnson Space Center, Houston, Texas. See *Soaring*, November 1976.

Maurice V. Gowdey
Fremont, California

I would like to suggest another possible use of the Satellite Solar Power Station (SSPS) that may not have occurred to many of your readers. The SSPS, as it is generally thought of, is designed to beam down microwaves at a frequency that avoids the loss of energy to water molecules in the atmosphere. If such a system were, instead, operated at much the same frequencies as a microwave oven, a great deal of benefit might be gained from it. The power beam-down would not be directed at a receiving antenna, but rather, it would be directed in a wide beam at existing cloud banks or bodies of water. This would not present a danger to persons on the ground, as the beam would be absorbed in the intervening cloud layer. The purpose in doing this would be to modify the weather.

The weather patterns in our atmosphere exist in a delicately balanced state, such that relatively small power inputs, in the right places and at the right times, could act as a trigger to cause desired changes in the weather. A beam-down of power into a cloud bank would tend to heat the system up, causing a low-pressure system at the

desired location. Such a low-pressure center could be instrumental in steering the path of weather systems. For instance, if the path of hurricanes could be deflected early in their lifetimes, they could be steered by a tiny angle in the Caribbean, resulting in their missing the mainland U.S. entirely. Considering the destructiveness of hurricanes, a very few years of deflecting them from our coasts might well pay for the satellite in savings of lives and property. The more subtle, and thus less apparent, effects on our agriculture could well exceed this level of savings in the lessening of crop damage, due to irregular rainfall periods that occur naturally. We should never forget that there are, indeed, dangers involved in any alteration of natural systems. However, I feel that these dangers could be coped with and avoided, resulting in a benefit for all of mankind.

Steven D. Hamm
San Marcos, Texas

Controlling weather (on Earth) may always be beyond our abilities. It has been suggested to use SSPS to keep orange groves from freezing, but wouldn't it have been more fun to watch this last winter from L-5? - K H

I would like to register a protest to changing the name of the L-5 Society to the Space Colonization Society. Although most meanings of *colony* are positive in nature, the Oxford English Dictionary lists one definition as "a number of people of a particular nationality residing in a foreign city or country. . . a body of people of the same occupation settled among others, or inhabiting a particular locality."

Today, the term *colony* is loaded with negative connotations, especially among those peoples who have recently broken the bonds of colonization. If L-5 is truly to be a new start for humanity, as many have advocated, why not start with a clean slate? Surely the lexicons of the world are not so paltry as to give us but one word, *colony*, to define what L-5 hopes to do?

Jonathan Coopersmith
Princeton, New Jersey

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