L5 NEWS

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Covers: The front cover shows an ion engine which could carry payloads for an asteroid sample return mission. (Picture courtesy Hughes Aircraft Co.) The back cover shows a "heliogyro" solar sail approaching Halley's Comet. This system could also be used for an asteroid mission. (Picture courtesy JPL.) See related story on page 9.

German Space Capitalist Under Attack

Nobody seems to trust poor Lutz Kayser. The West German rocket engineer is trying to offer a competitive space transportation system to would-be customers of the 1980s and has so far wound up with enemies on four continents.

Kayser is head of the West German firm named OTRAG - for Orbital Transport-Und Raketen - Aktiengesellschaft. Based outside of Stuttgart, the commercial operation has been soliciting and spending private funding in order to develop a satellite launch booster which promises to be cheaper and more available than either America's reusable Space Shuttle or Europe's expendable "Ariane" booster.

The customers are there. Commercial users, according to a NASA study, will account for more than a quarter of all Space Shuttle missions. Commercial users, primarily communication satellite builders, are the primary financial stimulus behind Europe's (read: France's) competitive space booster, the 'Ariane' rocket which will be the equivalent of NASA's Atlas-Centaur, but cheaper. Kayser hopes to undersell, and perhaps bankrupt, them both. So he should not have expected anything less than the cold-shoulder treatment he has been receiving from official space agencies in Europe and America.

But Kayser has run into trouble with the Communist world as well,' and has managed to stir things up in Africa, too. An observer might be tempted to conclude that anyone who can cause that much trouble must have something truly revolutionary going on.

OTRAG, which has forty full-time rocket engineers in West Germany, has developed a design for an expendable space booster which can put twenty thousand pounds into earth orbit for about ten million dollars, in 1981 prices. Initially considered something of a nut or a con man by European space specialists, who saw Kayser's fund raising as just another sordid business gimmick hitch-hiking on West Germany's industrial prosperity, Kayser has begun to earn a grudging respect among these observers. OTRAG hired ex-NASA rocket specialist Kurt Debus, formerly of von Braun's V-2 team and later director of the NASA missile test center at Cape Canaveral, to be chairman of the board. OTRAG went on to build and ground-test its promised rocket engines. And last May 17, OTRAG actually launched one of its rockets towards space.

Europe is a densely populated region, so space launchings there are out of the question. The French fire space rockets from southern Algeria or from Kourou in French Guiana, South America. The British launch satellites with facilities loaned by the Americans and the Australians. The Italians have a rocket platform off the coast of Kenya. OTRAG wanted an equatorial launch site, to maximize payload into orbit, so in 1975 its representatives began secret discussions with governments of countries which lie on the equator.

For various economic and logistic reasons, OTRAG finally reached an agreement with President Mobutu Sesse-Seki of Zaire (formerly Belgian Congo) in 1976. Mobutu promised to lease OTRAG a large uninhabited region in the southeast section of Zaire for its rocket tests. He was impressed, no doubt, with the idea that satellites launched from there would, by United Nations standards, carry the Zaire flag into space.

OTRAG quickly plowed a dirt airstrip the jungle and began airlifting equipment and personnel. By late 1976 the base was in operation, and on May 17, 1977, the first rocket was launched successfully.

That was not the only fireworks in the region, however. The base was neatly set up right on the equator, in a desolate jungle region of Zaire which was officially part of Shaba province. For Shaba, read 'Katanga', the former name during the secessionist days of the late politician Moise Tshombe. In Shaba, don't overlook the abortive invasion of the province by Soviet-backed refugees early in 1977. For OTRAG, the fireworks had only just begun.

Moscow noticed the OTRAG rocket center several months ago, and a new round of fireworks was set off. "Rocket complex in the heart of Africa!" headlined the Pravda feature story. "West German militarists prepare new threat to the peace and stability of liberated regions of Africa," announced the TASS dispatch breathlessly. The next Pravda dispatch was even more specific: "Despite all International Agreements" was the scare headline on September 7, 1977:

"West Germany is more and more following a policy of secret re-armanent," TASS fearfully disclosed in a news item datelined Bonn. Shades of Nazi Germany in the 1930s were called up, not by accident! "Many military developments are disguised under 'private' corporations doing 'peaceful' research," the dispatch went on. "One example is OTRAG, with close connections with the German military-industrial complex. It has recently tested a missile capable of carrying nuclear warheads from a provocative base in the heart of Africa."

(continued next page)

Russians Continue to Blast
Private Satellite Launch Group

Pravda, Oct. 26, 1977
Artist: Yu. Cherepanov.

Cartoon title is difficult to translate: "Solemn Wishes" is literal, with sense of a holy (unholy?) alliance. Figure on left is NATO, on right is white colonialist. Map is labeled "Rocket Base OTRAG".

This is the fourth mention of the OTRAG "rocket base" in PRAVDA since August.

Western observers are puzzled by the vehemence of the Soviet reactions to OTRAG's rocket test. Most dismiss it as a smokescreen being used by Moscow as phony issue to whip up anti-Western hysteria in Africa. Few believe that the Soviet Union really thinks that Lutz Kayser's outcast rocketmen are a threat to peace in Central Africa.

But Moscow's hostility to private enterprise in space cannot be underestimated. At space law conferences a decade ago, Soviet representatives branded any commercial applications of space as 'cosmic piracy'. Moscow insisted, unsuccessfully, that the United Nations declare that only national governments be allowed to carry out space activities. Kayser's attempts are idealogical anathema to the Soviets, besides being a useful propaganda target.

A more important issue remains in dispute in the West: could Kayser succeed in his project? Could OTRAG provide truly cheaper and more dependable space transportation services for the commercial space traffic of the 1980s?

Such a possibility, while surely welcome to the cost analysts of the corporations who will be purchasing such services, strikes at the heart of the commercial feasibility of America's Space Shuttle and of Europe's competitor, the 'Ariane'. If OTRAG can attract a significant fraction of the expected commercial space transportation market, the economic justifications for these programs may go out the window.

Kayser and Debus claim they can do so. They claim that the only way that Shuttle and Arianne can be economically competitive is for the respective governmental space agencies to require by law that all commercial space activities in their nations use the national space transportation systems exclusively, regardless of any extra cost this may entail for the user.. NASA's Space Shuttle may become the cosmic AMTRAK of the 1980's.

More experienced rocket engineers disagree. They point out that the price schedule which Kayser is promising for OTRAG services is very similar to prices originally envisioned for the Space Shuttle prior to the hard engineering work. As the rocket designers began to actually 'bend metal', their first optimistic cost estimates vanished. The same effect, these rocket engineers assert, will wipe out the illusory cost advantage of OTRAG's services, and will bankrupt the corporation.

Some, however, are not so sure. What OTRAG is doing resembles in many ways what the private mail carriers in the United States have been trying to do for a decade: skim off the most profitable business and leave the unprofitable portion (which should have been balanced by the profitable portion) for the price-fixed subsidized governmental operations.

OTRAG has set its sights on the "weight into orbit, no payload return" traffic, the juiciest part of the market. Governmental users must pay extra to subsidize capabilities such as payload return which are not really needed by this portion of the market. If OTRAG is successful, they will not be forced to subsidize these unneeded options -- and the actual cost of the remaining market may rise high enough to forestall any serious customers, unless massive governmental subsidies are introduced.

Kayser, meanwhile, continues to release plans and promises. A two-stage version of his mass-produced booster is to be launched in 1978, and a satellite will be fired into orbit in 1979 by a three-stage version. By 1981, the full launch capability is to be available to would-be customers, assuming that the launch complex in Zaire is still accessible via friendly regimes. If not, other sites from Brazil to Uganda to Singapore to Nauru may be required.

Moscow denounces his 'space piracy', and African nations publicly condemn his 'aggressive missile base'. Space officials in Paris and Washington either ignore him, or quietly hope he is a charlatan or fool. In true free enterprise fashion, OTRAG is a threat to the communists and to government monopolies as well. That fact alone has earned it secret admiration from many sources in Europe and America, sources who hope Kayser is right and that venturesome capitalism can pave a way towards rapid space industrialization despite opposition from practically every power bloc in the world. Whatever is to happen, the space fireworks have only just begun and OTRAG is in the middle.

Rockwell's Gould: Time to "Break Free"

Rockwell International, the outfit that built the Enterprise, is conducting a space industrialization study which is considering a host of ideas--at least ZOO--every one of which could lead to major space industries. Space industrialization study manager Chuck Gouldstates that it's time to "break free of the Earth environment." Adding that "we're right here where we build the hardware," Gould believes that his Rockwell-based team has the background and know-how to turn dreams into products.

While Gould feels that space colony enthusiasts are often unrealistic in their plans, he is anxious to avoid "a collision course" between hard-nosed aerospace veterans and starry-eyed dreamers. "That's why we've brought in Gerard K. O'Neill as a consultant," he explains, adding that O'Neill has made major contributions to their study.

Gould's biggest concern is with people who want to build themselves Taj Mahals in the sky with no regard for the needs of our home planet. Gould explains that "My basic motivation is to make a real contribution to the billions of people already born." He looks for a "synergy between developed and developing nations," adding that "the trend to put more complex things in space and simple stuff on Earth lets people in poorer countries share in the advantages of space." Examples he cites are 24 hours per day education stations, interactive learning programs and specialized seminars, all tied together with satellite links.

Co-worker Bruce Murray points out that "We're getting more urbanized and interdependent--which scares us." Murray believes our need for individualized things could be met with advanced satellite communications which could allow any citizen of the world to tune in to his or her choice of at least 1000 programs. Murray stresses the advantages of "finding one's own peers," being able to tie in with a few dozen people with similar needs and interests from all over the world via satellite link--a link which could become cheaper than today's ground phone network. According to Murray, this impending realization of McLuhan's prematurely announced global village "could leapfrog the 100 year development time" that industrialized nations went through.

The Rockwell team hopes for a public service space platform with "freedom to evolve in unexpected ways." They see the first space industry workers living in low earth orbit and using "teleoperators" (remote control robots) in the harsher cosmic radiation environment of higher orbits. Why not control them from the ground? "The nitrogen and water absorption bands are nonexistent in space so data transmission is better," explains Gould. Delay times in the robot controls due to the speed of light could be as high as .7 seconds, but Gould found that workers operating simulators had little difficulty adjusting: "Billy Jean King, shifting from grass to cement, has a harder time than an ordinary person coping with a 0.7 second delay." -- *Carolyn Henson*

Industrialization of Space Conference Postscripts

The "Industrialization of Space" conference, held Oct. 18, 19 and 20, generated "the most excitement we've seen since Sputnik," according to one conference veteran.

Do You Sincerely Want to Become Rich?

G. Harry Stine, one of the organizers of the "Industrialization of Space" conference has said that "the first billionaire space moguls are already alive". After hearing Chris Basler's paper, "Space Industrialization, the Challenge to Private Enterprise Capitalism", many conference participants were more inclined to believe Stine.

By Robin Snelson

There is apparently no substance to the rumor that Christian 0. Basler is the emissary of an advanced and beneficent spacefaring species who was sent to Earth to hasten the process of space industrialization on this planet and save our species from certain extinction.

His appearance at the San Francisco Industrialization of Space conference last October did raise some speculation to that effect. However, it now seems certain that Basler is a Wall Street lawyer who wears three-piece pinstriped suits and worries about legal matters for Western Electric.

But his idea for a private enterprise approach to space industrialization is a concept that might get things moving. He proposes a new business structure called a "staging company" which will raise the capital for -- and eventually reap the profits from -- research, development and operation of large-scale space industry.

Imagine a corporate animal designed to raise and send $100 billion. A private enterprise equal to the task of jumping into space industrialization where the government gets cold feet and NASA runs out of money. A corporation that could finance the construction of solar power satellites, space habitats, orbital factories and research laboratories, space-based observations and radio telescopes . . . not to mention tourist attractions.

A company whose employees would be space construction workers paid partly in shares that could be used to buy a piece of a cooperatively owned space habitat.

If this imaginary company were incorporated next week and you could buy stock, would you? And how much?

First realize that you wouldn't see dividends for 15 to 25 years, if at all. But if there is money to be made exporting energy, information and goods from space to earth -- and if this is the company that will make it -- the potential profits are enormous.

It is unlikely that such a company will be incorporated next week and in any case don't buy anything until your broker gives you a prospectus. But there has been a lot of interest and Xeroxing generated by Basler's paper.

According to reliable sources at the Industrialization of Space conference (this reporter couldn't make the airfare), Basler followed T.A. Heppenheimer, whose paper "Space Community Planning from a Viewpoint of Experience" presented a downbeat, evolutionary, 50-year approach to space industrialization.

Ironically it was not until that last session on the last day that the theme of the conference -- "Planning for Profit at the High Frontier" -- was seriously addressed. Basler's matter-of-fact explanation of how a staging company could make large scale space industry feasible -- and profitable -- in 20 to 25 years caused something of a sensation.

Basler called the new corporate structure a staging company because "it performs the function of a staging area, accumulating in safety the amount of capital needed to minimize the risk of a planned assault."

In its first stage, it would function as a closed end management investment company with a portfolio of stocks in companies likely to profit from space industrialization, particularly aerospace and high technology concerns.

The income from that portfolio, instead of being paid as dividends to stockholders, would be spent on relevant R&D, mainly contracted out to those same companies.

The object of the R&D would ultimately be firm bids for necessary component systems of large space projects.

When and if the company accumulates enough capital, valuable patents and the required technological know-how, it would convert to an operating company.

And that's when it would start advertising jobs for space construction workers.

Basler estimates the overall investment before payout to be in the neighborhood of $60 billion to $100 billion. For perspective, Basler notes that those figures are only a little lower or higher than the total assets of AT&T, presently the world's largest corporation.

Because no existing corporation, or even a small group of existing corporations, can undertake a project of that magnitude without alienating dividend -- hungry stockholders or violating antitrust laws, Basler suggests the staging company.

The staging company as Basler first conceived it may evolve as much as O'Neill's original concept has evolved over recent years, but clearly it is an idea with possibilities. And it's an attractive idea to those who are frustrated with the lack of NASA money available to study the "High Frontier" concept. (A solar power satellite feasibility study planned by NASA and the Department of Energy will not consider a model using extraterrestrial materials.)

Even if first year revenues from the staging company's stock portfolio generated only $2.5 million for R&D contracts, that's $2.5 million that nobody else is spending and it could result in valuable patents for the company -- as well as speed up the process of settling L-5 (or whatever).

Things do tend to happen faster when the profit motive is involved.

But there are plenty of questions to be answered about any free enterprise

approach to space industrialization and about the staging company in particular.

--Can a private corporation exploit space under existing U.N. treaties on the uses of outer space?

--Should it be international in nature and how could international participation be assured?

--Are more government-sponsored studies in order before a private company can hope to sell stock in such a high-risk, long-term return on investment venture?

--Can we look forward to any substantial government studies?

--Who will manage the investment portfolio and R&D contracts?

--Can everybody currently and potentially involved agree on a common workable concept?

--Is there enough confidence in, or even general knowledge of the proposed company's goals to attract an investment of the size contemplated?

After all, if nobody buys the stock because nobody believes solar energy from space can be profitable, the company doesn't have a chance.

O'Neill and others have already indicated a willingness to invest in a staging company such as Basler proposes, and the paper is reportedly making the rounds in corporate boardrooms even now.

But the concept needs a good deal of further refinement and input before the staging company will be ready to sell its first stock offering.

An Open Letter from Chris Basler

I gave a paper, "Space Industrialization, the Challenge to Private Enterprise Capitalism", at the American Astronautical Society's San Francisco Conference. Since then, the encouragement and offers of support generated by the paper have convinced me that the once academic concept of a staging company to industrialize space may now be a viable approach in the real world of corporate finance.

The staging company's success will depend upon its acceptance by the public as the company that will in fact eventually industrialize space. This in turn will depend upon its acceptance by the people who have made and continue to make contributions toward this goal. It is thus important that anyone who wishes to participate in addressing the specific problems involved in forming a staging company be given an opportunity to do so.

I am therefore addressing this letter to the American Astronautical Society, the American Institute of Aeronautics and Astronautics and the L-5 Society. I have asked them to publish or distribute it in whatever manner they feel will promote the objective of broad participation. I am also sending copies directly to those persons who presented papers at the AAS San Francisco conference and the last AIAA Princeton conference and to certain other persons whom I know to be interested in space industrialization. I would like to receive comments and suggestions from anyone desiring to participate. I shall eventually put people with the same areas of interest in touch with each other and ask them to come up with specific work products that will be useful in the actual formation of a staging company. The L-5 News has offered to publish comments or summaries of comments I receive on questions of a general nature.

It is my hope that this process of interaction will result in a natural coalescing of ideas, talent and hard work that will give the staging company its initial form for a public stock offering. I personally feel that it is important to the success of the staging company that, until such coalescing occurs, the group remain open to participation by anyone interested. Though this is a somewhat unorthodox approach to the formation of a new company, I believe it will maximize our chances of success in the long run.

Christian 0. Basler
250 West 94th Street
New York, New York 10025

Space Law Topic at Conference

--Although the movie "Star Wars" did not have any courtroom scenes, as inevitably as its Princess Leia was rescued and Darth Vader escaped to fight again, when real people begin living and working in space, laws will be there with them.

This was the consensus, again, at the Industrialization of Space Conference which was attended by a select group of international lawyers who have been discussing the need for space law ever since the earliest satellites were launched.

"Identifying the need for some kind of international agreement on how law will operate in space is the easier part of the problem," explained Hamilton DeSaussure, University of Akron School of Law professor and a conference participant.

"There are 52 legal systems in the United States and some 200 other legal systems around the world. When more and more persons from these jurisdictions go into space, and crimes are committed and contracts are broken, for example, one code of law will be a necessity. Developing this legal regime through international cooperation is the more difficult part of the problem."

In his paper given at the "Industrialization" conference, Prof. DeSaussure specified some of the legal difficulties of persons of different nationalities and jurisdictions living and working in space. These include the choice of law and the appropriate forum or court for legal action to be carried out. For example, what will happen, he asks, if an American scientist negligently injures a Frenchman in space? Will the French citizen have the power to bring the American to France for a lawsuit?

Until now, the only space "participants" have been U.S. and U.S.S.R. astronauts, and there have been no legal difficulties. "But as the duration and frequency of human conduct expands," said DeSaussure, "so too will the need for controlling rules of law."

An example of future conduct in space might be the space colonies planned by Princeton physicist Gerard K. O'Neill, the unofficial leader of the space humanization effort in the U.S.. O'Neill believes the U.S. has the technology to have self-sufficient space colonies operating by 1995. Ten thousand persons would live in each colony, which would serve as a space manufacturing center for solar power satellites and other, larger colonies.

Also of interest to space lawyers is the eventual entrance into the space arena of commercial enterprise, some of whose companies may be acting entirely without government influence. One West German firm, OTRAG, has already agreed with Zaire to conduct suborbital tests of the company's rockets from that African country.

"Having private enterprise conducting its business in space opens up another set of problems, including patents, anti-trust laws and others," DeSaussure said. "The time has come for a number of distinguished lawyers, representing the principal legal systems of the world, to assess the diverse laws which could apply to space activity, and determine how to establish a uniform order of law for space."

News from NASA

Shuttle Update

Fares for Travel on Space Shuttle

"How much does it cost to fly on the Space Shuttle?"

That is an often asked question and one to which NASA is paying a great deal of attention. NASA plans to begin Shuttle operation flights in 1980. The answer to the question of price ranges from less than $10,000 to more than $21 million, depending on how much the cargo weighs and what volume is involved, whether a reservation has been made or the flight is on standby basis and what optional services are desired.

Passengers?

"No, not yet," NASA's space transportation system operations director, Chester M. Lee says. "Non-astronaut payload specialists may fly on some missions to conduct experiments and operate equipment but we're not ready to book tourists yet."

Lee notes that the Space Shuttle will carry as many as seven people on a flight. Three of these will be crew member astronauts supplied by NASA -- pilot, co-pilot and mission specialist. The other four would be payload specialists, assigned by the customer for the mission.

At the low end of the fare structure is the so-called "get-away special" which permits an individual or organization to fly a payload in the Shuttle on a space-available basis for $10,000 or less. To qualify for this low fee the proposed payload must involve research. weigh less than about 90 kilograms, have a volume of less than five cubic feet and be self-contained. Any services cost extra.

The $21 million fare is for using the full capacity of the Space Shuttle on a reservation basis by non U.S. government customers.

In between are charges made for customers sharing the Shuttle flight with other customers, willing to fly on a stand-by basis, and customers who have made a substantial investment in the Space Transportation System development. The latter category includes the European Space Agency, its member nations and Canada. ESA is developing the Spacelab to be carried within the Shuttle and Canada is developing the remote manipulator system that will be used in the Shuttle.

Lee says the pricing policies are designed to encourage full use of the Shuttle by making the charges economically attractive while recovering the total operating cost incurred by NASA

Space Shuttle's First Year to Be a Busy One

NASA has identified some 40 payloads for 11 Space Shuttle flights in its first year of operation beginning in 1980.

Chester M. Lee, NASA's Director of Space Transportation System Operations, said that three civilian firms have deposited "earnest money" with the space agency covering payloads on eight flights. He added that NASA has firm plans for launching five payloads, and the Department of Defense will launch one.

"And there are 12 non-NASA civil payloads, 10 NASA and four Department of Defense payloads forecast for launch during 1980 and 1981," Lee said. "Clearly the pipeline is beginning to fill up."

The Space Shuttle is the key element in NASA's Space Transportation System. It will make its first space test flight in 1979. Six of these orbital flight tests are scheduled before the first operational flight takes place in 1980.

Allocation of payloads to specific flights is still in the early planning stage and will not be firmed up until about one year before launch. Current allocations are as follows:

Space Shuttle Flight 7 (Flights 1 through 6 are test flights) -- Long duration exposure facility (LDEF), is a passive, free-flying satellite that will accommodate a large number of experiments to be conducted in space and in an experiment pallet.

Space Shuttle Flight 8 -- Tracking and Data Relay (TDRSS-A), for Western Union and a communications satellite for Satellite Business Systems (SBS-A).

Space Shuttle Flight 9 -- A geostationary operational environment satellite for the National Oceanic and Atmospheric Administration (Commerce Dept.) and Telesat-E, a communications satellite for Canada.

Space Shuttle Flight 10 -- TDRSS-B for Western Union and SBS-B for Satellite Business Systems.

Space Shuttle Flight 11 -- Spacelab 1. Spacelab is being built by the European Space Agency. This first Spacelab mission is a joint NASA/ESA science mission.

Space Shuttle Flight 12 -- GOES-E for NOAA and Intelsat 5 for the Communications Satellite Corp.

Space Shuttle Solid Rocket Motor Fired

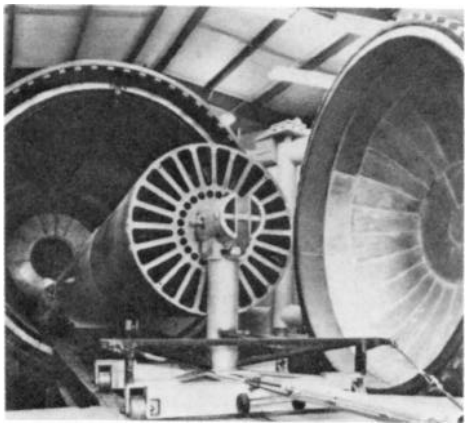
The first firing of the largest solid rocket motor ever developed for space flight was conducted successfully July 18 near Brigham City. Utah. The motor for the Space Shuttle solid rocket booster (SRB) was tested by Thiokol Corporation's Wasatch Division, prime contractor to NASA's Marshall Space Flight Center.

The solid rocket motor (SRM) has about 50 percent more propellant than the next largest motor ever fired at the site. Earlier firings were conducted to gather data on the feasibility and possibility of developing the large motor.

The SRM uses a composite propellant consisting primarily of ammonium perchlorate as the oxidizer, powdered aluminum as the metallic fuel, and PBAN (polybutaciene-acrylic acid-acrylonitrile-terpolymer) as the polymeric fuel binder. A small amount of iron oxide is added to increase the burning rate. Ingredients are mixed with a curing agent and poured into the cases of the four major segments of the motor, the forward. two center and the aft tasting segments. The propellant then is heated in the cases at 57 degrees C for four days. This cures the propellant into a rubbery material somewhat the consistency of a typewriter eraser.

Each segment is moved on a road transporter to the test site where the segments are joined horizontally, a task which required special handling equipment and fixtures.

Flight motors are to be transported by rail, one segment per special railcar, to the Kennedy Space Center, where the segments will be joined vertically in the vehicle assembly building. Later, deliveries will be made to Vandenberg Air Force Base, Calif.



A Piece of the Shuttle's Solid Rocket Motor—Casting segments of the solid rocket motor at the Thiokol Corp., at Brigham City, Utah. The largest such motor ever developed for space flight was fired successfully for the first time recently. The mandrel shown in this photo will be used for making the center segments of the motor.

The largest solid propellant rocket currently in regular use is the Titan III. It has about 192,780 kilograms of propellant, or about one-third as much as the SRM.

The SRM, weighing 568,097.3 kg fueled. fired for 123 seconds, producing 12,232,550 Newtons of thrust. Propellant accounts for 502,454 kg of the SRM's total weight.

Thiokol's SRM is the propulsive part of the reusable SRB being developed for the Space Shuttle. The SRB is 3.7 meters in diameter and 45.5 m long.

Facelift at KSC for Space Shuttle Launch

More than two years have passed since launch complex 39 at NASA's Kennedy Space Center reverberated with the sound and fury of a rocket catapulting men into space from the Florida facility. And it will be two more years more before the Space Shuttle climbs into the sky on its first orbital flight.

Many of the facilities at the center -- built for Apollo journeys to the Moon -- have already been reshaped for their roles in the Space Shuttle era.

KSC was selected as the primary launch and landing site for the Space Shuttle in 1972 and construction has been aimed at preparing to receive the first Shuttle flight hardware in 1978 and to support the first piloted orbital flight in 1979.

Among factors leading to the Kenned) center's designation as the prime Shuttle site was the existence of complex 39, whose structures are readily adaptable to Shuttle launch and servicing requirements. Only two major new facilities were required. These were:

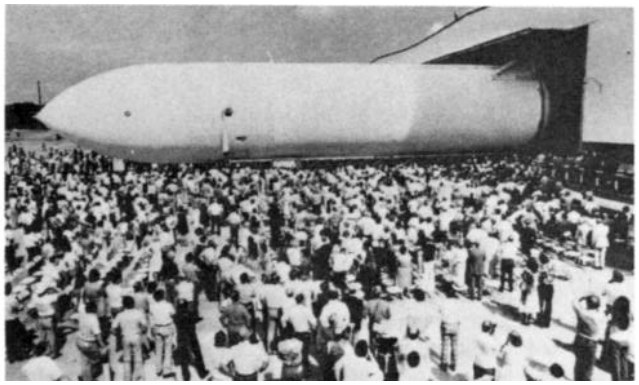
- The orbiter landing facility, one of the largest runways in the world, located northwest of the vehicle assembly building. It is roughly twice as long (4.5 km) and twice as wide (91 m) as the average commercial landing strip and it has a 300-m safety overrun at each end. Its equipment includesa microwave scanning beam landing system to guide the orbiter to an automatic landing on its return from a mission in space.
- The orbiter processing facility, located in the heart of complex 39 and connected with the landing facility by a 3.2-km towway. The OPF is a "hangar" with two bays in which orbiters will be checked out and serviced 'after landing. Protected from the elements, ordnanceand residual fuels will be rendered safe, flight and landing systems refurbished, and payloads removed and installed. A technological "facelift" has been undertaken to prepare the existing facilities for their new roles.
- The vehicle assembly building, site of assembly for the Saturn V/IB rockets used in the Apollo, Skylab and Apollo Soyuz programs. is being modified for the assembly of the Space Shuttle in two of its four high bays. The remaining two high bays will be used for processing and staging the Shuttle's solid rocket boosters and external tank.
- The launch control center, the "brain" of the complex, is being fitted out with the highly automatic launch processing system (LPS) developed for Shuttle checkout and launch. Two of four firing rooms are being equiped with LPS consoles and associated equipment. So sophisticated is the new system that only about one-tenth of the people required for Apollo will be needed in the firing room to check out and launch the Space Shuttle -- 45 persons as compared to more than 450 in the earlier launches. And the final countdown for the Space Shuttle is expected to take only 2½ hours as compared to the 28 hours needed for an Apollo Saturn V.
- Launch pads 39 A and B are undergoing major changes. With the exception of the six fire pedestals that support the mobile launcher platform, the structures on the surfaces of these twin pads (originally built for Saturn launches) will be removed or relocated. The upper portions of the umbilical towers from the mobile launcher platforms are being removed and installed at each pad to serve as fixed Shuttle service and access towers. With the exception of Spacelab-the large space laboratory being built by the European Space Agency -- payloads may be loaded into the Shuttle orbiter at the launch pad from the payload changeout room. The payload changeout room is a "white room" structure mounted on a semi-circular track extending from the Shuttle service and access tower. The room is "swung" along its track to its park position prior to launch. The Saturn Mobile Launchers are undergoing major changes to adapt them for the Space Shuttle. The most striking visual changes involve removal of the launch towers and their cranes from the platform. The need for these has been eliminated on the mobile launcher platforms by installation of permanent launch towers on the pads.

The single opening in the center of the mobile launcher platform is being replaced by three openings to permit exhaust gases from the orbiter's main engines and two solid rocket boosters to escape during liftoff.

The ponderous transporters bearing massive loads on a back the size of a baseball diamond will be used to move mobile launcher platforms with the

assembled Space Shuttle between the assembly building and the two launch pads at complex 39. These twin giants originally were adapted from strip-mining machinery and used to carry Saturn V / Apollo flight hardware around complex 39. Both have amassed odometer readings in excess of 800 km. The transporters are expected to be able to perform their load-carrying chores throughout the life of the Space Shuttle program.

Much of the construction and modification work has already been completed. The eventual cost of the entire project will approximate $240 million, less than a quarter of the cost of building the Spaceport for Project Apollo in the 1960s.



Largest Part of Space Shuttle System -- A large crowd was on hand at the Michoud assembly facility in New Orleans to watch the rollout of the Space Shuttle external tank.

Interviews Begin for Shuttle Astronaut Applicants

The first 20 of approximately 200 Space Shuttle astronaut applicants to be selected for individual interviews and physical examinations reported to NASA's Johnson Space Center in early August.

The second group of 20 reported to JSC in mid-August. A third group of 20 Space Shuttle astronaut applicants selected for individual interviews and physical examinations, all in the mission specialist category, reported to NASA's Johnson Space Center on Aug. 29, to remain there for one week.

NASA expects the applicants to be interviewed at the Johnson center to be about evenly divided between pilot and mission specialist applicants. All in the first two groups are pilot applicants.

Eight of the 20 potential astronauts are women. All 20 in the third group either have Ph.D. or medical degrees or both and one also has a degree in veterinary medicine.

"We are pleased with the quality of applicants," Johnson center director Christopher C. Kraft, Jr., said. "It is difficult to narrow the field for interviews and paring that number will be a real challenge."

Each group of applicants -- which will include 20 of the 8,079 applicants -- will spend about one week at the Johnson center. Officials expect to complete the process by mid-November. In December. NASA will select as many as 20 astronaut candidates in each of the two categories -- pilot and mission specialist. The candidates will report to the Johnson center in mid-1978 for two years of training and evaluation. Final selection as an astronaut will depend on satisfactory completion of the evaluation period.

"Put Yourself in the Driver's Seat"

The last Friday of every month frustrated shuttlephiles can fantasize to their hearts' content. It's Rockwell open house night at their Downey, California plant, and visitors -- everyone is welcome-can clamber into a full-scale shuttle mockup. Lectures and displays on the shuttle and other Rockwell space projects are also available. Admission is free; all you need to bring is your imagination.

• • •

For more details, call Pat Knapp, 213/922-2846 or write to her at Space Division, Rockwell International, 12214 Lakewood Blvd., Downey, CA 90241.

"Put up the deflection shield, Chewie, they're coming in fast" --*L-5 editor Carolyn Henson encounters unfriendly fire.* **(Photo courtesy Rockwell International)**

NASA Virtues Under Carter: "Patience, Perseverance and Intelligent Procrastination"

How is SPS research faring in the federal government? A "program definition plan" being prepared jointly by NASA and the Department of Energy calls for only $19.5 million over the next four years to study the concept on paper. (Compare with $400 million for fusion research next year.)

The program definition plan will be completed and made public in December or January, but as it now stands less than $5 million a year will be split "roughly 50-50" between the two agencies, according to Duff Ginter, head of NASA's energy program. Ginter's last known title (pre-reorganization) was Assistant Administrator for the Office of Energy Programs.

The Office of Management and Budget's first swipe at the plan pared funds for studying microwave transmission from space. The environmental impact of microwave transmission is still in the study plan, but technology R&D is out.

The four-year plan focuses on four basic areas:

--Technical system definition, with parallel studies conducted by Marshall and Johnson.

--Environmental impact.

--Broad impact and benefits.

--Comparative evaluation of SPS and other energy alternatives.

Although Ginter said he thinks $19.5 million is sufficient to carry out four years of careful feasibility studies, he agreed that a bigger research budget could be easily justified.

"There's always room for more money. But NASA can't rush in and pour all kinds of money into a concept and find out a few years down the line that it just doesn't work. We have to operate within the realm of the possible."

Ginter, who referred to himself as "an old federal bureaucrat," said there are three great virtues that NASA bureaucrats live by: Patience, Perseverance and Intelligent Procrastination.

When asked about a private capital approach to researching and development solar power satellites, Ginter said, "That's the only way it's going to take off."

Shuttle Orbiter 101 as seen in its fourth free flight, tail cone removed. October 12. 1977.

Report of the Summer Workshop on Near-Earth Resources

By J.R. Arnold, Chairman

Our subject, near-earth resources, is something new. The first stage of activity in space could properly be called the Age of Discovery. Although some direct human benefits developed early, especially in the areas of tele-communications and weather observation, the main thrust of our efforts has been in the exploration of the unknown.

It is now possible that a discovery phase will be succeeded by a phase of utilization for human benefit. One example is a response to the energy crisis. Prof. G.K. O'Neill and his colleagues have been developing such a response in detail: the fabrication of satellite solar power stations (SSPS) out of lunar or asteroidal materials. Our group has used this proposal as a "point example" of the sort of enterprise which might call for the use of near-earth resources on a large scale. There are other ideas, less well developed, or yet unthought of, which may call for the large scale use of near-earth resources. We have tried to be general enough to include such possibilities. At the same time we have referred our ideas to the SSPS proposals, where concreteness seems desirable.

Why not supply our resource needs in space from earth? This has been the path so far. But we, and those resources, are at the bottom of a deep gravitational potential well. The energy requirement for transport into space is measured, qualitatively, by the square of the escape velocity $(\Delta v_e)^2$ where ΔV_e for the earth is 11 km/sec. By comparison, for the moon ΔV_e is 2.4 km/sec, so that the energy requirement to go from the lunar surface to free space is only a few percent of that for the earth. As in most technical enterprises, the reality is more complex than this simple comparison shows. We still need very large multi-stage rockets to remove matter from the earth's g-field, and these must accelerate their own much larger weight to high speed along with the payload. On the moon it appears that much simpler means, not using chemical rockets, may serve.

The near-earth asteroids are a much less familiar but equally promising possibility. Our best present estimates are that at least hundreds of objects larger than 1 km must pass through or near the orbit of the earth. Of these only about forty have so far been found. Smaller, but still massive, objects must be much more numerous. These near-earth asteroids probably hold a wider variety of useful materials than the surface layers of the moon. Their ΔV_e's are very small, but another significant ΔV is required to reach them from the earth and to return material, because of the differences in orbit.

When will we be using these resources? We are not ready to attempt a definite answer to this question, which depends on many things we do not understand. However, we have taken it as a working assumption for purposes of this study, that a significant level of production of transferrable (useful) material can occur on a time scale of 20-30 years -- say by the year 2000. Some of us believe this is probable. All of us believe in the desirability of having this option, either because of our energy needs, or for reasons not now foreseeable.

What must we know first? This has been the main focus of our study. As our recommendations should make clear, we do not attempt to evaluate the worth of the SSPS concept to meet the country's energy needs, or of other specific ideas. We do know one thing: if a program for use of near-earth resources were needed tomorrow, we do not know enough.

How long will it take to get the facts? The detailed answers to this and the previous question are given in the bulk of our report. We have tried to lay out a program, for a period of 5-15 years, that will reach the desired point. This we take to be a state in which a senior government official, faced with a major proposal involving near-earth resources, will have the minimum technical facts needed for an intelligent choice.

The interaction of resource-oriented research and "pure" research in this field deserves special emphasis. Most of the ground-based studies we recommend, and the first generation of missions proposed, have a high yield of basic scientific knowledge, irrespective of any future applications. The resource concept might suggest some change in the order of priority in a program of scientific studies of the solar system. Its main effect, we believe, will be to strengthen the case for that program, by bringing in a new reason for doing it.

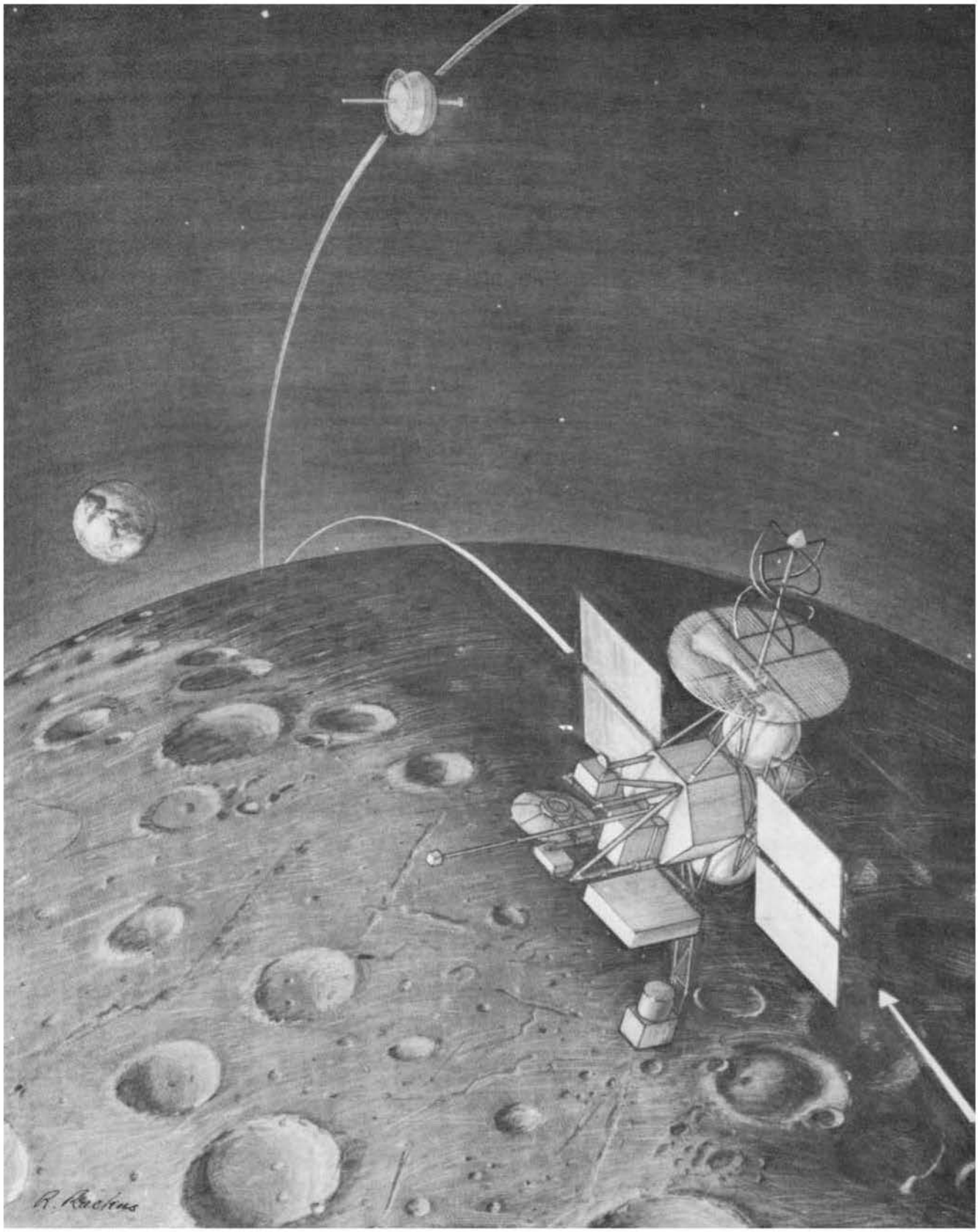
We have not attempted an engineering, economic or social analysis. We are not competent to do so. We try to say what is necessary to learn about these resources, (1) where they are, (2) what they are, and (3) as far as we can, how they might be extracted and processed.

Previous lunar programs have provided extensive photographic coverage, detailed sample studies at 9 frontside sites, local and regional geophysical information and limited orbital maps of chemical composition. Telescopic observations continue to contribute. As a result, we already know that lunar materials could be used for purposes such as thermal and radiation shielding.

Most of our data have been obtained only from equatorial regions. Although a first order understanding of the moon has been developed, many major geologic units and most apparently anomalous areas have not been sampled or chemically mapped from orbit.

The Lunar Polar Orbiter (LPO) will carry a complement of scientific instruments that will improve our understanding of the Moon's evolution and the diversity of major rock types over nearly the entire lunar surface. These are necessary first steps in exploration for developable lunar resources. Subsequent resource exploration strategy will be based on what LPO finds. We have reviewed the LPO and its individual experiments for their applicability to resource problems. We believe that the proposed payload is excellent for the exploration stage of resource evaluation, though some changes of emphasis may be desirable to optimize its usefulness.

A research and development program should be initiated to address key problems related to lunar resource definition and use. The data from this program, if available in the mid 1980's when LPO data become available and resource needs are better established, would allow prompt definition of the next exploration step.



The Lunar Polar Orbiter is shown here in lower orbit; the relay satellite, in higher orbit, transmits data from the LPO when Earth is eclipsed by the Moon.

We therefore recommend that:

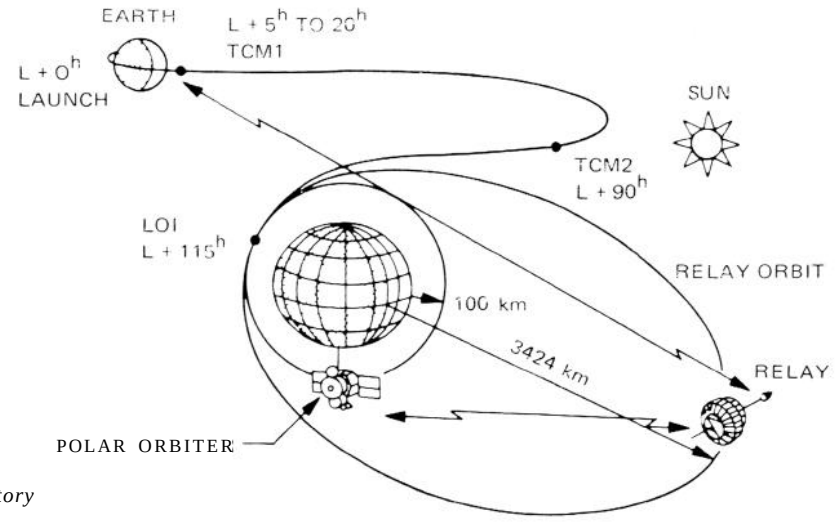
1. LPO should be flown as soon as possible with its present instrument complement, because further lunar resource exploration depends on the diversity revealed by LPO.
2. The resource survey aspects of LPO should receive continued study to maximize its usefulness as a survey mission. Relatively simple modifications such as definitions of extended mission capabilities may be important.
3. A research and technology effort should be initiated to provide a basis for lunar resource exploration beyond LPO. Early starts of importance include (a) studies of lunar samples and data aimed at extending our understanding of special lunar environments and rare materials; (b) studies of beneficiation and refinement processes for known varieties of lunar materials; and (c) conceptual studies of lunar resource prospecting techniques and missions.
4. OAST and OSF initiatives in defining non-terrestrial material requirements should be supported.

We know very much less about the earth-approaching asteroids than we know about the moon. The moon has been studied with telescopes for centuries. It has been the object of numerous orbiting and surface missions. Samples have been returned. In contrast, the first earth-crossing object was discovered in 1932, was promptly lost, and not seen again until 1973. Only in the last few years have these bodies been studied systematically, and only a very few have been investigated using the state-of-the-art remote sensing techniques of planetary astronomy

Therefore we have much to do before we will be in a position to evaluate the importance of these bodies in a program of space utilization. The following recommendations represent our view concerning the scale of effort required if there is to be any chance of making such an evaluation within the next 10-15 years. Because there is so much new knowledge needed, we recognize that this level of effort will require a significant shift of priorities in the current program of planetary exploration. We believe the recommended investigations have great scientific merit, quite apart from their contribution to a program of space utilization. However, the recommended program of spacecraft missions, including rendezvous, landing and sample return could easily unbalance a scientific program of planetary investigation. Therefore they are recommended under the condition, that after appropriate consideration of the engineering, economic and social issues involved, NASA will decide to embark on a program of near-earth resource evaluation. The justification of this program of missions would extend beyond their purely scientific priority.

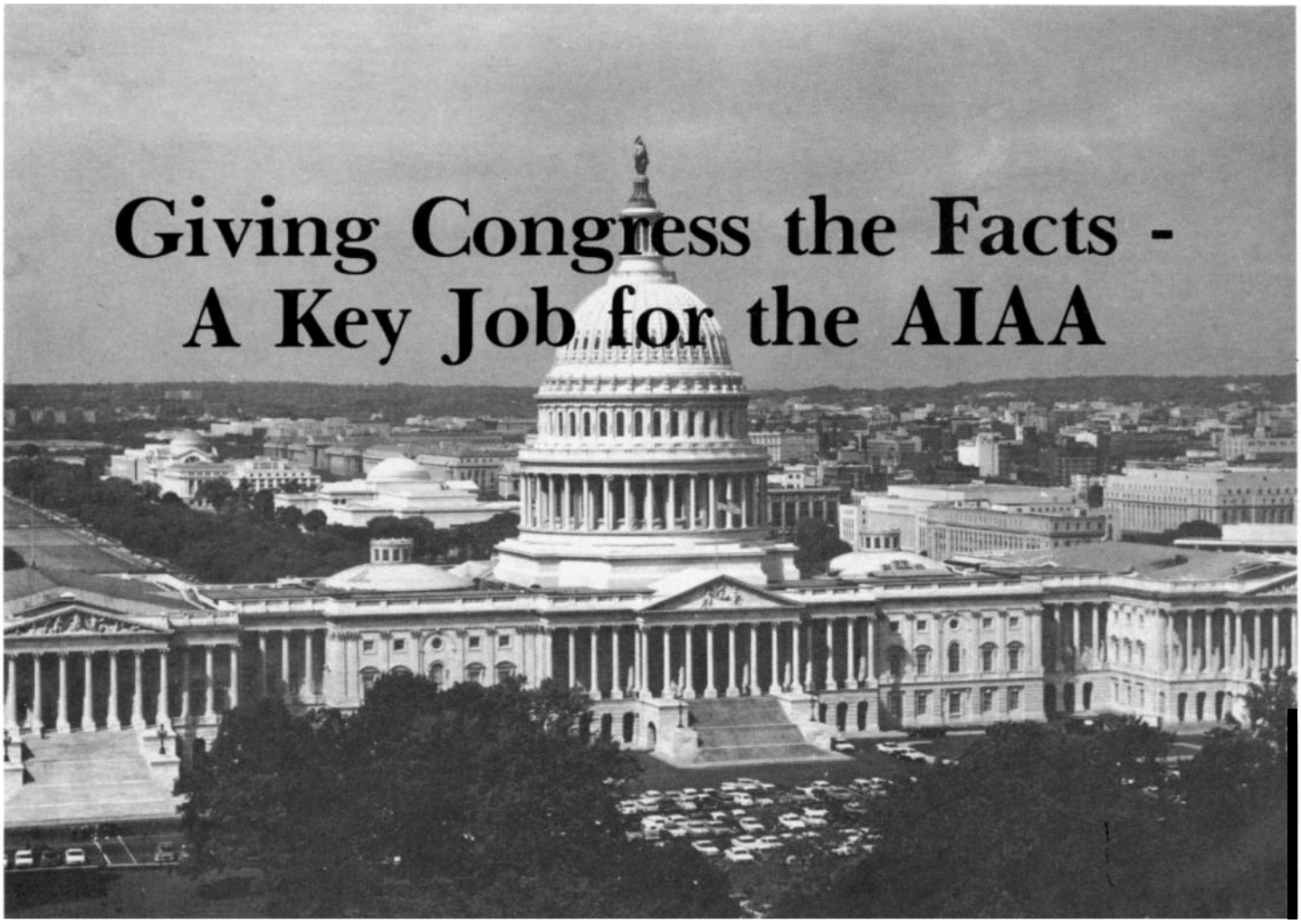
In the area of asteroidal studies, we recommend the following NASA actions:

1. Asteroid search.
   a. Take immediate steps that will increase opportunities to search for near-earth asteroids with large-field telescopes having apertures of 60 cm or larger.
   b. Support construction of a new 100 to 120 cm Schmidt camera which would be dedicated to the search for near-earth asteroids.
   c. Increase support of effort associated with the search for near-earth asteroids from the present level of two full-time persons to at least four full-time persons and to at least six persons when a large dedicated Schmidt camera becomes available.
2. Physical and chemical studies of asteroids.
   a. Expand the ground-based asteroid observing program by developing new instruments useful for multi-wavelength observations of very faint objects.
   b. Make available more large aperture telescope time to permit the characterization of newly-discovered earth-approaching and main belt asteroids in terms of their physical, chemical and mineralogical properties.
3. Studies of meteoritic materials.
   a. Based on current knowledge, meteorites represent our best estimate of the type of material to be found on asteroidal surfaces. Therefore, an evaluation should be made of the extraction techniques needed to produce useful materials from meteoritic matter.
   b. The mechanical properties and chemical nature of meteorites should be further studied in order to evaluate material processing techniques.
4. Advanced studies.
   The current program of advanced studies for small bodies being conducted by OAST and NASA should be expanded to embrace important issues relevant to near-earth asteroids as retrieval resources.
5. Flight missions.
   A program of rendezvous and sample return to low delta V asteroidal targets must be defined. The purpose of these missions will be to characterize the physical and chemical properties of these bodies in order to permit evaluation of their potential as natural resources. It is proposed that this program be a FY '80 new start leading to missions in the mid 1980's. These missions add a new dimension in planning for NASA and should have a broader base of support than the planetary exploration program within the Office of Space Science.



Lunar polar orbiter trajectory

Giving Congress the Facts - A Key Job for the AIAA



The American Institute of *Aeronautics and Astronautics (AIAA), while not a "lobbying" group, nevertheless makes a big impact on U.S. legislators. AIAA's Jerry Grey tells us how.*

"Keep slugging and pushing. I think that AIAA deserves a lot of credit for the push they have given in the past, when they have appeared before the committee and the sub-committee, and I think it is the type of push that we really need because many of us sit here day upon day upon day, and we ask NASA and ERDA, 'What are you doing to try to tell the people of the country what the space program is doing for their tax dollar -- giving them back?' and even though we talk about it all the time, I think we are in agreement that we really have not sold the American public on many of the ideas and many of the benefits which can be derived from the space program."

That was Congressman Larry Winn, Republican from Kansas, following testimony by AIAA's Jim Hartford and Gerry Grey to the Subcommittee on Space Science and Applications of the House Science and Technology Committee on February 16, 1977.[1]

In May 1977 the AIAA completed its 31st trip to Capitol Hill in the five years since it began testifying before Congressional committees.[2]

In February, AIAA's general manager, James J. Harford, and its administrator for public policy, Jerry Grey, testified before the House Subcommittee on Space Science and Applications. As in past years, the appearance went well; AIAA is now known to both the Subcommittee members and staff. Harford told the Subcommittee that, with the advent of the Space Shuttle, it is "an appropriate time to assess the prospects for utilization of our coming ability to observe, move, and work in space to the maximum benefit of our nation and of the world."

In support of NASA's FY78 budget request, Harford urged that "basic research activities must continue to be pursued at the highest level of effort that can be justified, since they represent one element of the fundamental resource in which all mankind's future activities will be based. The AIAA encourages the strongest possible across-the-board activities" -- including the much delayed space telescope. Failing to fund the space telescope, said Harford, would be like "going to the edge of the Grand Canyon and not looking down."

Giving a preview of the Institute's latest major educational effort, "Space: a Resource for Earth," Harford asked the Subcommittee's support in four areas of space applications:

--Public-service communications.

--Earth-resource observations.

--Manufacturing in space.

--Space-based solar powerplants for Earth.

Congressman Larry Winn (R-Kan.) noted that the AIAA "almost speaks the minds of many of the committee members." But the Congressman went on to say "We cannot fund everything according to your or our enthusiasm." The space telescope, emphasized Winn, is a "question of funding, not technology."

A month later, Harford and Grey returned to testify before the Senate Subcommittee on Science, Technology and Space. This subcommittee of the Committee on Commerce, Science and Transportation assumed the responsibility of the old Senate Aeronautical and Space Sciences Committee after the Senate reorganized its committee structure earlier this year.

Senator Adlai Stevenson, chairman of the subcommittee, opened the hearings by stating: "The agency (NASA) and this subcommittee should be prepared to cast off any shackles from the past -- inertia and habit -- and examine new ideas with an open mind. I have in mind such possibilities as a greater contribution by agencies of industry and government for the immense benefits bestowed upon them by NASA and the taxpayer."

Harford told the subcommittee that the AIAA will study the potential economics of new communication concepts, including electronic mail and tele-conferencing via satellite. The AIAA, in fact, has suggested to President Carter that tele-conferencing offers him an ideal and practical method for implementing his "President-to-People" dialogues. Harford also urged setting up an operational Landsat Earth-resources program to follow the present technology demonstration. "A mechanism needs to be established to exploit the invaluable Landsat technology," said Harford.

Senator Harrison Schmitt of New Mexico (ex-astronaut and an AIAA member) commended Harford and Grey "on your efforts to get members of your society involved with specific members of Congress. I think an educational effort like that is very important and I notice that some other associations are trying to do it also."

In April, AIAA returned twice more to Capitol Hill, making appearances before the House and Senate Appropriations Subcommittees with responsibility for the NASA budget. The limited time available to a witness at committee hearings always presents a problem, especially before the appropriations subcommittees.

Grey's appearance before the House Subcommittee on HUD and Independent Agencies of the House Appropriations Committee resulted in an unexpected give and take between Grey and the Subcommittee's chairman, Edward P. Boland (D-Mass.). Grey's testimony followed that of Providence, R. I., Mayor Vincent Cianci on the work of the New England Innovation Group funded under a National Science Foundation (NSF) grant. (The NSF project aims at providing some science and technology input to state and local governments). Grey told Boland that aerospace "can provide the taxes to pay for the Providence sewer systems needed by the Mayor," and he decried the "level NASA budget," which tends to preclude such society -- conscious innovation.

Boland answered that the decrease in the NASA budget was "to be expected" following the peak Apollo funding. Grey pointed out that R&D in general has a large multiplier effect on the economy, yet the Federal Government's support of R&D has not been increasing. Boland countered that "the real fall-out [in R&D support] has been in the private sector."

Grey went on to urge greater support for both space sciences and space applications. For among other reasons, said Grey, not too long after the Shuttle becomes operational, "five orbiters probably will not be enough" to satisfy well-defined needs in these areas.

Grey urged support for the space telescope, describing it as an "incredible resource." "But why not wait five years?" asked Boland; "there is a limit to our resources." Considering the estimated cost of the space telescope, running as high as $700 million, Boland argued that this would mean "$8 million per astronomer for the next fifteen years."

Boland tried to pin Grey down to ranking the priorities for a space-based solar power station (SSPS), a space telescope, and a Jupiter probe. "Which has the biggest payoff?" Grey answered that it made a difference as to the time over which one wanted to measure the benefit. In the short-term, Grey said, perhaps the SSPS might have the biggest payoff. Over the long term, a space telescope might have a greater payoff. Boland smiled and told Grey, "Jerry, you are a very effective and persuasive advocate."

Next came Harford's appearance before the Senate Appropriations Subcommittee on HUD and Independent Agencies, chaired by William Proxmire (D-Wis.). Making the fifth appearance before Senator Proxmire, Harford was now a familiar face. "You have carried the banner for NASA very impressively for the last several years," said Proxmire. "We're glad to have you back to testify on the programs for NASA."

Harford's appearance before the subcommittee came the day after President Carter issued his energy message to the nation.

Submitting his prepared remarks for the record, Harford used his five minutes to discuss aerospace and energy. He told the budget-bearcat Senator that, while he was cheered by Carter's energy speech, he was depressed that "aerospace is not being responsive to the President's objectives as it ought to be." President Carter had urged that the nation develop new sources of energy needed for the next century. Harford noted the "growing opinion in the aerospace community that space-based solar power may be the answer." He decried the fact that the $5 million in the Energy Research and Development Administration (ERDA) budget for FY77 has not been spent.

"I want to congratulate you. I think you have made a most intelligent and timely presentation," said Proxmire. "There is no question that the energy crisis can be assisted by the right kind of research. Frankly, it hadn't occurred to many of us that the research being carried on now can be directed, I think, very wisely in the direction of providing economies that we won't achieve without very vigorous action. So I want to think you for a very fine presentation and for calling our attention to a most relevant point."

AIAA public testimony before congressional committees represents but one part of a broad public-policy effort. It includes a Washington office, support of the Congressional Fellow program, AIAA survey reports and assessments, reports of the technical committees, and even the Annual Meeting, which in recent years has been held in Washington. Developing a concrete evaluation of the influence of these efforts on the Washington scene remains elusive.

A senior staff member of the House Science and Technology Committee summed up the AIAA efforts this way, after complimenting the Institute for trying to get "one-on-one meetings with both [Committee] members and staff." He noted that the effort the AIAA undertook to literally pick up and deliver people from Capitol Hill to the Annual Meeting "over the long run gets people acquainted with the AIAA and had to be useful." The staffer described this year's testimony as "good quality." "Most significant," he thinks, have been the position papers, which he believes "did have some influence." These position papers included treatment of such fields as satellite communications. (A current AIAA position paper "in the mill" deals with space-based solar power stations). "While hard to measure the influence," he said, "it was positive." And he added, "having the liaison with the staff is particularly useful to us."

This staff member says that AIAA is perceived as a professional society and not as a lobbying group because it "maintains its relatively low key approach and does not necessarily sell a very one-sided point of view."

Beyond public testimony, the staffer sees some value in individual AIAA members contacting their respective congresspeople. So long as the effort is well done and related to the congressperson's particular district, the effort has merit.

According to another staffer, people in aerospace don't "understand political power and how it affects their interests." He believes, for example, that AIAA "underrates its impact." Noting that other interests express their views, aerospace has "to keep up the pressure just to hold its own." This Senate staffer pointed out that only fierce effort on the part of veterans and groups aiding the aged saved the two related Senate committees during the recent reorganization effort. On the other hand, aerospace-related groups made little or no attempt to retain the Aeronautical and Space Sciences Committee.

Thomas van der Voort, staff member

of Proxmire's subcommittee, acknowledged that by now the Senator does know who Harford is when he testifies; and, says van der Voort, Harford is "pretty good at making off-the-cuff comments and fitting his remarks to the very brief time. He does a good job." Van der Voort also confirmed that the AIAA is not perceived as a lobbying group. The Institute, for example, "does not stimulate mail to a particular member or have all its members contact their congressmen on behalf of one particular provision in a bill. This tends to give the Institute a more disinterested aura." That, he says, is a plus.

When van der Voort needs answers on the NASA budget he "usually goes to the agency. They are pretty responsive to the subcommittee that funds them." On the other hand, he believes that individual senators and congressmen might more readily use groups like the AIAA, since the NASA staff might not be quite as accessible to them.

Van der Voort himself finds AIAA valuable mainly as a source of general information and studies. In addition, he sees some value in AIAA reinforcing the NASA request.

Minority counsel to Senator Proxmire's subcommittee, Robert B. Clark, doubts that the AIAA is "going to change Senator Proxmire's mind" with its testimony. The main value, says Clark, is to "get the testimony in the record. During the committee debates, the record just might influence the swing votes."

Staff members, however suggest that as a technical critique AIAA's testimony proves much more effective. One staff member on the former Senate Aeronautical and Space Sciences Committee called AIAA's testimony "helpful." He saw the AIAA as without the "standard vested interest," a savvy source of aerospace opinion, and generally considered "straight shooters." The AIAA, he said, gives the Senate committee staff another angle on the problem. In addition, the close working relationship between AIAA Washington representative Johan Benson and Public Policy Administrator Jerry Grey and the staff provides a source of information and topics that might be of interest to the staff and ultimately the Senators. Such suggestions often put them on the track of topics that might not otherwise be considered. The staffer noted that the committee's staff was cautious on holding hearings on solar-powered space stations and were hesitant to make such a recommendation. But after talking to AIAA people, they "made us take a second look," and the hearings were subsequently held.

Gilbert Keyes, also a former staff member on the Senate authorization committee, called AIAA's efforts "quite valuable." Keyes noted that the symposium on fuel conservation held a few years ago was a "major benefit to our committee" and served as the impetus to later studies held by NASA. Keyes also noted that AIAA testimony some time ago on the future of aircraft was the "best in that hearing" and some of the ideas advanced were proposed for further activity by the committee.

Tony Taylor, staff member of the House Subcommittee on Aviation, Transportation and Weather, chaired by Dale Milford, says that the AIAA is perceived "not to have special interests and a broad outlook." This gives AIAA the "highest levels of credibility." The AIAA recently conducted a workshop in RT&D policy in the civil aviation field, he noted, at the request of the subcommittee.

Taylor said the subcommittee does not always have authoritative outside witnesses to balance NASA's statements. This is one area where AIAA can be helpful. And when AIAA is in agreement with NASA, he said, this is important also. Taylor believes AIAA's public testimony has the "potential of changing people's minds," but he considers as probably more important the AIAA reports and symposia given visibility through the public testimony.

AIAA's own analysis of the effectiveness of its Washington legislative activities runs this way: Harford admits it is difficult to "measure the value of the AIAA Capitol Hill activities, but if it does have an effect, it can be very appreciable."

Harford believes that the AIAA should testify in the public sessions and leave the Congressional arm-twisting to individual AIAA members. "We have encouraged our members to get to know their Congresspeople and the congressional staffs, and we have tried to illuminate the issues for them."

Seeing one's Congressperson is not that difficult, according to AIAA Congressional Fellow, Frank Hurley. "Almost anyone can get to see a Congressman if you're from his district and you have a particular axe to grind. It's expected."

Harford also notes the equal importance of going to the Office of Management and Budget (OMB). So far, AIAA has not done that or gone to the many other Executive offices, including those of the President's Science Advisor, the Secretary of Commerce, Secretary of the Treasury, and the Secretary of Defense.

The fruits of the AIAA legislative effort will come over the long run, says Benson. "We haven't really seen the full benefit of our inputs even though we may have sown lots of seeds." Over a period of time the AIAA has "gained a measure of respect," adds Grey. "At first, no one knew who we were."

As one Senate staffer put it, the aerospace industry often forgets that the interest behind the Apollo program was a political decision born partly out of the fear of the Russians -- not a technical decision. The technical community responded magnificently and enjoyed the benefits of that decision. Technical capability may be a necessary though not a sufficient condition for the next round of activities. Political realities suggest the necessity for continued involvement in the Washington scene.

1. Harford, J.J., "Pushing Washington," Editorial, *Astronautics & Aeronautics*, April 1977, pp. 18,19.
2. Hudock, Robert P., "AIAA On The Hill: Jimmy, Are You Listening?", *Astronautics & Aeronautics*, June 1977, pp. 6-11.
3. Hurdock, Robert P., "AIAA On The Hill: Presence or Power?", *Astronautics & Aeronautics*, April, 1977, pp. 18,19.

Department of Energy Formed

On August 4, President Carter signed the law authorizing creation of a new Department of Energy, bringing together three energy-related agencies and parts of several others. The department began official operations in October.

The President, during the bill-signing ceremony in the White House Rose Garden, also sent to the Senate his long-expected nomination of James R. Schlesinger to head the department. The Senate unanimously confirmed the nomination the same day.

The Energy Department is the first cabinet-level department created since the Transportation Department was born in 1966.

It was built around what was the Energy Research and Development Administration, the Federal Power Commission and FEA.

In addition, it will include portions of the Department of the Interior (the power marketing administrations, a large part of the Bureau of Mines and energy data functions), the Navy (oil and shale reserves management), the Department of Housing and Urban Development (the thermal efficiency standards program for new buildings), the Department of Commerce (the voluntary industrial conservation program) and the Interstate Commerce Commission (the pipeline valuation function, which is closely tied to pipeline ratemaking).

The President is required to make a comprehensive review of the Energy Department's performance and report on it to Congress by January 15, 1982.

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*Available January 1978

More on Proxmire

The November '77 L-5 News *reported the excitement (and upset) generated by Senator William Proxmire's (D-WI) letter to* 60 Minutes *attacking space colonies. Following is an excellent example of a response.*

Dear Senator Proxmire:

This letter is being written to you in response to your letter of October 10, 1977 on space colonization which was read on the October 16, 1977 "60 Minutes" program. Thank you for being kind enough to send me a copy of the letter.

Space colonization is only a part of the broad range of activities covered by the term "space industrialization". By space industrialization is meant the utilization of space and non-terrestrial bodies and materials for the benefit of mankind here on this planet. In order to most effectively obtain these benefits we require eventually the establishment of permanent habitations for people in space. The residents of these space habitats will be workers and their families. These habitats will be established in an orderly, evolutionary way, starting out small and the number and size of these habitats growing as the need develops. The initial establishments will not be idyllic. Life will be hard and possibly somewhat dangerous and regimented.

Four areas of tremendous worth for space industrialization are information, energy, manufacturing and material resources. Considerable benefit can be obtained in all of these areas even before the establishment of permanent space habitats.

The initial impetus for the involvement of the Energy Committee of the B'nai B'rith of the State of Maryland in space industrialization was the energy aspect. A major reason for the creation of the Energy Committee was to help undertake whatever is necessary for this nation to attain energy independence so that it can develop and implement foreign policy free of external pressures with regard to energy.

The satellite solar power station (SSPS) is possibly the most promising means for satisfying a large fraction or maybe even all of the energy demand of the United States of America by the end of this century. Studies have indicated that after the construction of the first few SSPS's from all terrestrial materials, the most cost-effective approach could very well be to build SSPS's from non-terrestrial materials in a space manufacturing facility (SMF).

The Energy Committee has recently formed a Space Industrialization Subcommittee to further explore and to develop the beneficial ramifications of space industrialization. For example, an influx of materials economically manufactured in space (because this cannot be accomplished on this planet) having unusual and desirable properties could lead to the employment of people in new industries without taking away anything from the old ones. In general, space industrialization should create the plenitude of meaningful jobs that are necessary to combat unemployment. The Bakke case is an example of what space industrialization would eliminate. Space industrialization would remove the tendency to take jobs from one group of people in order to give them to another group. To the Jewish people who have known the effects of quota systems this is very important. Space industrialization would make the pie of prosperity and employment bigger so that everyone could have a bigger slice.

In order to reap. the tremendous benefits of space industrialization as expeditiously as possible, will require a large capital investment in research, development and manufacturing in the near future. This also means jobs. There is no reason why all of this money should go to the traditional aerospace regions. In fact, most of the money could go the remainder of the nation.

The Energy Committee has met with a number of L5 Society members and has found them to be serious, intelligent and concerned with the future of the nation. There is also a significant body of people outside of the L5 Society very actively involved in the technical studies for space industrialization.

The Energy Committee of the B'nai B'rith of the State of Maryland would very much appreciate the opportunity of meeting with you at a time and place of our mutual convenience in order to discuss matters more fully and in a more quantitative manner.

Respectfully yours,
Bruce Friedman, Chairman
B'nai B'rith Energy Committee
of the State of Maryland

I'd like to point out some significant points in Bruce Friedman's; letter.

First, the letter starts by thanking Proxmire. This establishes a friendly tone.

Second, Mr. Friedman writes as the representative of a group. Such a letter will carry much more weight than one from an individual.

Third, he requests an opportunity for his committee to meet with the Senator to discuss matters in more detail.

Unfortunately, Friedman's committee doesn't hale from Wisconsin. A letter of this quality from Proxmire's home state would have a far greater impact. -- Bruce, have you considered emigrating?

--Carolyn Henson

Full Text of Proxmire's Letter to "60 Minutes"

L-5 by 1995 calls for "only" a few billion dollars of the taxpayers' money to establish an idyllic colony out in space with all the amenities of life for a few thousand adventurous earthlings.

This proposal gives the best argument yet for chopping NASA's funding to the bone. The cost would have to be millions of dollars annually for each earthling maintained in space.

As Chairman of the Senate Subcommittee responsible for NASA's appropriations, I say not a penny for this nutty fantasy.

Sen. William Proxmire

So You Want to Lobby?

by Kenneth McCormick

One of the best, and certainly the least expensive, generally available sources of information for the lobbyist is *Braddock's Federal-State-Local Government Directory*. It is being made available at a discount to L5 Society members by the president of Braddock Publications, Jason L. Stern, who is, himself, a proponent of the use of space and a trustee of the National Space Institute.

The director lists the names, addresses, and telephone numbers of 10,000 elected and appointed officials in the White House, Congress, the federal judiciary, executive departments, and regulatory and independent agencies and commissions. It lists national and local political leaders, sources of statistical information, selected communications, media offices, and chief state and local government officials. It lists the chief staff members of senators and representatives, the committees of Congress (with members) and state legislatures (with chairperson), and shows you how to obtain federal, state, and local government publications.

The fact that the directory is used by the White House, the diplomatic corps, and most of Congress attests to its value. I would like to suggest a few ways in which it might prove useful to L5 Society members. First, for the person who is, like many of us, largely ignorant of the structure of government, it provides an organizational illustration. It is hard to send a letter or a request for information to the proper area of government when you don't even know what agencies exist, much less what their addresses are.

Second, the names and telephone numbers can get you fast service. If you want information of some kind from an agency, you will do best to call some particular person in that agency. If you don't ask for a specific person, the person who answers the phone may assume that you aren't very important, and may give you minimal help or information in the hope that you will simply give up. Also, when you ask to speak to a high-level bureaucrat, you may not reach that person, but the middle-level bureaucrat whom your call is handed over to will be more cooperative than otherwise because he or she will not know whether or not you actually know the boss, or whether or not you might some day reach the boss and mention that you had received very little help when you spoke to so-and-so.

Letters to an agency should likewise be addressed to a specific person or title. A letter which is not addressed to anyone in particular stands a good chance of being ignored. If you seem to know what you are doing, most agencies will be very helpful in sending you reports on specific subjects which you are researching.

If you don't know which organization or official can best handle your problem or request, or if you want the address of some local federal official not listed in Braddock's, make a toll-free call to your local Federal Information Center, the number of which is listed in the directory.

Braddock's lists the telephone numbers of the local offices of senators and congressional representatives. You can call your local office and ask them to relay your message to their Washington office. In some cases, the local office can patch you into a line to the Washington office.

To find out where any given piece of legislation stands in Congress, call the Bill Status Office. If you don't have the bill number, you can often persuade them to find it for you.

To obtain the directory plus an update to make the listings current, send a check or money order for $5.25 to Braddock Publications, Inc., 1028 Connecticut Ave., N.W., Washington, D.C. 20036. $5.25 is a discount price, and you must state in your order that you are an L5 Society member. The regular price of the directory plus update plus postage is $6.60.

Inside the L-5 Society

I am writing just to let you know how our chapter has been coming along. On November 2nd, George Koopman came to John Muir, and addressed over 750 students on space colonization and industrialization. The assembly was fantastic, and Mr. Koopman did a great job. For once, the students were quiet, and their attention was held. About two weeks earlier, Mr. Tom McDonnough from the Jet Propulsion Laboratory gave a talk to our membership (about 40) during a lunch period, which also turned out well. As far as the treasury report is concerned, we have exactly $21.00 in our student bank account. Pitiful, true. But . . . just wait till after our school homecoming fair! It is at this time that school clubs erect booths and sell things like pickles, popcorn, cookies, and confetti eggs. The L-5 Society will be selling "Spacedust" candy, and Star-Wars posters.

As a special added attraction, we are renting the "Jupiter Jump Spacewalk" from Funservices. The Jupiter Jump is a 22 foot-wide balloon of sorts that has air-inflated cushions on the floor and springy walls. Kids take off their shoes, go in, and jump around off the floor and walls, simulating a kind of less than normal earth gravity. It'll cost $75.00, but it will be the first "ride" at a homecoming fair! It will be a beautiful publicity stunt, and we'll charge admission to pay our renting debt. If worst comes to worst, and we need financial assistance, our school ASB government will bail us out. But this is unlikely.

I, however, have faith in our wares, and the profit should bolster our account considerably.

In the future, we're planning a guided tour of JPL for our members, but if we're not careful, we'll be running out of things to do. If we have our way, though, we'll still be keeping busy the rest of this scholastic year.

Darren Nigsarian
L-5 Vice-President
In charge, SPACEHAVEN
John Muir High School
Pasadena, CA

An English speaking L-5 chapter is being formed in Canada by Erik T. Paterson. People interested in assisting him are invited to contact him at P.O. Box 2010, Creston, B.C., V0B lG0, Canada.

Philadelphia L5ers are on the move again. Our new and perhaps permanent location is the Center City Y.M.C.A., 1421 Arch St. right near City Hall. We have negotiated a year's lease. Our meetings are held 10a.m. Saturday mornings, in the Marie Como room.

For further information contact:
Richard W. Bowers
3059 Cedar St.
Phila. Pa. 19134
Phone 739-7780

The above bumper sticker is available from L-5 Ole Miss, Box 5563, University, MS 38677. Cost is 50¢ each, three for $1.25. For larger orders, include 25¢ for mailing.

Letters

I thought the articles by Kenneth McCormack, "NASA: Priming the Pump", and Marc Boone, "So You Want to Lobby", were excellent. It seems to me that this is the kind of information needed if we are to have any impact on our government's space efforts. I would like to see more of this kind of writing in future L-5 News reports, especially identification of specific legislation. I would also like to see a timetable as to when to write my congressperson so that my letters won't arrive too late.

Riley Bishop
Kansas City, MO

Although I am very complimented by my byline appearing on the article "so you want to lobby" in the October L-5 News, I cannot take full credit for it. I drew most of the facts, and much of the material verbatim from an article "The Art of Lobbying" written by Ann Roosevelt several months ago for Not Man Apart, *the official organ of Friends of The Earth. Ms. Roosevelt has contributed a number of very interesting pieces to* Not Man Apart, *and I recommend that L-5 people who enjoyed the lobbying article search out this ecology newspaper and look especially for Ms. Roosevelt's works. F.O.E. and L-5 have a great deal to learn from, and to contribute to each other.*

--Marc Boone

I read with interest your interview with Rusty Schweickart in the October issue of L-5 News. Despite the bureaucratese, he made some useful points about strategy for L-5 supporters. First, fanaticism must be avoided at all costs. Secondly, the word "frontier" is probably best dropped from our vocabularies due to the unpleasant connotations the word derives from the history of 19th century America. And finally, support for space industrialization must continue to be drawn from many fronts at once. "Lots of people can do lots of things." (italics mine)

However, on one point Mr. Schweickart is dead wrong. On page 3 of the October issue he states, "If you want real international cooperation, you actually start to do things and open it up purposely to international efforts. If you go the other way--that is to say, we only start things when we have agreed to international agreements-then nothing happens." I sympathize with Mr. Schweickart's attitude toward modern diplomacy and its practitioners and it's quite true space exploration is one of the few areas of human endeavor where there is significant international cooperation thanks largely to the kind of direct contact between national scientific communities authorized by Section 205 of the National Aeronautics and Space Act of 1958.

But space industrialization is unlike any previous form of space activity in one important respect. It *is* the first large scale attempt at space exploitation as opposed to space exploration. Article II of the Outer Space Treaty of 1967 to which the United States and most of the other nations of the world are signatories is clear on this point. It reads, "Outer space, including the moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use or occupation or by any other means." So, as long as the concept of space industrialization includes the use of the resources of the moon and the asteroids, it cannot be made a reality without, if not significant international participation at the outset, at least some kind of sanction from the international community. That is to say, there is just no way the United States can unilaterally dig a hole on the moon and use the resources obtained to achieve energy independence without provoking howls of protest from the other signers of the Outer Space Treaty of 1967 and risking retaliation from some of them, most notably the Soviet Union. Of course, just digging the hole and using its contents would not be making a claim to the whole moon nor would we prevent any other nation or group of nations from doing the same thing. But the digging of the hole combined with our earlier planting of the flag on the moon are the traditional bases for a claim of sovereignty under international law and no matter what our government might say about peaceful intentions, these two actions would give us de facto sovereignty over the moon.

Now if the United States is going to take Article II of the Outer Space Treaty of 1967 so lightly, what is to prevent other nations from finding a way around Article IV? Article IV begins, "States Parties to the Treaty undertake not to place in orbit around the earth any objects carrying nuclear weapons or any other kinds of weapons of mass destruction, install such weapons *on* celestial bodies, or station weapons in outer space in any other manner."

The foregoing points out the utmost importance of making every effort to achieve space industrialization on an international basis. L-5 supporters should train themselves to think of the first habitat in international terms, e.g., as a group of workers representing many nations working together to bring solar energy to the world.

Tim Prouis
Madison, WI

May I disagree with the proposal of naming the Space Shuttle 102, "Mayflower"?

Anything connected with space should avoid a distinct reminder of one specific nation.

A name like that of the "Enterprise" seems more appropriate since that starships represented a Federation of many different species.

We should be able to find names which touch the future and not the past.

Sincerely,
Mrs. Eric Muhlmann
Kailva -- Kona, HI

I am writing in reply to the letter of Kenneth Brakke in July 1977 L-5 News.

Kenneth Brakke asks if the high angular velocity of a space habitat may cause violent weather. The problem is that unstable air rising from the surface of the habitat will have a higher angular velocity than the air near the axis, causing high winds.

I have studied the problem of weather in space habitats for the last two years, and would like to comment on Mr. Brakke's observation. The prospect of violent weather such as the 'hurricanes' familiar to readers of Arthur C. Clarke's *Rendezvous With Rama* is more than a little disturbing. However, I feel that the outlook is not necessarily that grim.

First, the stability of the air is not simply a function of the surface temperature, but depends on the vertical distribution of temperature (and humidity). In a space colony we can control the temperature distribution of the air. In fact it will be desirable to cycle the air through temperature and humidity controls as well as filters to remove accumulated dust. In fact, with the Bernal sphere and torus designs, assuming that they are well insulated from direct sunlight, it will be absolutely essential to have some heating/air conditioning devices. Since heavy industry is not planned for the habitat's interior, instability would be unlikely, and could be avoided by design. Small localized instability would result in a plume, whose rise would be determined by the temperature humidity profile of the environment. Such a plume, however, would be subject to compensating motions and friction, limiting the velocity of the resulting wind.

I have left the O'Neill cylinder for last because it is a different case. In an O'Neill

cylinder, depending upon the choice of materials, a circulation can be built up due to differential heating of the land and window areas, with a total of six cells. In an O'Neill cylinder it seems likely that there will be some wind above the surface along the direction of the curved surface. The land-window temperature difference will determine the depth of the circulation, which will in turn determine the upper wind velocity. By choosing a window material with suitable absorption characteristics and varying the angle of the mirrors one could minimize this effect.

Numerical models can and will be developed for space habitats, as soon as the boundary conditions are determined by design studies.

Warren Ziegler
Research Assistant
Department of Meteorology
Pennsylvania State University

A question: Has anyone in L-5, or Dr. O'Neill, for that matter, considered the thought that a space colony of the kind we are advocating might well be properly considered a living organism? It has occurred to me that a colony has many features in common with a single-celled microbe, with the people and machines within it playing roles perhaps analogous to the roles of the organelles within the microbe's cell. And it displays many of the properties usually assigned to living organisms:

1. It metabolizes material and energy, changing the composition and form of the raw material it takes in to create the industrial products it produces.

2. It displays irritability. the ability to respond to stimuli. For example, if a meteor punctures a window, or a leak springs anywhere, there will be a swift response on the part of the inhabitants and their machinery to stop the escape of air. And of course, the colony displays phototrophy to track its solar power source.

3. It can reproduce, making more colonies. Moreover, it is even capable of mutation during the reproduction process, building a colony of different size or of different design than itself.

The colonies O'Neill has designed are more nearly analogous to one-celled plants than animals, since the outer covering is a rigid "cell wall" rather than a flexible "cell membrane", and since the energy source is "photosynthetic". And since present designs don't include anything corresponding to a nucleus, they are more nearly analogous to prokaryotes than eukaryotes.

Second question: Might these "organisms" undergo an evolutionary process, as our microbes did, leading to "multicellular" organisms with specialized cell types and "tissues"? And might some of these multicellular types evolve intelligence, an intelligence as little aware of the lives of the humans within their cells as we are, most of the time of the lives of individual cells within our own bodies -- and vice versa?

An awe-inspiring thought, no?

Larry Friesan
Webster. TX

I recently started substitute teaching at a local high school, the work isn't steady but while there I noticed our school library did not display the L-5 News. I am now going to remedy that by donating them a subscription order form and check enclosed. Many small local and school libraries welcome subscription donations, if even 500 of our members donated subscriptions in their home towns how many more people would be educated about our goals? A government or science class may use it as reference material; let's get cracking on this market of minds.

Michael C. Strong
Swartz Creek, MI

I think that one of the major obstacles to popular enthusiasm for the colonization of space is the belief that space is reserved for a few super-qualified astronauts. Therefore I would like to see ordinary people going in shuttle flights as soon as possible. A lot of flights will be quick up-and-down satellite launchings, and a passenger or two could go along. Perhaps lucky people could be chosen through a lottery.

In regard to getting all this started, I recall reading that NASA was feeling uncomfortable about handling the commercial shuttle operations. A new agency could be set up to do that, and its name could be chosen in a nationwide contest. First prize would be a free shuttle flight.

Kenneth A. Brakke
West Lafayette, IN.

Somebody suggested raising the fish *Tilapia* in the colony. *Tilapia* are quite large, require a lot of water, and taste like algae. They raised them on Trinidad for a while, until one good hurricane distributed them rather evenly over the island. I prefer the suggestion about raising quail, or Carolyn Henson's about rabbits. Every ship I have ever sailed on had an irritating shortage of birds and bunnies.

David Murphy
Carbondale Research Center
Carbondale. IL.

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

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

Please enroll me as a member of L-5 Society ($20 per year regular, $10 per year for students). A check or money order is enclosed. (Membership includes *L-5 News,* $3 to members; the balance -- $17 or $7 -- is a tax-deductible donation.)

__ Please enter the above as a nonmember *L-5 News* subscriber ($20 per year). A check or purchase order is enclosed.

__ Enclosed find a donation of $_____. (Donations to L-5 Society are tax-deductible.)

BIBLIOGRAPHY UPDATE

by Conrad Schneiker

"Flying The Space Shuttle", Al Ragsdale, Analog, December 1977

A description of the factors involved in "flying" the space shuttle. Many helpful diagrams accompany the text. Some topics covered are the space shuttle controls & instrumentation, counterintuitive aerodynamics. On this last topic, the following point is made: "A comparable situation is backing a car at high speed -- make one wrong move and you've had it." Given the shuttle's complexity and very small error margins, one is glad 5 computers are on board to help out. In fact, they can "fly" the shuttle from orbit to the ground, doing everything but lowering the landing gear and applying the brakes upon landing.

"Solar Satellites -- Space Key To Our Power Future", Gordon R. Woodcock, **Astronautics & Aeronautics,** July/August 1977

This paper is partly based on early results from Boeing's "Solar Power Satellite Definition Study" for NASA. It presents compelling arguments for Solar Power Satellites (SPS). It takes the major issues ("it won't work, too costly, it will damage the environment, it's a year 2050 system . . . ") and answers them point by well-made point. In the process, a great number of interesting details about the design, launch, construction, operation and maintenance of proposed SPS systems are given. Note that this is the Earth-launched variety of SPS -- unfortunately this otherwise excellent article fails to consider the O'Neill/Space Manufacturing approach. An aside: A very striking painting illustrating a SPS system described by the article appears on the cover of this issue.

"The Next 25 Years: Industrialization Of Space", Jesco von Puttkamer, **Space World,** October 1977

This article discusses the integration of extrapolative ("push") and normative ("pull") modes of long range planning. This "realistic" mode is applied to space industrialization. Much information is presented: useful attributes of space, many "examples of opportunities" for space industrialization, new themes for manned space flight, a relevance tree for far-future space endeavors, etc. This article also appeared in the November, 1976 L-5 News.

"Space Stations For The International Future", J.F. Madewell and R.E. Sexton, **Space World,** September 1977

This lengthy article takes up the whole issue of Space World. It is profusely illustrated with paintings and diagrams. A variety of space station configurations are discussed with the primary orientation toward support of space industrialization and space solar power.

"Space, The Ultimate Suburb", Phil Tracy, **New West,** November 7, 1977

This article is the result of an interview with Peter Vajk and encounters with L-5 members at the recent space industrialization conference in San Francisco. Its an interesting collection of random bits of gossipy information about space colonization, the L-5 Society, and impressions of L-5 Society members, complete with scattered misinformation and errors to keep readers on their toes.

"Large-Scale Space Operations For Solar Power Satellites", Gordon R. Woodcock, AIAA/EEI/IEE Conference On New Options In Energy Technology, San Francisco, Calif., August 2, 1977

This is another paper partly based on Boeing's "Solar Power Satellite Systems Definition Study" for NASA. It summarizes the technical basis for concluding that "space operations on a scale far greater than any accomplished in the past" can "be achieved at acceptable cost by the end of the century" for "a practical power-from-space program."

"Orbital Antenna Farms", Burton I. Edelson & Walter L. Morgan, **Astronautics & Aeronautics,** September 1977

Discusses giant geostationary space station concepts for communication and remote sensing. Various comments written by 5 persons allowed to read the article prior to publication are included.

"Solar-Powered Laser Communication System For Space", James D. Barry, **Astronautics & Aeronautics,** September 1977

"Now well along in development, a single laser unit weighing less than 15 lb can allow the transfer of 1 billion bits per second of data, presaging extraordinary new worldwide communication systems in the 1980's." That's equivalent to sending an entire set of' the 1975 ENCYCLOPEDIA BRITANNICA in ONE second.

Note to readers: I am interested in learning about what types of books/ articles you're interested in, what are the key pieces of information you want to see in a review, etc. Of course, other comments are welcome as well --

Conrad Schneiker

New NASA Publications

NASA Films, July 1977 is available agencywide from the NASA public information office. The 32-page brochure lists films of general and special interest as well as many designed for classroom use. Filmstrips and audiotapes also are listed. The brochure explains how to go about purchasing or borrowing the 104 available NASA films. Address requests to Mail Code F, NASA headquarters.

Space Shuttle, NF-79 is a new eight-page NASA Facts publication for sale by the U.S. Government Printing Office at 60 cents per copy. The heavily illustrated publication explains the basic features and philosophy of the Space Shuttle.

Skylab Explores the Earth (NASA SP-380) -- As one in the series of formal NASA Special Publications resulting from the highly successful Skylab project, "Skylab Explores the Earth" is unique in that it shows through the eyes of the Skylab 4 cameras the massive climatic systems that govern the Earth from season to season. The cameras were trained-and scientific analyses completed-on such natural phenomena as mesoscale cloud features, desert and seas, floating ice (from the St. Lawrence River to the South Pacific), global tectonics, and vegetation patterns-to mention some of the observations. Clothbound. 536 pp. For sale by Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, for $17.50.

Pioneer Odyssey (NASA SP-349) -- This summary volumedescribes the flights and the scientific results of the Pioneer spacecraft. It includes four-color images of Jupiter obtained by Pioneers 10 and 11. Cloth-bound. 236 pp. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, for $9.85.