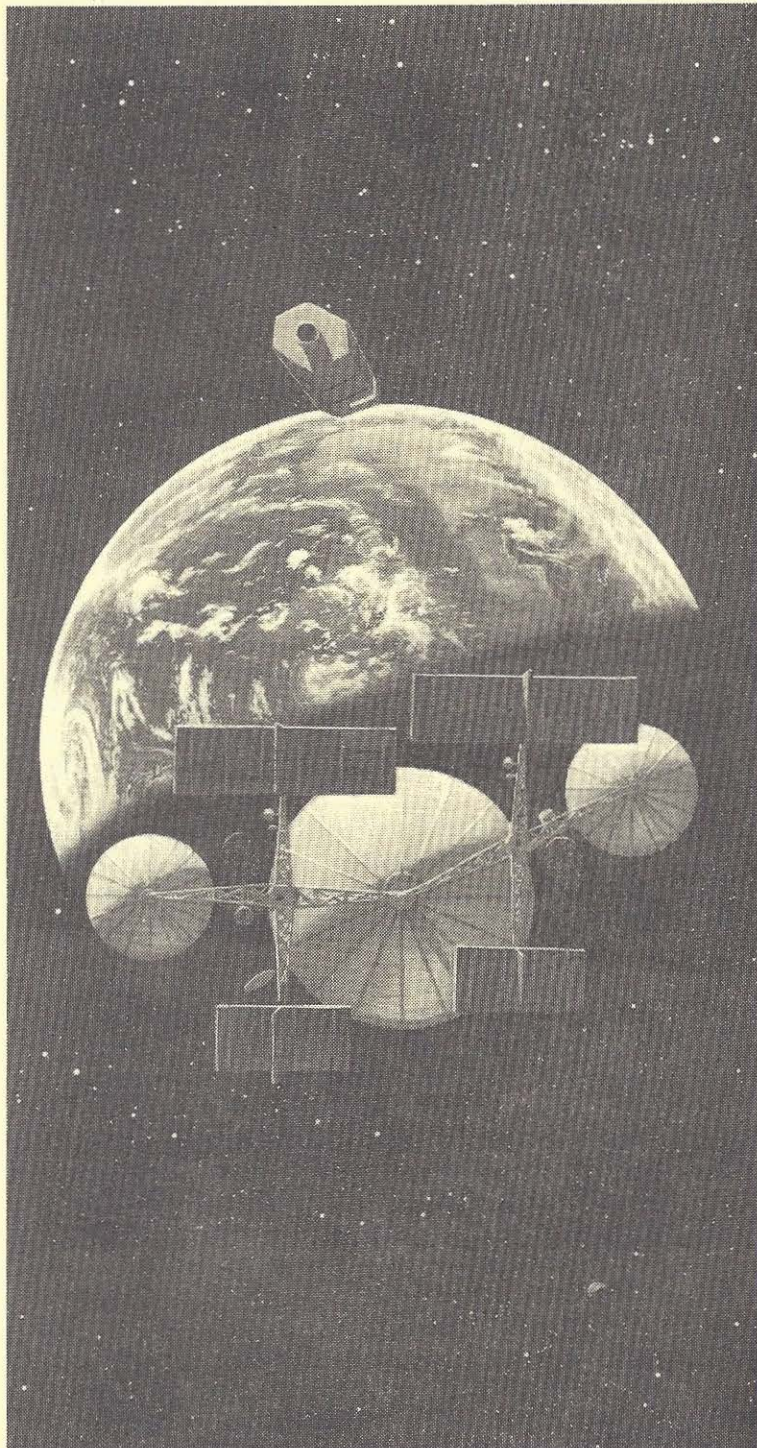


the Foundation Institute Incorporated 1971

REPORT:

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ADVANCES IN COMMERCIAL AND GENERAL SPACE DEVELOPMENTS



MULTI-MISSION GEOSYNCHRONOUS SPACE STATIONS FOR COMMUNICATIONS SERVICES

A few large space stations placed into geosynchronous orbit can replace the dozens of individual communications and sensor satellites now aloft. Writing in *Astronautics & Aeronautics* (October 1977) Burton Edelson and Walter Morgan of Comsat Laboratories suggest such centralized communication platforms could also offer new services.

Already there are dozens of specialized communications satellites in earth orbit, and the potential crowding of the orbit positions and frequency allocation difficulties are prompting engineers to consider alternatives such as the Edelson-Morgan plan. They reason that the Space Shuttle can launch much larger payloads, both more massive and bulkier, than existing launch vehicles. Such payload capabilities will permit the consideration of such outsize platforms as the OAF's (Orbital Antenna Farms).

Among the advantages to a single large communications platform are:

- Smaller earth stations due to less interference from crowded orbits.
- Economies of scale by providing common support functions for many payloads (power, station-keeping, pointing antennas).
- Permits mounting large antennas for direct user service.

Continued on Page 2.

View from behind an Orbital Antenna Farm. Large square panels are solar power array, disks are direct broadcast antennas. Station would have links to other platforms in different geosynchronous orbits, providing worldwide coverage eliminating most single mission communication satellites. *Original Artwork by Foundation Staff Artist D. Egge.*

The Foundation Institute REPORT:

Exclusive—

Soviets, Others Attack OTRAG Flight

Sharp criticism of the first flight of the OTRAG launch vehicle module (Report—September 1, 1977) has been leveled at both the company and West Germany. The attacks are coming from both European sources as well as the Soviet Union and Africa.

The first charges were made in an article in the leftist publication *To The Point Internationale*, by a leader of the Katagan forces which attempted to overthrow the government of President Mobutu of Zaire this spring. It was claimed the Zaire government, with the help of OTRAG, was developing missiles which could carry nuclear warheads against other African states. The implication was the Katagan invasion helped to reveal this "secret" plot on the part of Zaire. The Katagans are heavily supported by Angola, which in turn derives most of its support from the Soviet Union and Cuba.

The Marxist government of Mozambique has reportedly protested the flight to the West German government.

Within the past six weeks, the Soviet paper *Pravda* has condemned the flight three times. The Soviets charge that the OTRAG operation is a demonstration of Germany's desire to rearm with medium and long-range ballistic missiles which can carry nuclear warheads. No mention is made of the fact that the vehicle has been developed as a satellite launcher, however, there is reference to Kurt Debus, OTRAG's Chairman. Debus was involved in the V-2 development during the Second World War, and the Soviets have not forgotten this.

European aerospace officials have also made disparaging remarks in an article published in *Aviation Week and Space Technology* magazine September 12. However, these latter comments seem to stem from the potential embarrassment caused by the low cost OTRAG operation, and are not considered substantive or dangerous to OTRAG's continuation.

Continued from Page 1.

APPLICATIONS MISSIONS IN GEOSTATIONARY ORBIT

Communications	Other applications
Trunking systems and fixed networks	Navigation
Intercontinental service	Data collection
Regional service	Earth resources
Domestic service	Meteorology
Mobile systems	Standard time and frequency signals
Maritime mobile service	Space tracking
Aeronautical mobile service	Disaster warnings
Land mobile service	
Distribution systems	
Broadcast services	
Intersatellite communications	
Geostationary (OAF to OAF)	
Deep space	
Low orbit	

Additionally, the use of large platform communication satellites may allow economical on-orbit service and repair of individual mission modules. Using a remote-operated tug, ground crews could replace failing electronic modules or retrofit new modules or antennas as the technology may permit.

The authors also suggest improved communication service may result from OAF utilization. The use of a few large satellites will minimize the number of relays through which a packet of data or a voice signal has to travel. This would tend to prevent signal degradation.

The OAF would use a central computer and distributed processors for control of mechanical devices, and the handling, storage and processing of command, telemetry and communications signals.

Among the new services which could be added to the OAF in the future would be the capability to track low-altitude satellites or deep-space probes; communication with mobile users; and nationwide VHF beams for emergency and disaster services use. The OAF may be one way to introduce services which in themselves would not be able to afford the cost of a single-mission satellite, but would be feasible if they were an "add-on" to a large multi-mission platform.

Combining missions on a single spacecraft could also produce problems. The institutional arrangements, the authors suggest, may prove more difficult to solve than technical problems.

The Foundation Institute **REPORT:**

Editorial—

What We Are About

Often, during the course of my travels or during a lecture, I am asked: "What does the Foundation Institute do? And where did you get your company name? Isn't it redundant?". This is an opportunity to set the record straight.

The Foundation Institute is a non-profit organization, chartered in much the same fashion as Stanford Research Institute, Battelle, or the Hudson Institute. On a smaller scale, we attempt to do many of the same things. Several years ago, the founders and officers of Foundation recognized that the future of industrial progress, scientific research and ultimately civilization, lay in moving humans off-planet. There was no fanaticism in this approach, merely a recognition that to survive and prosper, civilization requires frontiers. Space, for all that is said about the oceans, or the human mind, offers the last true frontier. New societies and technologies can be tried out there which for various reasons can not be experimented with on earth. Historians have tied the frontier to progress and even suggested it to be the spawning ground for a renaissance in the parent culture.

Given this motivation, (as well as the simple fact that this could be a most exciting endeavor) the large bulk of the Foundation's resources were given over to studying space, and the economics of it's industrialization. Very rapidly, two observations were made. First, we saw that the costs of entry into space had been grossly exaggerated by years of government involvement with the space program. No real thought had been given to lowering costs, since there was no pressing economic need to do so. Second, we decided the sub-field of space transportation needed the most work. The need for high priced electronic and mechanical equipment evaporates in the face of adequate propulsion systems. This fact, though adequately and forcefully stated many times in the last few decades by a handful of individuals, has yet to penetrate to the awareness of space transportation experts. Given a look at suggested plans for "advanced" space vehicles and systems of the 1990's and beyond, it is doubtful it ever will.

That was the state of affairs several years ago, about the time the Space Shuttle program began, when we began to try to sell the idea of low-cost chemical transportation systems of a single-stage-to-orbit type to various people in the aerospace industry. At that time, the idea was five to ten years ahead of its time—now the need for such

vehicles has been demonstrated by Boeing and other aerospace giants. The Foundation Institute is now considering much more advanced space-ships (not launch vehicles). While some in the aerospace industry would argue that such vehicles as we suggest are needed for large scale exploitation of space may never be built, we on the other hand suggest they are not more than fifteen years away. It will be interesting to see who's right this time.

What do we foresee in space? First, we must make clear that our major orientation is toward private initiatives, not public ones. We would like to see widespread exploitation of asteroidal and lunar resources beginning in the next decade . . . along with manufacturing and space processing on-board privately-developed space stations. We would like to see the establishment of a freeport . . . in space, more than on earth . . . with minimal governmental involvement in trade and economics. Given the wealth which can be generated from space-based activities and businesses, and the freedom available to individuals who might be part of a space freeport, there is no doubt in our minds that the quality of life almost everywhere on the planet might be improved.

These desires may be decades delayed or never fulfilled, but the task of the Foundation Institute is to make these points over and over again. Someone must be the curmudgeon in this business!

Ultimately, as the law and circumstances permit, the Foundation would like to get into the transportation business. We have defined several launch vehicles which could be developed by private capital investment, and are actively pursuing this goal. It may be that spun-off business from this organization may be the best way of providing low-cost space transportation services. (This is, by the way, why we advertise ourselves as the world's first private launch service . . . we had the idea non-exclusively, but are the longest-lived and most persistent company in the business. We'll still be here a decade or two from now.)

So there, in a few words you have it. Help us or hinder us, we're glad to have you along . . . it makes things interesting. And besides, there is room enough for everyone, in space.

Oh yes, about the name of the company. We borrowed it, with permission, from Issac Asimov's classic science-fiction novels titled the Foundation Trilogy. At the time it seemed like a clever idea. Now, after many hundred "the what foundation?", I'm not so sure.

—Gary C. Hudson

The Foundation Institute REPORT:

Earthport

A group of specialists, gathered under the sponsorship of the Sabre Foundation, is working on a study which will examine the potential of an international space launch site at the equator. The group, calling itself the Space Freeport Project, will initially prepare a report assessing international interest in the concept. Project members will then evaluate the economic, technical, legal and political aspects of establishing such a launch site, and publish a final report.

The Space Freeport, or "Earthport", would be an area located on or near the equator for launch efficiency reasons. It would be run by a politically neutral organization which would assure peaceful use of the facility by all nations. A minimum of taxation and bureaucracy would encourage private industrial users as well as public. Tariffs would be reduced or eliminated for the most part to increase trade in space-produced products.

The specialists are a large group of people coming from universities, government, industry, the legal profession, and many other fields. They have divided into three main study groups: the Government Launch activities Committee, which will examine government and public uses of Earthport; the Private Users Committee, which will do the same for industrial and other non-governmental groups; and the Freeport Design Committee, which will recommend possible sites and alternative legal and economic configurations of the site.

Recent progress has been primarily directed toward fundraising. An anticipated \$150,000 is needed to complete the entire study. Letters have been sent to various equatorial countries to sound out those countries which may be willing to host the Earthport. About 40 nations are being approached.

Continued on Page 5.

Contributed perspective from Arthur M. Dula, member International Institute of Space Law and Space Law Committee of the American Bar Association.

FRONTIER LAW

Within the next decade man will establish his first permanent settlement in space. By 1990 a significant portion of America's power may come from solar power satellites. Before the turn of the millennium, industry will be in orbit and the moon will have a gross national product. Hundreds and then thousands of men and women will live in space. What law will govern their lives? How will law come to the frontier of space?

Activities in space are presently governed by treaties and agreements between sovereign nations. These prevent the transport or explosion of nuclear weapons in space, govern the rights of distressed astronauts, and provide liability for damage caused by space objects. Additionally, like ships on the high seas, nations retain jurisdiction over a government space craft in flight. Treaties, however, bind only nations and only then if they have consented to be bound. At the present time there is no national law that would extend to colonies or industries in space and no Earth court would have jurisdiction over them.

In the short run, absence of law in space stands as an obstacle in the path of development. Before business can commit the large sums of capital needed to establish factories in orbit, planners must know the nature of the rights they will have, the liabilities they will face, and who will tax their industry. In the long run, men must know what code of laws will govern their lives, properties and relations if they chose to live on the frontier.

Let me cite a few examples. Who owns discoveries made in space? Under present NASA guidelines, NASA owns a portion of all inventions made in NASA funded work. If NASA launches the payload, will they retain ownership of the discoveries it makes? If an industry operates manufacturing entirely in space, who can tax it?

During the next year, NASA will continue to fix the terms on which business can use the Shuttle. Will the National Space Transportation System be spun off as was COMSAT? Will it operate as a common carrier? Will private industry be encouraged to compete with the Shuttle?

History suggests that law follows man into any new territory and becomes better defined as the territory begins to produce a profit. Initially the law of the parent country is adopted in total. (But what if a German space lab is orbited by an American Shuttle from an American base?) Then the circumstances of the new territory cause the law to evolve and assume a form more suited to reality.

As men move into space, the law must be flexible enough to allow profit, growth and freedom. It must also be rigid enough to insure rights and permit reasonable evaluation of economic and social risks. Most importantly we must begin now to define national jurisdiction in space, because expansion into space and the benefits it will bring are necessary to America's and the World's survival.

The Foundation Institute REPORT:

news notes...

UCLA SPACE SHUTTLE PAYLOADS COURSE...Los Angeles...The UCLA Extension Department will sponsor a course titled "Space Shuttle - Shuttling Payloads". The course will be conducted in Los Angeles during the week of October 17-21, 1977. Designers, managers and marketeers who hope to work with the US Space Transportation System should attend. (Mr. Gary C. Hudson, Chancellor of the Foundation Institute, will be one of twenty speakers.) Among the speakers will be several from NASA, TRW, Rockwell, and Boeing. A tour of the Shuttle mockup at Palmdale will highlight the first day. Contact Hap Hazard, (NSSA-52), Navy Space Systems Activity, P.O. Box 92960, Los Angeles, CA 90009 or call (213) 643-1648.

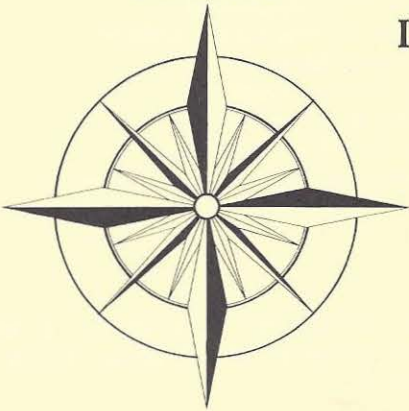
ARTICLE TO BE PUBLISHED...San Diego...World Research, Inc., San Diego, will publish "Renaissance", an article by G. Hudson and T. Brosz in their October issue of their monthly news magazine. World Research is a free enterprise oriented organization.

IAF MEETING...Prague...Foundation General Counsel Mr. Arthur Dula is attending the meeting of the International Astronautical Federation in Prague, Czechoslovakia. A full report of the meeting will be in a future issue of this newsletter.

REPORT SCOOPS AW&ST...Minnesota...The Foundation Institute Report was the first US publication to break the story of the first test flight of the German OTRAG booster (Report, September 1st, 1977). Subsequent to our photo exclusive, the respected trade magazine Aviation Week and Space Technology ran a four page article on the company and the flight in the September 12 issue. Until the September 12 article, AW&ST had made no mention of the project.

Continued on Page 6.

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Continued from Page 4.

OTRAG, a private launch organization based in West Germany, has indicated that it will make a contribution to the study. Earthport study director Mark Frazier and private users committee chairman Bob Poole will deliver papers at the conference on the industrialization of space to be held in San Francisco beginning October 16. The conference is sponsored by the American Astronautical Society and the American Institute of Aeronautics.

Among the study advisory board members is author Arthur C. Clarke and Princeton Professor Freeman Dyson.

The project is anticipated to be of great use to potential investors in space, and support is needed. Further information can be had by contacting Mark Frazier, Space Freeport Project, Sabre Foundation, 221 West Carrillo St., Santa Barbara, California 93101.

advertisement

The Foundation Institute REPORT:

Continued from Page 5.

news notes...

AAS CONFERENCE...San Francisco...
 Theme of the American Astronautical Society's 23rd Annual Meeting will be The Industrialization of Space. Co-sponsored by the American Inst. of Aeronautics and Astronautics, as well as the British Interplanetary Society, the meeting will be held at the Airport Hilton Hotel October 18, 19 and 20. Presentations will include Technical Aspects of Large Space Structures, Advanced Transportation Systems, Economic Realities, Historical Precursors and Analogues, Space Law, Space Community Planning, Communications and Navigation, and Psycho-Social/Biological Considerations. The week of the conference will be designated Space Week in the San Francisco Bay Area, with tours of local space-related facilities like NASA/Ames. Fee for the conference will be \$40 for the members of sponsoring organizations, and \$10 for students. For further information contact: E.V. Stearns (408) 742-8150 or write to the AAS Conference, PO Box 7205, Menlo Park, California 94025.

"LOOK TO SPACE"...Los Altos Hills...
 As part of the Space Week to be held in the Bay area in October (see above), the Space Science Center of De Anza/Foothill Colleges will sponsor a symposium for the general public on October 22. The symposium, entitled "Look to Space", will feature twelve speakers and a panel presentation. For further information, contact: Thomas M. Gates, Director, Space Science Center, De Anza & Foothill Colleges, 12345 El Monte Road, Los Altos Hills, CA 94022. Phone: (415) 948-8590, Extension 381

THE FOUNDATION INSTITUTE was incorporated in 1971 as *Foundation*, a non-profit 501(c) (3) tax-exempt Minnesota Corporation. The Institute is a diversified research and development organization formed to engage in advanced scientific and technology studies. Funds are provided by contract research for industry, as well as by donations, gifts and internal business profits.

Capabilities include theoretical research and study, systems research and development of services and products. A high level of effort is presently being expended in astronautics, especially the commercial utilization of outer space and the need for economical space transportation.

The Institute has a permanent and consulting staff of professionals to call upon including engineers, designers, scientists, communications experts, management specialists and the like. Corporate headquarters is presently in St. Paul, Minnesota.

THE FOUNDATION INSTITUTE REPORT is a concentrated effort to report all areas of private and industrial initiatives in the development of space. We hope it will stimulate ideas by raising questions and offering innovative concepts contributed by acknowledged leaders in the field.

If you have any comments, ideas or requests for information or articles, we encourage you to contact us. The **REPORT** is published monthly, and has a subscription price of \$10/year.

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