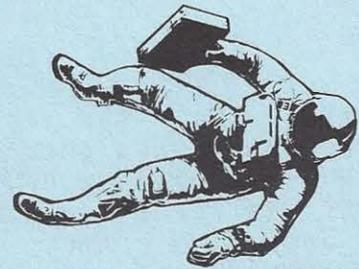


THE FOUNDATION

COMMERCIAL SPACE REPORT



PUBLISHED MONTHLY

Gary C. Hudson, Editor

© FOUNDATION 1980

Dear Subscriber:

October

This month finds us exploring the business of launch sites for commercial rockets. Whenever we talk about private spaceflight, the question always arises: "Where are you going to launch from?" This is not necessarily the problem that it is made out to be. For example, in the United States there are no Federal regulations concerning launches. (If they are manned launches for profit FAA regulations on transport aircraft may apply, but this is problematical. The FAA has ruled that the NASA Space Shuttle is not an "aircraft" within the meaning and interpretation of the civil aircraft code. This precedent should apply to private launch vehicles as well. Federal Communications Commission rulings vis a vis transmitter frequencies must also be followed, but this is straight forward.) The general state or local requirements often involve obtaining a "fireworks" permit in the county of launch as the sole requirement.

OFFSHORE LAUNCH SITES

As a contingency, however, it still behooves us to investigate other alternatives. One of these alternatives has been suggested by Don Hervey of the Offshore Construction Division of Brown and Root Development, Inc. Don writes:

"An Offshore Space Center (OSC) from which space vehicles could be launched into and returned from orbit, is a logical concept for development of the high level of space activity expected in the not too distant future. The OSC provides substantial benefits as a support base and launch site for such a pattern of use. Any activity which requires the development of a heavy launch lift vehicle (HLLV) will benefit by operation from an OSC. Cost, operational, and political advantages make the OSC an attractive concept.

Operating from near the equator provides a twenty percent increase in payload in an ecliptic plan orbit. The offshore site, in international waters, will function as a central location, easily reached by earth-bound transportation from worldwide sources of materials which must be launched into space. The remote location in international waters isolates the launch operations (e.g. noise) from population centers and from some other major potential environmental objections. Such an OSC site provides independence from foreign control. Acceptable sites exist, affording a mild climate with excellent weather and orbital windows for each orbit around the earth.

OSC concepts considered include a moored floating (semisubmersible) design, a stationary design supported by fixed piles, and a combination

of these two. The facility supports: a 15,000 foot long, 300 foot wide runway, designed to accommodate a two-stage winged launch vehicle, with a one million pound payload capacity to low earth orbit; an industrial area for HLLV maintenance; an airport terminal, control and operation center, and observation tower; liquid hydrogen and liquid oxygen production and storage, and fuel storage platforms; a power generation station; docks with an unloading area; two separate launch sites; and living accommodations for 10,000 people.

Potential sites such as the Paramount Seamount at 3°N, 91°W (in the Pacific Ocean off the north coast of South America) afford an acceptable water depth of less than 600 feet. Wave heights are below four (4) feet for eighty percent (80%) of the time. Hurricanes do not occur this near the equator, which leads to an anticipated severe design wave of only twelve (12) feet. A tolerably small current of one-half to one knot further enhances the favorable expected design conditions for such a site.

Cost estimates for the supporting structure (not the above deck facilities) have been developed for both the moored semisubmersible design and the pile supported stationary design based on an assumed installation in a 600 foot water depth. The total installed cost estimate is \$3.0 billion for the moored semisubmersible OSC and \$3.9 billion for the stationary pile supported concept based on projections from structures installed in the Gulf of Mexico where design conditions are much more severe (e.g. 80 foot design waves). Thus, these estimates are viewed as upper bounds which should decrease somewhat with the benign weather conditions of the more desirable equatorial sites. The 15,000 foot long runway is the primary cost driver in the designs and the suitability of a floating (semisubmersible) support for the runway is questionable. Less deviation from a truly level and straight runway will result from a pile founded stationary structure. An OSC can progress from conceptual design to completion in approximately six years.

Boeing studies have shown that upgrading the Kennedy Space Center in Florida, for HLLV operation will require \$2 to \$3 billion. Assuming a cost of \$60 billion for a five (5) gigawatt Solar Power Satellite (SPS) with a twenty percent (20%) transportation cost, the OSC can be shown to pay for itself with the construction of a relatively few SPS's. With ion engine cargo transportation from an orbit inclined 30 degrees, approximately five percent (5%) of the total transportation costs or \$600 million could be saved per five (5) GW SPS by an equatorial launch. The cost of the development of the ion engine drive would also be eliminated. With chemical engine cargo transportation the improvement in costs is even more apparent. Approximately twenty percent (20%) of the total transportation costs or \$2.4 billion could be saved per five (5) GW SPS by an equatorial launch.

An OSC is the logical, cost effective choice for supporting HLLV launches when an HLLV is justified. Site selection studies, collection of environmental and soil data to permit design and trade-off studies between different OSC layouts, operations concepts and specific component designs should proceed to prove the cost effectiveness of the OSC concept."

ANOTHER OFFSHORE CONCEPT

An early at-sea launch site might be constructed more easily than the permanent facility suggested by Don Hervey. While the OSC has much to recommend itself once the commercial traffic to orbit reaches the point where HLLV's are required, a near term solution to the launch problem is needed. Commercial users might take some direction from early Navy Department studies of sea-launched ballistic missiles in the early sixties.

Faced with the task of firing a multi-ton missile from a submarine at sea which must remain submerged to stay undetected, the Navy investigated a technique known as "canister launching." In this concept missiles are stored and deployed in waterproof containers which are stored aboard the submarine. When the missile is to be fired, this canister is ejected from the boat in a manner similar to a torpedo. It is ballasted such that it floats to the surface with its top barely awash. A signal to launch is transmitted through a long cable running from the submarine to the container - at launch the missile blasts through the canister and breaks free of the water. (The Soviets use a technique similar to this in some of their missile systems.)

This concept has been successfully tested by more than two dozen launches with small to medium sized rockets. There is no reason to assume that its application to large vehicles of the 100 to 1000 ton class would be anything more than straightforward.

We can envision this launch technique offering great promise for near term operations of commercial rockets. For example, geostationary satellite launches could be flown from equatorial sites on the open ocean directly into the equatorial plane orbits necessary. Access to open ocean is inexpensive and affords a competitive advantage to commercial launchers. Additionally, it avoids the international political difficulties attendant to operation in Third World equatorial nations such as local political and economic instability and Superpower intervention. For these reasons it may be a technique we see in operation fairly soon.

The need for at-sea launches grows out of the market projections we have made for commercial space flights. If the market projections are to be fulfilled it is necessary that there be persons with a need to launch payloads into space - space entrepreneurs. Helping these entrepreneurs is the goal of a short course in New York.

ENTERPRISING SPACERS

If you were an enterprising merchant of Venice in 1600 and you wanted to do business in the New World, what would you need to know to get started? How could you learn about potential products and services, markets and venture capital for the exploitation of an entirely new frontier. It's unlikely you could have picked up a course or two at the University of Padua.

However, if you're an enterprising merchant in the 20th century or if you're just plain curious about the possibilities for business offered by the newest frontier, the Space frontier, you may be able to pick up the basics by going to school. Dr. Mark Chartrand III, Chairman of the Hayden Planetarium and soon to be Director of the National Space Institute, is offering a course at New York's New School entitled "Working Space: A Primer to Extraterrestrial Profits."

Dr. Chartrand is serious about the New World analogy. The 14-session course, which began last week, will cover the basics of business and economics in space including a general overview and history of space exploration, characteristics of the space environment (including biomedical aspects), manufacturing in space, space law, the role of the military as a driver of high technology, the possibilities for Space Power Satellites and Space Colonies, extraterrestrial resources and general business topics such as unions, treaties, insurance and venture capital. The primary focus is near-term projects for this century. In conjunction with the class Dr. Chartrand is also working on a book entitled "Working Space" which will be published by Doubleday and Co.

The class has attracted students from a variety of backgrounds including law, anthropology, architecture and business. According to Dr. Chartrand so far most of his students are young and male with a basic interest in space and the possibilities for human activity there. The course is currently scheduled to be repeated next Spring, however, Dr. Chartrand's new responsibilities at the National Space Institute may prevent him from offering it at that time. Tuition is \$150.

Until next month,

Sincerely,



Gary C. Hudson

THE FOUNDATION
**COMMERCIAL
SPACE REPORT**

The **Report** is published monthly, and has a subscription price of \$12 per year, \$20 per year for institutional and library subscriptions and \$20 per year for overseas airmail. Back issues are available at \$1 each from September, 1977. Xerographic copies may be substituted as stocks are depleted. Address all correspondence to Foundation, 85 East Geranium Avenue, St. Paul, MN 55117 or call (612) 489-4466. Editorial Direction: Gary C. Hudson;

Special Assistance: Resident Fellows E. Anne Roebke and T.A. Brosz. Phone orders accepted at (612) 489-4466. No collect calls please. **Foundation, Inc.** 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. **Foundation** has a permanent and consulting staff of professionals to call upon including engineers, designers, scientists, communications experts, management specialists and the like. The **Commercial Space 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 we encourage you to contact us.