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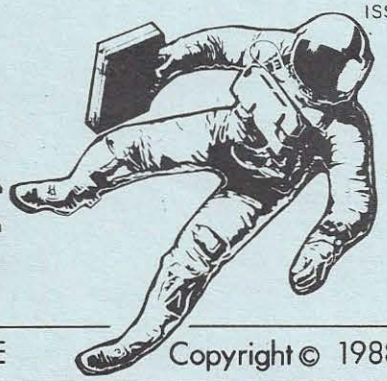
THE COMMERCIAL SPACE REPORT



A MONTHLY NEWSLETTER ON FREE ENTERPRISE IN SPACE

Volume 12, No. 1 January, 1988

New Government Space Policy Opens Opportunities For Entrepreneurs
(Part One of Two)

New government policies encouraging private space activities are slowly emerging from Washington. The policies, issued by the Reagan Administration, are said to be part of a consolidated program addressing government military and civilian space activities and goals, something which has been lacking for a number of years.

The new initiatives are the result of studies done by the National Security Council and the White House Economic Policy Council (which included the Department of Commerce, a supporter of commercial space endeavors). The initiatives include continued support for the transferral of space activities from the government to the private sector, including space station development; the removal of the 10-meter resolution limit on earth resources satellites; and third-party liability limits on private space activities. Following are details and commentary on the new policies, beginning this month with the private space initiatives, and continuing with the satellite resolution limits and liability limits in next month's issue.

Government Investigating Private Alternatives To U.S. Space Station

The most important of the new initiatives are those which reaffirm the Reagan Administration's backing of private space endeavors. This was a position first taken in August of 1986 when the President took the Space Shuttle out of the communications satellite launch business, leaving the field to private expendable launch vehicles (ELVs) (*C.S.R.*, Aug. 1986, pp. 1-2). The new rulings continue this policy, and go further. All Federal agencies are now directed to use private launch vehicles for their payloads whenever possible. NASA would be prohibited from procuring their own ELVs, and would be required to purchase launch services on the commercial market. Even the Department of Defense (DOD) will be encouraged to use commercial launchers for non-sensitive payloads.

To NASA's consternation, the broad new policy moves beyond ELVs to cover manned space activities, formerly a secure refuge from commercial encroachment. Chief focus of the new policy: the U.S. Space Station, centerpiece of current NASA operations.

Voices in the Administration and Congress are calling for private alternatives to the NASA Space Station.

The reason: the current Space Station program is getting out of hand. As design has progressed, the Space Station has become smaller, its costs have ballooned, and the target date of first operations has continued to move ever farther into the future. A brief review of "progress" to date:

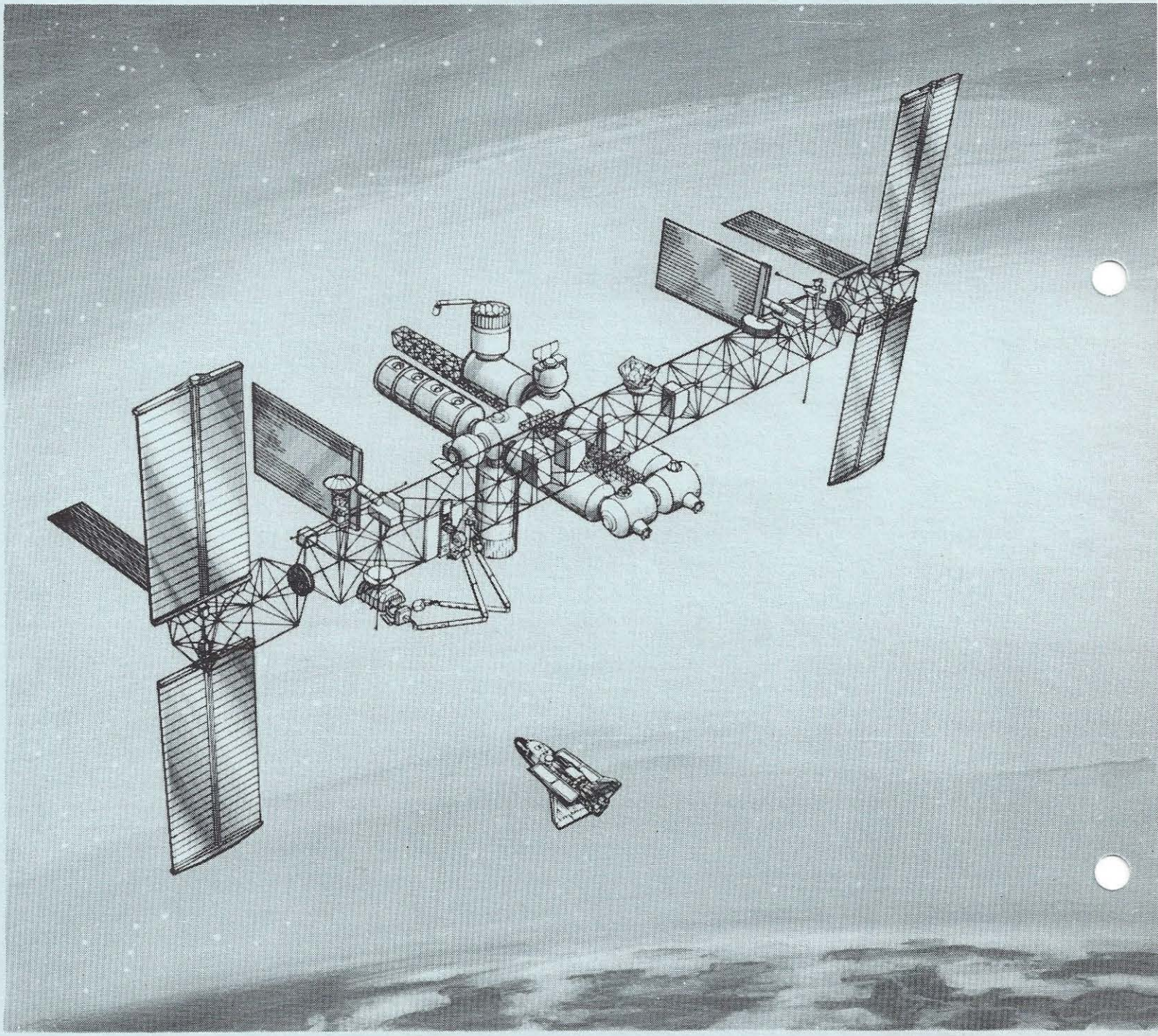
* Note: in this newsletter, the term "Space Station," when capitalized, refers to the official NASA manned space facility as opposed to, say, a Soviet, European, or privately operated space station.

Update: U.S. Space Station

In 1984, the cost of the complete U.S. Space Station was estimated to be $8 billion, and the date of initial operations was to be 1994. These were the figures when President Reagan announced his support in his 1984 State of the Union address. The Space Station NASA promised to deliver was the "dual keel" configuration (pictured at top right on page 3).

Since then, a number of changes have taken place. Costs began to increase until 1987, when NASA admitted that they has risen to $14.5 billion. At this point, to try to stem the growing price of the orbital facility, NASA proposed dividing the construction of the Space Station into two phases:

Phase One (illustrated below) would include the main structural truss, two U.S. pressurized laboratory and habitation modules, four resource nodes (the small modules on the ends of the larger ones with the docking ports), the European Space Agency's Columbus laboratory module and polar platform, the Japanese Experiment Module, and the first phase of Canada's Mobile Servicing Center. A solar power array would provide the Station with about 75 kilowatts (KW) of power.

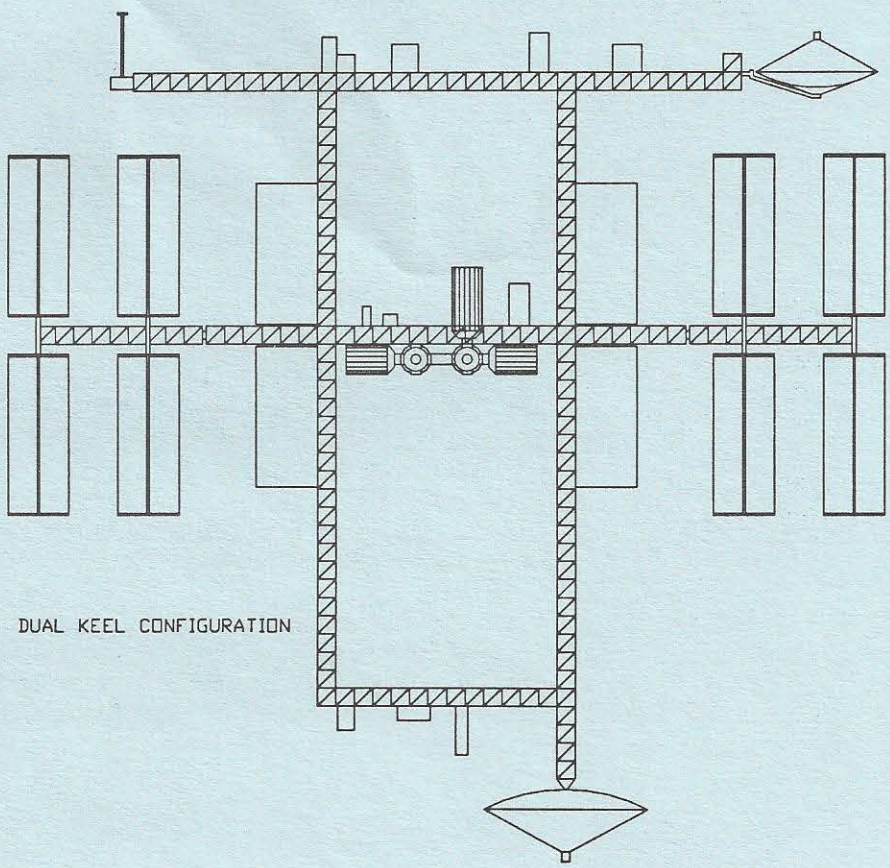


Phase Two would incorporate new structural elements to complete the dual keel configuration, additional payload attach points, a free-flying co-orbiting platform, a servicing bay, and a solar-dynamic power system to bring the Space Station's power levels up to about 100 KW.

The Space Station's completion date has been steadily receding. The original completion date for the dual keel Station was 1994. Now, 1994 marks the scheduled launch of the first element of the Phase One Space Station aboard a Space Shuttle. If all goes well, the Station would be completed to the point where it could operate in a "man-tended" capacity (which means that personnel could board temporarily to work on otherwise automated systems) by January of 1995. Permanent manned capability of the Phase One configuration would come in the fourth quarter of 1995. There is no certain completion date for Phase Two.

Phase One will cost $25 billion. Phase Two will cost an addition $7.8 billion, for a total of $32 billion (in 1988 dollars). These costs were arrived at by a committee of the National Research Council (see NRC table at right).

This is an astounding quantity of money. The Apollo Moon program, which put men on the Moon starting almost completely from scratch, cost about $26 billion. The Space Shuttle program cost about $30 billion (1987 dollars). A Naval carrier attack group (aircraft carrier, planes, one or more attack submarines, two cruisers, assorted destroyers and frigates, and logistics support ships) runs about $17 billion--and the Department of Defense is not noted for its frugal spending habits.



DUAL KEEL CONFIGURATION

SPACE STATION COST — from NRC Space Station Committee, using NASA estimates:

$ 8 billion	As presented in Reagan's 1984 State of the Union address
$12 billion	By early 1987, NASA's estimate (in 1984 dollars) had grown
$14.5 billion	After detailed NASA cost review
$16 billion	NASA's current estimate, incorporating two-phased deployment (phase 1, $12.2 billion; phase 2, $3.8 billion)
	Items in (or to be added to) NASA's space station R&D budget:
	$0.3 billion unmanned "telerobotic" service vehicle
	$0.1 billion Orbital Maneuvering Vehicle
	$1.5 billion crew emergency rescue vehicles
	$1.9 billion (phase 1, $1.8 billion; phase 2, $0.1 billion)
$17.9 billion	Overall space station R&D cost estimate (phase 1, $14.0 billion; phase 2, $3.9 billion)
	Other items in total cost of developing and deploying station:
	$2.4 billion space transportation (shuttle launches, etc.)
	$0.1 billion shuttle modifications for berthing at station
	$2.5 billion NASA personnel costs (direct and indirect)
	$4.4 billion operations prior to full station capability
	$0.2 billion related facilities
	$9.6 billion (phase 1, $7 billion, phase 2, $2.6 billion)
$27.5 billion	Estimated total station program costs (phase 1, $21 billion; phase 2, $6.5 billion — still in 1984 dollars)
$32.8 billion	The above total inflation-adjusted to 1988 dollars (phase 1, $25 billion; phase 2. $7.8 billion)

How did this happen?

NASA managers argue that they are being forced by Congress to stretch the Station's development time out, which saves some money in the short run, but ends up increasing costs in the long run. There is some justification to this, but certainly not enough to account for a quadrupling of the Space Station's price tag in the space of four years. In any case, there is still the matter of the original $8 billion cost, which was already outlandish.

The root of the problem is that the Space Station is currently conceived as a "technology driver." This means that new, advanced technologies, requiring extensive, fundamental research and development, are deliberately chosen to solve the problems of space station design rather than using any existing solutions. NASA is a vast research and development agency, which needs projects such as the Space Station to survive, and building a space station from off-the-shelf hardware does nothing to keep NASA's various divisions and multitudes of aerospace contractors fat and happy. NASA has not been secretive about the Space Station's status as a technology driver, and in fact has used the Station's status as a project on the "cutting edge" of technology to sell it to members of Congress on a number of occasions.

The result is that the Space Station has become an end, not a means, i.e. it seems that the major reason NASA is building the U.S. Space Station is to learn how to build a space station. Left out of the project for the most part are the potential users of the Space Station--scientists, materials processors and others--who long ago realized that their needs were being given little thought in the Space Station planning process (*C.S.R.*, Feb. 1984, pp. 1-3; Aug. 1984, pp. 1-3).

This is not why a space station should be built, and this is not how a space station should be built.

If one stipulates that the settlement of space and other worlds is not only desirable, but essential to the future of the human race (and you probably wouldn't be reading this if you didn't), then low-cost, accessible space transportation and space habitation are key elements of the colonization effort. Low cost space transportation has been addressed more often than low cost space habitation in these pages. This is because to a large extent I consider emphasizing space stations over transportation as putting the cart before the horse (more on this later), but space stations are no less essential to the total effort of space colonization.

What is needed is a facility in low earth orbit, as soon as possible and as cheaply as possible, which can be routinely--if not permanently--inhabited by personnel dedicated to solving the serious long-term problems of living and working in space.

These vital areas of research include:

Biological research, concentrating on the effects of reduced or zero gravity on living organisms. This is absolutely essential. Can ways be found to allow human and other life-forms to survive, thrive, and reproduce under weightless or low-G conditions? If so, can people born or adapted to such conditions ever return to a planetary surface? Would they want to? If gravity is required, how much? Does Earth's moon have enough? Does Mars? The answers discovered to these questions will dictate the entire course of space colonization, and they await an orbital lab dedicated to biology, preferably one configured so that parts can rotate to simulate varying gravity fields (no current U.S. or Soviet space station design has provisions for this).

Commercial research, centering on raw materials, materials processing, and services. If space is going to be settled to any great extent, then it is going to have to be made profitable. If not, then any settlements on the Moon, on Mars, in free space, or out in the asteroids will never amount to more than scientific outposts, like the research stations scattered across Antarctica.

Technological research, focusing on propulsion and space engineering. Transportation must be faster and cheaper to continue the growth of a space economy. And yes, research needs to be done into the technology of space habitation, but such research should be peripheral to the operation of a space station, a project undertaken by a space station customer, not the sole reason for a station's existence.

There are many cases where massive research and development is appropriate, even essential to advance in a given field. For example, applications requiring room-temperature superconductors, like miniature supercomputers or magnetically-levitated trains requiring little or no power, must wait for researchers to discover the materials that will make such applications possible.

This is not the case with space stations. The basic problems of constructing a habitat capable of supporting life in low earth orbit have for the most part already been solved. We know how to build a basic space station. The American Skylab, and the Soviet Salyut and Mir stations stand as incontrovertible proof that this is true. While we spend billions and wait years to research questions that we already have workable answers for, others, like the Soviet Union, have already moved beyond the problems of constructing a simple space habitat to begin the research into biology, space medicine, and materials processing that will let them live and work in space, and travel to the planets.

Manned space facilities for the Free World are not a luxury, but a necessity, and like so many other necessities the best way to get things done is to pry the problem from the hands of the government and give it to the private sector.

One Private Alternative: The Industrial Space Facility

Space Industries, Inc. (SII), a privately-held company based in Houston, Texas, is developing a commercial, pressurized, intermittently manned space module called the Industrial Space Facility (ISF). Founded in 1982, SII has made steady progress since then, both in financial and political arenas, and currently stands to be a major beneficiary of the Congress' current disenchantment with NASA's Space Station project.

In 1985, Space Industries signed an agreement with NASA allowing them to purchase three Shuttle launches "on credit" that would place into low earth orbit the elements required to form two complete ISF facilities. Instead of paying in advance, SII would be able to pay NASA back by turning over 12% of the revenues generated by leasing the facilities. This agreement added greatly to SII's credibility, attracting the attention of the Westinghouse Electric Corporation.

In October of 1986, SII signed an agreement with Westinghouse forming the Space Industries Partnership, bringing Westinghouse's skills and financial strength into the project as a general partner and the ISF's prime contractor (the agreement was a welcome break for SII, particularly after weathering the industry-wide storm following the loss of the *Challenger* in January, 1986). The partnership named Lockheed to be the contractor for the solar power arrays.

A year later, in October of 1987, Space Industries brought the Boeing Company into the partnership as a limited partner, and as the contractor of the ISF's docking mechanisms and experiment racks. At the same time, Westinghouse and SII acquired Astrotech Space Operations, the only privately-owned payload processing facility in the United States. By the end of 1987, private investments in Space Industries totaled over $30 million.

Potential space facility customers began to be keenly interested in the progress of the ISF. They included 3M, Boeing, the Department of Defense, and scientific and commercial factions within NASA, such as the NASA Centers for the Commercial Development of Space.

All this time, while consolidating its position in the private sector, SII had been patiently making inroads in Washington. Despite SII's status as a private endeavor, support from the U.S. government was considered essential to the company's success. There are two main reasons for this:

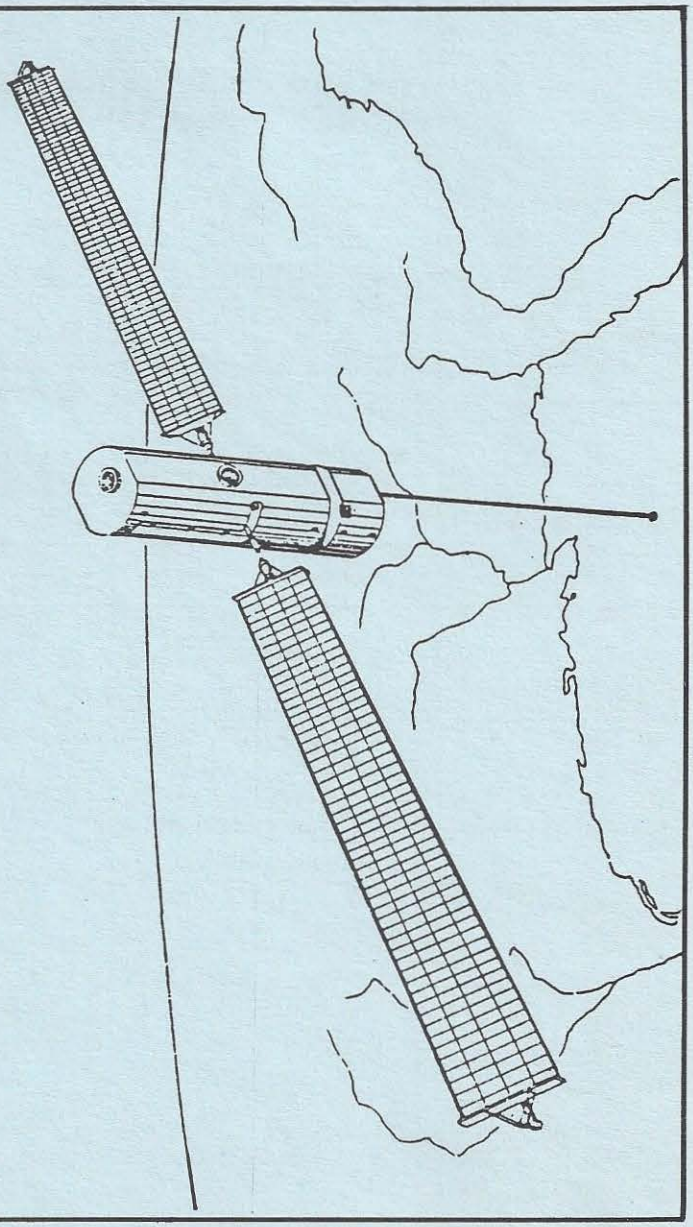
First, the ISF is totally dependent on the NASA Space Shuttle for launch and servicing. The testing and rebuilding of the Shuttle system that was required after the *Challenger* disaster has been slow, and the first post-*Challenger* Shuttle flight has been delayed again and again (the first flight is now tentatively scheduled for August of 1988). Needless to say, this is playing havoc with the payload manifest, and in a situation where politics is as important as anything else in deciding who gets a spot in the payload bay, anyone not constantly watching out for his interests may find that his payload bumped into oblivion.

Second, SII wanted to sign the U.S. government up as a paying customer. Space Industries' estimate of the money required to build its first two ISF facilities is between $500 and 600 million. To raise this kind of money up front would require SII to demonstrate in no uncertain terms that the ISF is marketable, and the best way--maybe the only way--to do that convincingly is to have some heavy-duty customers sign up ahead of time to lease the facility. The Federal government is a major consumer of

The Industrial Space Facility:
A Brief Technical Review

An Industrial Space Facility (ISF) consists of a pressurized module about 15 feet in diameter and 35 feet long, designed (unlike the Space Station) to make as much use as possible of off-the-shelf technologies. The interior provides up to 2,500 cubic feet of usable pressurized volume. Two 100-foot solar panels provide the facility with up to 11 kilowatts of power on a sustained basis, with the capability to deliver peak power levels of 50 kilowatts for short periods.

The ISF is designed to be launched by the Space Shuttle, and to remain permanently in orbit. An ISF facility can be fully operational after a single Shuttle launch. Once in operation, an ISF would be leased by customers for space processing or other uses. Every four to six months, the customers would travel to an ISF aboard another Space Shuttle flight, docking with the ISF and then moving inside it to service equipment or perform other tasks (although the ISF would be pressurized at all times, and provides temperature and humidity control, active life support would be provided only by the Space Shuttle while it is docked to the facility, making the ISF a "man-tended" facility). In normal operation, a supply module is docked to the ISF on the opposite end of the facility from the Shuttle. While the ISF is being serviced, the Shuttle's robot arm would be used to change an old supply module for a new one carried in the Shuttle's payload bay. ISF modules are designed to be clustered side-by-side, and up to six can be connected together without shadowing any of the solar power arrays.



goods and services in this country, and a firm contract to sell something to the government can be one of the best ways to convince the investment community that a company is viable. This may not sit well with some, but it is true nevertheless--particularly in the aerospace or high-technology industries.

Key to these tasks is SII's executive vice president Dr. Joseph P. Allen IV, who is in charge of congressional relations and ISF operational planning (a former astronaut, Dr. Allen was a mission specialist on two Shuttle flights, manning a spacesuit on Mission 51-A to rescue the Palapa B-2 and Westar 6 satellites). Dr. Allen has been SII's chief lobbyist since 1985, keeping the Industrial Space Facility in front of Congress, NASA, and other Federal agencies. Recently his efforts have begun to pay off, perhaps more than was expected.

This past month, in Washington, a groundswell of Congressional indignation with the NASA Space Station project was redirected into support for Space Industries' ISF.

In December, Congress earmarked $25 million of NASA's budget to be spent on investigating ISF leasing opportunities for the space agency. In a congressional report, the ISF was characterized as an "interim approach," a "bridge" between Spacelab and the Space Station. NASA had not requested these funds. More and more, the ISF and Space Station were being compared, and the ISF was looking better all the time.

This past January, the Economic Policy Council recommended that NASA commit to lease 70% of an ISF facility for a period of five years, beginning in 1991. Cost of the lease: $140 million per year, for a total of $700 million--a sum that would be carved from NASA's Space Station budget.

Shocked, NASA seemed to perceive for the first time the threat posed by the ISF to its bloated Space Station program. The space agency moved from its original position of polite support for SII into a stance of active opposition, and began to try to squelch the private space station company.

NASA is fighting the lease proposal on three counts:

First, that it would harm the Space Station program. This is certainly true. Despite protestations to the contrary by NASA, it has been painfully obvious for some time that those functions of a space station that are important to prospective commercial, government, and scientific customers can be easily duplicated by ISF or other similar commercial technologies at far less cost than the $25 billion NASA wants to build its facility. I pointed this out in the August, 1985 *C.S.R.* (see box on page 8). It was pointed out again in July of 1986 by Sen. Spark M. Matsunaga (D.-Hawaii), who proposed making the ISF the core of two orbital facilities, one dedicated to commercial functions, and the other dedicated to research (*Aviation Week and Space Technology*, Aug. 11, 1986, p. 11). And now, although the talk is still of "interim functions" and "bridges," the superfluity of NASA's current Space Station program is becoming clear even to some of the thickest heads in Washington.

Second, that there is no requirement for such a facility during the proposed ISF operational period between 1991 and 1995. In a letter to Treasury Secretary James Baker, NASA Administrator James Fletcher stated that NASA had no need for microgravity facilities during that time period, and, in addition, that NASA had identified no requirements elsewhere in the government or in the private sector either. This rather remarkable statement seems to imply that the market for orbital facilities will spring, full-grown like Minerva from the head of Zeus, into existence the day the NASA Space Station becomes operational at the end of 1995. As far as I know, no one in Washington has bought this argument. If anything, it just served to clarify the enormous gap which has developed between NASA's Space Station program and the needs of potential users.

(TEXT CONTINUED ON PAGE 9)

A Modest Proposal, Revisited

In the August, 1985 *C.S.R.* I showed that effective use of ISF technology is easily capable of making the U.S. Space Station redundant, at least from the point of view of potential users. I will now take the liberty of performing the exercise again, with revised numbers where applicable:

First, abandon the idea of a single, large, centralized Station in favor of a flotilla of small modules and module clusters. Some of these will contain living quarters and offices, and will normally be manned. The rest will be man-tended, and will contain materials processing facilities, scientific experiments, astronomy equipment, and other applications requiring a controlled environment, all of which can be handled much more easily in free-flying facilities completely separate from other functions.

Transport between workshops and living quarters could be accomplished by a simple, manned orbital transfer vehicle designed to accommodate a few people and a small amount of cargo. This "orbital pickup truck" would contain life-support hookups for any ISF assembly that may need them, and would have a manipulator arm allowing it to remove and replace supply modules. It would ferry the supply modules to an orbital depot point where they could be transferred in quantity to a Shuttle orbiter (one Shuttle flight could then handle cargo from many separate processing facilities without having to rendezvous with each of them). A vehicle like this would not be complex--one could practically assemble one from spare parts found at a NASA salvage yard.

NASA and Space Industries both argue that ISF technology, while ideal for man-tended free-flyers, is incapable of replacing the Space Station as a permanently-manned orbital facility. Now, NASA's price for a Phase One Space Station, containing about 6,800 cubic feet of habitable space, supplying 75 kilowatts of power, and with Shuttle launches and assorted sundries thrown in, is about $25 billion. Let's take the same amount of money and see what we can do to build a Space Station with ISF technology:

Our design will consist of six ISF modules (the largest number that can be easily clustered). SII plans to spend up to $600 million for the first two ISF assemblies. This amount seems to many in the industry to be unusually high for system described by Space Industries: a pressurized cannister with minimal environmental controls, power from passive solar arrays, and extensive utilization of "off-the-shelf" technologies (to put it in perspective, $500 million would buy you four fully-equipped Boeing 747 airliners hot off the assembly line). Nevertheless, let's assume the price figure to be accurate. Succeeding modules, in production, would of course be much cheaper, since the research and development would already be done. But, for the sake of argument, let's assume that each additional pair of modules still costs $600 million.

At this price, six ISF module assemblies add up to $1.8 billion. At least six Shuttle flights would be required to place them in orbit. Throw in a round $300 million per flight (the actual cost of a Shuttle flight without subsidies). We're now up to $3.6 billion. What do we now have? Each ISF has about 2,500 cubic feet of usable volume, adding up to a total of 15,000 cubic feet of habitable volume--over twice that of the NASA Space Station. All the solar arrays could deliver 66 KW of power, 9 KW short of what the Phase One Space Station delivers, but all that power probably wouldn't be necessary in our "flotilla" scenario, since most of the energy-hungry processing and lab operations would be taking place in their own facilities elsewhere in orbit (in fact, some of our ISF station's solar arrays could probably be left off, lowering costs even further).

Now, an ISF doesn't come with a life-support system. We'll have to build one, along with our little orbital pickup truck. How much money do we have left over? $25 billion less $3.6 billion leaves $21.4 billion in the kitty, which I believe could be stretched to cover these incidentals.

A friend suggested one way to get life-support systems for our six modules: purchase six Shuttle orbiters from Rockwell--$2.5 billion each, for a total of $15 billion--take the life-support machinery out of each orbiter, throw the orbiters away, and there you go. And we still have $6.4 billion left. Isn't *reductio ad absurdum* fun? I pointed out that you could probably sell an orbiter without its life support systems for something more than scrap value, so we'd probably have more than $6.4 billion left. Anyway, the idea fell through when we figured Rockwell's lead time on six orbiters.

This demonstration, admittedly oversimplified, still shows that space stations should not have to cost tens of billions of dollars to work. In fact, they don't even have to cost as much as the ISF--as mentioned in the main article, it should be possible for a company to design and develop a workable space habitation module for far less than the $600 million Space Industries plans to spend.

Third, that NASA is not legally authorized to enter into a sole-source agreement with Space Industries. The $700 million agreement, argues NASA, would (along with the original $25 million allotment) result in an unfair advantage to a single company.

In this, NASA is correct. If NASA, or any other government agency, purchases goods or services from the private sector, an open, competitive selection process should be used to try and insure a fair chance for the companies and the best value for the agency (I realize that current government procurement mechanisms are labyrinthine at best, but it has to be better than picking the vendor with the loudest lobbyists). Whether or not NASA is actually sincere in its concern about fairness will be discovered when--or if--such an open competition is ever held.

At the time of this writing, the outcome of this conflict is still uncertain. Many of the details of the new commercial space policies have apparently not been finalized. Parts of them have been leaking out here and there, with portions appearing in this publication and that. Many observers originally expected President Reagan to make the subject part of his State of the Union speech on January 25th. To the surprise and disappointment of many pro-space activists, space was not even mentioned in the speech, except for references to the Strategic Defense Initiative. According to sources in Washington, much of the silence and confusion on this subject can be directly attributed to the war currently taking place between NASA, Congress, and Space Industries.

Oddly, Space Industries' official position is still one of enthusiastic support for NASA and the $25 billion Space Station. All of the company's press releases and commentary stress the ISF as being "complementary" to the Space Station project. Their literature states that "the ISF cannot provide permanent occupancy of space, nor can it--or any number of ISFs clustered together--prepare us to travel or live beyond low-earth orbit...all of which are important capabilities of the Space Station and are goals vital to this nation." Readers may wish refer again to page 8.

This is puzzling, given that SII has dealt the Space Station project a crippling blow, ant that NASA seems to be trying to cut Space Industries off at the knees. Does the company's attitude simply reflect the feelings of its senior management, long-time NASA veterans who combined spent nearly 12 decades working with the space agency before SII was founded? Or is it the fact that the Industrial Space Facility is, as currently envisioned, a hostage to NASA's Space Shuttle? And what of the Space Station contractors, who seem supremely unconcerned about the whole thing? Is the fix already in?

Despite any current popularity that Space Industries may be enjoying in Congress, the company could run into serious problems farther down the road if NASA decides to make things difficult. There is no doubt that NASA, like any bureaucracy, would be able to make life hell for SII without appearing to the average observer to be anything other than the soul of cooperation (for an example of NASA's techniques in this area, I refer you to the space agency's slow and patient punishment of Transpace Carriers, Inc., chronicled in the October, 1986 *C.S.R.*)

I mentioned earlier that putting low-cost space habitats before low cost space transportation was putting the cart before the horse, and Space Industries' reliance on the Shuttle is an example of this. Each future launch of a complete ISF will cost the company nearly $100 million per flight. Resupply flights will be less expensive, since only part of the Shuttle's payload will be dedicated to the supply module, but they will not be cheap.

There is no way of knowing what SII's situation would be, what its attitude toward government-funded development programs might be, how much less expensive the ISFs could be to build and lease, if reasonable, routine manned space transportation were available that did not have the stringent requirements and high costs of the Space Shuttle.

If Space Industries manages to raise from the private sector the $600 million it says it needs to build the ISF, and if NASA ends up buying space for its research programs aboard a privately-built space station, then it is entirely possible that NASA and the rest of the government may one day end up going to the private sector for manned space transportation as well.

It should be noted that $600 million is enough money to develop Pacific American Launch System's manned Phoenix launch vehicle and Third Millennium's manned Micro Van spaceplane.

Both.

Today the Space Station--tomorrow the Shuttle.

* * *

Articles of Interest in Other Publications

For more on the history of the U.S. Space Station: "The Space Station Nobody Wants" by T. A. Heppenheimer in the February, 1987 issue of *Reason* magazine (pp. 22-28).

Note to subscribers: this issue is late, largely due to the fact that I waited until the State of the Union speech to try to assemble and analyze the complete picture on the new commercial space policies. Reagan came up with a big zero on space, so I was left to rake up what I could find. Despite limited information, the new policies have so many ramifications that my article seemed to expand faster than the Space Station's budget. The result is this issue, which is 10 pages instead of the normal 4 to 6. And I still had to put some of the article off until next month! The good news is that this is not a "two-in-one" issue--just a real fat regular one. Think of it as a bonus of sorts to make up for the delay. Thanks for your patience.

Until next time,

The Commercial Space Report (C.S.R.) is published monthly, and endeavors to report and analyze developments in the field of private initiatives in space transportation and exploitation.

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