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White House Releases Shuttle Pricing Policy

The Reagan Administration has proposed a Space Shuttle pricing arrangement involving auctioning cargo bay space with minimum bids starting at $74 million (1982 dollars) for an entire dedicated cargo bay. Under the proposed procedure, the National Aeronautics and Space Administration (NASA) would be limited to auctioning only three cargo bays' worth of space per year to commercial and foreign customers until two years before the scheduled launch date. At that time, NASA could sell any remaining space that is not spoken for by the U.S. Government. There are apparently some exceptions to the three-per-year restriction, but details are still somewhat fuzzy. This procedure is scheduled to begin in 1989.

The space industry has been waiting for this announcement which represents a major turning point, although not a final culmination, of the launch vehicle price war which has been going on in private industry and government for some time (C.S.R., Mar. 1985, pp. 3-4).

The $74 million price is an enormous victory for NASA, the Congress, and payload customers, which have been pushing hard for lower Shuttle prices. Although NASA had been battling for the slightly lower price of $71.4 million, at one point the agency had shown a willingness to live with a price as high as $87 million. With the actual cost per flight hovering between $250 to 300 million, the huge taxpayer subsidies to the Shuttle will continue. Even assuming that an auctioning process would tend to drive up prices, these higher prices would still not begin to approach actual costs. NASA insists that these low launch prices are essential to compete with France's Arianespace and the Ariane launch vehicle. The Congress agrees, and further points out that low prices encourage space commercialization. The customers agree with both of them, happy to get the lowest prices they can regardless of the issues involved.

The low price also represents a major blow to the Department of Transportation and the expendable launch vehicle (ELV) industry, which had been pressing for higher Shuttle prices such as $100 million per flight to allow ELVs to compete for payloads. Particularly hard-hit will be companies such as Transpace Carriers, Inc., which is attempting to market the McDonnell Douglas Delta ELV.

In addition, there is a negative effect on investment in future, low-cost space transportation alternatives to the Shuttle and Ariane. Although the launch costs of some of these proposed alternatives would be much lower than even subsidized Shuttle prices, the distortion of the market caused by the subsidies is still felt by entrepreneurs seeking investment funds for new launch vehicle ideas.

Adding insult to injury, Congress is still not satisfied, and demands for even lower prices are being heard. For example, Rep. Bill Nelson (D.-Fla.), chairman of the House Science and Technology Committee's Space Science Subcommittee, was unhappy with the White House policy. Nelson claimed that the uncertainty of the auction process and the new so-called "high" price would drive more business to Arianespace and worsen the foreign trade deficit.

It is possible that the Presidential policy will be modified, or even replaced by the Congress when the next session convenes. Until now, Congressional activity on Shuttle pricing has been somewhat chaotic, with the issue being batted about between the House and Senate as part of NASA funding legislation. However, this new action by the White House may inspire sudden unified action which may result in the auction idea being tossed out, and the post-1989 Shuttle payload bay price at even less than $74 million.

Space Industries Signs Launch Agreement With NASA

Space Industries Inc. (SII) of Houston, Tex. will be able to buy Shuttle launches on credit under the terms of a modified launch services agreement (MLSA) that the company recently concluded with NASA. Space Industries is planning to build a commercial, pressurized, intermittently manned space module called the Industrial Space Facility (ISF). The ISF would be launched permanently into orbit and then leased by customers for space processing or other uses. Normally, NASA requires money in advance for a launch, but this agreement would allow Space Industries to purchase launch space to place their ISFs into orbit, and then pay NASA later out of revenues generated by leasing the facilities.

The agreement covers three launches: the first, dedicated entirely to SII, would place one ISF into orbit along with about 10,000 lbs. of equipment from the first customer and one supply module. This launch is scheduled for sometime late in 1989. The second flight, sometime in 1990, will occupy only about half of one Shuttle bay and contain another supply module along with assorted hardware and equipment. The third flight, again dedicated to SII, would be launched in 1992 and deploy a second complete ISF module assembly.

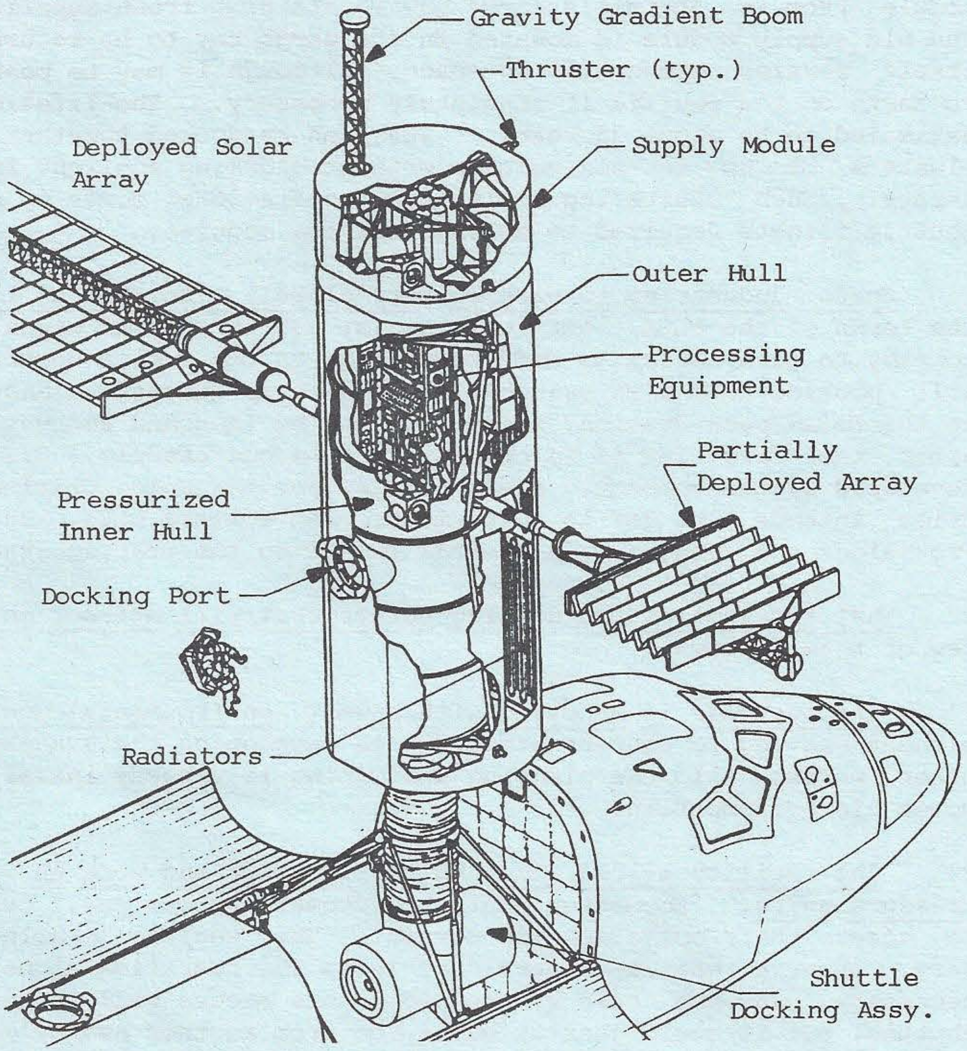
Space Industries would repay NASA by turning over 12% of its annual cash revenues to the space agency until the flight costs are paid off. If the current Shuttle pricing policy holds up, costs would be $74 million (1982 dollars) for the two dedicated flights, and some fraction thereof for the partial payload flight. There will also be some $20 million in additional fees to pay. NASA is charging the company no interest, although the payments will be indexed upward over time to allow for inflation. There is apparently no upper time limit to complete payments. How much 12% will come to depends on how much money SII makes. Any following flights to launch further ISFs, or to service existing ones, are not covered under the current agreement.

This arrangement has been hailed by some as representing a step away from subsidizing private endeavors with taxpayer money, referring to the nearly free flights which NASA has awarded some selected companies unable to come up with the large advance payments normally required. Maybe so, but it is a somewhat small step. Leaving aside the fact that the full Shuttle price is already subsidized, it is hard to look at an interest-free loan with no deadline for final payment and no apparent minimum size of payment and call it anything but a form of subsidy (I should only get such terms next time I buy a car).

What Space Industries does represent is an initial step away from a government monopoly on manned space facilities. All development funds for the ISF will come from the private sector. SII president Maxime Faget emphasizes that the ISF will employ as much off-the-shelf technology as can be managed. Despite this, his development costs for the first two module sets are estimated at $250 to $500 million, a figure that others in the industry regard as unusually high for the described systems. Space Industries is presently exploring funding sources, locating contractors to build the hardware, and actively marketing the facilities.

ISF Technical and Operational Information:

A single ISF (a preliminary version of which is shown at right) consists of a pressurized module 10 feet in diameter and about 32 feet long, containing some 2,500 cubic feet of usable space. The pressurized module is surrounded by an outer shell 14.5 feet in diameter and 35 feet long, containing exterior hardware and radiators for thermal control. The module has four docking ports: one on each end and two on the sides of the module. Two 100-foot-long deployable solar arrays will provide the facility with up to 12 kilowatts of power. Equipment is also included to provide the customer with temperature and humidity control. Other life support functions are not normally provided, as will be explained later.



A 10-foot-long supply module would be docked to one of the end ports. This module is designed to contain raw materials for the customer's processing requirements, and also to contain the processed materials for return to Earth. In addition, the module contains a supply of compressed air. While the ISF is operating in an unmanned mode, air from the pressurized module is routed into tiny low-pressure thrusters which are used to keep the ISF on station. The air inside the module is replenished from the supply module's tanks. This slow movement of air from tanks through the module and into space is insufficient to support human occupants, but may help to prevent any possible buildup of toxic gases which may accumulate from some industrial processes over a period of months in such an enclosed area. Aside from the thrusters, additional attitude control is provided by a 120-foot-long weighted boom for gravity gradient stabilization.

During resupply missions, which will probably occur two to four times per year, the ISF would be docked to a Space Shuttle orbiter using a docking facility which will be provided by Space Industries. While the Shuttle is docked to the ISF, crew members and maintenance personnel could move freely through the docking tube into the ISF's pressurized module. During this time, life support functions (that is, the replenishment of oxygen, removal of carbon dioxide, and rapid circulation of air) are provided by the Shuttle orbiter, using equipment normally used to perform similar services for Spacelab modules. Personnel will eat and sleep in the Shuttle.

While internal inspection and maintenance are performed, the Shuttle's remote manipulator arm is used to remove the old supply module (containing depleted stores and processed product) from the end of the ISF, and replace it with a fresh supply module from the Shuttle's cargo bay (containing fresh supplies and raw materials). The old supply module is mounted in the cargo bay to be returned to Earth. The ISF itself remains permanently in space, although it may be possible to bring one back to Earth on the Shuttle if absolutely necessary. The lifetime of a typical ISF is estimated to be about 25 years. ISFs can be docked together side by side in linear clusters of up to six modules without blocking sunlight from any of the solar arrays. Such clustering could reduce operational costs by reducing the number of Shuttle flights required to service all the modules.

Space Industries is working very closely with NASA on the ISF project. Under the terms of the MLSA, NASA will assist SII in several areas, such as helping the company to gain access to NASA technology in the public domain. For its part, SII will provide NASA with valuable experience in operations and technology applicable to the NASA Space Station, which will not be launched and until at least three years after the first ISF is in operation. As one example, SII's docking mechanism, developed by the company, could be used for the Space Station by NASA. Space Industries intends the ISF to complement, not compete with, the NASA Space Station. Provisions can even be made to dock an ISF to the Station itself.

What are some of the selling points that will attract customers to the ISF? A few of them follow:

1) The customer is supplied with power, environmental control, and other basics without having to concern himself with developing the systems to do the job. In other words, all the plumbing and wiring is already installed when the customer moves his equipment in.

2) The facility allows human beings to enter and work on equipment without using pressure suits. No matter what the automation boys say, customers want to be able to access their operations in person. They want to be able to tinker when necessary, observe when necessary, or leave the operation alone and undisturbed when necessary. In the case of the ISF, this access will initially be from the Space Shuttle, but it could just as easily be from another nearby manned space facility.

3) The facility is a free-flyer, normally dedicated to a single customer. One of the things that stands out about most space processes is that they are highly intolerant of any interference from other, outside operations. An unplanned human movement, an orbital correction at the wrong time, electronic or mechanical "noise," or any other influence from external sources can ruin many microgravity procedures.

4) The module is easily modified to accommodate a customer's needs. Although SII has not been specific, it is assumed that changing an ISF's function would involve either moving processing equipment in and out through the docking tunnel, or loading the entire facility onto a Shuttle and returning it to Earth for refurbishment. (Actually, considering that a dedicated flight would be required to do this, it may be just as cheap in the long run to put the unused ISF into mothballs in orbit until someone else needs the same processing equipment, and launch a new facility.)

The ISF and The Space Station--a Comparision:

Given all the technical and operational features of the ISF, one may ask, exactly what does the NASA Space Station have that a cluster of ISF modules does not? This is probably an uncomfortable question, to say the least, not only for NASA, but for Space Industries, which at present is relying heavily on NASA's good will and avoids any speculation on the subject. However, compare how each facility handles the needs of the space processing customer:

Both facilities accommodate the customer by providing power and a pressurized, temperature controlled environment allowing human access without pressure suits. However, for service personnel to enter a Space Station processing module, they can simply pop in from a nearby habitation module. At present, the ISF, with no on-board life support, must dock with the Shuttle or some other facility with life support equipment for servicing.

On closer examination, though, this is irrelevant. As has been mentioned earlier, the last thing a processing facility operator is going to want is to attach his module to a Space Station containing numerous other operations and six to eight people bouncing around inside it. Just try microgravity operations under such conditions. From another point of view, Space Station personnel may take a dim view of certain industrial processes being attached to their living quarters, unless great efforts are made to reduce any possible toxic elements that may be released into the air. Another problem with attachment to the Space Station is the large size of the Station. This tends to create a gravity gradient across the length of the Station that makes it difficult to create a microgravity environment less than 10^{-5} G, even at the Station's center of gravity. Free-flyers, such as the ISF, may be able to allow a microgravity environment as low as 10^{-10} G. As far as the lack of a life-support system for the ISF is concerned, I'll address that in a moment.

Most important to customers, the ISF will be operational before the Space Station. The first ISF should be in orbit and running by the end of 1989. The first portions of the Space Station will be launched in 1993 or later, and will not finish checkout and begin operations for at least a year thereafter. This is at least four or five years in which a space processor could be making money.

Now, a very uncomfortable question: do we need the NASA Space Station at all in its present form? In the February, 1984 issue of the C.S.R., I compared the McDonnell Douglas Manned Orbital Systems Concept with the current Space Station concept, and the Space Station came up considerably short. Let's see what we can do with the basic systems proposed by Space Industries.

A Modest Proposal:

First of all, we switch from a large, centralized Station to a flotilla of small modules and module clusters as a configuration. Processing would be done in free-flying facilities completely separate from the modules where personnel live. Transport between facilities and living quarters would be accomplished by a simple, manned orbital transfer vehicle designed to accommodate a few people and a small amount of cargo. This vehicle 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 (think of it as an orbital version of a small pickup truck). It would ferry the supply modules to an orbital depot point where they could be transferred in quantity to a Space Shuttle. One Shuttle flight could then handle cargo from many separate processing facilities without having to rendezvous with each of them (the only other way to accomplish this is to attach all the materials processing ISFs to each other, creating many of the problems for the processing customers as docking to the Space Station would have). Such a "fleet" of free-flyers is also ideal for other space activities such as astronomy and some forms of life sciences requiring a highly-controlled environment.

Okay, you say, but we still need a Space Station. Where will the personnel live? Also, there is still a need for a central facility for repairs, and other functions less sensitive than microgravity processing. Well, let's take the ISF system and build one.

NASA's price for a Space Station containing about 6,800 cubic feet of habitable space, supplying 75 kilowatts of power, and assorted sundries: $8 billion--minimum.

Assume Space Industries' upper cost figure of $500 million for two ISFs. Each has, as was mentioned, 2,500 cubic feet of habitable space, and supplies 12 KW of power. They can, according to SII, be easily clustered in numbers up to six. So, let's put six together. Assume that each pair of additional modules still costs $500 million (basically absurd, since they would get much cheaper after the basic R & D is done, and they are being built in production). Six would add up to $1.5 billion. At least six Shuttle flights would be required to place them in orbit. Throw in, oh, a round $100 million per flight. We're now up to $2.1 billion. What do we now have? 15,000 cubic feet of habitable volume (over twice that of the NASA Space Station). All the solar arrays could deliver 72 KW of power--only 3 KW short of what the Space Station delivers. All this power probably wouldn't be necessary in our "flotilla" scenario, since most of the energy-hungry processing and other 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, for that nagging life-support problem. An ISF doesn't come with one. We'll have to build it, along with our little orbital pickup truck. How much money do we have left over? $8 billion less $2.1 billion is $5.9 billion. Think we can manage some oxygen tanks, fans, CO2 scrubbers, and an orbital tranfer vehicle or two out of that? Don't forget to set aside about a billion for the toilet...

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NASA Administrator Rules Out Shuttle For Space Tourism

NASA Administrator James Beggs has informed a space tourism company that the Space Shuttle will not be made available for carrying tourists in the foreseeable future. According to the August 26th issue of Space Business News, Beggs informed the president of Orbital Adventures, Edward Swandstrom, of this new policy. In a letter to Swandstrom, Beggs cited safety problems and the scarcity of available payload space as his major reasons.

This leaves Orbital Adventures and other companies looking at the space tourism market (Society Expeditions is another) high and dry, unless they resort to one of the manned launch vehicle systems proposed by private companies such as Pacific American Launch Systems ("Phoenix") or Third Millenium Inc. ("Space Van").

Articles of Interest In Other Publications

An excellent analysis of the Strategic Defense Initiative is contained in an article in Reason magazine for September, 1985. Titled "A Down To Earth Guide To 'Star Wars'," by Richard Vigilante, the article correctly emphasizes the strategic consequences of the proposed systems as opposed to the technologies involved. Unfortunately, the latter gets most of the attention in a majority of the discussions of the subject.

Until next time,

Tom Brosz

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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