Space Commerce: The Quest for Coherence

Space commerce is now a stormy adolescent; the Administration, like a first-time parent, wonders how to set the rules

President Ronald Reagan's enthusiasm for the commercialization of space seems boundless: not only was it a major factor in his endorsement of the National Aeronautics and Space Administration's (NASA's) space station, but he has made it a centerpiece of his space policy.

In the real world of politics, money, and bureaucracy, however, it has not been so easy to turn that enthusiasm into a coherent program. The biggest bone of contention at the moment is the pricing of launches on the space shuttle, and the near impossibility of promoting all forms of space commerce simultaneously. But looming in the near future are issues such as international and private sector participation in the space station, the eventual privatization of the space shuttle, and the question of who will call the shots on federal space policy. The Administration has made a beginning, but only a beginning.

The source of all this federal activity is a growing investment in space by private industry. Development has been proceeding along two rather separate paths, a fact that is not unrelated to the Jekyll-Hyde nature of the space shuttle.

On the one hand, the shuttle has clearly fulfilled its promise for manned spaceflight, as dramatized by *Columbia*'s performance as an orbital laboratory during last autumn's flight of Spacelab 1 and by *Challenger*'s recent repair of the Solar Maximum Satellite. The result is a surge of interest in developing new high-technology industries in orbit. McDonnell Douglas and Johnson & Johnson are projecting that their zero-gravity pharmaceuticals process will be producing sales of $1 billion per year by the mid-1990's. Rockwell International recently estimated that sales of space-produced semiconductors and high-purity glasses would reach $10 billion per year in the 1990's.*

On the other hand, the shuttle has turned out to be a lot more expensive and balky than NASA expected, as dramatized by *Discovery*'s recent engine failure on the launch pad. So far, the system has simply failed to live up to its billing as a cheaper pathway to space. This has provided an opening for private companies or foreign governments to pick up on the older style expendable launch vehicles and go after the communications satellite market or the occasional remote sensing satellite—payloads that do not really need an astronaut's supervision (see box on p. 814).

Both the people who want to use the shuttle for space manufacturing and the people who want to offer competing private launch services have made their voices heard in Washington, and in many ways the Administration has responded briskly. Craig Fuller, for example, the President's special assistant for cabinet affairs, organized a working group last year under the Cabinet Council on Commerce and Trade to develop an Administration policy on space commerce. Reagan duly announced the results on 20 July, the 15th anniversary of the Apollo 11 moon landing: rationalize the laws, eliminate discriminatory tax structures, and generally grease the regulatory wheels. In other words, direct subsidies are out, but, for example, a product manufactured aboard the space shuttle will not have to pay customs duties at landing. Specific executive orders and legislative proposals to implement the policy are promised soon.

NASA Administrator James M. Beggs

Meanwhile, Fuller and the agencies have been working out a bureaucratic division of responsibility for space commerce. The Commerce Department, for example, will handle the international and macroeconomic aspects; the Department of Transportation will oversee the fledgling private launch industry; the Treasury Department will work on eliminating discriminatory provisions in the tax code; and NASA will continue to focus on space-related research and development. (Congress recently amended NASA's charter to require the agency "to seek and encourage, to the maximum extent possible, the fullest commercial use of space.")

In short, the Administration is beginning to treat space commerce like any other industry. "It represents a maturing of space," says L. J. Evans, NASA's representative to the cabinet council working group. Space commerce has outgrown NASA and has begun to make itself felt all through the Executive Branch. "What surprised me was the relative lack of turf fighting," Evans says. "We're all of a mind that there's more than enough to go around."

Unfortunately for *gemütlichkeit*, however, there is the matter of shuttle pricing. Reagan has thus far maintained a genial attitude of "promote everything." But promoting everything may be a contradiction in terms.

At the moment the shuttle prices are set through 30 September 1988 at the highly subsidized level of $71 million per launch (for a full payload bay; partial loads are prorated). Sometime within the next 6 months, however, NASA must decide whether to let the post-1988 price rise to "full cost recovery," or to continue some form of subsidy. The din on either side is loud.

On the side of full cost recovery are the struggling private launch services. They maintain that they should not have to compete with Uncle Sam. "Our actual costs are much lower than the shuttle's," points out Charles M. Chafer, vice president of Space Services, Inc., of Houston. "But *we* have to make a fair return on investment."

They are supported by the Transportation Department, which is understandably going to bat for its newfound constituency; by the Defense Department, which would love to see the shuttle prices go up to justify its own move to expendable launch vehicles (*Science*, 29

*These ventures and many others are detailed in a special issue of *Aviation Week & Space Technology*, 25 June 1984.

June, p. 1407); and by the White House Office of Management and Budget (OMB), which loathes subsidy on principle, and which would love to see the shuttle flight rate minimized in order to minimize the total outlay.

On the other side, however, the high-tech people argue just as loudly for a continued low price. Zero-gravity materials processing is not a proven technology by any means; in the early years, at least, the experiments will have to be done in the hands-on environment of the shuttle. So if the shuttle price skyrockets, the smaller investors and the riskier projects—the potential Apple computers of space commerce—will be out of the game before it begins.

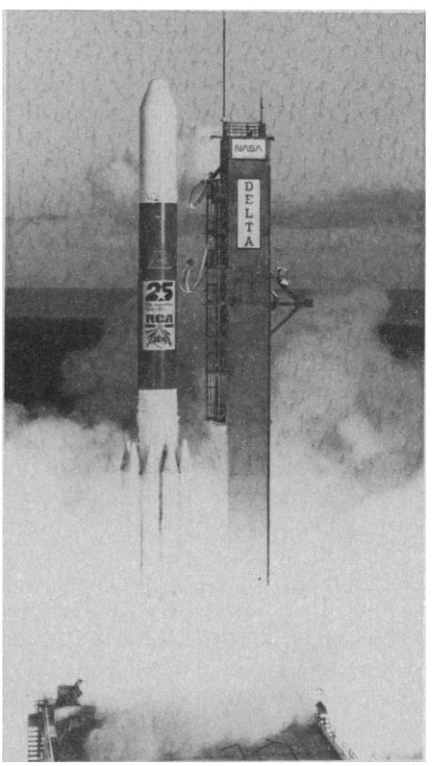
They are supported in this by NASA, in part because the agency is convinced that the high-tech industries will ultimately be much more important than an expendable launch vehicle industry—"They are more technically exciting and have more of a potential for new market opportunities," says agency administrator James M. Beggs—and in part for a purely bureaucratic reason: NASA is eager to get rid of the shuttle and hand it over to a private operator.

It should happen about 1988, says Beggs, just as soon as the shuttle is through its development phase and the flight rate is up to 18 or 20 flights per year. Otherwise NASA will cease to be a research and development agency and will instead become a high-tech trucking company. "The agency would be impacted severely by that kind of operating responsibility," he says. "We'd spend most of our time worrying about how to keep the flight rates up." On 31 July he announced the formation of a "Shuttle Operations Strategic Planning Group" to assess the options; the report should be ready by 1986.

But the only way to make this happen, NASA believes, is to keep the shuttle program vigorous, competitive with Ariane and the Japanese, and full of customers. Otherwise who would want it? "The best of all possible worlds is where we get the costs down to providing a reasonably competitive price," says Beggs. He believes the agency can hold its post-1988 price to a relatively modest rise of 25 percent—if the shuttle maintains a good flight rate. But if shuttle prices skyrocket, then customers will start a serious migration to the competitors, there will be fewer launches over which to amortize fixed costs, the cost of NASA's own flights will be that much higher, and the whole mess will be less than attractive to a private operator. "The effect of a big price jump in 1988," says one high agency official, "is that the shuttle will be heavily subsidized indefinitely."

Thus the agency's strong reaction to the Defense Department's move to put some of its payloads on expendable launchers. "If the Defense Department got off the shuttle entirely, it would have a very significant impact on shuttle cost," says Beggs. "They say they aren't, but somehow I worry."

One possible compromise solution is to go to full cost recovery for those payloads that can use expendable launchers, and then give various subsidies to high-tech payloads—for example, something along the lines of NASA's existing joint endeavor agreements, in which experimental modules by McDonnell Douglas, John Deere, or 3M ride free on certain shuttle flights. But then NASA would also have to endure a storm of criticism about "sweetheart deals" and "trying to pick the winners." It will be a good trick to find a balance that everyone can live with.



The Delta

Can expendable launchers compete with a subsidized shuttle?

Looking a bit further, there is the issue of the permanent space "infrastructure," and who will build it.

In retrospect, NASA should have given its next major project a plural name like "space flotilla." It would have been less confusing. Since Beggs first made the space station an agency priority in 1981, the concept has evolved from being a single large *thing* in space to being a cluster of free-flying pieces—in some cases in entirely different orbits. Some of the pieces mentioned most often:

- Laboratory modules for materials and life sciences.
- Unmanned, free-flying platforms to support telescopes and some of the more sensitive materials science experiments.
- Unmanned, remotely controlled "orbital maneuvering vehicles" to service instruments on platforms and free-flying satellites.
- Orbital construction facilities, fuel dumps, and "drydocks" for satellite assembly and maintenance.
- A reusable orbital transfer vehicle to ferry satellites into geosynchronous orbit.

NASA's estimate for the complete list is $20 billion by the early 2000's, which works out to an average of $1 billion per year, or somewhat more than half of what the agency is now paying for space shuttle development.

Obviously, there is plenty of room here for arguments about options, timing, and cost effectiveness. On the other hand, there is widespread enthusiasm for the general idea of a permanent space infrastructure, even among those like the OTA or the space science community, who bitterly criticize NASA's specific plan (*Science*, 13 July, p. 146). The most telling testament is that a vigorous and increasingly independent aerospace industry is eager to make and market various pieces of the infrastructure on its own, with private, not public, money at risk.

An example is Fairchild, which is marketing its Leasecraft as a rental platform. Fairchild is hoping to fly a McDonnell Douglas/Johnson & Johnson electrophoresis module and a NASA ultraviolet telescope jointly on the first Leasecraft mission in the late 1980's. An even more ambitious platform is being proposed by Space Industries, Incorporated, of Houston: specialized for materials processing, the module would have a pressurized interior allowing astronauts to resupply and service the facility in a shirt-sleeves environment.

In addition, there is the possibility of NASA doing joint ventures—say an orbital transfer vehicle co-funded by the communications satellite industry. Moreover, overseas allies such as Japan and West Germany are extremely interested in building part of the NASA space station.

The upshot is that there is a happy opportunity for the United States and its allies to build an extensive space infra-

structure on an as-needed basis, with minimal public investment. The problem is that both statesmanship and a lot of clever politicking will be needed to pull it off. NASA will have to become as much a coordinator as a builder, spinning off major pieces of the space station to international partners; it has rarely had to do such a thing in the past. Successive administrations will have to master the delicate interplay between government and private sector investment; that particular subject has been buffeted in the ideological winds for generations.

And NASA will probably have to justify once again why it needs to bother with building "infrastructure" at all. It is a legitimate question: if the private sector enthusiasm is so high, why not just let private investors build the pieces as needed—and as they become profitable?

These questions should begin to take on some urgency by late next year, when NASA's fiscal year 1987 budget request for the space station will approach $1 billion. Some critics, such as the authors of the OTA's upcoming space station study, are not too sure that the agency will rise to the occasion. They worry that NASA's space station is mostly the product of agency officials' bureaucratic concern for keeping their own engineers and research centers busy, plus a corporate culture that still sees space as NASA's sole preserve and that is obsessed with thinking big.

NASA, however, maintains that a permanently manned space station, while absolutely necessary for large-scale industrial and scientific research in space, is far too expensive and financially risky for private investors; the government has a long tradition of taking the lead in this kind of project. Top agency officials also say they are eager to cooperate with private industry in space. "We're trying to leverage our money," says Evans. "If we could let the private sector do the more mundane things, it would free up our limited funds to do the cutting edge things."—**M. Mitchell Waldrop**

Congress Drafts Generous Biomedical Budgets

Although Senate approval is still pending, Congress is expected to boost NIH and other agencies by more than 10 percent

Congress is close to approving a budget increase of at least 10 percent for biomedical research in fiscal year (FY) 1985. The Administration had requested virtually no increase, partly on the assumption that Congress would follow its usual practice of boosting whatever was requested, but the final totals are likely to be well above what the Administration anticipated. The expected increases would permit a sharp rise in the number of new grants that could be funded.

The funds are included in the appropriations bill for the Department of Health and Human Services (HHS), which was approved by the House on 1 August. The Senate is expected to approve a broadly similar bill when it reconvenes in September. However, several important differences between the two bills will have to be reconciled before Congress departs for the election, and there is also an outside chance that President Reagan will veto the bill. Nevertheless, the chances for passage are considered good.

The biggest difference between the House and Senate appropriations bills arises from the House's refusal to allot money for unauthorized programs. Although both the Senate and House have passed bills that would reauthorize many National Institutes of Health (NIH) programs, disagreements over how to deal with fetal research and other bioethical questions, and whether to establish arthritis and nursing institutes are holding up final passage. Observers say there is less than a 50–50 chance of a bill being enacted this year.

The House did not include any funds for unauthorized programs in its version of the NIH appropriation, making it look at first glance vastly different from the Senate version. However, once the unauthorized component is taken away from the Senate's total for NIH, the two are very close. The House calls for a total of $4.834 billion, while the Senate is slightly higher at $4.932 billion. Both figures are considerably higher than the comparable FY 1984 appropriation of $4.301 billion or the $4.395 billion recommended in the President's budget request for NIH.

The biggest chunk of unauthorized funds in the Senate bill, but omitted from the House version, is for training grants, amounting to more than $220 million (see box). The House also has not allocated money for the National Cancer Institute's cancer control and construction programs or for the National Library of Medicine's grants and contracts program—altogether nearly $100 million. If Congress fails to pass an NIH reauthorization bill, these programs will be funded at current (lower) levels under a continuing resolution.

Both the House and Senate bills seek to bolster NIH support for extramural research. The Senate version shows greater largesse, recommending an additional $240 million over the President's budget to fund approximately 6850 new and competing grants. The House also recommends an increase, of $151 million, to allow for a total of 6200 new grants—1200 more than the Administration calls for. The recommended increases would enable about 40 percent of proposals that receive high ratings from peer review committees to be funded, according to an NIH official. The current rate is about 30 percent.

Several items in the appropriations bill represent unsettled, potentially contentious issues. The House report and the Senate version of the bill carry strong language about restoring most of the 588 full-time job slots at NIH that the Administration has recommended cutting.

NIH officials have said that the cutbacks could hurt intramural research programs, especially if they affect postdoctoral fellows, foreign visitors, and summer students. Congress has provided money to prevent this from happening, but the Administration contends that it, rather than Congress, has the prerogative to set personnel levels. HHS officials recently sent a strongly worded letter to senators on the Appropriations Committee, objecting to "unnecessary constraints on personnel management" in the Senate bill. The HHS officials called portions of the bill "an inappropriate intrusion into the responsibility of the Secretary [Margaret Heckler] to manage the Department. . . ."

A similar situation has come up for the Alcohol, Drug Abuse, and Mental Health Administration, with Congress

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