Private Launch Prospects Improve

Paying customers are finally beginning to sign up for private rocket launches; enthusiasts think the new industry could transform the space program as a whole

On 8 April, a little more than 14 months after the space shuttle Challenger disintegrated over Florida, aerospace giant McDonnell Douglas announced that paying customers had so far booked nine separate communications satellites for a $50-million flight on its new Delta II launcher, at a down payment of $50,000 per reservation. Rival Martin Marietta has likewise announced nine reservations for a $100-million ride on its Titan series of launchers, at $100,000 per reservation. On 10 April, General Dynamics announced an agreement with the National Aeronautics and Space Administration (NASA) giving it the right to produce, operate, and sell the Atlas-Centaur vehicle commercially. And industry observers expect a spate of further announcements within the next few months.

In short, the launch crisis precipitated by Challenger has transformed the nascent commercial rocket industry: after years of stagnation, frustration, and delay, it is finally starting to move. Indeed, with major aerospace companies pursuing the traditional, high-stakes communications satellite market, and with a number of start-up companies trying to open up broad-based markets for their simple, relatively low-cost rockets, the situation is reminiscent of the computer industry back in the days when "IBM" meant "mainframe" and Apple Computer was just coming out of its garage.

There is plenty of room for skepticism, of course. The first commercial launches are still nearly 2 years off, and the long-term demand for them is hazy at best. Nonetheless, the industry is worth watching, and as more than just a business venture. If it develops as enthusiasts hope—admittedly a big "If"—it could help bring a new emphasis on simplicity and efficiency to the U.S. space program. It could provide scientists and other users with easier and more frequent access to space than they have now. And it could ultimately make space flight into precisely the kind of low-cost, "customer-oriented" endeavor that the space shuttle promised and never delivered.

The idea for a commercial launch industry is not a new one. But until recently it has been a study in frustration. The idea first drew wide attention in the early 1980s, as NASA began to phase out its conventional, or "expendable," rockets in favor of the reusable space shuttle. Even then, many of the shuttle's commercial customers were growing impatient with the shuttle's frequent schedule delays, together with the expense and bother of "man-rating" their satellites to meet NASA's astronaut safety requirements. It occurred to many observers—especially rocket manufacturers McDonnell Douglas, Martin Marietta, and General Dynamics—that profit could be made by offering the familiar expendables as a cheaper and more convenient alternative. In parallel, start-up companies such as Space Services Incorporated in Texas and American Rocket Company in California announced that they would offer low-cost launchers developed from scratch using off-the-shelf technology.

The entrepreneurial flavor of the idea appealed to the Reagan Administration; thus, in June 1983, Reagan signed a formal order making it government policy to commercialize the existing Atlas, Delta, and Titan launchers and to encourage the start-ups. At the same time, the Office of Commercial Space Transportation Systems was created within the Department of Transportation to facilitate the transition and to set up a rational regulatory environment for the new industry.

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However, Reagan's policy had a loophole, one that eventually stalled the whole enterprise. In those years, under former administrator James M. Beggs, NASA was trying to amortize the shuttle's multibillion dollar per year operating cost over as many paying customers as possible, which meant filling up the shuttle with all the commercial payloads it could find. Thus, to placate NASA, Reagan's 1983 policy allowed the shuttle to continue in the commercial launch business. Very quickly, in fact, the Administration's attention was deflected away from promoting the infant launch industry and into a long, divisive interagency fight over shuttle pricing policy. In 1985 Beggs won: the shuttle would be subsidized to keep it competitive with the European Ariane rocket and with any other launch vendor.

"We didn't even have a commercial environment," says Courtney Stadd, director of the space transportation office at the Transportation Department. The shuttle's price may have been "competitive"—but what was to keep some future administration from cutting the price still further?

The upshot was that the potential launch vendors, for the most part, lost interest, and the commercial payloads were left to Ariane and the shuttle—until 28 January 1986.

In the aftermath of the Challenger disaster, the U.S. launch industry emerged as one of the few beneficiaries. First, the accident removed the space shuttle as a competitor. Any support that NASA may have had for its all-shuttle strategy vanished in the Challenger fireball. On 15 August 1986, at the same time he gave the agency the go-ahead for a replacement orbiter, Reagan issued the decree: henceforth, NASA shall not pursue commercial payloads that can fly on expendable launchers. "Only since then," says Stadd, "has industry really believed that there was a fundamental commitment [to commercialization]."

Second, the Challenger accident provided the industry with a guaranteed market: the inexorably growing backlog of shuttle payloads. Reagan did not insist that NASA jettison the commercial customers that had already been signed for the shuttle. But with the system grounded for at least 2 years—NASA officials have recently abandoned the original target date of 18 February 1988 for the next launch, but have not yet set a new one—and with priority going to science and national security payloads that cannot get into space any other way, the issue was moot. When the agency released its first post-Challenger shuttle manifest in September 1986, it left 25 communications satellites looking for an alternative.

The result has been the flurry of reservations mentioned earlier; McDonnell Doug-

las and Martin Marietta both say that they hope to have firm contracts soon. True, the U.S. companies have not been in the ideal position to pick up the shuttle orphans. Most of the vehicle assembly lines had been shut down in the pre-Challenger years as part of NASA's phase-out, and restarting them will take time; none of the companies will be ready to launch until 1988 or 1989 at the earliest. On the other hand, as Stadd points out, the U.S. companies have been in at least as strong a position as their foreign competitors, which have their own problems.

Consider the most important competition, Ariane. The operating company, Arianespace, has indeed booked five former shuttle customers in the past year, in addition to two new American payloads. But Ariane's manifest is now full through 1990, and accommodations are sharply limited. In any case, the Arianes are still grounded after a string of their own launch failures; much of the company's credibility rides on the success or failure of its next launch attempt, which should come sometime this year.

Meanwhile, Japan's new liquid-fueled H-2 booster will not be tested until 1992; the first payloads will not fly until 1994. The People's Republic of China has signed two American satellites for its Long March II launcher, yet the Long March has only had two successful launches out of three attempts so far, and it has to be rated as an unproven vehicle. And the Soviet Union's offer of launches aboard its Proton booster seems primarily aimed at developing nations such as India or Indonesia; technology transfer restrictions make it a highly unlikely choice for an American company.

"Can U.S. launch companies be competitive?" asks Stadd. "Damn right they can."

In addition to all of that, two of the U.S. companies also have a large and unique advantage: a guaranteed industrial base, provided courtesy of the Air Force.

In the aftermath of the Challenger accident, the Pentagon was facing backlog problems at least as bad as those of the communications industry, with 21 payloads standing idle and more coming through the pipeline. As Air Force Secretary Edward Aldridge recently explained to a Senate hearing on launch vehicle policy, "There is a growing demand to use space to support military operations on the ground." Instead of just operating a handful of intelligence satellites, he explained, the Pentagon is now planning whole networks of satellites for navigation, command and control, early warning, and weather forecasting. Indeed, he said, "Space is the fastest growing element of the Air Force budget." (The Pentagon's total spending on space in 1986 was some $17 billion, or roughly twice NASA's budget; prior to the Reagan Administration it was roughly half NASA's budget.)

Martin Marietta

A Titan III at liftoff. *Martin Marietta has announced nine reservations for its Titan series of launchers.*

As a result, Aldridge had both the incentive and the money to move quickly. Before the shuttle accident, after a bitter argument with NASA, the Air Force had already awarded Martin Marietta a contract to develop and produce ten heavy-lift Titan IV launchers as a supplement to the shuttle; shortly after the accident, Aldridge ordered another 13. He also accelerated efforts to refurbish 13 of the older Titan II ICBMs. (An additional 56 are still available.) And in January 1987, after a vigorous competition among the aerospace companies, he awarded McDonnell Douglas a $316.5-million contract for seven newly developed Delta II rockets—"medium-lift launch vehicles" for the Pentagon's new system of Global Positioning Satellites. The Air Force also has an option for 13 additional Delta IIs if they are needed, for a total of $669 million.

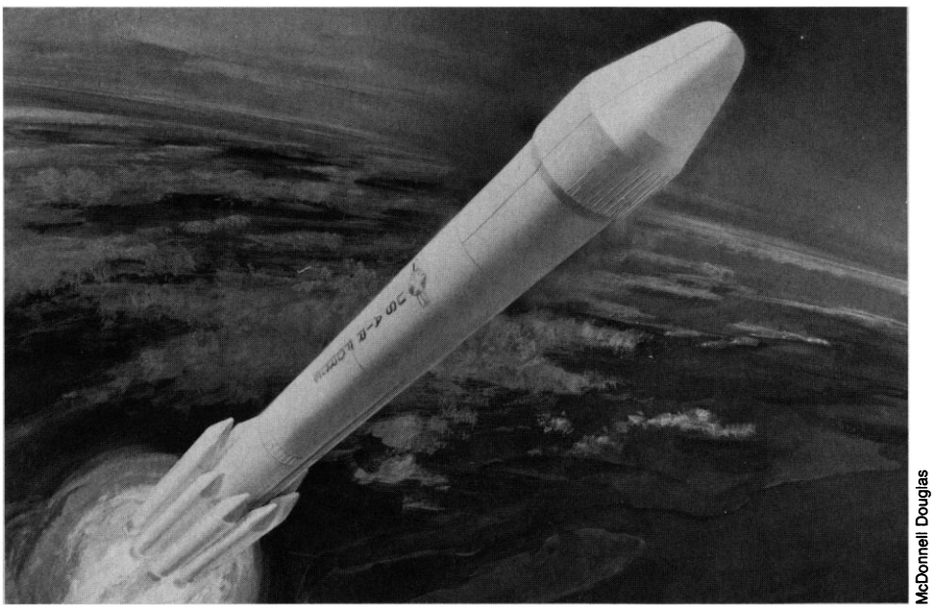
The payoff from the commercialization point of view is that the Air Force purchases will keep the assembly lines humming for years to come, which means in turn that Martin Marietta and McDonnell Douglas can produce additional rockets for their private customers at a lower marginal cost. A rough measure of this advantage comes from the Air Force's Delta II contract: the cost of the first seven vehicles works out to about $45 million apiece, whereas the cost of the next 13 works out to $27 million apiece. As a company spokesman admitted when the first nine business reservations were announced on 8 April, "We couldn't have done it without the Air Force contract."

In sum, then, the prospects for a private U.S. launch industry now look brighter than they ever have. On the other hand, one has to ask whether this is really the dawn of a new industry, or something more closely akin to a flashbulb.

Consider the most fundamental question one can ask of a new commercial enterprise: "Where's the market?" Obviously, there is the shuttle backlog and the ongoing purchases by the Air Force. NASA will presumably be using expendables for some of its science and applications payloads if it can ever find the money. (The agency currently has no official plan for how it will balance expendables with the shuttle.) The National Oceanic and Atmospheric Administration will be launching the occasional weather satellite. But what else?

The fact is that long-term demand for commercial launches is exceedingly vague. In the pre-Challenger years this was a major stumbling block for the companies, leaving aside competition from the shuttle, and little has changed. On-orbit materials processing is still little more than a wish and a prayer; despite extravagant forecasts of multibillion-dollar profits in space by the year 2000, no one can hope to rely on commercial materials processing customers for a decade or more—if ever. Commercial remote sensing is still mired in an endless series of arguments about transferring the federal Landsat system to a private operator; in any case, remote sensing is unlikely to require more than a handful of launches per decade. And the prospects look unsettled even for communications satellites, the world's staple payload for the past 25 years. Since the early 1980s new data-processing technology has made it possible for existing satellites to handle a much higher data rate. The spacecraft themselves have proved to be much more durable in orbit than expected. (The average lifetime is now about 12 years, up from 9 years.) And ground-based fiber optic lines are becoming major competitors for long-distance telephone service. Industry observers do foresee a continued increase in demand for communications satellite services, especially for broadcasting and data transmittal—but they are not at all sure about the long-term demand for communications satellite *launches*.

Added to the vagueness of the commercial market is the companies' striking and intimate involvement with government. They will be using rocket technology developed at government expense. They will be relying on government purchases for economies of scale. They will be leasing government launch facilities and sharing liability with the government. (Stadd's office is currently trying to hammer out an agreement on exactly how this will be done.) They will be regulated by government—for safety, if nothing



McDonnell Douglas

McDonnell Douglas' Delta II. *An upgrade of the launch fleet's venerable workhorse, the new Delta takes aim at the shuttle backlog—with a lot of help from the Air Force.*

else. And as time goes on they may very well be depending upon government for the bulk of their business. So how, exactly, are they going to be anything but government contractors by another name? Will they feel any incentive to develop new markets, or to take on the enormous financial and technical risk to develop new generations of launch vehicles?

The answers to these questions depend upon whom one asks. The established aerospace companies, for example, do seem rather cautious about the long-term commercial market. At both McDonnell Douglas and Martin Marietta, spokesmen admit that their companies have few specific commercial plans beyond competing for the shuttle backlog and the conventional communications satellites. Certainly they are not now planning to develop new-generation vehicles with their own money. "We think we're positioned right for the market for the next 5 to 6 years," says McDonnell Douglas spokesman Jeffrey Fister, "and that's about as far ahead as you can tell in a business environment." With their hefty Air Force contracts, moreover, both companies seem comfortable with their reliance on government. "Ideally, we'd like to have half and half," says Fister. "We expect to make a lot more profit on the commercial payloads, but the problem is that they only come in ones and twos. It's hard to plan. So we always hope to have the government contracts as a steady base."

However, one can hear a very different set of answers from the small start-up rocket companies. Probably the best known of these firms is Houston-based Space Services, Incorporated, founded in 1981 by local businessman David Hannah, who is now the chairman. Former astronaut Donald K. Slayton is president. Space Services' Conestoga rocket, which is assembled from solid-fueled boosters developed in the 1960s by Morton-Thiokol, can lift as much as 2000 kilograms into low earth orbit, or as much as 220 kilograms into geosynchronous orbit; depending on the customer's requirements, Space Services will charge from $12 million to $20 million per launch. In September 1986 the company signed an agreement with NASA for the use of the agency's launch facilities at Wallops Island, Virginia. In February it received an infusion of venture capital—$30 million, according to one press report—from Houston Industries, Inc., a local power company. And later this year it hopes to announce its first firm contract, which calls for five separate launches.

"The world we have right now—mainly big communications satellites in geosynchronous orbit—is a steady-state or declining market," says Charles Chafer, Space Services' vice president for marketing. "That market is well served by the existing Deltas and Titans. But that's not where we think the action is." The real future lies with nontraditional payloads and nontraditional customers, he says—start-up remote sensing companies, mass-market navigation satellite services, or (ultimately) new zero-gravity industries. These are people who could never afford to get into the game before. Moreover, they are a prime market for small, simple, low-cost satellites deployed in innovative ways.

Look at communications, says Chafer. Instead of launching a $150-million Intelsat 6 spacecraft into geosynchronous orbit aboard a $100-million Titan, a customer could launch a dozen or more miniaturized, $500,000 satellites into low earth orbit aboard one of Space Services' $15-million Conestogas. A start-up company called Globesat Express has proposed a network of 50 such satellites that would provide continuous voice and data communications for the entire United States. The Defense Advanced Research Projects Agency is exploring a similar idea—"Lightsat"—in which 240 miniature satellites would provide global communications for the Pentagon. Another such network might provide battlefield commanders with quick aerial imagery of their combat zone.

In a military context, says Chafer, such systems have the virtue of survivability: one big satellite is a sitting duck for hostile action, whereas 240 little satellites would be as hard to destroy as a swarm of mosquitoes. In a civilian context, an operator (or his insurance company) does not lose everything if one launch lands at the bottom of the ocean; some capacity is still there. By the same token, the operator can allow his capacity to grow in step with the demand. "You don't have to put up a $150-million satellite, take it or leave it," says Chafer.

Chafer's mass-market approach is admittedly not going to make Intelsat 6 and its brethren obsolete, in the same sense that a desktop personal computer cannot take the place of a Cray X-MP supercomputer. Moreover, it is admittedly an untested vision. Hopeful ventures have failed before. About all one can say at this point is that the business climate in the aftermath of Challenger is as conducive for such ideas as it has ever been.

On the other hand, if this mass-market approach to space does work out, one can imagine it having far-reaching effects on the space program as a whole. Certainly the idea should strike a responsive chord among space scientists and space applications researchers. Simplicity, redundancy, low cost, frequent flight opportunities—these are exactly the themes that researchers have been sounding, with increasing urgency and frustration, ever since NASA began pushing all its missions onto the shuttle. If the vision of low-cost commercial access to space ever really does begin to come true, one can easily imagine university groups, industrial laboratories, and even NASA rushing to take advantage of it—if, of course, they can also adapt to a new way of working and thinking. ■ **M. Mitchell Waldrop**