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Space Deals

The Coming of the New Space Industry

The late summer of 2006 provided many exciting developments for those interested in the high frontier—including both supporters of NASA's human spaceflight program, and enthusiasts of the new, entrepreneurial space passenger activities of the private sector.

In late August, NASA achieved a major milestone in its plans to return to the moon, over a third of a century after the last men left it, when it awarded a multi-billion-dollar contract for the Orion spacecraft to a team of contractors led by Lockheed Martin. Orion, formerly called the Crew Exploration Vehicle (CEV), is the modern version of the Apollo command module/service module (CSM) that represents part of NASA Administrator Mike Griffin's so-called "Apollo on steroids" approach to fulfilling the Vision for Space Exploration announced in early 2004 by President Bush. Like the original CSM, after being launched on an expendable vehicle, it will carry crew to lunar orbit (though with at least one more crewperson than the three-man Apollo missions), remain there while some or all of them descend to the surface in another vehicle, and return them to Earth, reentering the atmosphere in a blunt capsule and landing by parachute, either on land or water. The idea is that by going back to the methods used safely and successfully in the Sixties, the chances of deadly accidents and disasters, like those that befell the *Challenger* and *Columbia* shuttles, can be minimized.

The choice of contractor was a surprise to many in the space community, and a blow to the Boeing Corporation in particular. The conventional wisdom was that the team led by Northrop Grumman, along with Boeing (designated NGB), was favored to win, because those companies (particularly with Boeing's acquisition in the 1990s of Rockwell International's space divisions and the McDonnell Douglas corporation) had most of the historical experience with manned space programs. Though it builds the external tank for the space shuttle, and is a co-owner with Boeing of the United Space Alliance, which operates the shuttle and the International Space Station (ISS) for NASA, observers considered Lockheed Martin to have little experience with the development of systems designed for human spaceflight. In addition, some thought that the company's performance on the ill-fated X-33 program in the 1990s, in which a billion taxpayer dollars were wasted on an experimental prototype of a potential shuttle replacement that never flew, would weigh heavily in NASA's decision.

Perhaps these expectations led to complacency on the part of the NGB team (on which I played a part as a consultant in systems engineering). NASA indicated that one of the factors

in its decision was the performance of the two teams in the first phase of the program, with Lockheed Martin reportedly outdoing NGB and showing more innovation in its proposed solutions. Politically, Lockheed seemed more aggressive in promising to move the work to favored NASA locations, such as Houston, Texas; Huntsville, Alabama; and the Space Coast of Florida, rather than California, where NGB reportedly proposed to do much of the work.

Another much smaller NASA award, announced in mid-August, is of more interest to those who follow "NewSpace"—a term used to describe the emerging industry of startup ventures aimed at developing new, low-cost systems that can satisfy the expected demand for private space travel. From a field of contenders that had already been winnowed down to six, NASA selected two companies, Rocketplane Kistler and Space Exploration Technologies, for a new program called Commercial Orbital Transportation Services (COTS). The goal of this program is to nurture potential providers of commercial services to resupply and possibly help carry crews to and from the ISS after the space shuttle is retired in 2010. A half-billion dollars will be provided to the two firms, split roughly in half between them, to develop the systems they will need to provide such services.

This is a new way of doing business for NASA. While the Orion program is a traditional cost-plus-fixed-fee contract in which the contractor is reimbursed for actual costs as reported, plus a fixed percentage for profit, regardless of whether or not the hardware ever works up to specification (the shuttle and ISS being examples, though there are many military ones as well), COTS will provide incremental payment only upon the successful satisfaction of predefined program milestones. NASA micromanaging will be limited, and the hope is that the "bang for the buck" will be much greater.

Rocketplane Kistler, one of the two COTS awardees, is a recent merger of two companies that had been around since the early 1990s—Rocketplane LLC, and Kistler Aerospace. The former was originally formed to build a two-stage partially reusable vehicle for orbital delivery, with a first stage supplied with liquid oxygen in mid-air from a tanker to minimize its takeoff weight. It never got funding for this project, but recently has gotten funding (helped with transferable tax credits from the state of Oklahoma) to build a suborbital passenger system that will compete with the services Richard Branson plans for his Virgin Galactic space tourism company. Kistler has been planning a vertical-takeoff two-stage reusable vehicle type since its inception, and raised (and spent) several hundred million dollars toward that end, but ran out of funding when the projected low-earth-orbit communications satellite market collapsed in the late 1990s. The companies' merger earlier this year resulted in a more diversified entity, with potential for both hori-

zontal and vertical takeoff, and both suborbital and orbital markets.

By contrast, the other COTS awardee, Space Exploration Technologies (SpaceX), is a new kid on the block, only formed four years ago. Founded and funded by Elon Musk—one of the founders of the Internet money firm PayPal—it has not had to raise any outside capital to date. It had a failed first launch attempt in March 2006, but plans another for later this year, and continues to build hardware intended to grow to both heavy-lift capability and human transport capability, with expected low costs.

NASA's innovative COTS program, and its selection of these two providers, indicates a seriousness in creating a competitive commercial launch industry far beyond anything it has attempted in the past, even if the funding level remains a tiny fraction of the total budget it plans to spend on the development of its own vehicles.

But progress is rapid among NewSpace companies unblessed by NASA contracts as well. In July 2006, the Bigelow Aerospace company—started by billionaire Bob Bigelow, owner of the Budget Suites chain of hotels—launched a prototype space hotel, called Genesis 1, on a Russian Dnieper rocket. (Bigelow had originally hoped, and even contracted, to use a SpaceX vehicle, but it wasn't ready on time.) Genesis 1 is an inflatable module, littered with instrumentation to determine how it performs in orbit. Based on NASA technology from a taxpayer-funded program called "Transhab" that NASA never actually used, Bigelow built an inflatable module carrying hundreds of personal items that people paid to have sent on it; they are floating around in a kaleidoscopic whirl in weightlessness, with a camera watching and beaming the images down to Earth. Bigelow offers a money-back guarantee that every individual's memento will be viewed at some time as it tumbles around in space. (You can see this online at BigelowAerospace.com.)

While Bigelow was prepared for the failure of this first attempt, the Genesis 1 mission was successful beyond his wildest expectations—so successful that in September he announced his intention to fund and fly a three-person habitat to low Earth orbit by the end of the decade. It would be expanded to a capacity of nine people by 2012. He was, he said, not going to wait for the rocket industry or passenger market to catch up.

However, it turned out that Bigelow was hedging his bets. Later the same day, he held a joint press conference with George Sowers of Lockheed Martin, in which they announced an agreement to explore the possibilities of "human rating" Lockheed's Atlas V launch vehicle to allow it to carry a passenger module for transporting customers to and from Bigelow's new hotel.

Following on the heels of Lockheed Martin's surprise win of NASA's Orion contract, this was yet another shock to most of the space industry, for at least two reasons. First, it was extremely

out of character. Lockheed is primarily a government contractor; the company had done nothing remotely commercial for decades. Second, and even more surprising, were the timing and political implications. Only three weeks earlier Lockheed had been selected as NASA's partner for the Orion project, which will involve two new launch vehicles: the Ares I, which will carry the Orion, and the Ares V, which will serve as the equivalent of the Apollo-era heavy-lift Saturn V rocket. NASA had argued that it needed these new rockets because existing vehicles, like Boeing's Delta IV and Lockheed's Atlas V, could not be human-rated in the manner that NASA will demand for its crew launcher. Lockheed's partnership with Bigelow, combined with technical papers by that company describing the means of human-rating the Atlas V, undermines NASA's argument, perhaps making it much more difficult for the agency to sell its plans to Congress. Those within NASA who have been pushing for this new mission architecture, up to Administrator Griffin himself, cannot be happy with the agency's new industrial partner.

So why did Lockheed Martin do this?

No one outside the executive suite of the company can know for certain, of course. But one intriguing possibility is that they mean what they say—they're actually serious about this new market. The company hasn't been able to sell many Atlas flights recently, partly because the price is too high, due to a low flight rate resulting from a drop in commercial satellite and government business. That market reduction is partly the result of NASA's insistence on developing the Ares I, rather than using existing vehicles like the Atlas. One way out of this chicken-and-egg problem would be to find a new market, which Bigelow is obviously serious about. And what does Lockheed Martin really have to lose? It would be all but politically impossible for NASA to renege on the Orion award now. NASA is currently unwilling to use the Atlas for its new manned spaceflight plans, so they can't take that business away. Yet from Lockheed's point of view, it might be more lucrative to persuade NASA (or Congress) to use a vehicle derived from the already-existing Atlas instead of building the new Ares. Lockheed wins either way.

If Lockheed has finally embraced commercial spaceflight, it wouldn't necessarily be surprising, given the improving climate for this new industry. After all, just a few hours before Bigelow's announcement, Anousheh Ansari, an Iranian-American, became the first woman to pay her own way into space, passing through an airlock into the only existing "space hotel," the government-owned ISS. And just a few days afterward, Jim Benson, founder of the aerospace company SpaceDev, announced the formation of yet another new company dedicated to taking passengers into space, noting that he raised the initial million dollars with just a few phone calls, something that would have been unthinkable a few years ago.

With one of the OldSpace "dinosaurs" perhaps starting to sprout a little fur and throw its lot in with the "mammals" of NewSpace, 2006 may be viewed in the future as a critical inflection point—an apogee for NASA's influence over the future of large-scale expansion of humanity off the planet, and the beginning of a new space age for the rest of us.

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