

## NASA's Bold Plan for Private Spaceflight

The space agency wants private partners to launch cargo and crews into orbits. But is the private sector up to the challenge?

By Mark Williams



SpaceX's Falcon 1 rocket undergoes a "hot fire" or static engine test in the Kwajalein Islands in February. (Courtesy of SpaceX.)

From its beginnings in the 1950s, through the glory years of Apollo and to the present day, NASA has always owned and operated the rockets with which it launches crew and cargo into space. But last fall the agency attempted to kick start a quiet revolution in near-earth spaceflight.

In an [announcement](#), titled "Commercial Orbital Transportation Services (COTS); Spaceflight Demonstrations," NASA requested proposals from companies interested in building and operating rockets that could reach the International Space Station and serve both government and private-sector customers (see "[Private Space](#)," March/April 2006).

NASA recently disclosed that it has narrowed down the 20-plus companies that submitted proposals to a group of finalists. The winning companies won't be revealed until August 2006, according to the office of James Bailey, the COTS program's contracting officer.

But while NASA isn't talking, six companies have acknowledged they're finalists: Spacehab, Andrews Space, Rocketplan Kistler, t/Space, SpaceDev, and SpaceX.

The assumption behind NASA's COTS program is that market competition will reduce launch costs -- especially manned launch costs -- to make it commercially practical. Using the space shuttle, it costs NASA \$10,400 to put one kilogram into low-earth orbit - far more than originally promised when NASA first pitched the shuttle to President Nixon in 1969 -- while commercial prices range all the way from about \$4,300 per kilogram for a [Proton](#) launch to around \$30,000 for a [Pegasus](#) launch (the Pegasus is a small rocket, launched from the wing of a B-52, that is usually used to boost small satellites into orbit).

If the private sector doesn't step up, then between 2010, when the space shuttle is scheduled to be phased out, and 2011-2014, when the next-generation [Crew Exploration Vehicle](#) (CEV) is scheduled to take off, the agency will have nothing to carry a crew to the space station but the likes of Russian [Soyuz](#), [Zenit](#), and Proton rockets, which cost between \$30 million and \$90 million per launch. Even after the arrival of the CEV, though, which is designed mainly for missions to the moon and Mars, NASA says that vehicle will be too costly (at more than \$400 million per flight) to use for resupplying the space station if any other capability exists.

So just how affordable can manned launches get? Private companies could do them more cheaply than NASA by developing rocket engines that use hybrid fuels rather than traditional propellants, for example. The six companies who say they're finalists also use money-saving strategies such as building rockets from ceramic matrix composites, which are substantially lighter than conventional steel and nickel-based alloys. SpaceX claims that this approach could help it reduce launch costs by a factor of 10 and expects to be able to offer a price of \$1,000 for each kilogram sent into orbit by 2010.

In practice, however, SpaceX has experienced a dismaying series of failed test launches. Most recently, the company's Falcon 1 failed when a fire shut down the launcher's engine some 30 seconds after liftoff on March 24.

Indeed, the assumption that an unleashed private sector would automatically turn spaceflight into a reliable, relatively cheap service may be overly optimistic. Launching a ship into orbit is an achievement of a different order than air flight. And an analysis of actual spending by real-world rocket programs suggests that lower propellant costs wouldn't drastically drive down overall launch costs.

It turns out that the most expensive part of any rocket project is labor -- the high cost of retaining the necessary talent -- which accounts for 60 percent or more of most spaceflight programs. Steven Buckley, an Northrop Grumman aerospace engineer who works with the Rocket Systems Launch Program at Kirtland Air Force Base in New Mexico, has estimated that a typical launch team includes about 50 people. That works out to as much as \$7.5 million a year, Buckley calculates -- regardless of the number of launches the team achieves.

High labor costs could be reduced by downsizing launch teams. But how many personnel can be cut without jeopardizing safety? The size and the salaries of launch teams, in fact, are determined by the frightening challenge of safely accelerating tons of payload to escape velocity -- a speed at which problems not only cannot be fixed but often can't be properly seen (as in both the Challenger and Columbia shuttle disasters). Yet NASA and the companies competing for COTS program contracts are betting that both the costs and risks of spaceflight can be seriously reduced. Stay tuned.

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