

The private space industry soars higher by lowering its sights.

BARBED WIRE SURROUNDED the Bigelow Aerospace compound, set in a stretch of dry, rock-strewn Nevada desert. Las Vegas glittered in the distance, but otherwise the vista had the desolate look of a lunar landscape, with one difference: The summer heat was oppressive--enough to make you long for the cool vacuum of outer space.

The van full of visiting space geeks didn't mind the harsh conditions. Last July they happily left the air-conditioned glamour of Vegas' Flamingo Hotel and Casino, where the cream of the private space industry had gathered for the NewSpace 2006 conference, to spend a few hours at Bigelow's warehouse and mission control center. They couldn't have been more excited if the van had been on its way to a Star Trek-themed strip club.

Earlier in the week, Bigelow Aerospace had successfully launched Genesis I into orbit. A small pod that inflates once aloft, Genesis I is a prototype for cheap, livable, interconnecting rooms for commercial use in space. The first in a series of launches scheduled every six months for the next two and a half years, it marked the beginning of what could be the first privately funded space station.

Robert Bigelow, president and CEO of the company, made his fortune with the hotel chain Budget Suites of America and other real estate ventures. He has a logical goal in mind: an orbital hotel. Similar in concept to the International Space Station but much larger, Bigelow's space-habitat project uses a cast-off National Aeronautics and Space Administration (NASA) system of inflatable pods. He bought the rights to the technology in 2001, when he read that NASA was scrapping the promising system after many years and many more millions of dollars of development. Bigelow, 62, has since sunk \$75 million into the project, with a promise of \$425 million more to come.

Stepping inside Bigelow Aerospace's cool, antiseptic, heavily guarded warehouse was like walking into a science fiction novel. Enormous models and pieces of space-bound machinery were strewn about like forgotten Lego blocks over tens of thousands of square feet. The delegation from the NewSpace conference shuffled along with the quiet awe usually reserved for holy places. At one point, a member of Bigelow's mission control team looked at his watch and said, "Actually, Genesis should be passing overhead right now." Everyone in the room looked up, instinctively, as though the module would be visible. Then they grinned sheepishly at each other.

The grins reflected something more than embarrassment at having fallen for an old gag. ("Hey look," someone cracked, "gullible is written on the ceiling.") The visitors were just plain happy. After years of hope and

speculation, the private-sector space enthusiasts were thrilled to hear the words "It's overhead right now" from one of their own.

The Genesis launch, while exciting, is peanuts compared to what's coming in the next two years. Besides the ever-larger Bigelow launches, scads of private suborbital space vehicles will be popping up all over the planet and breaking out of Earth's atmosphere, about 62 miles above sea level.

Bigelow and his ilk are part of an industry that calls itself NewSpace, though some prefer the techy alt.space and others favor the touchy-feely personal space. Since the late '90s, they've been coalescing into clubs, nonprofits, and other associations. In the bad old days, this crowd got together mostly to bitch about NASA and its evil stepchildren, Lockheed and Boeing. But while NASA remains a topic of interest, NewSpacers have passed out of their whiny adolescent phase and into industrious young adulthood. Their aspirations are appropriately modest--mostly suborbital, just a quick trip to the edge of the atmosphere. They're setting aside deep space exploration and the moon for now (though they talk a big game about what's next), opting instead for reasonable, practical, short-term goals: quick hops for tourists and other near-to-Earth fun. And instead of crying on each other's shoulders, suddenly the NewSpacers are seeing each other--and sometimes NASA--as the competition.

Thanks in part to a preponderance of tech millionaires, the NewSpace industry is picking up speed. As Bigelow has noted, "We are probably a very close cousin to the world of the Internet and the computer world--doubling every 18 months."

In addition to big-name companies like Virgin Galactic, dozens of smaller entrepreneurial ventures wait in the wings, including Armadillo Aerospace, the rocket company started by Doom and Quake programmer John Carmack. So do communications equipment manufacturers, spacesuit designers, and many other enterprises, releasing pent-up innovation and creativity as NASA's long-lived monopoly on space, or at least suborbital space, wheezes to an end.

The industry, dominated just a few years ago by a bunch of seemingly loony space cadets with big dreams, is becoming the province of respectable, hardheaded CEOs. What happened?

[Three-Hour Tours](#)

The biggest name in the NewSpace business is the British billionaire Richard Branson. The pop entrepreneur founded the space **tourism** company Virgin Galactic in 2004, and he plans to be flying missions by 2008. Apparently taking a page from Gilligan's Island, Virgin will carry paying passengers on three-hour tours, complete with seven minutes of zero gravity, after just a week of preflight training. The Virgin spacecraft will be modeled on SpaceShipOne, the vehicle dreamed up by the aviation legend Burt Rutan. Rutan's spacecraft captured the privately funded Ansari X Prize in 2004 by being the first private manned ship to exit the atmosphere twice in a span of two weeks. After taking the \$10 million prize, Rutan's company, Scaled Composites, signed with Branson to build the bigger, better SpaceShipTwo. Rutan says the new ship will fly higher than the first model and carry eight people.

Branson has generated headlines for the private spaceflight industry (and himself) by accepting several \$200,000 down payments for early flights. Potential tourist-astronauts include Moby, Sigourney Weaver, Brad Pitt, Stephen Hawking, and Paris Hilton. In March 2005, Doug Ramsberg of Northglenn, Colorado, won a free trip on a Virgin vehicle in a company-sponsored lottery. (Perhaps he'll be one of the lucky few to witness Hawking and Hilton colliding in a brainy yet glamorous zero-g mishap.) Branson says he intends to be on the first flight of the geekily named *less Enterprise*, along with members of his family, two years from now.

Two additional companies, Space Adventures and Rocketplane, are also taking reservations and down payments for flights expected to launch on a similar timetable. But they aren't Virgin's only competition in the suborbital sweepstakes.

Elan Musk, the founder of PayPal, now runs SpaceX, which is developing the Falcon rocket series, designed to be a cheap, reusable means of getting satellites and eventually heavier space vehicles for human use into orbit. Falcon testing has been mostly unsuccessful to date, with several delayed launches and an unfortunate fire at the first launch, which sent the rocket crashing into the ocean. But Musk continues to be regarded as a leading figure in the commercial space world--some say the leading figure. NASA recently awarded SpaceX, in partnership with Rocketplane, a \$500 million prize to build a vehicle that will deliver crew and cargo to the International Space Station by 2010. Another potential customer for SpaceX is Bigelow, who has expressed a preference for privately developed U.S. rockets. Until a domestic option emerges, all of his modules "are flying on Russian Dneprs" Bigelow says. "They altered and removed nuclear warheads and they're using them for commercial purposes, which I think is pretty damn neat."

The most secretive entrant in the commercial space race is Jeff Bezos, the founder of Amazon.com (and a donor to the Reason Foundation, the nonprofit that publishes this magazine). His space *tourism* company, Blue Origin, is based on a 165,000-acre Texas ranch. It's developing a rocket ship called the New Shepard. A flight on the vehicle would last just a few minutes and allow a brief period of weightlessness. In mandatory government filings, Blue Origin revealed plans to start testing unmanned vehicles at the end of 2006. Otherwise Bezos has remained mum.

Branson and his peers are confining themselves to suborbital travel for now" blastoff, a few minutes of zero gravity at the edge of space, then back again. The technology to make this type of trip has been around for decades, though NewSpacers are working to make the trip exponentially cheaper, better, and faster. Bigelow's hotel-in-space project is more ambitious, on par with the International Space Station, but also has a longer time horizon. And no one has taken serious practical steps toward a private voyage to the moon, though there has been a lot of discussion about the legal preconditions to make a moon trip attractive to entrepreneurs. For starters, it's not clear how property rights will work on the moon or on asteroids. Who is allowed to build, and where? Perhaps more important, what can be brought back to Earth and sold?

Devotees of private space travel have long blamed NASA'S monopolistic behavior for their own failures. And it's true NASA has done virtually nothing to encourage outside innovation over the years--despite repeated mandates to do so--while selfishly sucking up billions of dollars and all the dreams and hopes of space buffs nationwide. But when the NewSpacers lowered their sights from "infinity and beyond" to a few minutes of floating, they realized NASA couldn't really stop them from snagging a little bit of space all their own.

Extraterrestrial Entrepreneurs

It was 1999 when the free market faction of the space world finally gave up on NASA. In that single year, NASA boasted two failed Mars robot missions, a mostly grounded shuttle fleet, a busted space telescope, and a semi-abandoned space station; it also aborted several pet projects, from a space plane to a planned landing on a comet's nucleus, in large part because they were politically inexpedient. Most space geeks had long ago lost hope that NASA would ever make it back to the moon, as the space agency seemed resigned to sending shuttles scooting back and forth to the International Space Station with small scientific payloads, spare parts, and the occasional astronaut. Pessimists pointed to the average age of NASA professionals, a ripe old 46, and sighed about the lack of innovation. Gone were the Apollo days, when the command was "Waste anything but time." NASA seemed happy to clunk along with its \$16 billion a year, doing what it had been doing since the 1970s: not much.

From that despair, the seeds of dozens of companies were tossed to the winds. A few promise bumper crops soon. Once the really big projects were out of the picture--Mars colonies, dinner at the Restaurant at the End of the Universe, etc.--a few guys with big money started to ask: What could be worse than NASA? We might as well try.

Surprisingly, many private space enthusiasts concede that things have started looking up at NASA in the last few years. The Mars rovers Spirit and Opportunity performed well, pluckily winning the hearts of the American public. The recent shuttle excursion to resume work on the International Space Station got good publicity and actually achieved something of practical worth by delivering new solar panels to the station. And there's another reason the grumbling has diminished: Getting out of NASA's orbit and into their own suborbital groove has left many NewSpacers with a more generous attitude toward the agency, or at least a willingness to turn a blind eye to NASA'S failings when their own projects are under way.

The Vegas conference was dubbed NewSpace 2006 but could just as easily have been called "Selling Space," since pretty much everyone in the room was doing just that, in one capacity or another. As one participant noted: "A few years ago, all these guys had the names of struggling nonprofits on their nametags. Today everyone's a CEO."

For years the Space Frontier Foundation, which organized the conference, has been nagging space geeks to stop thinking like engineers and start thinking like businessmen. The trouble with engineers, apparently, is that they are naturally authoritarian. If we could just calculate everything out to the nth decimal place, they say, we could tell you the One Right Way to get

to the moon or to launch a rocket. During the no-go '90s, conferences about commercial space ventures were dominated by talk of propellant, rocket design, and lunar habitation specs. "Here's the thing," warns Kevin Greene, founder of a fledgling startup called Lunar Constructors. "There is no 'optimum design' for a moon colony. This is hard for engineers to understand. This is not a libertarian tirade; there is a role for government. But don't over-design it."

Bigelow agrees with the sentiment, adding: "Whether you're building a regional shopping center mall or a 70-story office building, go out and find your anchor tenants. Don't build the whole thing from your idea of what might work."

Having shed their pocket protectors and donned pinstriped suits and silk ties--most of which, mercifully, didn't have little shooting stars or pictures of the starship Enterprise on them--NewSpace enthusiasts have grown comfortable with the language, and the indeterminacies, of business. The conference participants talked about "selling ourselves to the public," market segmentation, and strategies to fend off government regulation. Many were starting to think beyond the One Right Way to get to space and beginning to consider extra frills to offer travelers once they're up there.

This isn't to say the field has shed its nerdy image or impulses. Nearly every laptop in the Flamingo's Red Rock meeting room sported space-themed desktop wallpaper. (Perhaps 40 percent were Star Trek-related.) One speaker flattered a colleague by saying his "light saber is sharper" than most. And the trade fair presented in conjunction with the conference looked less like a cutting-edge technology expo and more like a middle school science fair. Foam boards with laser-printed pictures of spaceships dotted the walls, and a model rocket engine filled with water bubbled in the corner.

Selling Space

With the recent rise of the market-savvy spaceman, the business plan competition should have been a highlight of NewSpace 2006. Sadly, the viability of the proposals correlated inversely with how awesome they were. Not that rockets aren't cool, but it's hard for the layman to get really excited about which kind of hybrid propellant is going to maximize efficiency.

First among the compelling losers: a pitch for a suborbital football league cum reality show called Space Champions: Zero Gravity. The downs, company president Rocky Persaud conceded, would have to be short to fit into the 30 to 40 seconds of zero gravity at the apex of parabolic flight patterns, and tackling in the absence of gravity was going to be tricky. But he optimistically predicted the venture would be profitable almost immediately, with just \$3.2 million in financing at the outset. I longed to give this man my money, or someone else's, but his weak PowerPoint presentation and lack of an impressive board of directors suggested he had a long way to go.

Another plan mentioned "memorial space flights" where clients can outdo LSD guru Timothy Leary and Star Trek creator Gene Roddenberry by ensuring that all of their cremated remains, rather than just a few grams, make it into space. More measured options included cheap "dedicated launches for small payloads" and easier microsatellite launches. The fun stuff

captured the imagination, but the nitty-gritty on rocket manufacture and launch efficiency was bound to win out.

The guys pitching wacky projects have one thing right, though: If the public is going to be interested, it needs to see exciting images and hear wild stories about space. Grainy footage of "One small step..." can sustain people's interest only for so long. NASA has lost its touch at selling space, and NewSpace companies are just starting to learn the skill. Virgin Galactic has done the best job so far, with a sharp little product placement in the recent Superman movie: A Virgin Galactic-branded spaceship, possibly piloted by Branson himself, appeared in trailers for the film.

Even without a totally refined message or perfect, snazzy graphics, a handful of wealthy people are ready to get suborbital. The recent, highly publicized trip to the space station by Anousheh Ansari, the entrepreneur who helped bankroll the X Prize, has kindled broad interest in personal space travel. Another female space-traveler-to-be, Reda Anderson, told NewSpace participants she didn't need more reassurance or sales pitches; she preferred the rugged appeal of the young industry. "We're not tourists here" she said. "We're not going to go up and spend time in a hotel and have a nice meal and all that kind of stuff. "The first breed of space tourists and entrepreneurs will be attracted, as one conference participant noted, by the fact that space is "fresh real estate, like the Internet" room to grow and expand in an essentially lawless atmosphere (or, more precisely, no atmosphere at all).

But an industry cannot live off adventurers and libertarian dreams alone. Although the market is largely untested, a 2002 survey by the research group Futron found that interest levels were high enough to generate more than 15,000 suborbital tourists by 2021, assuming the price of a ticket comes down to about \$25,000 (in 2006 dollars). The Federal Aviation Administration's Office of Commercial Space Transportation put out a report last February estimating the space travel industry would be worth \$1 billion a year within 20 years.

The industry is already talking about what's next if and when suborbital jaunts become commonplace. Unlike NASA, commercial space companies answer directly to customer demand, so the dream of pushing on to the moon is strong. "That's what people want--the moon," says Bigelow with a grin. "But we've got a lot of steps before we get there. It doesn't mean we're not always thinking about it, though."

[Working for the Man](#)

There's the perennial problem of money, of course--of getting it to the right place at the right time, to ensure that the whole industry doesn't turn out to be a collection of fizzled vanity projects. Bigelow says vaguely that he's had some "serious interest" from customers for short stays in his space hotel, including various governments keen on sending up astronauts and scientists without the expense and hassle of running their own space programs. But Virgin Galactic has \$10 million worth of "interest" in hand--in the form of down payments from future space tourists. Virgin spokesman Will Whitehorn has bragged about the company's popularity and its cash on hand, saying, "I'm sure we will have sold out at least the first couple of years by the time we start flying."

The company's first commercial ship is expected to go up in 2008, and Branson says he intends to fly 500 people a year-the same number of people who have been to space in all of history. Perhaps with these confidence-inspiring figures in mind, Virgin inked a deal earlier this year to build a spaceport in New Mexico with some state funding on land set aside by the state for that purpose.

Virgin also has cleared a bureaucratic hurdle that many NewSpacers insist could still kill the newborn industry: the International Traffic in Arms Regulation (ITAR). The problem, oversimplified, is this: U.S. law limits the extent to which you can share technological information in any way related to defense with foreigners. This is understandable when it comes to new kinds of bombs or even snazzy night vision goggles. But it also could restrict the exchange of ideas about propulsion or guidance technologies for purely civilian use. Rick Tumlinson, co-founder of the Space Frontier Foundation and a sort of master of ceremonies at the Las Vegas conference, declared in one presentation: "As far as I am concerned, space ITAR is America's new Iron Curtain. Mr. Bush, tear down that wall."

The partnership between Virgin Galactic and the company that built SpaceShipOne managed to procure an exception to ITAR, though in a way that does not set a strong precedent. The victory came after five months of quiet legal spadework aimed at getting permission for the U.K.-based Virgin to use American SpaceShipOne technology for its commercial suborbital flights. As one attorney discussing the ITAR problem at a conference panel commented, "You should think of lawyers as your friends--your very expensive friends. We want to be part of the solution, not part of the problem."

Meanwhile, the government continues to baffle the young industry by other means. In January 2004, when the White House released its plan to get Americans back to the moon and then on to Mars, even the most hard-bitten NASA cynics took heart in the Bush administration's repeated suggestion that the space agency should contract with private companies for suborbital and orbital services. A mandate for the government to use private contractors where possible would be a serious shot in the arm for the industry. It would also reduce its independence, of course, and would elevate the preferences of government bureaucrats over the preferences of private consumers. Still, the possibility of extra cash was exciting, especially after NASA created the Commercial Orbital Transportation Services program (COTS). It offered a \$500 million prize to the company able to come up with a vehicle to move cargo and people back and forth from the International Space Station.

Thirty months later, the Space Frontier Foundation issued a despairing white paper. NASA couldn't let go entirely: While suggesting that it was open to private solutions, NASA invested millions in a redundant system, scaring off would be contestants for the COTS prize. NASA Administrator Michael Griffin, the paper declared, "claims that he hopes that COTS will work, but that he needs to fund NASA vehicles to go to [the space station] as an 'insurance policy' against the possibility that COTS doesn't work. But most insurance policies are a small amount of the value of the thing being insured."

Part of NASA'S unwillingness to gracefully cede suborbital jaunts to the private sector is its fear about "closing the gap." This "gap" is the period between 2010, when the space shuttle is decommissioned, and whenever its replacement kicks in. The COTS prize, recently awarded to a SpaceX/Rocketplane partnership, is encouraging. But it's hard to ask outside entrepreneurs to throw themselves into a project they know will be pushing against NASA'S entrenched bureaucracy.

NewSpacers don't consider NASA irredeemable, however. Ken Davidian, a NASA consultant, was the surprise winner of the popularity contest at the Vegas conference. He came representing the agency's prize program, officially known as the Centennial Challenges. Davidian spoke gleefully about competitors for the prizes who spend many more millions to win than the prizes themselves are worth. "Whatever their motivation is, we don't question it very much because we're making out like bandits," he exclaimed. "They do understand capitalism!" whispered Jeff Krukin, executive director of the Space Frontier Foundation, who was sitting next to me in the audience.

But the nerd orgy really began when Davidian clicked over to open a blank PowerPoint slide and asked for ideas for new prizes. For the first time all day, the crowd really perked up. Just a few of the ideas for prize contenders: largest lunar radiation-proof windows, first transmission of one kilowatt of power from orbit, paving the lunar surface for easier landing, and a fully funded college education for the first baby conceived in space. The whole affair was an embarrassment of riches. "This happens everywhere I go," Davidian says. He speculates that "even the most hard-core NewSpace guys really have a soft spot for NASA. NASA got them into this stuff in the first place, right?"

As the conference participants tried to shout each other down, there was a distinct scent of testosterone in the air. Richard Godwin, president of the space publisher Apogee Books, says that's typical of such gatherings. Though a young industry, NewSpace is already subject to some Golden Age-ism. "There was time when it was more purely cooperative, but now there's less collaboration and more competition," Godwin says wistfully. But then he shifts gears: "That's probably a good thing, actually." He even suggests taking the impulse all the way: "Everyone thinks they're the smartest guy in the room. I think we should just have a mud-wrestling match. Everyone, shirts off, and we'll decide who's smartest right here, right now."

The question will be answered one way or another in the next 24 months. Someone will be able to make money by taking people into space on a privately developed, privately owned spaceship. They won't go very far, and they won't be gone very long. But just a few short years ago, the smartest guys in the room were content to sit around and argue better than anyone else. Now--with help from an infusion of smart, rich guys--they're fighting for success in a competitive industry with real results on the horizon.

And the mud-wresting match? You know the industry is growing up, because when Godwin repeated his proposal to several fledgling CEOs, not one reached to unbutton his shirt.

[Everything You Wanted to Know About Sex in Space but Were Afraid to Ask](#)

RIGHT OFF THE BAT, there's bad news. According to Vanna Bonta, a poet and space sexpert with a sweet, breathy voice, "Zero gravity could cause a slight decrease in the size of the erect penis because of the heart not working hard, or low blood pressure."

So began "Sex in Space," the final panel of the NewSpace 2006 conference in Las Vegas. It was cleverly scheduled for noon on Sunday, to induce even the most hung-over participant to make it to the closing session. After some debate about whether or not it would be unacceptably sexist, the conference organizers sent up a nubile young volunteer named Starla (seriously) to introduce the panel, which included both the poet Bonta and a NASA scientist.

After Bonta's shocking first revelation, the news grew worse: "One of the by-products of sex is people," said Bonta. Unlike in Vegas, what happens in space does not stay in space, and there's a major concern that babies born off planet would not be able to return to Earth. It's pretty clear that conception doesn't require gravity, but "there may be some problems with embryo survival." And fetuses can't take gravity-simulation countermeasures, such as exercise with weights and running on a treadmill, which even adults staying in space for a relatively short period must do.

Laura Woodmansee, author of the 2006 book *Sex in Space*, laments the failure of an actual attempt "to make a porno film in space at the Mir space station. That didn't work out, which is a shame. Not that I'm into watching porno films, but think how many people would have bought that and developed more of an interest in space."

Too bad that Mir porn didn't get made. Nothing drives technology like pornography, and nothing would jumpstart the commercial space industry like a bunch of space fetishists. One conference participant later suggested, only half-jokingly, the creation of an orbital brothel to, ahem, stimulate interest. He even had a name for it: The Zero G-Spot.

There may already be a fetish community out there tailor-made for this market: bondage. According to Bonta, space sex will require "stabilization rooms" with handles, cubicles, Velcro, and bungee cords. It turns out that Newton's Third Law--the one about equal and opposite reactions--makes sex in low gravity something of a logistical challenge.

The fact that time and energy is being devoted to discussion of zero-gravity sex shows how confident the NewSpacers are about their hardware falling (or rather, rising) into place. The triumphalism notwithstanding, there are a few more kinks to work out.

One problem is whether women will want to go to space in the first place. A few of the early tourists will be women; Angelina Jolie has already plunked down cash for a seat on a Virgin Galactic flight. But if women can be induced to go, they're going to fret about what to wear. Such was the insight of Misuzu Onuki, Asia development rep for Rocketplane. In October 2005, Onuki held a Space Fashion Show in Fukuoka, Japan, complete with a floating wedding dress. "This concept is a good idea to attract young ladies to space," she says, noting sadly that "there are not many young ladies interested, even in space *tourism*."