Billionaires aim for cheaper spaceflight

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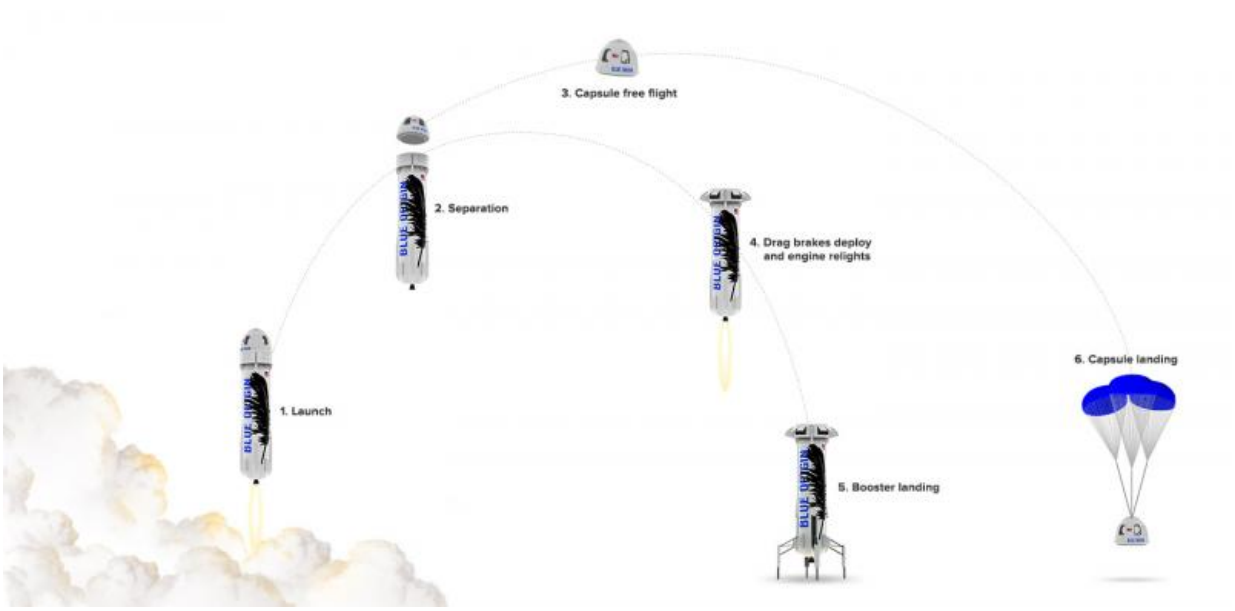

Credit: Blue Origin

In the booming commercial space business, ventures founded by tech billionaires Jeff Bezos, Elon Musk and Paul Allen are reinventing the most expensive aspect - launching spacecraft into orbit.

All three are intent on tapping the Seattle region's aerospace and software talent, and all three speak in visionary terms.

"Earth - this blue planet - in all its beauty, is just our starting point," Amazon chief executive Bezos says on the Blue Origin website. "Now is

the time to open the promise of space to all."

In April, Blue Origin successfully tested its New Shepard rocket. It's also partnering with Boeing and Lockheed to design American rocket engines that will replace the current Russian engines on government launches.

Bezos has gathered a 350-strong engineering team at Blue Origin headquarters just outside Seattle.

Serial entrepreneur Musk, who made his fortune as a co-founder of PayPal and reinvented the car at Tesla Motors, formed SpaceX to pursue his ambition to colonize Mars.

Already he has aggressively muscled his way into the heavy rocket market formerly dominated by Boeing and Lockheed Martin.

And SpaceX has just opened an office in the Seattle area where a team expected to grow to hundreds of engineers will design an ambitious satellite constellation.

Chuck Beames, president of Microsoft founder Allen's Vulcan Aerospace, says his boss perceives a business tipping point "analogous to the PC industry in its infancy."

From offices overlooking the stadium where Allen's Seahawks play in the NFL, Vulcan is developing a launch concept quite different from the Blue Origin and SpaceX rockets.

Later this year, it plans to roll out from a hangar in the California desert the biggest airplane ever built, designed to carry a rocket under its wing and shoot it into space from 30,000 feet.

The premise for all three companies is that launch vehicles must be

reusable so getting to space becomes dramatically cheaper. That could revolutionize the sector by encouraging startups to develop new space-based applications.

"The key to anything that any space company does is relatively inexpensive access to space," said Marco Caceres, space-industry analyst with the Teal Group. "The moment you see launch costs come down dramatically, you'll see a lot of companies popping up."

BLUE ORIGIN

Rob Meyerson, who in the 1990s worked at Kistler Aerospace - the reusable-rocket pioneer that went bankrupt after the dot-com bubble killed off its satellite-maker customers - is now president of Bezos' Blue Origin.

Though the company has been very secretive and still won't permit press visits to its facility, Meyerson opened up about some details in an email interview.

He said the company has about 400 employees, including "more than 350 and growing" at its engineering, manufacturing and business headquarters in a 260,000-square-foot facility on 26 acres.

"We're proud to call Washington our home base," Meyerson said.

The rest of the employees are at Blue Origin's remote launch site in West Texas.

In April the company launched the first developmental flight of its New Shepard vehicle, blasting an empty crew capsule capable of holding six people to a test altitude of 58 miles then returning it safely to Earth by parachute.

The plan to land the rocket itself back on the ground near the launch site failed when the hydraulic system lost pressure. Yet Bezos was undeterred, promising in a statement "to fly again soon."

Meyerson said the company is also getting ready for the next step - orbital spaceflight. "We're already designing our orbital launch vehicle that is many times New Shepard's size."

That rocket will be powered by a new Blue Origin engine fueled by a combination of liquid oxygen and liquefied natural gas. In a coup for Bezos, United Launch Alliance, the Boeing/Lockheed space-rocket joint venture, has earmarked that BE4 engine to replace the current Russian engines on its future heavy rocket.

Meyerson touted it as an "all-American rocket engine that will help assure American access to space."

Starting in 2010, Blue Origin received almost $26 million from NASA for work on the agency's space-taxi concept, a project to replace the space shuttle with a vehicle to carry astronauts to and from the International Space Station.

Since 2013, Blue Origin has been privately funded, though collaboration with NASA continues.

Asked about Blue Origin's ambitions, Meyerson said space tourism is one nearer-term goal.

"Offering the adventure of spaceflight to a new generation of explorers and adventurers is certainly something we're looking forward to," he wrote.

As for future destinations, "we want to go everywhere," Meyerson

added. "We're focused on our goal of making spaceflight more affordable and accessible so that one day there are millions of people living and working in space."

Caceres said Blue Origin has made quiet but impressive progress.

"They are for real," he said. "They are probably where SpaceX was six or seven years ago."

SPACEX

Founded in 2002, SpaceX has already slashed the cost of space access.

Caceres said the launch of a Boeing Delta IV Heavy rocket to launch a big military satellite costs $350 million or more. A Lockheed Atlas V launch for smaller payloads costs at least $150 million.

SpaceX, by contrast, lists its Falcon 9 rocket launches at about $70 million, he said.

After Musk dropped a lawsuit attempting to force the issue, the Air Force last month granted SpaceX certification for national-security missions - ending the monopoly on military launch contracts long held by the Boeing/Lockheed joint venture.

"The United Launch Alliance will have to change to survive," Caceres said. "It's not competitive commercially."

Having disrupted the launch business, the ever-moving Musk is now progressing to satellites.

He has talked about initially hiring about 60 engineers for the new Seattle-area office and potentially growing that base to as many as 1,000

within five years.

Musk plans a constellation of more than 4,000 low Earth-orbit satellites that will provide planet-wide broadband Internet access.

If the project progresses to the manufacturing stage, it's likely he'll look for state incentives to locate a factory to build the satellites - just as he did in choosing to manufacture the lithium-ion batteries for his Tesla cars in Nevada.

Still, the engineering work alone is a huge boost for Washington.

Alex Pietsch, who heads Gov. Jay Inslee's office of aerospace, said state officials are "excited at the chance to further diversify the aerospace industry" here.

VULCAN AEROSPACE

Vulcan Aerospace's concept is to launch space rockets into orbit from 30,000 feet up.

The idea is to make launches more routine, substituting an airport for a launchpad and costing only as much as the jet fuel to fly two 747s from Seattle to Los Angeles, according to Beames.

Vulcan's giant carrier plane, now taking shape inside a hangar in Mojave, Calif., is called Stratolaunch.

The main structure features twin fuselages - each roughly the size of a 747 jumbo jet.

A huge wing stretches across the top - the wingspan of 385 feet is the length of the Seahawks' home field, including the end zones. The

payload-carrying booster rocket will be slung under that wing, between the two fuselages.

The jet's airframe is largely carbon-fiber composite plastic. Janicki Industries - which has expertise in fabricating large, one-off composite structures - had more than 150 people working on providing large pieces of it, Vulcan confirmed.

Stratolaunch's engines, avionics, cockpit and landing gear have been cannibalized from a pair of used 747s.

That provenance highlights the challenges ahead; even test flights of new conventional airliners from Airbus or Boeing usually throw up unwelcome surprises, like the wing-flutter problems that caused unacceptable vibration in early flights of Boeing's 747-8.

With the Stratolaunch's novel shape, Vulcan will almost certainly run into such hard-to-predict issues once the plane flies.

Despite that, Vulcan has used Boeing engineers only as consultants, reflecting a typical tech-industry bias against established players.

"Candidly, I specifically recruit engineers who are not typically cut from the traditional cloth but are more entrepreneurial and less big-company-oriented," said Beames.

That spirit of pioneering innovation comes with risks.

Richard Branson's Virgin Galactic suborbital-space-tourism project is based on a precursor to the Stratolaunch concept and operates the technology under license from Vulcan.

The deadly in-flight breakup last October of Virgin's SpaceShipTwo

rocket plane - which killed one of the two pilots on board - served as "a cold, hard reminder that this can be a dangerous business," Beames said.

Unlike Blue Origin and SpaceX, privately funded Vulcan hasn't received any government contracts.

Its strategy has already undergone several changes, and right now what will be strapped under that huge wing is not clear.

Originally, SpaceX was to provide the booster rocket; Vulcan then switched to relying on rocket-maker Orbital ATK.

As recently as last fall, Beames spoke about a plan to put a human-crewed spacecraft developed by Sierra Nevada on the tip of the Orbital booster rocket.

But now that human spaceflight plan is shelved, along with Orbital's planned rocket.

Beames said Orbital's rocket "was not hitting the economic sweet spot to generate revenue," so Vulcan has reopened the design plan and is "evaluating over 70 different launch vehicle variants."

This shift won't affect the timetable for flying the carrier plane, he said, but it could mean "maybe a little delay" in the plans to use it to launch spacecraft into orbit.

Launching a manned spacecraft will be even further out, "in 10 years," he said.

Meanwhile, said Beames, Vulcan has decided to diversify beyond the Stratolaunch project by investing in other space companies. It put money into Seattle-based Spaceflight this spring and is actively searching for

more candidates.

As for direct Vulcan Aerospace employment, Beames declined to say how many engineers the company has in Seattle but predicted, "It'll likely double in the next year or two."

Though in 2011 Vulcan had said its space unit headquarters would be in Huntsville, Ala., Beames said it's now firmly established here.

"Paul (Allen) wanted a closer, more personal leadership on it," said Beames. "All future work ... will be run out of Vulcan Aerospace here in Seattle."

More information: www.blueorigin.com/