The New York Times

February 28, 2011

Space Tourism: One Giant Leap for Researchers

By KENNETH CHANG

If all goes as planned, within a couple of years, tourists will be rocketing into space aboard a Virgin Galactic space plane — paying $200,000 for about four minutes of weightlessness — before coming back down for a landing on a New Mexico runway.

Sitting in the next seat could be a scientist working on a research experiment.

Science, perhaps even more than tourism, could turn out to be big business for Virgin and other companies that are aiming to provide short rides above the 62-mile altitude that marks the official entry into outer space, eventually on a daily basis.

A $200,000 ticket is prohibitively expensive except for a small slice of the wealthy, but compared with the millions of dollars that government agencies like NASA typically spend to get experiments into space, “it’s revolutionary,” said S. Alan Stern, an associate vice president of the Southwest

Mark Greenberg
Virgin Galactic's SpaceShipTwo vehicle, also known as VSS Enterprise, on its first manned flight.

Research Institute's space sciences and engineering division in Boulder, Colo.

He is a spirited evangelist for the science possibilities of what is known in aerospace circles as suborbital travel. Just as important as the lower cost, scientists will be able to get their experiments to space more quickly and more often, Dr. Stern said.

"We're really at the edge of something transformational," he added.

Dr. Stern's institute announced Monday that it has signed a contract and paid the deposit to send two of its scientists up in Virgin's SpaceShipTwo vehicle. Southwest also intends to buy six more seats — $1.6 million in tickets over all.

That follows an announcement on Thursday that Southwest is buying six seats from another suborbital company, XCOR Aerospace of Mojave, Calif., which has been charging $95,000 a seat for tourists. XCOR's Lynx space plane carries just two people — the pilot and the paying passenger — so each flight will carry an experiment and an institute scientist.

"We have built, on our own dime, three payloads," Dr. Stern said. "We're buying tickets, before there is a government program from suborbital providers, for our own people to fly with those experiments."

XCOR
An illustration of the XCOR Lynx Suborbital Vehicle.

One of the Southwest experiments will look at how loose soil and rocks like those that cover asteroids behave. Another will fly an ultraviolet telescope that flew on the space shuttle Discovery in 1997. The third is a biomedical harness to measure heartbeat, blood pressure and other physical parameters of the scientist during flight.

When the experiments will get to space has not been set. Neither company has yet announced when commercial flights will begin, but eventually SpaceShipTwo could fly once or twice a day, and the Lynx is designed for up to four flights a day.

Virgin has already performed unpowered glide tests for the six-passenger SpaceShipTwo at Spaceport America in New Mexico and will begin powered ones soon. XCOR may begin flight tests of the Lynx later this year.

Two other companies — Blue Origin, created by Jeff Bezos, founder of Amazon.com, and Armadillo Aerospace — are also developing spacecraft for the tourist business. Another company, Masten Space Systems Inc., is developing a suborbital vehicle that will carry only payloads, not people.

Even if only some of these companies succeed, the prospect is that in a few years, hundreds of suborbital flights could be taking off every year. Dr. Stern predicted that even though a single flight would offer only a few minutes of weightlessness, the cumulative time of the suborbital

experiments could quickly overtake that of the International Space Station, which has been in orbit for more than a decade.

NASA will be flying automated scientific payloads on Masten and Armadillo rockets this year, and the agency will provide more opportunities for researchers in future years, although it has not offered to buy seats for people to accompany their experiments.

For scientists, that could finally provide them ready access to space.

“It’s almost impossible to get research on the space station at the moment,” said Mark Shelhamer, a professor at the Johns Hopkins University medical school who would like to study people’s balance and other motor sensory abilities before and after suborbital flights.

On Earth, gravity is the dominant force, and many common processes — the way that water boils, for instance, and that a flame burns — behave much differently without it. But many of the theories describing how physics should work in weightlessness have not been tested in detail.

Scientists currently have a few options for investigating weightlessness. They can drop the experiment from a tall tower, which provides a couple of seconds of zero gravity before it goes splat on the ground. They can send the experiment up in an airplane that flies an arcing trajectory known as a parabola, which provides up to half a minute of apparent weightlessness. Or they can get something to the International Space Station, where the pull of gravity is continuously absent.

The suborbital flights will offer an opportunity that falls between the parabolic plane flights and the space station.

The new commercial vehicles are essentially rocket-powered projectiles that arc upward and then fall back down, never coming close to the 17,500-miles-per-hour velocity needed to achieve orbit. At the top of the arc, passengers float for a few minutes.

The suborbital flights will also let atmospheric scientists explore in detail the Earth’s middle atmosphere, extending from about 30 to 50 miles above the surface, which cannot be easily observed from Earth or satellites. Biologists also hope to study how people, who rely on gravity to tell which way is up, respond to the rapid gyrations of gravity during a suborbital flight.

Reflecting the interest in the science community, more than 300 people are registered to attend a conference this week at the University of Central Florida in Orlando, organized by Dr. Stern, to discuss suborbital research. Researchers, Dr. Stern said, “vote with their feet. They go to these meetings.”

At the conference, the suborbital companies will provide updates on their progress, and scientists will talk about what types of research will be possible.

The Southwest Research Institute is the first paying science customer for Virgin, which already has deposits from more than 400 would-be space tourists. George T. Whitesides, chief executive, said that science and technology development could turn into a big market. “We think that many new applications and studies will flourish with such access — access which does not exist today,” he said.

Mr. Whitesides said that the science experiments would generally fly separately from the tourists, although it might be possible for researchers with unobtrusive biology experiments to ride on a tourist flight. “We would of course not mix the two categories on the same flight if we thought that one would negatively impact the other,” he said.

Not all the experiments require the scientist as passenger. Blue Origin, for example, has selected three scientific payloads that will fly on unmanned test flights of its New Shepard vehicle. One of the Blue Origin scientists is Joshua Colwell, a professor of physics at the University of Central Florida, who wants to understand how dust grains in the early solar system stuck together through low-speed collisions and grew in size to five-mile-wide planetesimals, which then combined into planets.

In 1995, Dr. Colwell applied to NASA to fly his experiment on the space shuttle, and it flew twice, in 1998 and 2001, but he has not been able to get follow-up research off the ground since then.

For Dr. Colwell's experiments, which require only a few minutes of weightlessness, the suborbital flights would work just as well as a much more expensive shuttle flight. And he hopes to be able to fly them perhaps several times a year instead of once every several years. Blue Origin declined to say when the test flights might occur.

Another of the Blue Origin researchers, Steven H. Collicott of Purdue University, is looking at how surface tension — the force that causes raindrops to roll up into beads on leaves — pulls liquids in space. Without gravity, these so-called capillary effects are the dominant forces on liquids.

Dr. Collicott, who has collaborated on experiments on the space station, said the suborbital flights will be a complement to the station, not a replacement.

"I think that first off, they really are two vastly different opportunities," he said. On the station, "the ability of running an experiment hour after hour after hour is the ultimate. On these new suborbital rockets, we might get three minutes, but it's a lot cheaper. It's a lot quicker."

He said his Blue Origin experiment, financed by the National Science Foundation, cost $20,000. He has also has a couple of smaller, shoebox-size experiments built by undergraduates for less than $1,000. Those are slated to fly on developmental flights by Masten and Armadillo.

"It's a nice, really great addition to the facilities available for research," Dr. Collicott said.