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SPOTLIGHT

GARVEY SPACECRAFT CORP.

Powerful Prospects

DEBRA WERNER, SAN FRANCISCO

On June 15, Garvey Spacecraft Corp.'s Prospector-18 rocket took off from a test range near Mojave, Calif., carrying four cubesats to a height of roughly 3,000 meters on a mission designed to characterize the launch environment. Although the parachute attached to the cubesats ejected prematurely near the end of the rocket burn, NASA recovered the rocket and payloads.

The cubesat's on-board instruments gathered data that will help NASA officials determine exactly what happened during launch and prepare for future flights, said Garrett Skrobot, launch services program mission manager at NASA's Kennedy Space Center. Cubesat developers remain eager to conduct additional high-altitude testing on Prospector rockets, he added.

The June 15 flight was the second time the Prospector-18 suborbital reusable launch vehicle carried payloads for NASA's Launch Services Program (LSP) and its fifth flight overall. During the first LSP flight in December 2012, a Prospector-18 powered by a single liquid oxygen and ethanol engine flew experiments and instrumentation provided by the NASA Ames Research Center, California State Polytechnic University in San Luis Obispo, Calif., and California State University in Long Beach to an altitude of 5,000 meters.

"The [recent] flight wasn't perfect, but it was still productive," said John Garvey, Garvey Spacecraft chief executive. "The liftoff and launch were nominal. The engine burned well and showed improved performance."

Garvey, who previously worked as a senior manager on the Delta 3, Delta 4 and Delta Clipper-Experimental programs at McDonnell Douglas Corp. and later at Boeing after the companies merged in 1997, quit his job in 2000 to devote his attention to Garvey Spacecraft Corp. His goal was to develop advanced technology to launch satellites more quickly, easily and inexpensively than existing rockets.

"Many interesting launch vehicle technologies were stuck in the transition between development and flight testing," Garvey said. "There was an opportunity for smaller players to pursue their development with focused projects based on simpler test vehicles featuring just one or two technology experiments. In other words, the opposite philosophy of the X-33 program, which tried to squeeze a whole set of ambitious technologies into a single airframe with almost no margin for error."

In 2000, Garvey Spacecraft teamed with Microcosm Inc. to conduct the first flight of a composite liquid oxygen tank. In 2003, the company worked with Cal State Long Beach professor Eric Besnard and his students to demonstrate the first flight powered by a liquid-propellant aerospike engine. Five years later, Garvey Spacecraft and Cal State Long Beach launched the first rocket with an engine fueled by liquid-oxygen and methane. Last year, Orbital Technologies Corp. conducted the first successful flight test of its Vortex liquid engine on the Prospector-15 developed specifically for the project by Garvey Spacecraft.

Providing the rocket airframe and launch support services to test technology inflight is a growing part of Garvey Spacecraft's business. "We know how to work through the logistical, procurement and regulatory challenges associated with initial flight testing of launch vehicle technology," Garvey said.

The firm currently is focused on developing a dedicated launch vehicle for nanosatellites. Company engineers are working incrementally to develop a simple two-stage liquid-fueled launch vehicle capable of sending a 10-kilogram payload into a circular polar orbit at an altitude of 250 kilometers. Later, Garvey Spacecraft plans to modify that design to produce a larger rocket capable of lofting 20 kilograms into a 450-kilometer orbit.

"Instead of pushing the envelope to launch very large, million-pound payloads to orbit with a big dumb booster like folks were proposing back in the 1960s, we see a market for launching 10, 20, 50 or 100 kilograms with a small, somewhat dumb booster," Garvey said. "That capability will enable cubesats and nanosats to transform on-orbit services and business models."

Currently, most nanosatellites hitch a ride with a primary payload. "We have to go whenever the primary goes, which is not always the optimal location for science," Skrobot said. If dedicated nanosatellite rides were offered, cubesat developers could choose their own orbits, launch on their own schedule and do away with racks like the picosatellite orbital deployer that houses cubesats during launch and releases them in orbit, Skrobot added.

Garvey anticipates growing demand for rockets offering frequent, dedicated rides for nanosatellites. Although company officials are not yet ready to discuss the cost per kilogram of their planned launches, Garvey said small-satellite mission officials may be prepared to pay a premium for dedicated flights. "It would cost more than flying as a secondary payload because it's like flying first class instead of standby," Garvey said.

Nanosatellites traveling into orbit on dedicated launches also may be able to avoid some of the safety restrictions imposed on them by mission officials seeking to protect the primary payloads. For example, nanosatellites could carry their own propulsion, something that primary payload managers generally prohibit. That on-board propulsion could enable nanosatellites to move into their optimal orbit and create constellations or swarms.

Although nanosatellite developers and their customers may be willing to pay more for a dedicated flight, it is not clear how much of a premium they will pay for a dedicated launch vehicle as opposed to riding piggyback, said Richard David, co-founder and chief executive of NewSpace Global. "Is it a 10 percent premium or a 20 percent premium?" he said. "It's hard to say."

Although nanosatellite developers may be willing to pay for dedicated flights, Garvey continues to look for ways to limit launch costs. Many launch costs have nothing to do with the rocket technology, but are related instead to procurement processes, range costs and launch operations, Garvey said. As a result, the company is eager to explore options for launching rockets from ocean barges. "We will go wherever we have to for launch," Garvey said.

During the last two decades, Garvey Spacecraft has performed rocket engine research and development under contract for the U.S. Air Force Research Laboratory at Edwards Air Force Base, Calif., the Air Force Space and Missile Systems Center at Los Angeles Air Force Base, the U.S. Department of Defense's Operational Responsive Space office at Kirtland Air Force Base in New Mexico, NASA and industry clients.

The June 15 Prospector-18 flight was carried out under a NASA contract awarded to Garvey Spacecraft in October 2011. That contract called for the company to perform a single high-altitude launch and included options for four additional launches, one of which has been exercised to date.

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GARVEY SPACECRAFT PHOTO

Prospector-9 launch

GARVEY SPACECRAFT PHOTO

Assembly of Garvey Spacecraft's Prospector-18

Garvey Spacecraft Corp. at a glance

Top Official: John Garvey, president and chief executive

Location: Long Beach, Calif.

Employees: 10 full-time, part-time and associates

Mission: To focus on the cost-effective development of advanced space technologies and launch vehicle systems.