

## Antelope Valley Press

### Firm has sights set on space, beyond

By: Allison Gatlin

LANCASTER - For companies like XCOR Aerospace, the sky is not the limit, it is merely the starting point.

XCOR is among the firms working toward civil, commercial spaceflight, a field often termed "New Space" in juxtaposition to the traditional government-run space agencies.

"We are founded by four very hard-working, dedicated people that want to go to space and they want to take everyone else with them," said Khaki Rodway, XCOR's director of sales and operations. "We're all in this. We're all going to space. We're all excited to do this."

Rodway discussed the accomplishments and future plans of the company Thursday at the Lancaster Museum of Art and History. The talk was part of the "Free Enterprise: The Art of Citizen Space Exploration" exhibit at the museum, which features XCOR's first rocket plane, the EZ-Rocket, and other rocket parts among pieces investigating the connections between art and civilian space travel.

She was joined by a number of the firm's founders, engineers and others to tell the story of the rocket company that started "with a rocket engine and a dream."

"Not only are we building a new company, we're building a new industry," Rodway said. "We have embarked on

something that is going to foster innovation, foster creativity, for science, technology, engineering and we expect a lot of people to come with us."

XCOR, one of the earliest space companies to take up residence at the Mojave Air and Space Port, was founded in 1999.

Since that time, the firm has designed and built 14 different rocket engines, with nearly 4,200 rocket engine firings, and has built and flown two different rocket-powered planes.

Now, it is developing another rocket plane, the Lynx, a reusable suborbital spacecraft designed to fly to 100 kilometers, or 61 miles. It carries a pilot and one passenger or payload, taking off and landing on a standard runway much like an airplane.

In addition, the company continues to develop rocket engines, rocket components and materials.

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## Page 2

"We're doing this all in Mojave," Rodway said.

XCOR differs from some prominent spaceflight companies in that "we are not funded by a billionaire," she said. Instead, the company has so-called angel investors, sales, government and commercial contracts and similar means of generating investment capital and revenue to fund its activities.

When XCOR began, one of its first creations was the "tea cart engine," a small rocket engine mounted on a cart that was used to demonstrate the company's technology by firing it anywhere and everywhere - schools, state fairs, conferences, Rodway said.

The firm engaged some of its first investors by firing it at a conference in a Holiday Inn ballroom, "with fire marshal approval," chimed in XCOR founder Doug Jones.

The legacy of the tea cart engine continues today, as it is the predecessor to the reaction control engines for the Lynx, used to maneuver in space.

The engine did the trick, as XCOR began to get contracts from paying customers such as United Launch Alliance; The Boeing Co.; NASA; the Defense Advanced Research Projects Agency, better known as DARPA; the National Reconnaissance Office; and SpaceX, another private space firm.

The tea cart engine demonstrator led to a larger demonstration vehicle, the EZ-Rocket. This rocket plane began as a broken Long-EZ aircraft owned by the chief engineer, modified to be powered by twin rocket engines.

"We did it really just to prove that a small, private company could design and build and fly a rocket-powered vehicle," Rodway said. "We wound up flying it 26 times and breaking a world record."

Flown by test pilots Dick Rutan, Mike Melvill and former NASA astronaut Rick Searfoss, the EZ-Rocket demonstrated the safe, reliable operability of the rockets, with multiple flights per day and multiple engine restarts in flight.

The project had unexpected benefits as well, as it also demonstrated the low cost of operations, about \$1,000 per flight, with a \$1 million development cost.

"We proved that you didn't have to be the government to build a rocket-powered vehicle and didn't have to have hundreds of millions of dollars to do it," Rodway said.

The EZ-Rocket was followed by the X-Racer, developed under contract for the Rocket Racing League, an organization with plans for "NASCAR in the sky."

The plan called for multiple flights with a quick, pit-stop-like turn around between each, she said.

XCOR demonstrated the X-Racer at the Experimental Aircraft Association's AirVenture in Oshkosh, Wis., flying it seven times in one day.

The X-Racer was a flying demonstrator for the firm's unique piston pump technology, used to pump fuel through the rocket engine. Not typically used in rockets, this approach is mechanically simpler and less expensive to develop, without a loss of power for the weight.

The piston pump is a feature for the Lynx rocket engines, as well as others XCOR is developing under contract.

Both rocket planes generated lessons in technology, operations and safety practices that are being applied to the

company's next vehicle, Lynx.

Also a horizontal take-off and landing, reusable vehicle, the small rocket plane will operate similarly to an airplane. It needs only a 7,500-foot runway at an Federal Aviation Administration-approved spaceport (like the Mojave Air and Space Port) and little in the way of ground support.

The Lynx is designed to fly up to four times per day, with about two hours notice to start and less than two hours between flights, Rodway said.

"We really strongly focus on safety and reliability," she said. "We're a commercial company. We have to be safe. Otherwise, we don't make a profit and we don't stay in business."

Development of the Lynx Mark I, the initial prototype for the operational vehicle, is underway in XCOR's Mojave shop. Portions of the structure are in place and testing continues on the propulsion system, Rodway said.

The Lynx Mark I is the initial phase of a planned series of vehicles that will fly to progressively higher altitudes, eventually reaching 330,000 feet. The two-seat spaceplane is designed to take off under rocket power and climb to 200,000 feet before returning for a runway landing.

The space plane concept offers flexibility, in that it can fly from any number of sites around the globe, transported there in a C-130 or 747 cargo plane, Rodway said.

Tickets for flights are selling for \$100,000, and XCOR has agreements to provide flights for a partner firm, Space Expedition Corp. from the Caribbean island of Curacao.

Among the customers lined up for future Lynx flights are a firm from the Netherlands looking to study the dynamics of electrifying water to create a "water bridge," in which the water stretches like a bridge between two points. They need the longer period of microgravity offered by Lynx to test their theories, Rodway said.

"They think they have found a new state of water," she said.

Another use for a future Lynx model, one with a pod on top for payloads, is a suborbital observatory for planetary science. A prototype of the device will fly on the early Mark I missions as part of the equipment development.

"What they like about Lynx is it can go up when they want it to go up," Rodway said. "This is at their command."

Another customer wants to use the spacecraft to study noctilucent clouds, which form above 260,000 feet altitude in the Arctic regions. Little is known about the composition of these clouds, but scientists believe they are associated with climate change.

The Lynx can get researchers and their equipment into the clouds to collect data to validate their models, Rodway said.

XCOR's customers are not limited to adventurous space tourists or scientific missions. Much like the relationships demonstrated in the museum exhibit, customers are interested in using the company's spacecraft for artistic endeavors as well.

One artist has a concept for "Space Wishes" in which a robot will fly outside the spacecraft, controlled by the artist's brain waves in the passenger seat. In this way, the artist intends to carry peoples' wishes into space, Rodway said.

Another example is part of the exhibit at the Lancaster Museum of Art and History. Called Space Dolphin, it was intended to be launched by NASA many years ago as a structure to emit dolphin clicks into space as part of the search for extraterrestrial life.

The project was thwarted by the Challenger disaster, but has gained new life with plans to launch it from Lynx, Rodway said.

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