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Wired Animation

Issue 6.10 - Oct 1998

Rocket Change

Got a satellite? Have we got a launch vehicle for you.

By Stewart Taggart

On the edge of Australia's vast central desert, with the midday heat quivering above the ground, an air-conditioned Land Cruiser cold enough to freeze beef glides across flat terrain stretching hundreds of miles toward a vacant and cloudless horizon.

Judging from initial appearances, range activities manager John Draper remains sane after four years of working in this two-tone habitat of bush and sky, though when he veers off the paved road and bounces into trackless scrub and heath one might wonder.

Within months, a simple, single tower will rise up here, inaugurating an era of space access in which launching payloads to low Earth orbit could be as easy as booking a night flight to New York.

If Kistler succeeds, it will be the first in a group of companies dubbed the Four Musketeers to realize the vision of reusable space transport.

Nearly 1,700 payloads worth \$121 billion will need a ride to space over the next 10 years, estimates the Teal Group, a defense and aerospace market analysis firm.

Seventy percent of the payloads will be commercial communications satellites, most of them in low Earth orbit. Constellations of LEOs, as they are called, will let you travel around the entire world with one phone number.

Last year, 77 commercial payloads were carried to space worldwide, tripling the number seen the year before and outnumbering military and civil-government payloads for the first time.

Iridium, which will begin its global telephone service in late September, has set the stage for this coming revolution in space commerce.

Once these constellations are in place, replacements will be needed regularly as satellites burn out and break down.

These "big LEOs" will be joined by "little LEOs," which will soar about 500 to 1,500 miles above Earth (commercial airplanes fly at an altitude of about 5 miles) and perform highly specific functions such as reading water meters from space.

Around 2001, deployment will start for ultrasophisticated high-bandwidth constellations known as "broadband LEOs" that will make high-speed connectivity - for videoconferencing and Internet services, among other activities - available just about anywhere in the world.

Until now, most LEOs have gone skyward on heavy booster rockets capable of carrying several satellites into orbit at once.

Recognizing that every large edifice requires a maintenance staff, Kistler and the other Musketeers aim to be the lightbulb changers of space.

For 80-year-old George Mueller, the success of a reusable rocket would mark a final transition from Cold War technologist to commercial businessman.

Mueller, whose space career blasted off in 1961 when President Kennedy started the race to the Moon, left the agency to grow jojoba in Arizona.

Mueller's new line of work was made possible in 1984, when the US Congress passed the Commercial Space Launch Act to encourage companies to join the industry.

Not surprisingly, some of these nascent commercial space operations have set up shop in old government haunts - including Vandenberg Air Force Base and the shuttered Norton Air Force Base, now renamed the San Bernardino International Airport.

While the reliability rate of US-based launches in 1997 was 97.4 percent, the remaining 2.6 percent represents a set of devastating possibilities.

"Australia has a large footprint of flat land, and almost no population," says Robert Wang, Kistler's chair. "It's a lot safer to launch from there."

To the north of Kistler's base in Woomera, there's 1,000 miles of open territory that begins with the huge Simpson Desert and ends in the Gulf of Carpentaria, near Indonesia.

At Missile Park, in the center of Woomera, replicas of rockets, planes, and missiles are mounted on poles as if in flight.

The challenges Kistler faces remind George Mueller of NASA's gung-ho days, but he also sees the distinctions. "Now, while the schedule is just as intense, you also have shareholders to worry about," he says.

Others are equally confident. Revenues in the global space industry could rise 20 percent annually for years to come, says John Higginbotham, chair of SpaceVest, a Reston, Virginia, venture firm dedicated to space investments.

"In some ways the space industry in 1998 is where the automobile industry was in 1938," Higginbotham says. "If you look at where the space industry can be in 2048, it could be a major sector of the global economy, equal to health care or the auto industry today."

For Higginbotham, it's uncertain how many independent launch companies the space industry can support. Competition may emerge from a privatized US space shuttle and from low-cost launch services from China and Russia, both of which use expendable rockets.

Higginbotham believes the industry's financial viability will become clearer within three to five years, and plans to hold off on major investments until the winners become more obvious.

"If Iridium is operating and making money two years from now, and others are pursuing the concept, this is going to convey to investors that this is a real market," says Cathersa Christensen, director of the technology-management division of Futron, a Bethesda, Maryland, consulting firm specializing in space-market forecasting.

While Kistler is developing technology that launches rockets to Earth on parachutes and airbags, other outfits are eliminating the launchpad itself.

One of them is Kelly Space & Technology, which is camped out in the suburban confines of San Bernardino, California. Using a modified commercial jet, Kistler plans to tow an aerospace plane to 20,000 feet, where it will detach and rocket up to 400,000 feet.

"If you look at the first stages of any launch vehicle, that's where the most thunder and shaking goes on, and where 90 percent of failures occur," says Richard Hora, president and CEO of Eclipse Space Lines, a licensed operator for Kelly.

Tom Clancy invested \$1 million in a vehicle that will return to Earth using helicopter-like rotors.

Cofounder Mike Kelly says the idea for the company grew out of MX missile development and other aerospace work he did during a 12-year career with space and defense contractor TRW.

Musketeer Number Three is Pioneer Rocketplane, a start-up venture located at Vandenberg Air Force Base, just north of Santa Barbara, California.

"We'll be looking for replenishment business from Iridium, Globalstar, and, of course, the Teledesic deployment," Clapp says. "There's going to be no shortage of market."

Rotary Rocket is taking an equally bold step. The Redwood Shores, California, enterprise plans to use a piloted rocket on the way up to low Earth orbit and a unique set of helicopter-type rotors to return to Earth, requiring little in the way of ground infrastructure.

Among those watching Rotary keenly is novelist Clancy, an acknowledged space buff who invested in the venture after meeting its president, Gary C. Hudson.

Like Pioneer, Rotary has no contracts yet, but it believes the LEO-replacement market will provide ready bookings. "Expendables are big and can carry a lot at one time, but they're not very good for patching holes in a system when one satellite fails," says Geoffrey Z. Hughes, Rotary's director of business development.

It was Hughes who dubbed his firm and its three major competitors the Four Musketeers, and he thinks there's room in the market for even more players, all offering somewhat differentiated services and products.

Many of these more futuristic companies are focusing on tourism, with initial launches expected in 2001 or later. Conceivably, for a ticket costing about 90 grand, you could hop a flight to suborbital altitude for a quick dose of weightlessness, a view of Earth's curvature, and a peek into the blackness of space.

While the success or failure of these individual firms may not be known for a few more years, the early activity is already making for crowded conditions at established launch sites.

"It's hard to be treated as the prime customer here anymore," complains Edgar Zapata, a systems and advanced-projects engineer for the space shuttle at the Kennedy Space Center.

In Australia, other groups of entrepreneurs also are evaluating launch sites. One has studied the Northern Territory, focusing on Christmas Island, an atoll in the Indian Ocean that offers open seas for flight corridors to the south.

For George Mueller, the NASA vet now leading Kistler, the prospect of so many enterprises entering a chaotic new market, of costs dropping like descending reusables, and of hundreds of lightbulb-changing launches keeping vast networks like Iridium aglow - well, the changes are as startling as they are gratifying.

"During the Apollo project," he says, "I never thought that one day I'd be using Russian rockets." Yet today, Kistler's Russian-made NK-33 and NK-43 engines are powering the company's post-Cold War flights.

Traveling out to the lakeless, peopleless South Australian outback surrounding Woomera, Mueller is doubling back in time. Forty-one years after Sputnik - the first LEO - circled the globe and kick-started the space race, Mueller is returning to the launchpad, prepared this time to create a different kind of liftoff.

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