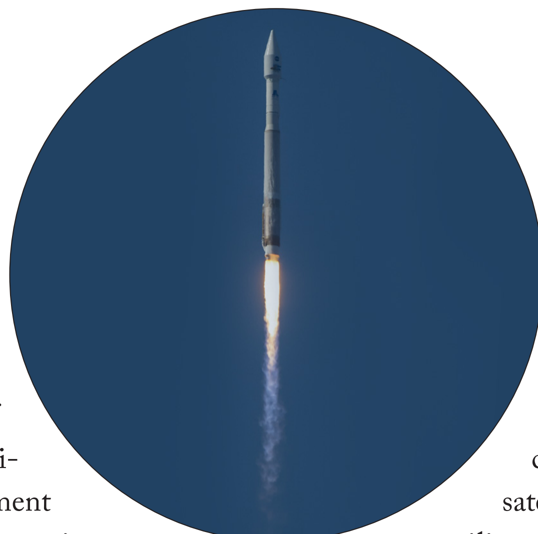
SUCCESSFUL SEPARATIONS

A low-impact, low-stress satellite separation system benefits both military and commercial space



Few sights are as thrilling as a rocket launch. The roar of accelerating engines, the plume of exhaust, the bright spot of flame at the base of the rocket. Finally, liftoff. But if you're a government agency or business owner with an expensive satellite strapped to that rocket—perhaps by nothing more than a tightly cinched steel band—the thrill could easily turn into white-knuckle anxiety.

"If the band cracks open when it's on the launch pad or in orbit, you've lost that quarter billion dollar spacecraft and a quarter billion dollar rocket," said Walter Holemans, founder and chief engineer of Planetary Systems Corporation (PSC). "That scares people, as it should."

This almost happened to the James Webb Space Telescope (JWST). Six weeks before launch the V-band accidentally actuated. A $10 billion mission could have been lost before launch.

Challenges surrounding satellite launch and separation from the launch vehicle have long been an area of concern for the military when launching satellites. And the recent surge in commercial space flight has made satellite separation a major issue for civilian entrepreneurs and investors as well.

Foreseeing the rapidly growing need for a better solution, in 2000 the Air Force issued a Small Business Innovation Research (SBIR) topic, with Phase I and Phase II contracts being won by Holemans and PSC.

Considering the problem, the PSC team realized that some of the trouble with existing satellite separation technology was inherent to its basic design, which can strain bands to breaking.

"They drive the tension up to six thousand pounds, about the weight of an SUV," Holemans said. "So we took that entire design and inverted it—instead of a tensile element on the outside, we put a compressive element on the inside."

This idea became the basis for PSC's Lightband satellite separation system.Lightband eliminates the two major problems of standard separation systems: fracturing and shock from the explosives used to break open the band to release the satellite.

"Because it's in compression, cracks don't grow. They'll just sit there," Holemans said.

And the Lightband reduces shock risk by using electric motors to trigger separation rather than pyrotechnics.

"With the prior technology, an explosive bolt-cutter cut the bolt that held the band together. Imagine pointing a gun at a quarter-inch diameter bolt and just blowing it off," Holemans said. "It's like hitting a satellite with a hammer."

The motorized separation system has another benefit as well: its reusability helps satellite designers improve reliability even while saving money.

"Engineers on the ground have to test things associated with the separation, and if they've got a pyrotechnic, they can only test it once. That can cost thousands, sometimes tens of thousands, a shot," Holemans said. "And the bolts they cut can also cost thousands of dollars. So engineers look at the costs and say, 'Whoa, do we really have to do this test?' Our system uses electric motors, so you can test and reset all day long."

The Lightband's compact weight—about five pounds, versus roughly fifteen pounds in the previous technology—is another money saver for satellite developers.

Launch costs can be calculated per pound of satellite, Holemans said, "so saving ten pounds of weight saves $200,000 or more in launch costs. That's more than the cost of the Lightband. For end users, it's a no-brainer."

Along with development, the SBIR program also helped Holemans and his PSC team with the last, crucial piece needed for the Lightband's success: proving it worked in actual missions.

"It's very important to prove that you've been exhaustive in your ground tests. But getting an actual record of space flight—that's what people really need to see," Holemans said. "The people we worked with at the Air Force Research Lab understood this very clearly, and they guided us through that process."

This included working with NASA's Double Asteroid Redirection Test, as well as the agency's infamous "Vomit Comet" reduced-gravity aircraft. With SBIR support, PSC was able to demonstrate the technology to major aerospace players like Lockheed and Boeing, in addition to the Department of Defense, Holemans said.

"The SBIR program was just wonderful across the board. We got to work with people who really knew what they needed."

The Lightband satellite separation technology is now used with a wide range of spacecraft, from commercial imaging satellites to university research and military craft.

"DoD, NASA, commercial space, universities—our Lightbands have even gone to the moon a couple of times," Holemans said. He credits the SBIR program for much of the Lightband's success. "The SBIR program was just wonderful across the board. We got to work with people who really knew what they needed."

Planetary Systems was recently acquired by Rocket Lab, but Holemans noted that his own success can be attributed in large part to good government leadership, as shown through the SBIR process. He is grateful for the support and excited about the future.

"If we didn't have the SBIR program, we would not have been able to convince the satellite industry to use our product," he said. "It's been an across-the-board remarkable success."

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National Defense Strategy Pillar: Force Readiness and Lethality

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