



Nick Karangelen, Trident Space president and CEO

The first of Trident's SAR satellites will offer two to five revisits per day. The full constellation? Every 10 mins.

< > completed an internal preliminary design review for its SAR smallsats. It concluded that the best option is a 300-kilogram satellite that is compatible with the growing lineup of commercial dedicated and ride-share launch options.

The design review was developed internally with the assistance of a select group of engineering services companies that specialize in satellite design, said Karangelen. The review was focused on satellite subsystems that are unique to the SAR mission – antenna, bus thermal design, X-band high-power amplifier and spacecraft power electronics. "The results show adequate system design margin consistent with our business and technical goals," he said. In addition to the space segment, the design review looked at the ground segment, mission planning segment, and data product storage and processing.

At 300 kilograms, these are "not-so-small" satellites with an on-orbit life of four years and a lifetime SAR image collection capacity of 44 million square kilometers at 1 meter resolution,

Karangelen says. At \$10 per square kilometer, that's a lifetime earning capacity of \$440 million for a satellite with an on-orbit cost of about \$42 million.

An engineering model of the company's SAR payload electronics has been tested on a Cessna aircraft. The payload technology was developed by Trident Systems Inc. The company flew the engineering model of the payload electronics on a small aircraft and collected raw SAR data around Southern Maryland. Karangelen said the results of these tests "confirm sub-meter resolution performance of the payload electronics."

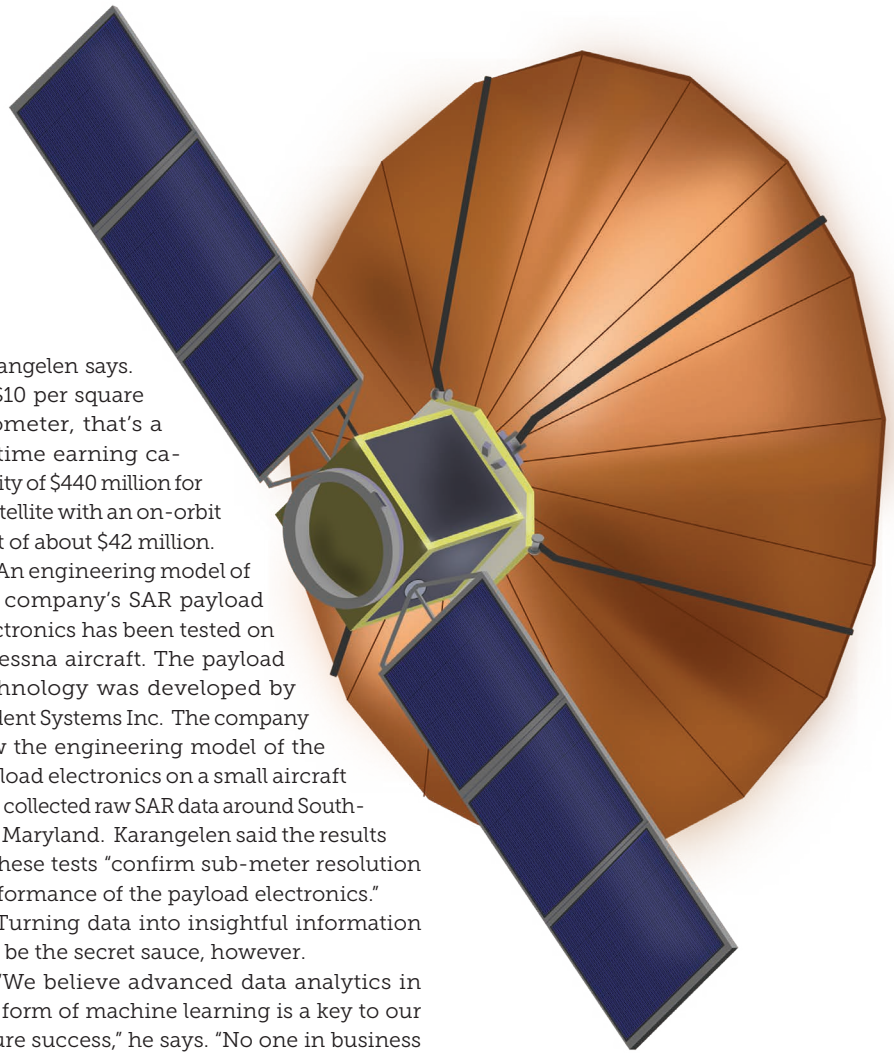
Turning data into insightful information will be the secret sauce, however.

"We believe advanced data analytics in the form of machine learning is a key to our future success," he says. "No one in business really wants to look at pictures. They want a reliable, consistent source of affordable information required to support their most critical business decisions."

The use of machine learning to extract information from electro-optical imagery is a booming industry. "However, the applications of machine learning to SAR has been delayed by the lack of large, affordable SAR image data sets required for neural network training," says Karangelen.

In response, Trident Space plans to conduct periodic high-resolution airborne SAR data gathering starting in early 2019. The plan is to collect SAR imagery at the same grazing angles, resolution and quality that would be collected from space. "We will use these SAR images, and concurrently collected electro-optical images at the same resolution, to create a portfolio of annotated SAR image data sets to support training of machine learning algorithms," he says. "Using this approach, we hope to establish a foundation for automated SAR data analytics development."

Trident Space wants to team up with emerging data-analytics companies while it tests the



market for business information applications of SAR prior to the launch of the first satellite.

Karangelen predict smallsats will become increasingly more capable as remote-sensing platforms. "Certainly, there are limits to what can be accomplished on a SAR smallsat," he says. Some important technical achievements of late are increased power and storage capacity for small satellites. "RF power, payload processing power, and available antenna aperture size will continue to improve in incremental steps."

Low-cost launch will be essential to the survival of this industry, says Karangelen, who is also an investor in Tucson, Arizona-based small-lift startup Vector. "In my view, affordable launch will set the pace in this new generation space race. Companies like Vector will be fully subscribed as they offer small satellites affordable access first to LEO and then beyond," he says. "I believe our biggest schedule risk in the future will be launch availability."

Trident Space is privately funded and expects to close on a \$7 million Series A round of financing in September. 🍀