



SBIR/STTR SUCCESS

98% of international telecommunications travel through subsea cables on the ocean floor, making the success and efficiency of their installation a vital component of the process.

MAKAI OCEAN ENGINEERING

Timing is everything when it comes to the success of a small business. In Makai's case, developing a technology to lay subsea cables right at the forefront of the Internet boom proved to be the perfect combination of timing and resourceful ingenious. With 98% of the world's international telecommunications traveling through cables laid on the seafloor, it is critical that the process is one that will preserve the integrity of the cables, as well as provide a rapid and accurate means of installation. The team at Makai had long been conducting ocean engineering projects since the company was founded in 1973.

PHASE III SUCCESS:

Over \$35 million in Phase III revenue stemming from the original Navy SBIR-funded technology

AGENCIES

DOD (NAVY), DOE

SNAPSHOT

~50% of revenue is from commercial sector; the company's patented technology, MakaiLay, is the #1 subsea cable installation software in the world and used by over 75% of subsea cable ships worldwide.

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In 2000, a Navy SBIR topic was seeking an improvement in the way underwater cables were laid on the ocean floor. Makai's response was a faster, more accurate and cost saving method that evolved into not only a Phase III contract with the Navy, but also a sought-after international commercial product. This was the time when the Internet was flourishing, and telecom companies needed an improved method to lay submarine fiberoptic cables. The installation software is called MakaiLay, and it has become the company's most successful project to date.

"This was a perfectly matched commercial application for the software that we developed with the help of the Navy SBIR program," explains Duke Hartman, Vice President of Business Development at Makai. "The real beauty of SBIR is that it took the risk out of the early R&D work, and that has opened up a new platform of technologies that we otherwise would not have had the capital or the risk tolerance to undertake."

A second area in which Makai has been working is renewable energy. Specifically, its Ocean Thermal Energy Conversion technology (OTEC) takes the ocean's warm and cold waters and generates electricity from the thermal gradients. Sponsored primarily by the Navy, the goal is to provide a stable flow of renewable electricity that does not need a separate energy storage system. Unlike some renewables, ocean thermal energy is available 24/7 year-round, and has the potential to power 4 times man's electricity needs. While Makai's work with OTEC dates back to 1979, this project began as a Navy SBIR in 2006, when the Navy was looking for ideas on how to power its various island bases. They knew if they could develop an offshore floating OTEC plant, they could have consistent, renewable, utility grade power. This concept made it all the way through Phase

III, and Makai is working with both the Office of Naval Research and the Hawaii Natural Energy Institute to make this goal a reality. In August 2015, the largest operational OTEC plant in the world, built by Makai, will connect to the grid.

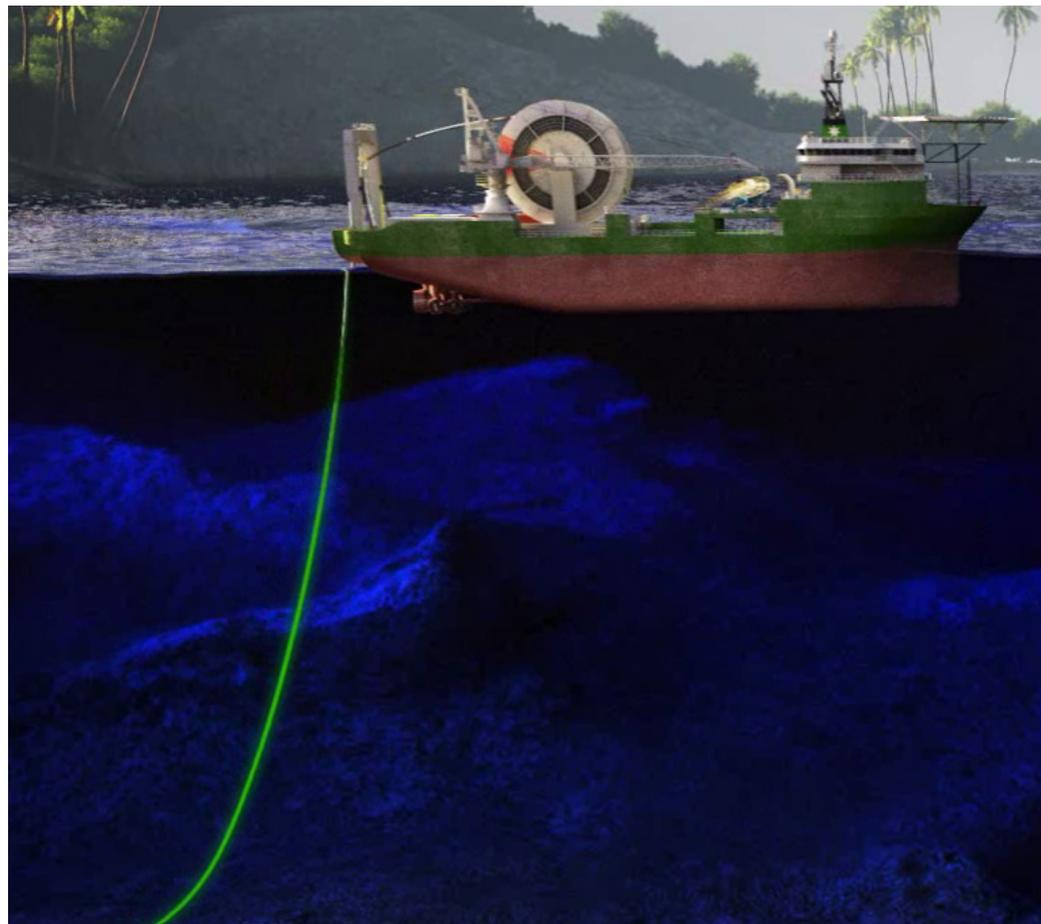
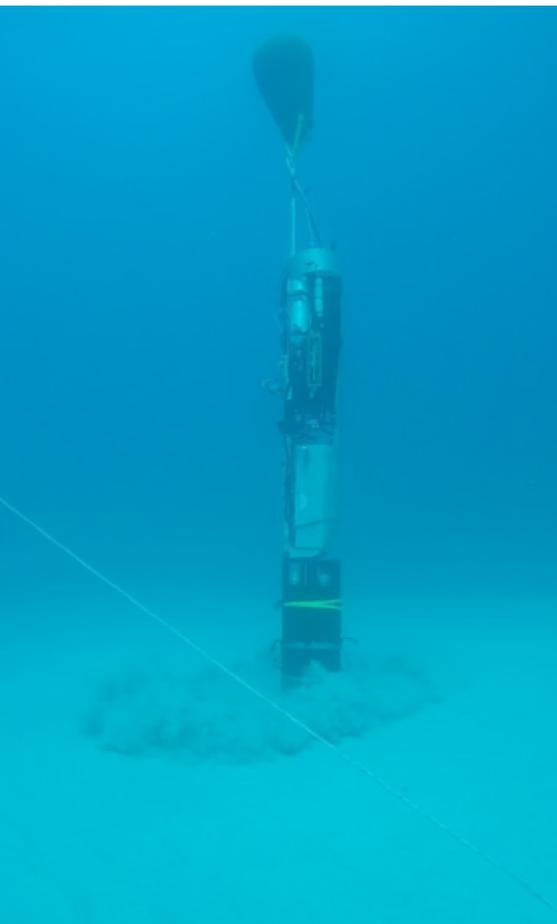
Along with underwater cables and OTEC, Makai is focusing on another business area that is being heavily invested in by the Navy. A 2012 SBIR Phase I marked the start of development for Makai's underwater vehicle program, and since then has generated approximately \$3.4 million in additional funding. This autonomous underwater vehicle (AUV), developed in tandem with the University of Hawaii, will be used to lay cables on the seafloor without a tether and without assisted navigation. It effectively deploys seafloor sensing units by combining features of a free-swimming AUV and those of a bottom-crawling vehicle. This Bottom-Skimming AUV, appropriately called B-SAUUV, is propelled by thrusters but can touch, glide along, and interact with the seafloor by adjusting its wet weight and buoyancy. The project is currently in a Phase II.5, and Makai plans to continue to manufacture vehicle components in-house through the prototype phase.

It seems fitting that a company so centered on the ocean set up shop in the picturesque state of Hawaii. The company was launched there because of the rich underwater habitat research that was going on in the seventies. Since then it has diversified to a wide range of hardware and software projects in the ocean.

"One large customer that has provided several new opportunities for us has been the Natural Energy Lab of Hawaii Authority or NELHA," added Hartman. "They own several of the largest and deepest seawater intake pipes in the world, all of which were designed by Makai. That gave us a lot of experience in ocean engineering and designing pipelines, which has allowed us to spin off new technology into other industries. Not to mention providing the ideal test bed for our OTEC plant!"

In Honolulu, Makai is working on a relatively new technology – Seawater Air Conditioning (SWAC), in which cold air conditioning for buildings is made from deep ocean water. They are the offshore engineers for a \$250 million commercial project with the goal of providing air conditioning via SWAC to all of downtown Honolulu.

With government enthusiasm, partnerships with local businesses, and its own internal expertise and persistence, Makai is continuing to push boundaries and fittingly, lay the groundwork for the next generation of ocean innovation.



LEFT: Makai's novel autonomous underwater vehicle (AUV) effectively deploys seafloor sensing equipment by combining features of a free-swimming AUV and those of a bottom crawling vehicle.

RIGHT: Makai's patented subsea installer and software package ensures efficient installation of subsea cables, creating a cost-saving and long-lasting process that is used by over 75% of the world's subsea cable ships.