

Makai Ocean Engineering

Company Capabilities Brochure



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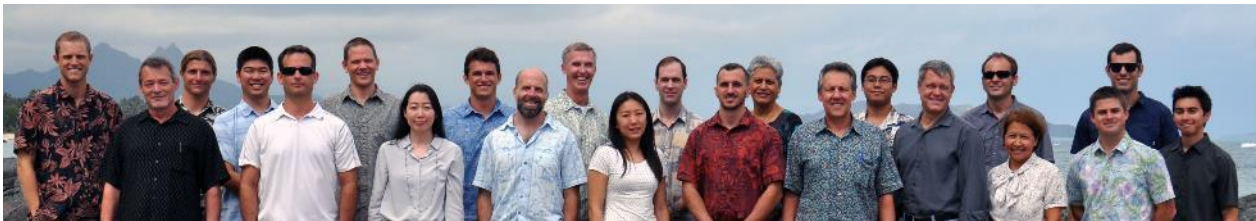
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1. INTRODUCTION

Our Company.

Makai has been in business for over 45 years providing a wide array of professional ocean engineering services. We have become a world-recognized leader in several areas of ocean technology. Our clients have referred to us as a “think tank” for ocean-related problems, owing to our reputation for being innovative, fast, and thorough in our designs. We attribute our success to hiring the highest caliber of engineers and scientists who have the rare combination of rigorous training in math, science, and engineering with an entrepreneurial and curious nature.

Makai has a healthy balance of roughly 50% private and 50% government work, primarily from the US Department of Defense. Many of our defense projects are related to underwater cables, sensors, or vehicles. Makai has been very successful in transitioning government-funded technology into commercial products and services, and recently received a distinguished national award for our ability to commercialize federal R&D.



Our People.

Makai has developed a unique and powerful culture where creativity, intelligence, hard work, and independence are celebrated. These values are tempered with respect, humility, flexibility, and an open, cooperative demeanor. Our engineers truly love working here and they feel as though they are part of a carefully selected team of only the very best engineers.

At time of writing, Makai has about 37 employees, with 29 engineers who hold advanced degrees and experience in mechanical, civil, ocean engineering, computer science, physical oceanography, physics, and chemistry, six of whom are registered professional engineers.

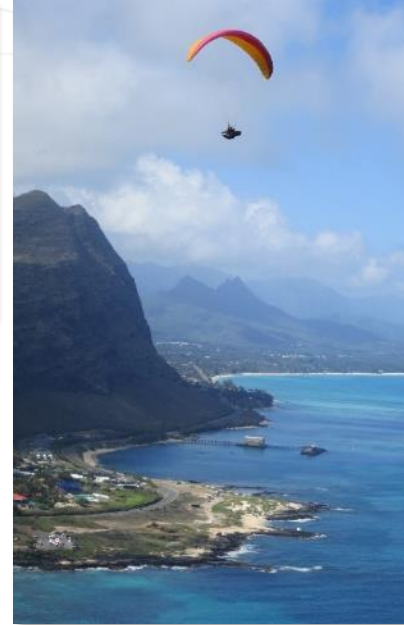
Our Place.

Makai's offices are located at the Makai Research Pier on the southeast coast of Oahu, Hawaii. The site is 30 minutes from Honolulu provides access to coastal testing areas for our ocean research and development projects.



Two views of the Makai Research Pier on Oahu (above/right).

Makai's corporate headquarters is located on a pier in eastern Oahu that has ideal conditions for testing surface and underwater vehicles. This location has ideal seabed soil conditions for at-sea testing of prototypes (Makai is currently performing tests for the US Navy here and near Pearl Harbor). Makai owns vessels to perform at-sea deployments, repairs, tests, and demonstrations in Hawaiian waters. Makai maintains an onsite workshop that houses welding and metal fabrication tools required for marine device fabrication and repair.



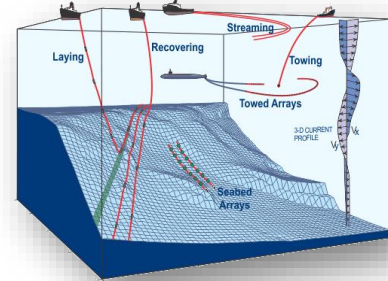
Makai has a satellite office in Kailua-Kona, on the Big Island of Hawaii. This is where Makai owns and operates the world's largest ocean thermal energy conversion (OTEC) demonstration plant in. Also part of this facility are seawater air conditioned (SWAC) facilities, a marine corrosion laboratory, and a marine heat exchanger test facility.



The Makai Ocean Energy Research Center is located in Kona

2. OVERVIEW OF TECHNICAL AREAS

Subsea Cables: Makai has been involved with deep-water cable installation since 1983. Makai has led the world in submarine cable installation and planning software for over a decade, with products used successfully by over 90% of the world's telecom cable laying ships to install more than 400,000 kilometers of submarine cable. Modules are available for power cables, seismic offshore oil & gas exploration, and defense applications.



Subsea Technology & Ocean Engineering: Makai has performed custom R&D, prototyping and testing of subsea technologies for a wide range of clients, including the largest defense contractors in the world, the U.S. Departments of Defense and Energy, and the oil and gas industry. Makai's areas of expertise are: unmanned underwater vehicles, naval architecture, subsea communications and sensor networks, marine buoys/structures, ocean and numerical modeling, fiber optic and power cables, robotics and winch systems, marine heat exchangers, and corrosion RDT&E.



Ocean Energy: Makai has been heavily involved in ocean energy research since the 1970s, especially on ocean thermal energy conversion (OTEC) and seawater air conditioning (SWAC) systems. Since 1978, Makai has been involved in over 50 contracts related to ocean energy, including the design of the world's first commercial SWAC system, and the design, build, and operation of the world's largest operational OTEC plant.



Marine Pipelines: Makai has been designing and working with marine pipelines since 1979, and to date has designed the cold water pipe for more deep water SWAC and district cooling systems than any other known engineering firm in the world. These designs include the largest deep cold seawater pipe in the world in Kona, Hawaii, and two large lake water cooling systems in North America. Makai's deep water pipeline designs have never been responsible for a lost pipe. Makai has applied the large marine pipelines, an enabling technology for these systems, to a variety of other applications such as desalination, power plant cooling, wastewater, and transmission pipelines. The deepest large diameter seawater intake pipe in the world was designed by Makai and has been operational in Hawaii since 2002.



2.1. ANALYTICAL TOOLS

Makai uses a wide variety of analytical tools in the course of our ocean engineering design projects. Makai engineers understand the engineering and physical principles involved in designing lasting structures in the ocean, and are proficient users of several commercial and proprietary design, analysis, and data collection software. Below is a partial list of the software used at Makai on a regular basis:

- **3D Design software:** Solidworks, AutoCad.
- **Finite Element Analysis (FEA) software:** Orcaflex, ANSYS, MakaiPlan Pro, MakaiLay, Makai's Marine Pipe Deployment Software.
- **Computational Fluid Dynamics (CFD) and related software:** Environmental Fluid Dynamics Code (EFDC), CORMIX, Makai's Environmental Coastal and Oceanographic model (MECO model, ANSYS Fluent, Simulating Waves Nearshore (SWAN), WAVEWATCH III, Cosmos, OpenFOAM, and SolidWorks Flow Simulation.
- **Systems Engineering and Economic Modeling Software:** Makai OTEC Thermodynamic and Economic Model (MOTEM), Makai's Economic, Thermal, and Hydraulic Optimization and Design software (METHOD) for district cooling.
- **Geospatial Information Systems (GIS) software:** MakaiPlan cable route planning software, GeoMedia, ArcGIS, Global Mapper.
- **Data Collection and Analysis software:** LabView software, OTEC Power Plant Data Collection & Control software, Makai Real-Time Corrosion Measurement System (RCMS) software.

The remainder of this document focuses on Makai's projects.

3. AWARDS

3.1. 2016, SMALL BUSINESS INNOVATION RESEARCH “TIBBETTS” AWARD



Makai has been awarded the prestigious Tibbetts Awards, which recognizes the very best in class of the Small Business Innovation Research (SBIR) Phase I and II programs. Awardees are evaluated on technological innovations that create jobs and have a visible economic impact, serve federal R&D needs, encourage diverse participation, and increase commercialization of federal R&D.

3.2. 2014, LEADERS IN SUSTAINABILITY FINALIST



Makai was nominated for Pacific Business News’ 2014 Business Leadership Hawaii Awards – Hawaii’s premier business recognition event of the year. Based on our outstanding work during the year, PBN selected Makai as a finalist in the *Leaders in Sustainability* award, recognizing a company that has made significant strides in reducing energy use or conserving natural resources for itself or other businesses.

3.3. 2011 APEC HAWAII BUSINESS INNOVATION FINALIST



Makai was chosen as one of the 30 finalist among 2000 local companies that competed to represent Hawaii at the 2011 Asia Pacific Economic Cooperative Summit, hosted by President Obama. The criteria for the award included business services or products that are attractive to markets outside Hawaii, having developed unique, leading and cutting-edge innovations in product development, technology, marketing or delivery; having positively impacted Hawaii's business environment, having growth and investment potential; and having adopted environmentally sound programs and practices.

3.4. 2011 AON GRAND BUILD AMERICA AWARD



Advanced American Construction, Inc. received the 2011 Aon Build America Award for their work constructing an innovative positively buoyant HDPE open channel flow sewage interceptor submerged in Lake Oswego, Oregon. Makai assisted in the design and engineering analysis of the pipeline. <http://www.lakeinterceptor.com/>

3.5. 2010 SBA PRIME CONTRACTOR OF THE YEAR FOR HAWAII AND REGION IX



The Small Business Administration honored Makai Ocean Engineering for their work in the Federal government contracting arena. Makai was nominated for their "outstanding performance, innovative solutions, professionalism, cost effectiveness and on-time delivery by the federal agencies that contracted their services.



4. **CONTACT MAKAI TO DISCUSS YOUR PROJECT**

Makai has been working on cutting edge engineering, R&D, ocean and energy-related projects for more than 45 years. Our engineering team is extremely well-suited for solving tough technical challenges in the ocean, and we'd be happy to help you overcome yours.

For new projects, Makai provides a preliminary engineering opinion of feasibility free of charge. If the project looks feasible, Makai will propose one or more options that fit within your budget.

Contact us via phone or email to discuss your project.



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