Makai**Plan**

Cable Route Engineering Software

MakaiPlan is the most popular, industry-standard software for subsea cable route planning and engineering. This brochure describes the features of MakaiPlan, how it works, and why it pays to join the more than 300 MakaiPlan users worldwide**.**

- Route Planning
- Route Engineering
- GIS Data Import
- Route Position Lists
- Single Line Diagrams
- Cost Estimating
- Automated Tools
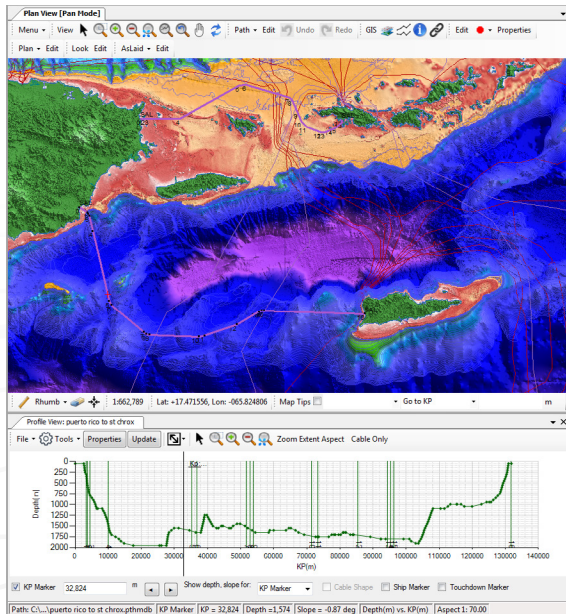
MAKAI OCEAN ENGINEERING, INC.

Telecom   Oil and Gas   Power

Makai**Plan**

MakaiPlan is the industry-leading Submarine Cable Route Planning Software that allows users to import and work with all relevant project data in one powerful and versatile GIS platform. Users can create and edit cable routes, define cables and in-line bodies, define and adjust slack, instantly create Route Position Lists (RPL) and Single Line Diagrams (SLD), and create preliminary estimates of cable installation costs. This single software platform provides all the tools necessary for cable route planning and engineering, making the process fast, efficient, and reducing the risk of making critical errors.

MakaiPlan allows multiple planners and designers to work collaboratively with easy access to, and exchange of, all project data. MakaiPlan is a Windows-based software with a simple point and click user interface. Users who are familiar with cable route planning can intuitively start planning cable routes with MakaiPlan from day one. Output from MakaiPlan can be imported directly into MakaiPlan Pro and MakaiLay, the latter of which is the world's most popular at-sea cable installation software, and has been used by over 75% of the global cable ship fleet to install more than 400,000 kilometers since the year 2000. This seamless flow of data along the cable lifecycle, from planning to installation, to repair, gives MakaiPlan users a competitive edge over those who plan their routes using other methods.

The Power of GIS

MakaiPlan takes full advantage of modern GIS to provide access to databases for bathymetry, shorelines, soils, existing cables, survey data, navigational charts, marine protected areas, and any other geographical data relevant to cable route planning. MakaiPlan uses GeoMedia by Intergraph, which has an open file structure and access to a variety of rich GIS databases. MakaiPlan comes fully equipped with global bathymetry data from GEBCO and World Vector Shoreline data.

MakaiPlan can import and properly translate data from other GIS databases in a variety of formats, projections and datums. GIS data is loaded as a layer in a unified plan view where the user can adjust the order and transparency of each layer and can toggle them on and off.

Defining the Route

Once all the pertinent GIS data are loaded, the user can quickly and easily create cable routes either by point and dragging to the desired locations, by entering precise coordinate points, by importing an existing RPL, or by letting MakaiPlan automatically choose the shortest distance along a great circle route in a series of Rhumb lines. MakaiPlan automatically computes and displays KP route distances and bottom profiles along the cable route based on contour or point data, and generates depth and slope charts. The route can consist of any number of altercourse points, as well as buried sections and special events along the cable. Slack is part of the route definition and both bottom and surface slack are shown.

Defining the Cable

In parallel with route selection, the user can define the cable assembly with cable types, transition points, repeaters, splices, and inline cable bodies. MakaiPlan enables these cable bodies to be precisely located along the route to account for proper distribution of cable slack. Adjustments can be made easily to configure the cable properly.

MakaiPlan works in two different modes. Flexible mode (during initial route planning) allows users to alter the cable lengths to achieve desired bottom slack conditions along the route. Fixed mode (after the cable has been manufactured) allows users to fix the cable length so that any changes in the cable route will change the slack rather than the cable length.

Easy Editing, Instant Updates

The real power of MakaiPlan lies in the ease of editing the cable and route information as conditions change throughout the planning and even into the installation process. Editing a route is simply performed by point and drag or precise reentry of data. As additional information is added to the GIS database (e.g., final bathymetric survey, as-loaded cable, cable lay direction or speed), the route and cable can be quickly and accurately updated to accommodate the needed changes. As a result, the plan is interactively created and modified based on the latest available information.

As the user makes changes to the route, MakaiPlan automatically computes important route parameters, and the Route Position Lists (RPLs), Single Line Diagrams (SLDs), and bottom profiles are generated and instantly updated. RPLs can be edited further, exported, reversed or split into separate cable lays. SLDs can be displayed, printed or exported.

Right: GIS data are loaded into MakaiPlan as multiple layers in a unified view. The user can adjust the order, transparency of each layer and toggle them on and off.
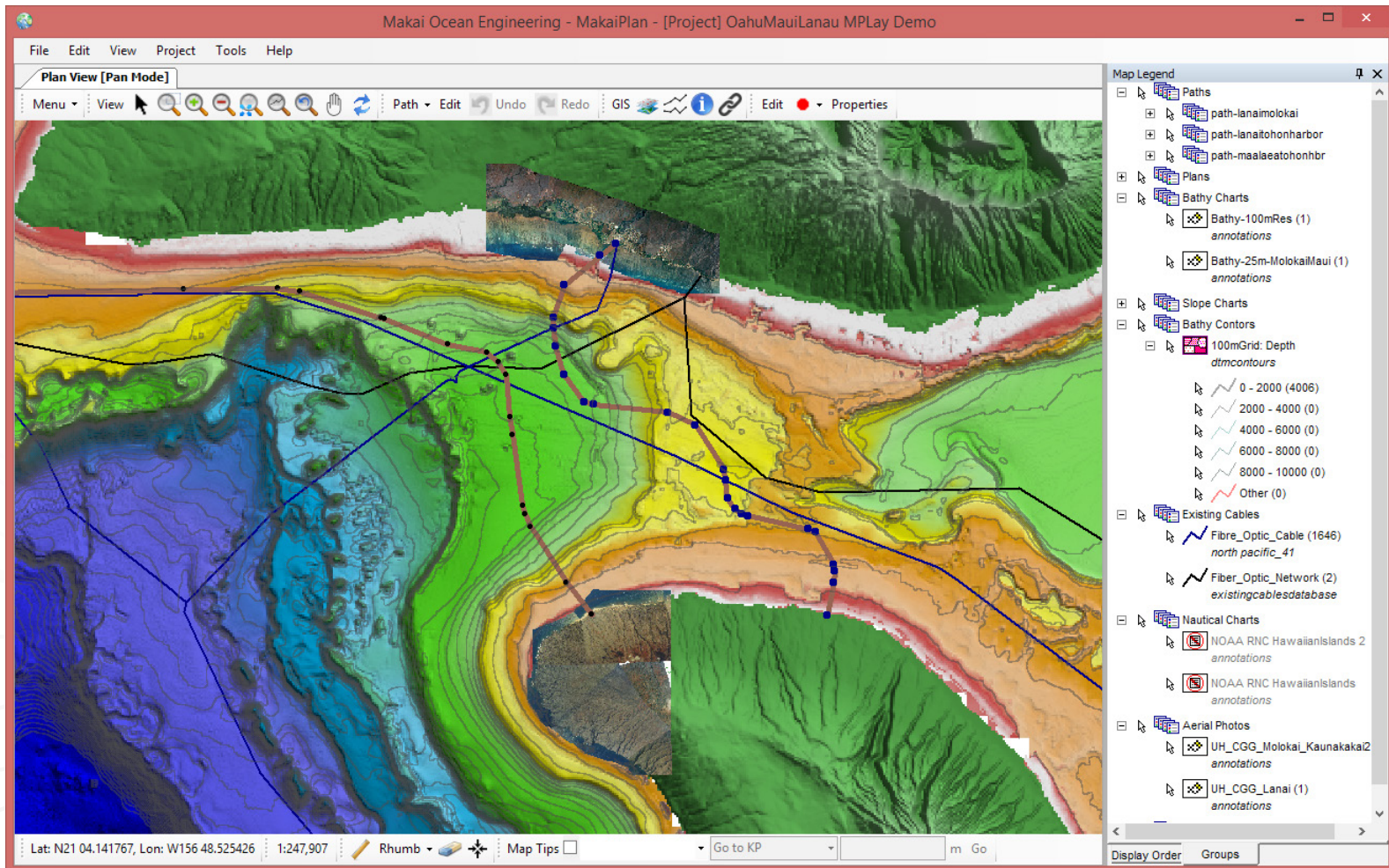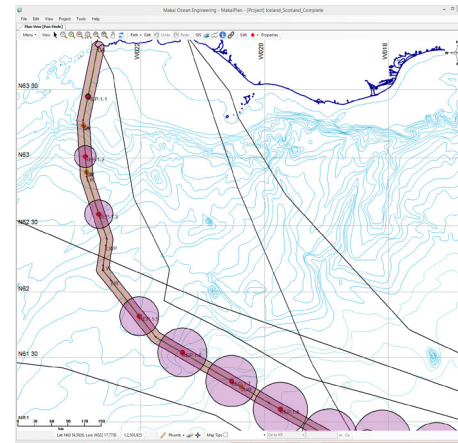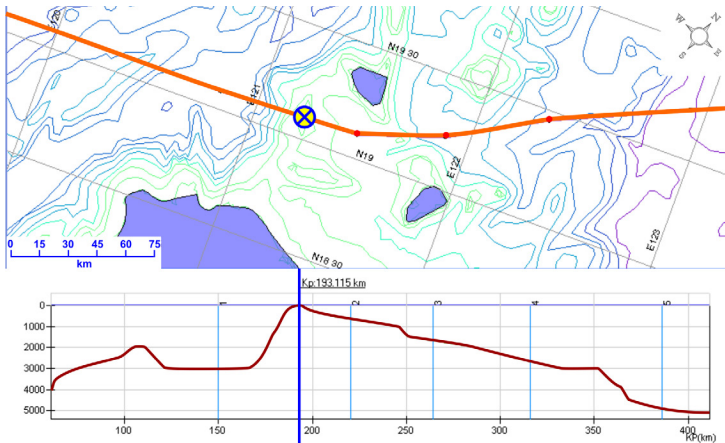
Far Left: Users can edit routes using plan and profile views simultaneously to quickly identify issues. These views update instantly as the route is edited, enabling planners to see and avoid rough terrain and steep slopes. The KP marker is a dual locator that allows the user to coordinate between the two views.

Left: Custom buffer zones can be added around the path and cable assembly items. Buffer zones update automatically with the path edits to continuously alert the planners about various clearances that should be maintained along the route.

Holistic Route Optimization

MakaiPlan provides a way to view the impact of changes on the holistic cable system, enabling planners to rapidly optimize the route. By zooming and panning along the route in both the plan and profile views, it is a simple task to modify the route such that it avoids obstacles while minimizing cable length. Some potential issues might be more apparent in profile view than in plan view; for example, a steep slope or rough terrain. An option called a dual locator links the profile and plan views of the cable path, so that the user can coordinate edits made in one view with the impact of those changes in the other view. In the same way, it is also possible to link the RPL and Cable Assembly windows in order to coordinate and optimize any changes.

Powerful Planning Tools

Route Planning can be a tedious process where many constraints must be met. As a result of more than 15 years of feedback from hundreds of customers, MakaiPlan has developed several purpose-built tools that streamline the route planning process. Some of these include:

Path Crossings: The Path Crossing Locator allows you to automatically identify locations where your cable path crosses other database features such as existing cables in the region, restricted regions, depth contour lines, etc. Once located, the crossing points can be added to the RPL as path points.

Define Cables by Depth: The user can define specific cable types that should be used at certain water depths. MakaiPlan will check the entire path and will automatically insert the correct cable types and transitions.

Path Buffers: Custom buffer zones can be created around path and cable assembly items. Buffer zones automatically update with path edits to continuously alert the planners about various clearances that should be maintained along the route. For example, buffer zones around the path will move with the path as it is being edited, and continuous alert the planners about the installation corridor.

User Annotations

MakaiPlan allows the users to add geo-referenced points, notes, lines, circles and polygons to the plan view. Notes can have hyperlinks that point to additional information. For example, if there is a restricted area, the user can plot it on plan view and then add a hyperlink to a document that has more information on the restrictions. This information flows seamlessly into MakaiPlan Pro and MakaiLay to improve the quality and richness of data available to the creators of the installation plan as well as the actual cable installers.

Preliminary Cost Estimations

A user can define unit costs and preferred laying speeds for each of the cable types and bodies that are being used in the cable assembly. Unit costs for cable installation such as vessel costs, burial costs, and any special events can also be included. Based on this information, preliminary installation cost for a given cable route can be estimated. As the route is modified, these costs are automatically updated.

Collaboration & Version Control

MakaiPlan contains tools to split, merge and reverse the cable path as needed.

MakaiPlan has a powerful importing wizard that can load structured text data in any format.

This allows for a long path to be broken into sections that can then be developed independently by separate planners. There are also version control options for the path, which automatically track edits that are being made to the path. The user has the option to instantly revert to any of the past revisions, which is particularly useful when working with long and tedious paths with several competing constraints.

Importing

MakaiPlan can automatically import RPL, Cable Assembly and profile data from text files. The versatile importing wizard can load text-based data in any format as long as it is structured. The user can then interactively link the various columns and rows to the appropriate fields of data in the wizard. This is a powerful feature that allows MakaiPlan to import required data from a vast number of third party software.

Exporting

Once the cable route and assembly is finalized, there are several options to export the data into tables, Single Line Diagrams, KML files to display on Google Earth, AutoCAD files, and more. As previously noted, a MakaiPlan file can be directly opened with MakaiPlan Pro and MakaiLay, making the job of the cable engineer in the next stage of the process easier and more information rich.

DTM Module

The Makai Digital Terrain Model, or DTM, is an optional module for MakaiPlan that enables planners to easily process and visualize original survey X,Y,Z point data. Users can visualize the bottom features that may impact the cable installation. DTM allows users to process and transform raw survey data into easily recognizable maps, images, and contours from which to view the seafloor conditions including bottom slopes along and across the route.

Using an automated wizard, DTM can import and divide large survey datasets into a series of overlapping data blocks. The automation tools enable users to grid data rapidly and easily, create and view grid maps, shaded
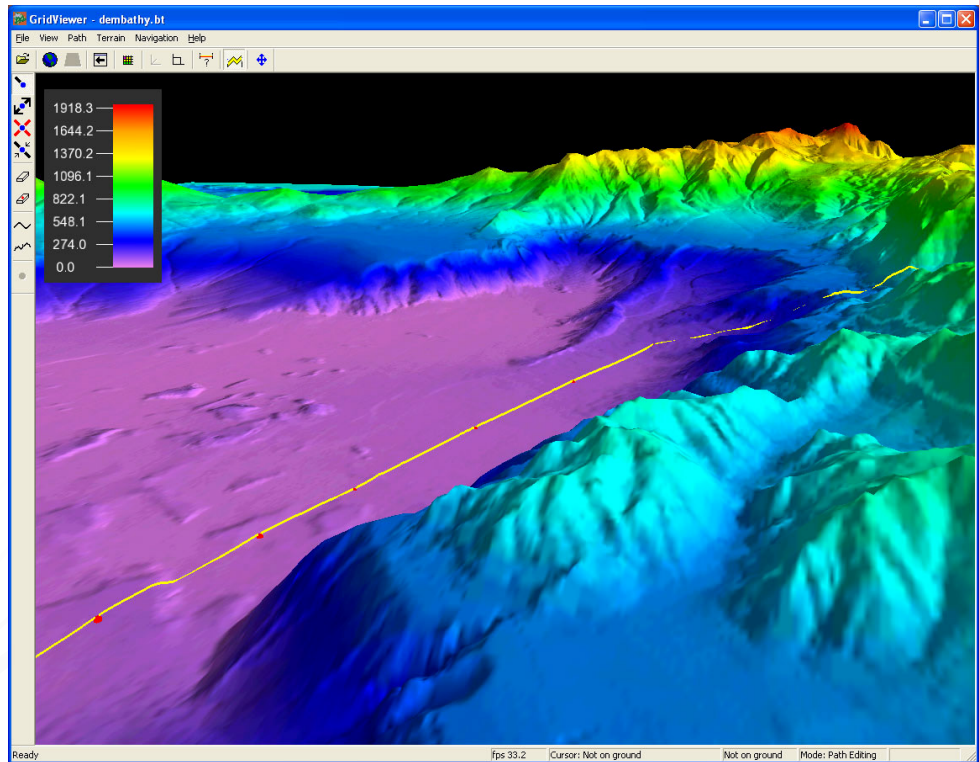

DTM enables route planners to use high resolution XYZ bathymetry survey data that is directly imported and processed in MakaiPlan, streamlining the process.

relief maps, and create GeoTIFFs. Once the 3D survey data is imported, all of the usual MakaiPlan features, such as superimposing the RPL on the map and generating depth and slope graphs, can be performed.

With DTM, it is no longer necessary to purchase and learn different software packages from different vendors to process digital terrain data. The entire planning process can be performed within MakaiPlan, increasing the accuracy and efficiency of the design process.
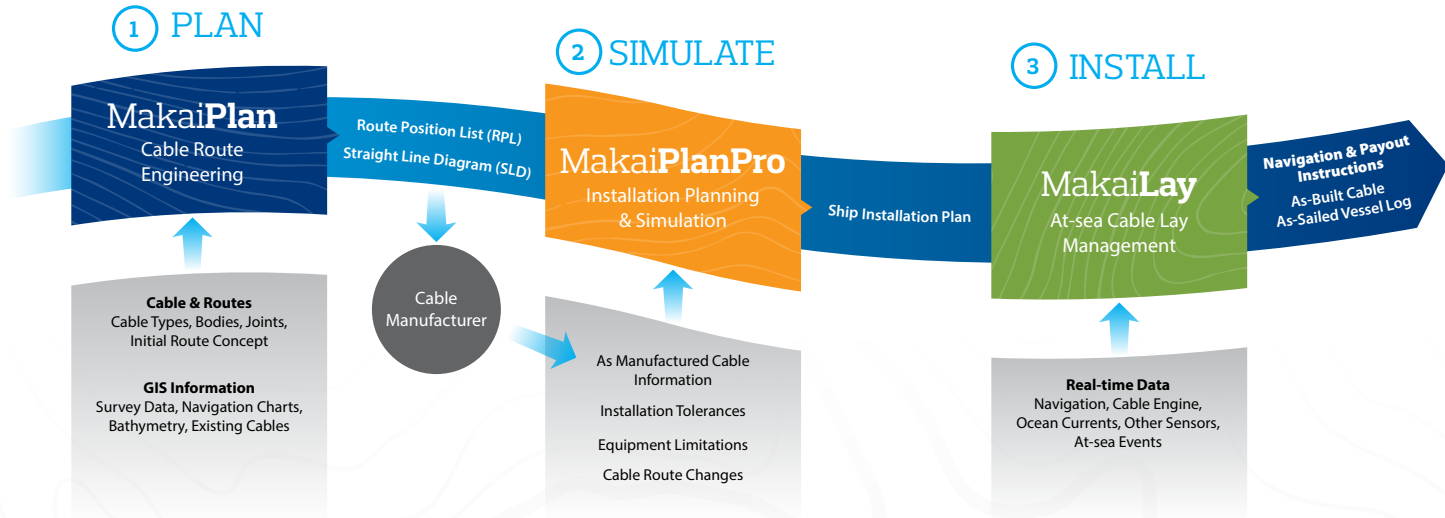
FME Module

FME is an optional module that can be included with MakaiPlan. FME provides the ability to import a broader range of GIS database formats directly into MakaiPlan. The FME module is based on Safe Software's FME Spatial Data Transformation Platform. This flexible and powerful tool makes it easy for planners to translate, transform, and integrate spatial data in over 150 different GIS formats. These include proprietary data types, such as ESRI ArcInfo, Autodesk AutoCAD, and many other nonproprietary data formats, such as the International Hydrographic Organization S-57 standard for navigation charts. This tool simplifies and streamlines the integration of disparate datasets into the planning process, saving cable planners time and effort.
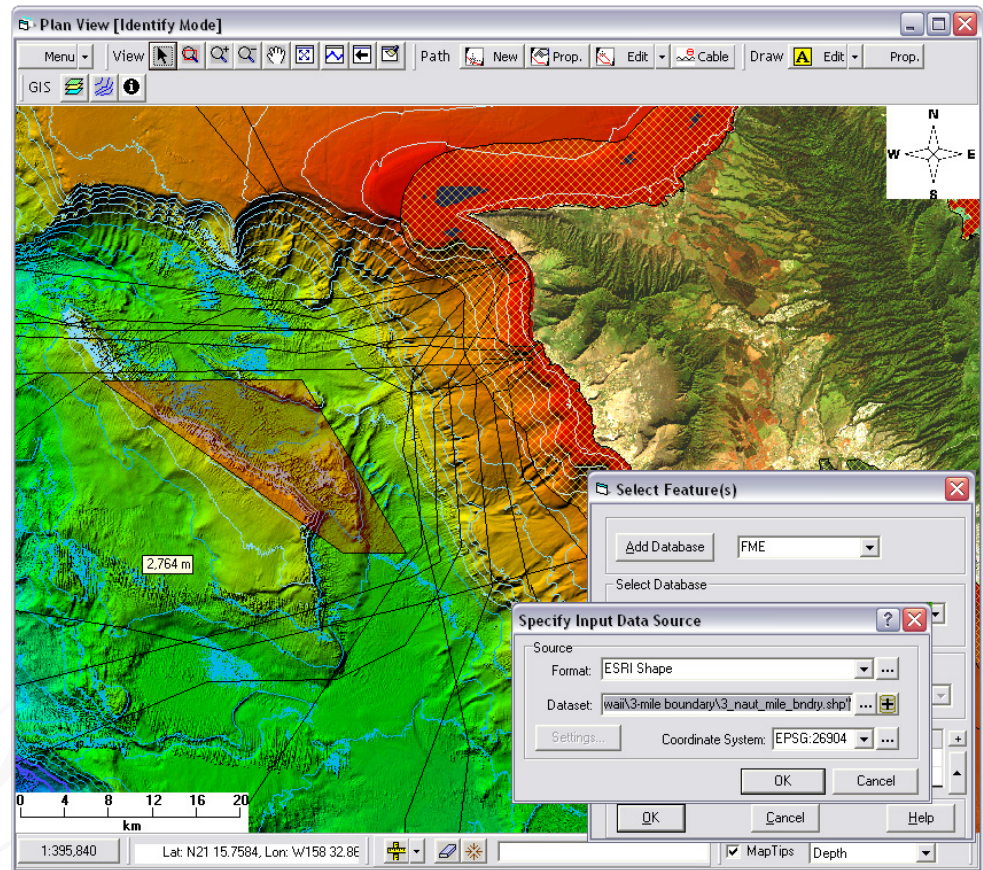
MakaiPlan comes with the optional FME module, which can import over 150 GIS data types, such as ESRI shape files as shown here.

Cable Planning, Simulation, and Installation Process

① PLAN

MakaiPlan
Cable Route Engineering

Cable & Routes
Cable Types, Bodies, Joints, Initial Route Concept

GIS Information
Survey Data, Navigation Charts, Bathymetry, Existing Cables

Route Position List (RPL)
Straight Line Diagram (SLD)

Cable Manufacturer

② SIMULATE

MakaiPlanPro
Installation Planning & Simulation

As Manufactured Cable Information

Installation Tolerances

Equipment Limitations

Cable Route Changes

Ship Installation Plan

③ INSTALL

MakaiLay
At-sea Cable Lay Management

Real-time Data
Navigation, Cable Engine, Ocean Currents, Other Sensors, At-sea Events

Navigation & Payout Instructions
As-Built Cable
As-Sailed Vessel Log

The Creators of MakaiPlan

MakaiPlan was created by Makai Ocean Engineering, Inc, a diversified ocean engineering firm with over 25 years' experience in the subsea cable industry. At Makai we pride ourselves on excellent customer service and technical support. We are an ISO 9001:2008 certified business and use strict quality control methods to ensure the highest quality of submarine cable software products and services.

MakaiPlan complements Makai's highly successful cable simulation and installation software packages, MakaiPlan Pro and MakaiLay. MakaiPlan Pro is a simulation tool that is used to create ship plans that are used for cable installation. MakaiLay is a practical at-sea software to accurately manage and control the installation of the submarine cable. MakaiLay has been used to accurately and reliably install more than 400,000 kilometers of

cable on the seabed, and is used by over 75% of the world's cable ships. Users of MakaiPlan Pro and MakaiLay are able to open project files directly from MakaiPlan, preserving the richness of planning information and giving MakaiPlan users a distinct competitive advantage over other route planners.
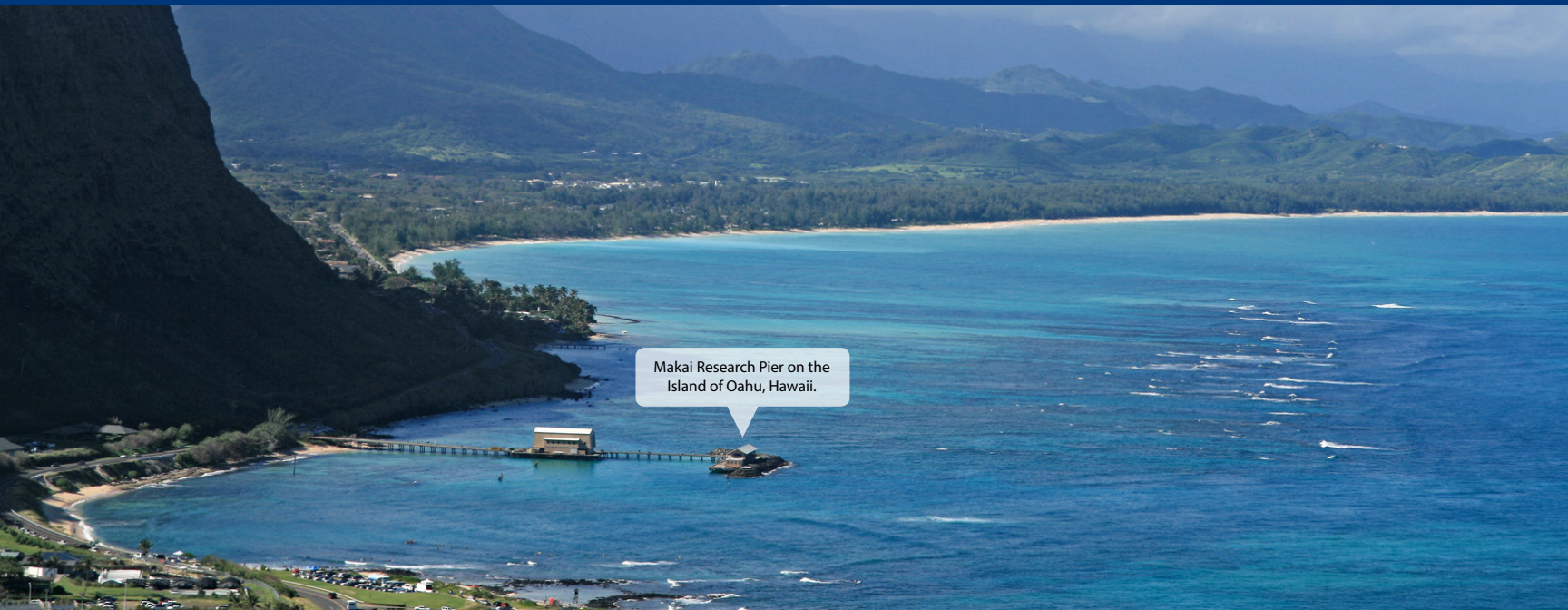
Makai Research Pier on the Island of Oahu, Hawaii.

MAKAI OCEAN ENGINEERING, INC.

For more information and pricing, contact one of our engineers today.

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