Mapping a Glacial Landslide

Remote Area Survey with the Z-Boat 1800RP

Teledyne Oceanscience

Vehicles

Products:
Z-Boat 1800RP

Application:
Remote Area Survey

Project:
Taan Fiord Landslide Assessment

Customer:
University of Washington Tacoma, Dr. Dan Shugar

Background

In October of 2015, a massive landslide was detected at Tyndall glacier in southeast Alaska, sending an estimated 145 million tons of valley wall into Taan Fiord. The landslide's significant mass created a seismic signature that was detected by seismologists thousands of miles away at Columbia University in New York. Taan Fiord is an arm of Icy Bay in southeast Alaska. Over thousands of years, Tyndall Glacier eroded the valley walls creating very steep sidewalls. Over the past several decades, Tyndall Glacier has retreated, no longer supporting those sidewalls. The steepening and then debuttressing of the walls caused the sidewalls to collapse catastrophically in the form of a massive landslide.

Doug Bonno, a student at Unversity of Washington Tacoma, operates the Z-boat from shore.

Image courtesy of Dan Shugar

The Challenge

With a grant from the National Science Foundation, researcher Dan Shugar from the University of Washington Tacoma traveled with a team to investigate the damage caused by the landslide in the summer of 2016. The terrain and its inherent hazards and shallow areas posed significant challenges for both the team and the technology they would use to survey the region.

The Mission

Shugar's team, equipped with a new ruggedized Teledyne Oceanscience Z-Boat 1800-RP remotely operated unmanned surface vehicle, set out on an expedition into the affected area. The goals of that trip were to map the fjord floor with multibeam sonar and other seismic geophysical techniques that would allow them to see below the surface to determine the thickness of the landslide debris. Along with Shugar were a large group of scientists from Columbia University, the National Park Service, University of British Columbia and elsewhere.

The team's plan was to map the submarine deposits with the UW-Tacoma's Z-Boat 1800 RP named 'Jökull' (Icelandic for glacier) with help from Jeremy Venditti, a professor from Simon Fraser University in Canada, and Doug Bonno, an undergraduate student at UW Tacoma. Also on site was another much larger boat, the USGS Gyre, carrying larger instrumentation aboard including a Teledyne Reson T50 and a couple of seismic systems.

The Z-Boat was equipped with a Teledyne Odom Hydrographic MB2 multibeam sonar and an SBG Ekinox-D INS, which gave the team Real Time Kinematic (RTK) position as well as heave, pitch, and roll of the vessel. The RTK

Z-Boat surveying the Taan Fiord

Image courtesy of Dan Shugar

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data were being broadcast from a Trimble R10 base station that Shugar's team brought on the excursion. Shugar's team performed some velocity corrections and CTD measurements with an AML Oceanographic MinosX instrument. Each day, they set up a makeshift office, which was comprised of a small table with a couple of chairs set on top of bouldery landside deposits on shore. A field laptop, power supply with solar panels, and radio antennas was used to communicate with the Z-Boat. The equipment was all powered by batteries, requiring the researchers to work efficiently in the wilderness.

The Outcome

The Z-Boat proved to be a useful tool, dodging icebergs and getting into areas too dangerous for the larger ship. "The Z-Boat was such a great tool for this particular project. We were working on a gigantic landslide in very steep terrain in front of a calving glacier, which is a pretty hazardous place to be around, so you don't necessarily want to have a vessel with people aboard in this kind of environment. The slope that collapsed is potentially unstable even now and so another landslide could occur. You don't want to be too close to the calving face of the glacier because if a big piece comes off, it could generate a wave that might flip your boat," explained Shugar.

Highlight:

"The Z-Boat allowed us to get into these otherwise inaccessible locations.... We were able to fill in the gaps where the big boat really couldn't go"

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"Not only can we answer more profoundly scientific questions than we've been able to in the past but we can also ask new questions"

Makeshift office on the landslide deposits

Image courtesy of Dan Shugar

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"The Z-Boat allowed us to get into these otherwise inaccessible locations that the larger USGS boat wasn't comfortable doing, either because it was too dangerous or potentially too shallow. We were able to fill in the gaps where the big boat didn't really want to go," said Shugar.

Having the Z-Boat greatly increased the team's chances of collecting important data and gaining access to remote locations.

"As a geoscientist that studies geohazards in particular, the ability to go where we have never been able to go or map what we have never been able to map, with this kind of resolution, in these extreme environments and remote areas, is a tremendous advantage. Not only can we answer more profoundly scientific questions than we've been able to in the past but also we can ask entirely new questions," concluded Shugar.

Highlights:

- Learn more about Dr. Shugar and the Water SHED Lab at http://faculty.washington.edu/dshugar/ (WaterSHED Lab)
- Follow Dr. Shugar's latest expeditions on twitter at https://twitter.com/WaterSHEDLab

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