SURVEY

GNSS Echo Sounder Guides Medical Ship through Uncharted Waters

An Australian company that manufacturers GNSS echo sounders aided the aiders — leading a medical ship through uncharted waters in Papua New Guinea.

The CEESCOPE echo sounder enabled the ship to reach volunteers who were working to save the life of a newborn.

The ship, operated by YWAM Medical Ships Australia (YWAM MSA), visits remote villages in Papua New Guinea, giving communities access to life-saving medical and dental services. The village locations are accessed by river, and while often there is adequate tide information to help navigate, there are no available charts or bathymetry data for the passages upriver.

Without a navigable route to follow, the medical ships simply could not travel to locations where help is needed the most.

To solve this problem, YWAM decided to make its own charts, with help from CEE HydroSystems. Using a small, fast launch equipped with a CEESCOPE single-beam echo sounder and GPS hydrographic survey system, YWAM volunteer and master mariner Jeremy Schierer set out to find safe routes through vast river deltas ahead of the medical ship.

The track of the medical ship on the previously uncharted Bamu River.

Jeremy Schierer, a YWAM volunteer and master mariner, uses the CEESCOPE Echo Sounder to chart a river in Papua New Guinea. (Photo courtesy of YWAM)

While surveying at high speed to maximize the area covered, Schierer executed reconnaissance patterns along the river while continuously updating the hydrographic survey plan based on the results seen.

Survey data gathered and processed in HYPACK acquisition software were exported to the navigation system of the ship to provide waypoints marking the safe passage route along the river. Used with available and observed tide data, the navigator of the vessel could confidently travel upriver without the risk of grounding.

The CEESCOPE is a one-box survey system that can be swapped between the two available 4.2-meter and 5.2-meter boats. It can be used without an acquisition PC on the survey launch if needed — all data recorded on the internal memory, and can run on its own battery power for an extended duration. With operation in remote areas on small boats, reliability and usability were key for YWAM.

YWAM also used the CEESCOPE with HYPACK from the wheelhouse to navigate the ship along the surveyed routes on custom electronic charts.

In the third year of YWAM's operation in Papua New Guinea, Schierer recorded a staggering 3,400 kilometers (2,000 miles) of bathymetry to help navigate the *Pacific Link*. All of the rivers were uncharted before the ship traveled upstream. With incomplete tide-station coverage, determining the ship's path was a complex calculation. Despite this, and complicated by a bore tide, YWAM was able to take its vessel 75 kilometers

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upstream in the Bamu River, Western Province, without published charts.

However, the most startling example of the benefit of the YWAM hydrographic survey approach took place in the second year of operation.

"Baimuru is up the Pie River from Port Romilly in the Gulf Province," Schierer said. "The only previous known route took us about four hours through the rivers and required high tide and daylight.

"We went out with the CEESCOPE to see if we could find an alternate and more direct route to the open sea. We left the ship just before sunrise and went as far as 8 nautical miles off the coast to confirm a good passage — and we found one that was deep enough."

Instead of leaving when scheduled, the ship received an emergency call from the medical center about 300 meters away on the shore, where there is no electricity or running water.

"A lady had just given birth, and they were requesting attendance by our doctor and midwife. Evidently the baby was born in the canoe on the way to the medical center, and for some time the baby lay in the bottom of the canoe.

"By the time we unsecured our small boat and got the medical team ashore, the baby was 35 degrees Celsius and not warming up. Our medical team was able to assist in warming the baby and reported that if we had not been there, they were quite certain that the baby would not have survived the night.

"The only reason we were still there was because we had the CEESCOPE and had been able to find another route. We've charted more than 1,200 kilometers with the CEESCOPE so far, and it is making a huge difference," Schierer said.

The volunteer organization YWAM operated the *MV Pacific Link* out of Townsville, Australia, between 2010 and 2014, before acquiring a new larger ship, the *MV YWAM PNG* in 2015.

Based in Sydney, CEE HydroSystems opened an office in San Diego, California, in late 2015, to serve the United States and Canada. The company specializes in RTK GNSS-enabled precision shallow water hydrographic echo sounders. Its products are aimed at surveyors conducting shallow water bathymetric surveys.

"For inshore hydrographic surveys of water bodies such as canals, lakes, rivers or industrial water impoundments, survey firms inexperienced in hydrographic methods often have to resort to conventional and laborious processes using sounding lines, range poles or basic sonar equipment," said Peter Garforth, CEE HydroSystems managing director. "Our CEESCOPETM survey system puts a RTK GNSS solution and precision echo sounder into a compact single package, allowing surveyors to vastly improve productivity on these surveys."

The CEE range of echo sounders with GPS was first developed to offer surveyors a one-box solution to reduce hardware setup time and the need for interconnecting components.

PORTABLE **ECHO SOUNDER**

The CEESCOPE uses a built-in RTK GNSS receiver and UHF radio modem to acquire RTK-quality position and elevation that is used in hydrographic surveying software to output xyz point-cloud data files of bottom elevations in local coordinates and datums. In RTK mode, the CEESCOPE can be directly connected to the local UHF base station radio. The internal CEESCOPE GNSS receiver provides accurate position data at 1–20 Hz, and the single-beam echo sounder records soundings at up to 20Hz.

Both data streams — plus any ancillary measurements fed into the unit such as heave, pitch and roll — are precisely time-tagged using a 1PPS signal and then recorded on the CEESCOPE internal memory. Simultaneously, the data are output to an acquisition PC or tablet.

The CEESCOPE aboard a kayak.