

CONTINUOUS DATA KEEPS BRAZILIAN PORTS' BUSINESS FLOWING

Xylem Analytics Instruments Vital Role in Rio de Janeiro Harbor Monitoring

Piloting a 256-meter (839-foot) cargo vessel into port is always a delicate operation, and it doesn't get any easier with swift currents and stiff winds cutting across the narrow channel. Or fog. Or driving rain.

But that's just another day at work for Brazilian pilots in the state of Rio de Janeiro, where freighters meet a fork in the channel on their way up tiny Sepetiba Bay toward a pair of terminals. Each year, the ships they guide carry away 48 million metric tons of iron ore and 39 million metric tons of containers and iron and steel products, threading their 43-meter-wide bulks down a dredged channel just 200 meters wide. Wind howls up the coast and ricochets off the 800-meter-high mountain range that rings the bay. During foul weather, the mountains trap fog and rainclouds, reducing visibility to near-zero.

It's little surprise, then, that the Rio de Janeiro pilots' association, whose members are responsible for guiding any non-Brazilian ship into those ports, requested that the port owners install the innovative SISMO®—in Portuguese, an acronym for Real-Time Meteocean Monitoring System—in the bay. Their colleagues in Sao Paulo state have used a SISMO system since 2013, which transmits current, level, tide, temperature, wind speed/direction and visibility data directly to their smartphones.

With that detailed dashboard, pilots can maneuver and dock precisely in nearly any conditions. Harbormasters use the same data to fine-tune the loading of each vessel, optimizing the load for the available draft.

"They can load to the maximum and get out quickly and not have any problem," notes Gabriel Aloi Paschoal, commercial director for HidroMares, the Brazilian Xylem representative company and systems integrator that developed SISMO.

The HidroMares team deploys SonTek Argonaut-XR ADCPs—three in total—to continuously monitor currents in a forked, narrow channel in Brazil's Rio de Janeiro state. The pyramidal housing protects the current profilers from damage in the busy port.

Significant Revenues

In Rio de Janeiro state, the owner of one of the ports has used SISMO to cut an hour off each vessel's approach time to the pier, using historical data to optimize the maneuvering patterns in its turning basin. SISMO has also opened the port to night operations, notes Paschoal.

"The terminal doubled the operational time and efficiency after navigation was authorized at night as a result of the SISMO implementation," he reports.

The extensive data from the four SISMO installations in the Rio de Janeiro facility also improve safe navigation, especially where the channel forks in a shallow area where rock had to be blasted out

before dredging, Paschoal adds.

"Every turn for a vessel is really problematic," says Paschoal, whose degree is in oceanography. "Pilots and naval engineers always say a vessel is only built to navigate straight, not to turn."

Continuous Monitoring

HidroMares has installed its SISMO systems at seven port complexes around Brazil, from ocean terminals in the south to an inland river port in the Amazon basin.

At the heart of each system is a SonTek acoustic Doppler current profiler (ADCP), which provides current velocity and direction data throughout the water column, as well as water level. That allows SISMO units to provide current data to pilots at six depths—from the surface to 12 meters, in two-meter increments—as well as highly accurate depth measurements from a vertical acoustic beam and a pressure sensor, all refreshed every five minutes. In Rio de Janeiro's Sepetiba Bay, HidroMares positioned three bottom-mounted SonTek Argonaut-XR systems in the channel, leading their cables up to surface buoys outfitted with data transmission equipment. HidroMares also positioned an Argonaut-SL side-looking ADCP at the end of the pier to deliver a current profile extending 120 meters from the dock.

The pier installation also includes a Mira visibility sensor, a wind sensor and a SmartGuard datalogger from SonTek's sister company, Aanderaa, which is also part of Xylem Analytics. On shore, another wind sensor provides additional insight on air currents.

The buoys—two of which are Tideland SB 138P polyethylene models from Xylem—contain redundant GPRS transmitters to ensure that measurements are relayed reliably to HidroMares' computers, which process them through Aanderaa Geoview software to create a visual display. Paschoal says data retrieval has exceeded 99 percent since

One of two Tideland buoys in the Rio de Janeiro SISMO system, with its hatch open to allow maintenance crews access to datalogging and telemetry equipment.

A HidroMares technician prepares a YSI Nile 502 radar water level sensor, part of the company's innovative SISMO® harbor monitoring system.

SISMO was installed in Rio de Janeiro in late 2015.

HidroMares created a smartphone app to deliver the Geoview data graphics to pilots and port personnel. Processing the Argonaut data takes less than a minute, so the display on pilots' cell phones is never more than a few minutes old.

"The data the pilot or operator sees is from 10 seconds ago to five minutes ago," Paschoal says. "Practically instantly they have visualization of data." SISMO also sends alarms to pilots and port staff when currents, waves or winds become hazardous.

Further Uses

SISMO data can be applied even after vessels have cycled through the port. HidroMares posts each port's data online through Geoview, and exports it to other programs as needed.

"Integration of this data with other products is very easy in real time," Paschoal notes. "In other ports, we have sent our data to improve the weather reports. In some cases, they use this data for environmental monitoring, too."

HidroMares sends monthly data reports to its clients. The Rio de Janeiro ports pass along that historical data to the naval engineering school at the University of Sao Paulo for analysis, part of the ongoing effort to fine-tune operations.

Even before installing SISMO for the Rio de Janeiro ports, HidroMares had gathered four years' worth of continuous current, wave, level and bottom temperature data in Sepetiba Bay at the request of the Brazilian Navy, which had used the site as a submarine building facility. That detailed information helped port owners develop the submarine base into a commercial iron ore loading facility, laying out the channels, sizing the turning basins, and planning logistics.

Easy Maintenance

A team of divers from HidroMares makes a maintenance visit to each Rio de Janeiro SISMO installation every 45 days. Paschoal says the Argonauts and other instruments are highly reliable and easy to maintain. Most of the work is ensuring that sediments have not buried the ADCPs, cleaning up summertime biofouling, and ensuring that cables are intact. The telemetry system is packed in a portable case that can be transferred from the buoy to the boat for more convenient, safer maintenance before being plugged back into the instruments and transmission antenna.

CTD Data

Paschoal notes that each maintenance visit provides the opportunity for the HidroMares crew to gather conductivity, temperature and depth (CTD) measurements with a SonTek CastAway-CTD at every SISMO site. The CastAway measurements reveal seasonal changes in salinity, which can impact buoyancy of ships in the port and, along with temperature, impacts the speed of the ADCPs' acoustic signals.

"We collect it into the database and use it to correct the data from the ADCP as well," he says.

Paschoal is an admirer of the rugged, baseball-sized CastAway-CTD.

"The CastAway was thought up by a person who goes into the field," he says. "You have common AA batteries, integrated GPS—everything you need—and you don't need a computer to operate it."

HidroMares used an image of its Aanderaa wind and visibility instruments as a lead image to promote its SISMO® monitoring system.

Thank you HidroMares for the information and photos used in this application paper.

Durable equipment designed for long deployments such as this Argonaut-SL500 allows HidroMares teams to extend the maintenance interval for each SISMO installation to 45 days.

Integrated Solutions

Isaac Jones, product manager at SonTek's headquarters in San Diego, California, says SISMO is an elegant integration of the broad range of Xylem brands.

"The way HidroMares has linked Argonaut ADCPs and the Mira visibility sensor on Tideland buoys with Geoview software—then supports the data with measurements from CastAway CTDs—reflects the deep knowledge they have of the products they represent," Jones notes. "But what's even deeper is their understanding of what their customers—the pilots, ship captains and harbormasters—need in order to operate safely and efficiently. SISMO is an outstanding example of applying great technology to not just generate data, but to deliver it in an elegant, customer-focused way."

SonTek
a xylem brand
SonTek
9940 Summers Ridge Road
San Diego, CA 92121
Tel: +1 858 546 8327
Fax: +1 858 546 8150
Email: inquiry@sontek.com
Web: www.sontek.com