Cellula Robotics announces the release of new hovering AUV

Canada-based subsea robotics specialist Cellula Robotics has introduced its first hovering autonomous underwater vehicle (HAUV), the *Imotus-1*.

Imotus-1 is designed to operate in confined environments, in a range of fluids. The navigation solution incorporates Cellula's simultaneous localisation and mapping (SLAM) algorithms, using data from a suite of sensors to calculate its location inside a confined, unknown environment.

The vehicle carries a range of inspection sensors including a high-resolution stills camera, ultrasonic thickness sensors and a light intervention cleaning tool.

SOLVE

Eric Jackson, president of Cellula Robotics, said: "We are excited to be entering the HAUV market with a vehicle designed to solve specific inspection challenges in confined spaces. Over the past 18 months, Cellula has taken the strategic decision to develop this technology, building on our strong control systems experience.

"With the global AUV market expected to grow significantly in the coming years and a drive to reduce costs in the oil and gas sector, we believe the *Imotus* family of vehicles will provide a new and cost-effective solution to many inspection challenges."

Real-time 3D surface models help accelerate new breakwater build

Mile Point scheme one of the first breakwater construction projects ever to use Trimble Marine Construction (TMC) software and Teledyne BlueView sonar to collect motion-compensated 3D point clouds and create a 3D model from the moving barge platform in real-time

Established in 1905, Manson Construction Company began as a small, family-owned Puget Sound marine pile driving business headquartered in Seattle, Washington, USA. Today, the company has more than 700 employees company-wide and a national presence in the US, with facilities in northern and southern California, Louisiana and Florida. Manson specialises in heavy marine construction and has extensive experience in dredging, waterfront construction and heavy lifting.

Recently, Manson was hired by the US Army Corps of Engineers to reconfigure part of the Mile Point channel in Jacksonville, Florida, to allow deep-draft container vessels to use terminals at JAXPORT without having to wait for slack tide. Amongst the Mile Point project's many features was the construction of a 4000-foot (1200-metre)-long wall that will not only function as a breakwater, but will also retain dredged spoils and retrain the river currents.

Ken Quiñones, survey engineering manager for Manson, explains that the multi-phase, US$43.5 million (£33.4 million) project involved building a one-of-a-kind concrete structural unit (CSU) wall to retrain the channel where the Intracoastal Waterway and St Johns River converge. Historically, currents created by this bend in the channel resulted in difficult navigational challenges for commercial traffic. Large container ships were restricted to travel the St Johns River during two, four-hour periods of the day due to the tidal effects at this location. The Mile Point project was set in motion to ease cross-currents that have traditionally kept larger ships from transiting that section of the channel on ebb tide.

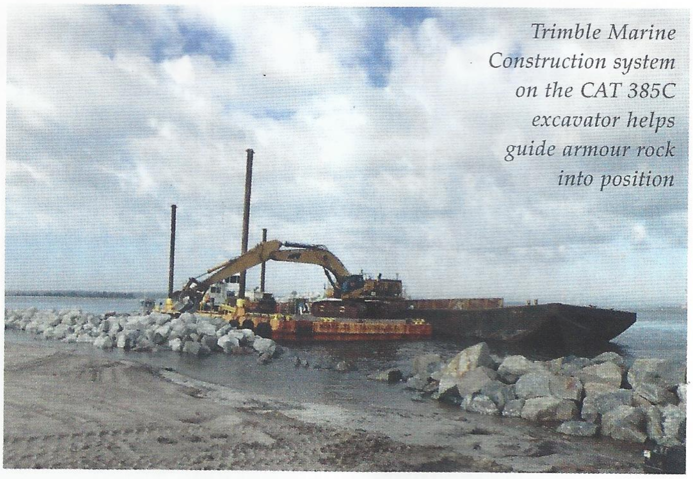
DESIGN

Project manager Patrick Kenning says that the Mile Point project's multiple phases entailed excavation of not ▶

only a natural river bed but also the removal of a relic training wall, rock placement, marine mattress placement, geotube placement, CSU placement and dredging. The end result is two entirely new training walls (east and west leg training walls). The design of the west leg training wall, which includes the breakwater feature, required the placement of CSUs on top of rock filled marine mattresses and a uniform surface of native material or rock, which serve as the foundation.

DEVELOP

During the bid process, Manson chose to partner with Trimble, USA, and Measutronics Corporation, USA, to develop a solid technological approach to deal with the need of critical plant positioning and the use of specialised acoustic imaging in shallow water. Measutronics is an authorised Trimble dealer and an expert in the application of marine construction technology. The company works with customers to solve complex marine challenges by integrating a full range of positioning systems, sonar, inertial motion, communication, attitude, software and echosounder systems.



Trimble Marine Construction system on the CAT 385C excavator helps guide armour rock into position

"The Mile Point project was a complex job with many phases of work," says Quiñones. "From our perspective, it required specialised machine guidance to accurately prepare the subgrade for where we would ultimately place the CSUs. With shifting tides and only three to four feet (0.9 to 1.2 metres) of water at low tide, the use of traditional acoustic systems would not have been an effective means to monitor our progress getting to grade. Additionally, we had to bring in material in some places, and we knew that getting the barge and excavator positioned safely and effectively in shallow water and meeting tight tolerances could be difficult. With the host of complicating factors, we looked to trusted partners and positioning solutions from Trimble to devise a plan of attack."

Lou Nash, manager for Measutronics, explains that Manson required positioning guidance for its excavator as well as guidance for its tugboat and excavation barge, which was the platform the excavator worked from.

"We'd only recently done a similar project, having its own unique challenges," says Nash. "But this second installation had quite a few more moving parts. The Manson guys are really sharp though and things came together relatively quickly as they overcame the learning curve."

DISPLAY

The team selected the Trimble GCS900 grade control system with real-time kinematic (RTK) positioning. The system uses a Trimble GNSS RTK base for global navigation satellite system (GNSS) corrections delivered over UHF radio. The grade control system includes the in-cab display, surface viewing screens, GNSS receivers, pitch and roll sensors, Wi-Fi network as well as angle sensors on the boom, stick and bucket. The excavation barge was outfitted with an RTK GNSS heading bundle, inertial motion unit and a commercial Wi-Fi connection.

"At the heart of the system was the excavator and Trimble sensors," says Quiñones. "We wanted to have RTK-quality measurement of the bucket movements right down to the teeth-level in real-time. The system Measutronics helped us put together worked because it was equally effective in placing rock and removing material with a high degree of accuracy and reliability in very rough conditions."

STITCH

The sonar system included Trimble Marine Construction (TMC) software combined with USA-based Teledyne BlueView's MotionScan system. MotionScan is a system comprised of Teledyne Blueview 1350 sonar, pan and tilt and motion compensation. Together, these systems stitch together an accurate picture of the river floor and the excavation work going on under the water's surface. The system shows the operator the actual versus planned surface in 3D or profile view, and displays the excavator bucket, design depths and colour-coded digital terrain model in real-time. With all the equipment submerged, the system displays visuals that show the operator precisely how work is going – without it he would be working blind.

Quiñones explains that the sonar system was later mounted on a small shallow-draft boat to expand the coverage of survey data in shallow water. This required the use of an inertial navigation unit. The team leveraged a Trimble GNSS and inertial navigation system to remove the distortion of the sonar image caused by the movement of the boat. The sonar sweeps the area in front of the excavator, the data is then

FROM OUR ARCHIVES...

100 years ago

In November 1917 John Edward Pearce, aged 75, a famous diver of Whitstable sadly lost his life. Amongst his great achievements was his salvage of the wreck of the *Orient* in Sydney Harbour, Australia, and for cleaning the bottom of the *Great Eastern*. He was single-handedly piloting a yacht from Rochester to Whitstable when it was caught in a storm and drifted into the pier at Herne Bay. His body was later washed ashore at Reculver.

150 years ago

In December 1867 a hurricane ravaged the island of St Thomas in the Caribbean. Several ships were sunk in the harbour taking down with them many sailors. Divers recovered a number of bodies using a Siebe diving apparatus borrowed from the dockyard at Antigua. Several further sets of Siebe diving apparatus were sent out from Liverpool together with a group of experienced divers on the steamer *Derwent*.

processed and loaded into the system so the operator can "see" what is in front of him. Quiñones believes the sonar scanning and positioning data were essential in ensuring the subsurface preparation was complete before moving ahead to avoid having to rework areas.

POSITION

With the Wi-Fi connection, the operator and an engineer monitored the tug's position, subsurface cut/fill progress relative to grade, and multibeam sonar data continuously throughout the day. This information provided the operator and project management personnel with a comprehensive view of how much material had to be excavated and how much fill was needed to meet the required tolerances.

"Every time the bucket went

Manson Construction and Measutronics personnel install and train on the system

underwater and either took material out or placed material in, the system updated the model that was right in front of the operator," says Quiñones. "Having all of that information flowing through our network allowed us to closely monitor our production from a variety of locations."

Nash says that these sonar as-builts collected, or "as-building" as he calls it, are essential for project monitoring and were key for the precise placement of the training wall foundation material over the course of the project. The team was able to quickly reach required tolerances and avoided over cutting and rework, which had the potential to cause more shifting of material, thus adding costs over time.

MODEL

Nash believes the Mile Point project is one of first marine construction projects ever completed using Trimble positioning and software systems in this way; where Teledyne BlueView sonar feeds Trimble Marine Construction software in real-time for a complete 3D model of work as it is happening.

"If you just give the operator a number representing the depth of the bucket, he could not be very productive," says Quiñones. "Give the same operator a real-time view of the exact orientation of the excavator, the geometry of the bucket (curled or open or anywhere in between) and the depth of teeth and then supplant all that information into a real-time 3D model that updates itself as it goes, that gives the operator the perspective to be very effective, indeed. That's because he can virtually 'see' the work he's doing below the surface. It's hard to imagine doing this kind of advanced work without this equipment. It was a massive team effort, Trimble and Measutronics helped us get there."