ON A STRAIGHT TRAJECTORY: Mobile Mapping

Smaller, smarter and cheaper are all familiar terms to those looking to build the next mobile mapping solution for land, sea or air systems. One company has helped lay the groundwork for the fledgling mobile mapping market. *by Stan Goff*

Miniaturization advancements including position and orientation systems and LiDAR solutions are changing the way the mobile mapping market operates.

Applanix is one of the industry's most recognizable developers of inertial and GPS/GNSS solutions for mobile mapping. Applanix was born in the shadow of the War in Iraq and the dawn of commercial GPS. Initially named Applied Analytics Corporation, the company was founded by three co-workers as a spin-off of Honeywell's Advanced Technology Centre in 1991. Their business plan was to engineer integrated inertial systems and real-time image processing for the aerospace and defense markets. Two years later, the founders shifted direction, re-focusing their energies on next generation off-the-shelf position and orientation systems (POS)—a move that would forever change the future of the company and the industry.

With its position and orientation systems, such as the POSPac direct georeferencing GNSS, the POS MV for underwater, and the lightweight APX-15 for unmanned aircraft systems (UAS), the company is at the forefront of innovation.

POS-itive Solutions

Applanix builds inertial navigation systems that can be directly integrated by developers and OEMs. For companies such as RIEGL USA, Applanix's innovative developments in positioning solutions—and its focus on integration—set the foundation for a partnership that began more than a decade ago.

"In the old days we were a sensor manufacture," recalled Andres Vargas, a system applications and integration specialist in RIEGL USA's airborne division. We developed sensors that our customers, primarily system integrators, could incorporate with other sensor suites. Over time, those same customers wanted more streamlined units and more integration support."

At one point, RIEGL was supporting upwards of 12 different IMU/INS manufacturers. "Of course, these systems can get very complicated and we found we simply couldn't continue to provide our customers with quality services and solutions if we continued to try to provide trajectory support for all solutions," Vargas added.

RIEGL executives evaluated the industry and, at the recommendation of CEO Jim Van Rens, opted to partner with Applanix. "Applanix already had extensive experience coupling GPS and IMUs for the airborne photogrammetry market," he said. "They'd already thought about the necessary integration so that camera systems work in the air. We knew we could leverage their experience and technology to deliver a complete integrated LiDAR solution and better support our customer needs and questions."

RIEGL's first joint project with Applanix was the integration of Applanix POSPac direct georeferencing GNSS and inertial technology with RIEGL LMS-Q40 and LMS-Q560 airborne sensors in 2004. "They offered a streamlined hardware and software workflow that's almost push button for the customer," Vargas said. "They put in trajectory information, push a few buttons and they're good to go—our customers go from the field to post-processing to delivery very quickly."

In 2008, that relationship was further solidified with the VMX 250 turnkey laser scanning solution, RIEGL's first dual headed integrated mobile system that includes fully integrated and calibrated laser scanners and IMU/GNSS. More recently, RIEGL unveiled the RiCOPTER, a remotely piloted aircraft that incorporates the APX-15 UAV GNSS/IMU direct georeferencing board, first introduced in 2014 by Applanix.

The evolutionary APX-15 incorporates a small single OEM board with a precision GNSS receiver and inertial sensor components plus post-mission Differential GNSS-Inertial office software—all in a package that weighs 60 grams and measures 6 cm x 6.7 cm. Combined with the POSPac UAV post-mission software, the APX-15 is able to produce a highly accurate position and orientation solution for direct georeferencing of cameras, LiDARs and other UAS sensors.

"Bottom line," Vargas said, "with the Applanix partnership, we can focus on sensors and our customers can focus on data—not the specifics of an IMU or GPS. Applanix provides a very tightly coupled INS that integrates with our sensors. They work out all the math and processing to get a solution that works every time, all the time. It just works."

Beneath the River Thames

Beyond the need for smaller and lighter solutions, today's navigation tools are be-

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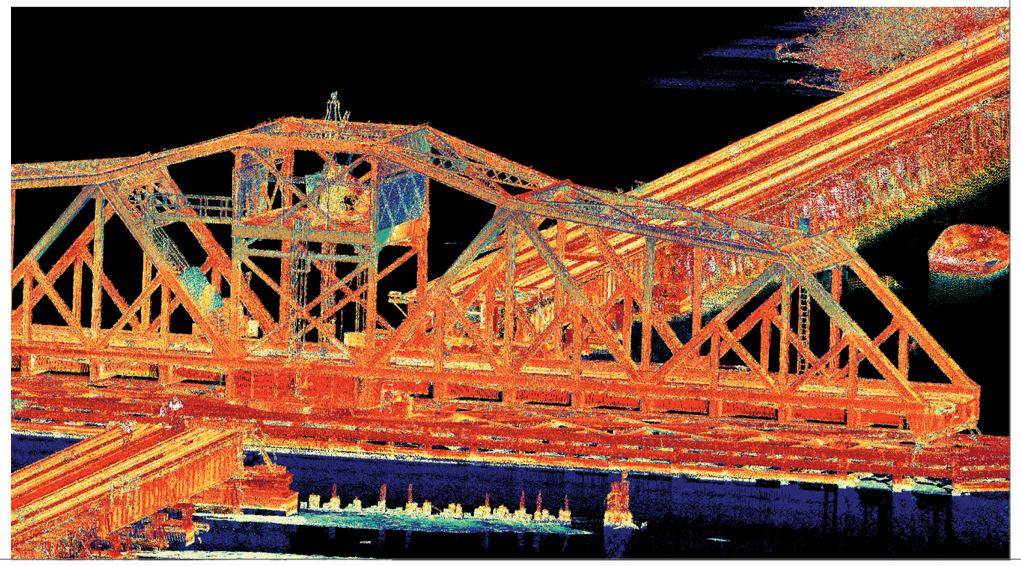

For today's **high-precision LiDAR** to work effectively, from data acquisition all the way to automated and semi-automated feature extraction, the integration between the GNSS and the LiDAR is critical to its success.

Photos courtesy of RIEGL USA.

Today's technology allows for UAS equipped with LiDAR to enhance the way mapping and surveying missions are conducted.

"THEY ARE THE INS INTEGRATION SPECIALISTS, WITH THE EXPERTISE, THE VISION AND THE TEAM SPIRIT TO HELP US CREATE TURNKEY SOLUTIONS THAT WORK—ON LAND, IN THE AIR OR AT SEA."

One system integrator summarized

ing asked to work in ever more challenging locations. The Port of London Authority (PLA), for instance, sought to perform hydrographic survey activities such as high resolution river/seabed surveys and marine asset inspection surveys with a multibeam echosounder (MBES) combined with laser and photography sensors.

PLA is responsible for monitoring trade and travel and facilitating navigational safety along 95 miles of the River Thames in and around London. Its fleet includes harbor and marine service and maintenance vessels, hydrographic surveying ships, catamarans and RIBs (rigid inflatable boats) as well as pilot cutters. The organization has relied on Applanix products to support surveying and engineering activities above and below the water since 2004.

"When we first imagined the multibeam system," said PLA Deputy Port Hydrographer and Commerical Manager John Dillon-Leetch, "we envisioned a single packaged system. We wanted a system delivered to us that had the multibeam, the motion sensor, the positioning—and we felt that the Applanix POS MV was the best available one on the market."

Today, the organization has three major survey vessels fitted with Reson Systems and Applanix POS MV, an inertial navigation unit designed specifically for marine vessels.

"Our long-term working relationships have, we believe, allowed both parties to benefit from this working (partnership)," Dillon-Leetch said. "We are certainly very pleased with the performance of the systems and the support we get from the Applanix team, whether that's supporting existing products or looking for new solutions to new surveying challenges."

Just recently, PLA began testing Applanix's POSPac software in conjunction with University of Southampton technologies. Dillon-Leetch said, "We've been able to achieve improved results utilizing the POSPac suite for post processing data during full GNSS loss. We were able to deliver required specification for navigational charting and engineering level of survey even beneath bridges and structures where GNSS data is lost when transiting the obstruction. We also wanted our team to get a good feel for the quality of the data at day's end—and I think POSPac has given us that."

Mainstream MEMS

The global MEMS market is estimated to reach USD 28.84 billion by 2024, according to Grand View Research, Inc.—and Applanix looks to maintain its industry leading role.

With ongoing improvements in MEMS-based inertial components, Applanix engineers continue to push capabilities ever closer to larger, more expensive and higher accuracy fiber-optic gyros (FOG) and IMUs, with an eye on today's hottest development areas that include driverless cars, UAS and robotic systems. ■

Photos courtesy of RIEGL USA.