POS MV™

POSITION & ORIENTATION SYSTEMS FOR MARINE VESSELS

Applanix POS MV is the marine-survey industry's most accurate, robust, and reliable position and orientation solution available today.

Representing the "state-of-the-art" in GNSS-aided Inertial Navigation Systems for marine vessels, POS MV computes a complete set of parameters including latitude, longitude, altitude, heading, pitch, roll, and heave – even under the most severe conditions and vessel dynamics.

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APPLANIX - THE PREFERRED CHOICE OF MARINE SURVEY

Applanix is transforming the world of marine mobile mapping. As pioneers of the first commercial position and orientation systems for marine survey vessels, and now with over 10 years of established market leadership, we supply superior technology, expertise, and support to customers, partners, and equipment manufacturers around the world. With over 500 systems in use worldwide, the Applanix POS MV is the "industry standard" in positioning and orientation systems for hydrographic vessels.

The APPLANIX Marine Team

We have the industry's most experienced team of marine survey engineers, geospatial experts, and quality assurance personnel – all here to guarantee you the highest quality solution and the highest level of performance. Every Applanix product comes with our company-wide commitment to world-class customer care, so whether you're looking for information on using your system with a new sensor, or just need some expert advice, Applanix is here to serve you in any way.

POS MV™

The Applanix POS MV system is a GNSS-aided inertial navigation system which provides a complete set of position and orientation measurements, including exceptional estimates of heave and ellipsoidal altitude. POS MV was launched onto the world market in 1996 and since that time has been the industry leader for users who are serious about making the most of their investment in multibeam technology.

The POS MV 320, POS MV Elite and the POS MV WaveMaster (for smaller survey launches) are tightly-coupled systems which use Applanix' unique approach to Inertially-Aided Real-Time Kinematic (IARTK) technology. They are user-friendly, turnkey systems which maintain positioning accuracy under the most demanding conditions, regardless of vessel dynamics.

With its high data update rate, POS MV delivers a full six degrees-of-freedom position and orientation solution. The POS MV is designed for use with multibeam sonar systems, enabling adherence to IHO (International Hydrographic Survey) standards on sonar swath widths of greater than ± 75 degrees under all dynamic conditions.

The POS MV Elite offers true heading accuracy without the need for dual GNSS installation and offers users the highest degree of accuracy in motion measurement for their marine applications

TrueHeave Technology
Applanix has redefined accuracy and reliability of heave data with TrueHeave. Based on advanced two-sided filtering techniques, TrueHeave uses both past and present vertical motion to compute a highly accurate heave estimate.

Hydrographic Mapping on the Ellipsoid
Unmeasured changes in the water level mean difficult challenges for hydrographers. Applanix has paved the way in providing centimetric level accuracy of the ellipsoidal altitude, allowing for coherent sea floor images to be obtained in even the most difficult tidal regimes.
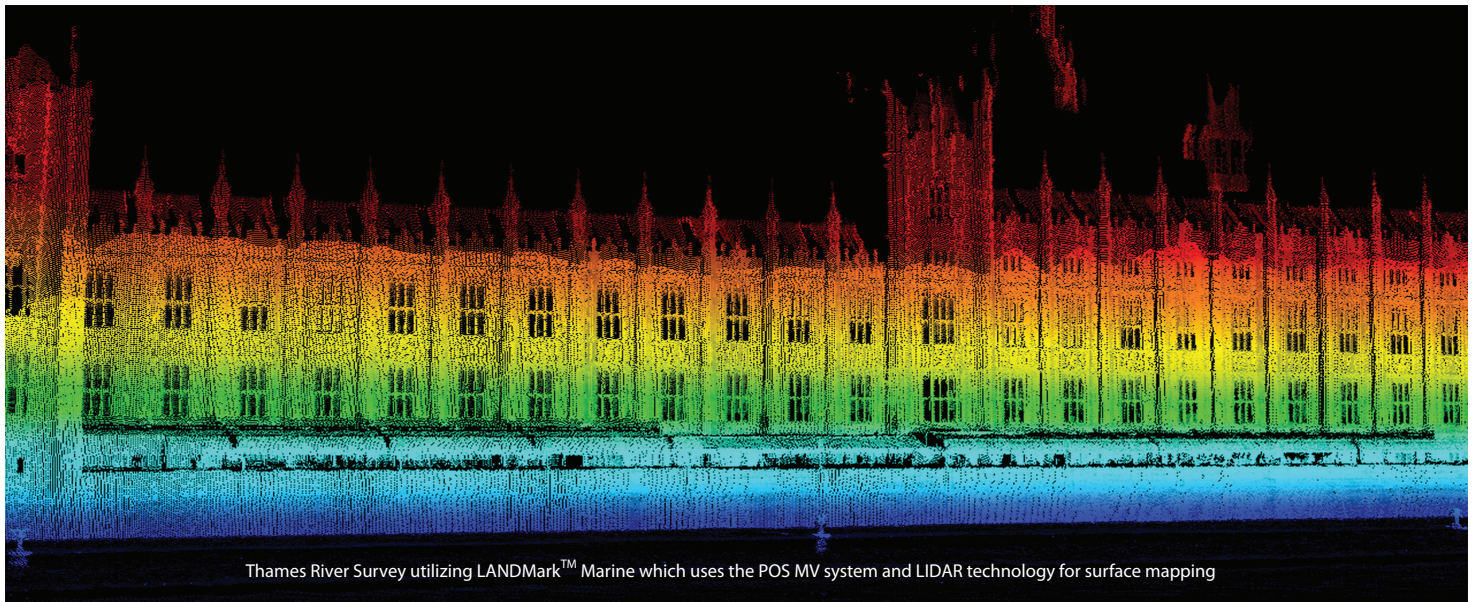
Thames River Survey utilizing LANDMark™ Marine which uses the POS MV system and LIDAR technology for surface mapping

POS MV BENEFITS

Applanix' POS™ technology was originally developed as part of an extensive military project. This proven technology was enhanced, customized and packaged to yield an off-the-shelf commercial product, uniquely suited to the requirements of precision marine motion sensing, hydrographic surveying and charting. It has been rigorously tested and proven in trials with numerous national hydrographic offices and commercial survey organizations. POS MV delivers:

- Reliable and repeatable performance under all dynamic conditions
  - Very low noise L1 and L2 carrier phase measurements
  - Superior low-elevation tracking performance regardless of latitude
  - Continuous sensor monitoring to compute a robust navigation solution. Continuity of all data is thereby assured when GNSS reception is compromised

- Improved accuracy and productivity with "TrueHeave"
  - TrueHeave software enables heave data to meet and exceed the highest marine industry standards. TrueHeave users reap the double benefits of significant improvements in accuracy and productivity.

- Immunity to GNSS outages
  - Provides almost instantaneous reacquisition of RTK following GNSS signal loss. The system uses accurate inertial data aided by GNSS observables from as few as one satellite to compute a robust navigation solution, thereby assuring continuity of all data including position and heading when GNSS reception is compromised. Short-term loss of GNSS does not significantly degrade the POS MV roll, pitch or heading solution.

- Robust centimetric positioning with Inertially Aided RTK
  - Applanix' proprietary Inertially Aided RTK (IARTK) algorithms enable the rapid re-acquisition of fixed integer RTK positioning. In difficult GNSS environments POS MV with IARTK affords a significantly more robust and accurate position solution than can be achieved with stand-alone RTK.

- Operation in a high multipath environment
  - POS MV uses high performance GNSS components that enable excellent carrier phase tracking capability even in a high multipath environment. The result is robust, dynamically accurate true heading data to accuracy better than 0.02°.

- Post-Processing Capabilities
  - Unique post processing package provides the most robust and accurate position and orientation solution possible, ensuring optimal georeferencing and motion compensation of hydrographic data

- Self-Calibration
  - POS MV continually monitors the status of its sensor and if required, automatically reconfigures itself to provide the best navigation solution.

- Upgradeability
  - POS MV uses the latest Trimble BD960 72-channel GNSS receivers with Trimble Zephyr L1/L2 antennas. POS MV offers a low cost upgrade path from DGNSS to L1/L2 IARTK (Applanix' unique tightly coupled Inertially Aided RTK technology) without modifying the hardware.

THE COMPONENTS

POS MV provides the functionality of a GNSS receiver, gyrocompass and conventional motion sensor in a single, user-friendly, turnkey solution:

POS Computer System (PCS):

The PCS contains firmware to perform all functions necessary to control the IMU and GNSS receivers, outputting data in the correct format to interface with other systems aboard the survey vessel. The processor software functions include the Strapdown Inertial Navigation Algorithm to compute velocity, roll, pitch and true heading from the accelerometer and gyro outputs, a Kalman filter that estimates long term drift in the inertial solution using GNSS aiding measurements, and an error corrector that applies the Kalman Filter estimates to the strap-down navigator to continually calibrate the inertial sensor. The PCS also contains a GNSS Azimuth Measurement Subsystem for computing true heading from carrier phase measurements output by the dual GNSS receivers. The processor firmware and software provide sensor calibration, and also fault detection, isolation and automatic reconfiguration.

Inertial Measurement Unit (IMU):

The IMU contains 3 high quality gyroscopes and 3 high quality accelerometers. The IMU is entirely solid state for high reliability, and is housed in its own rugged, water and salt resistant case. Power for the IMU is provided by the PCS.

GNSS Sub-system:

The GNSS subsystem is comprised of two antennas and two low noise, survey grade 72 channel receiver cards embedded in the PCS. The GNSS subsystem computes position to 0.02 m with optional RTK, or 1 m or better with standard differential corrections.

APPLICATIONS

Whether in shallow, narrow or rough waters where the GNSS environment may be compromised by large vessels, cranes and other dock-side structures, or in calm and open seas, the POS MV system provides accurate, robust results in the following applications:

• Harbour Mapping
• Seafloor Mapping
• Dredging
• Wreck and Salvage Charting
• Surface Mapping with LIDAR

Above right: Multibeam image of dredged channel.
Bottom right: USCGC Healy in Northern latitudes.
Below left: Multibeam image.
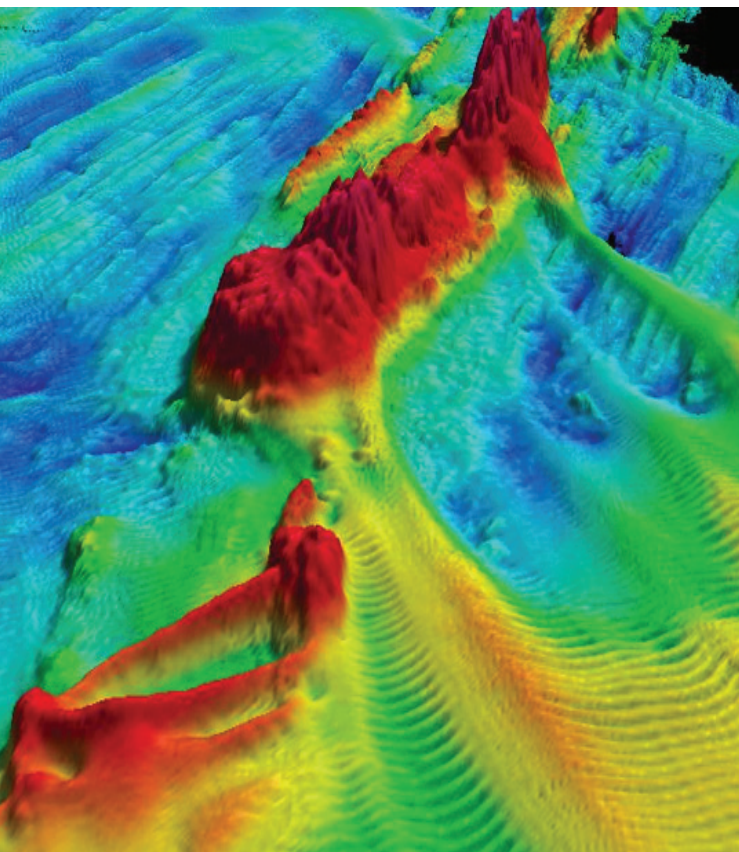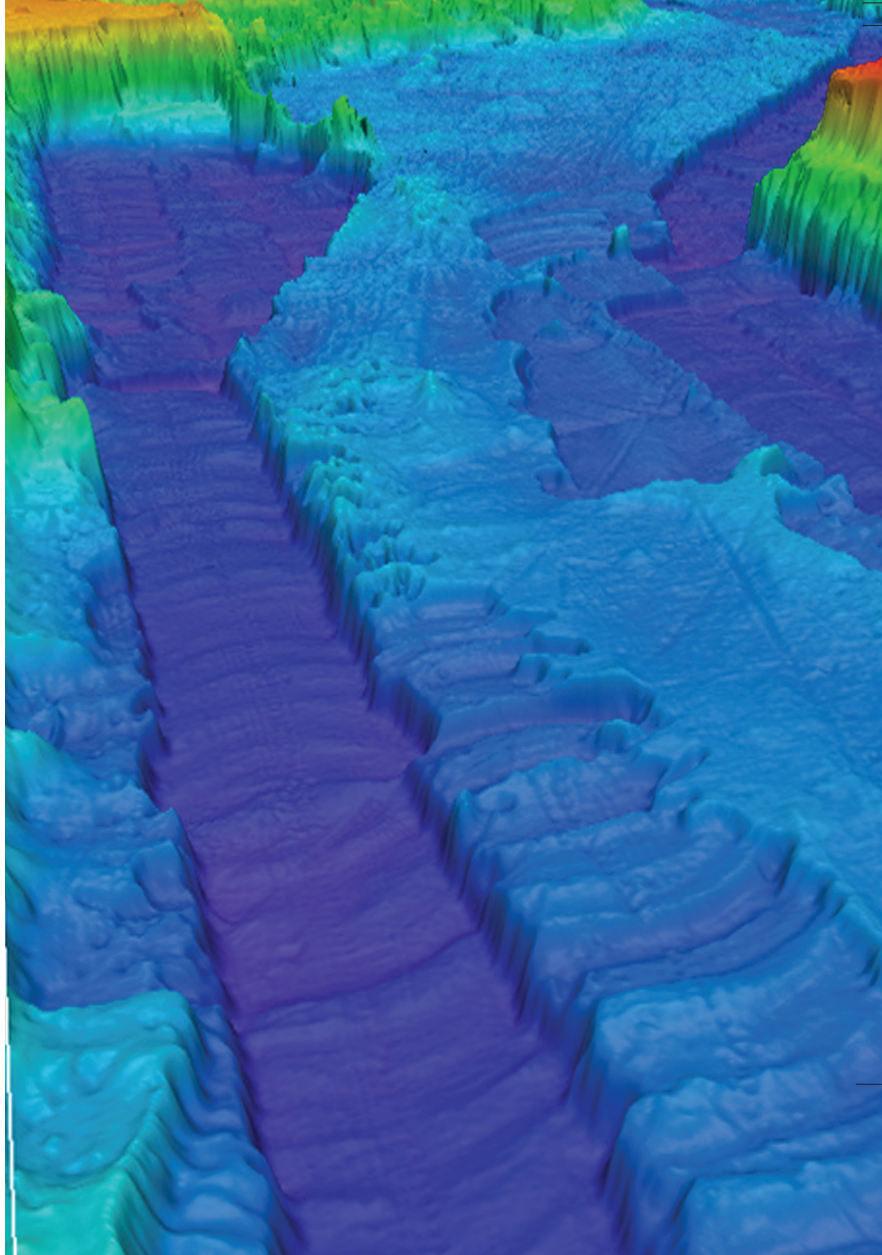
New Method for Hydrographic Surveying

This case study describes the SmartBase™ Post Processed Virtual Reference Station (PPVRS) technique as applied to a multibeam hydrographic survey. This technique uses GNSS network stations to determine atmospheric biases at the rover positions and tightly integrates GNSS with inertial data to provide a continuous, high-precision navigation solution with baselines of up to 80 km

THE TEST

A standard NOAA hydrographic survey was chosen in the Chesapeake Bay to test the SmartBase™ work flow. Data acquisition was conducted aboard NOAA Ship RUDE (pronounced "Rudy") on October 18th 2007 as part of the acquisition of a multibeam reference surface. RUDE performed inshore hydrographic surveys along the east coast in support of NOAA's nautical charting mission and was equipped with some of the most technically advanced hydrographic and navigation equipment available.

On the RUDE all raw positioning sensor data was logged for post processing. GNSS reference station data for the same time period was logged on-shore – no dedicated based stations were required! For this test actual CORS station data was used as provided on NOAA's National Geodetic Survey's website.

POSPac, the Applanix post processing tool was used to process the POS MV data and produce a Smoothed Best Estimate of Trajectory (SBET) file for import into Caris HIPS and SIPS, NOAA's Hydrographic Processing software.


SBET Derived Sand Waves in Chesapeake.

MLLW Derived Sand Waves in Chesapeake.

THE RESULT

Positional accuracies were substantially improved. The loading, dynamic draft, and tide effects were negated because the vessel's vertical position was being accurately measured. The data was accurate to better than 5 cm in X, Y, and Z.

THE CONCLUSION

The SmartBase™ process provides a logistically simple method, when compared with the traditional IAKAR mechanization, for achieving centimetric-level accuracy without installing and maintaining dedicated base stations. The overall process is simple and can be easily added to existing hydrographic data processing workflows without a significant decrease in processing productivity. The gains from the increased accuracies far outweigh the small amount of time required to process the data. It is expected that survey companies will realize significant efficiency gains with SmartBase.

Applanix' unique POSPac MMS software package utilizes SmartBase™ and tightly coupled IAPPK techniques to provide the best possible solution for high precision hydrographic surveying.

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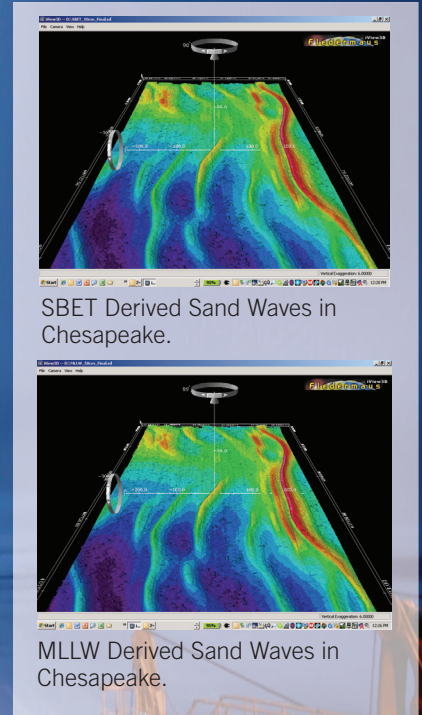
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