

POSPac™ MMS

AIRBORNE MAPPING APPLICATIONS

Technical Notes

Leading the way with increased reliability

Applanix POSPac™ MMS is powerful post-mission software that processes data from your Applanix POS AV™ integrated GNSS/Inertial system to perform highly accurate Direct Georeferencing of your airborne mapping sensor.



APPLANIX POSPac™ Mobile Mapping Suite (MMS): Airborne Mapping Applications

Applanix POSPac™ Mobile Mapping Suite is a powerful office software that processes data from Applanix POS AV™ integrated GNSS/Inertial systems to perform highly accurate Direct Georeferencing of airborne mapping sensors.

Applanix POSPac™ MMS is the industry-leading software for Direct Georeferencing of airborne mapping sensors using GNSS and inertial technology. Optimized for the airborne environment and compatible with a variety of mapping sensors, this smart software solution achieves both maximum accuracy and maximum efficiency for Direct Georeferencing.

It contains all the tools that you need to:

- Import, manage and assess the data from your POS AV™ system and GNSS reference stations
- Produce highly accurate position and orientation solutions from the GNSS and Inertial data logged by your POS AV system
- Generate direct exterior orientation of each image taken by your UltraCam™ DMC®, RMK Top, RC20/30, LMK 2000, Trimble DSS and other cameras, and export it ready for third party photogrammetry software
- Perform IMU to camera boresight and datum calibration
- Perform mission specific quality assessment and control of direct exterior orientation, camera calibration and datum transformations
- Document and provide full reports pertaining to the solution performance of a given mission
- Compute smoothed trajectories specifically optimized for SAR motion Compensation
- Plan and manage complete DSS missions
- Develop DSS imagery
- Generate RapidOrtho™ products directly from DSS imagery

With a sophisticated user interface, and featuring the revolutionary Applanix SmartBase™ module and Applanix IN-Fusion™ technology, POSPac MMS provides an unequalled level of productivity, accuracy and robustness to the airborne mapping professional.

POSPac MMS IS YOUR KEY TO POWERFUL, CONSISTENT, RELIABLE, AND ACCURATE RESULTS... EVERY FLIGHT.

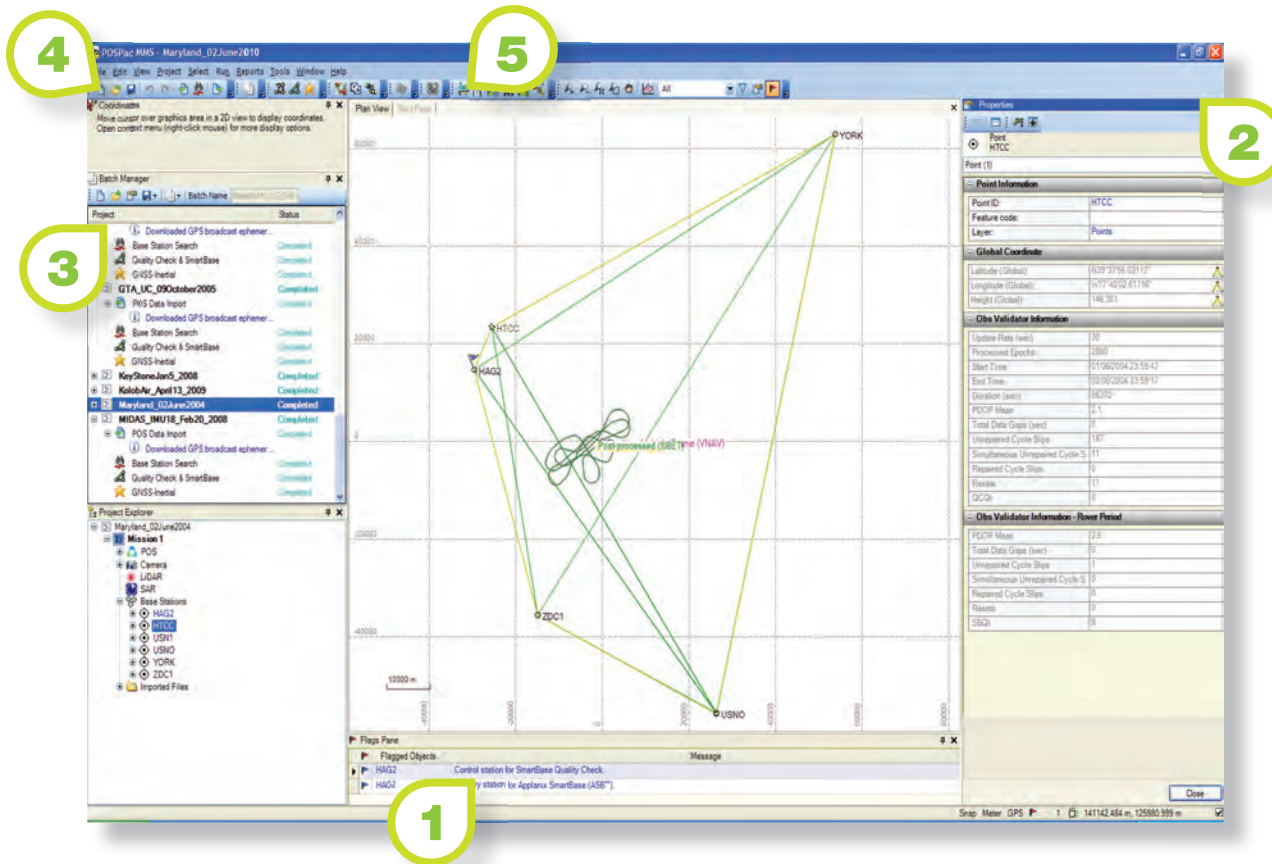


An All-New Easy-To-Use Interface For An All-New Level of Productivity

POSPac MMS uses a modern and customizable user interface, letting you work the way you want:

- User definable toolbar buttons and menus - add external tools directly to the toolbar to customize your workflow
- Simultaneous multiple user views (3D, 2D, and Points Tables) – view what you need when you need it
- Layered based viewing - overlay real-time and post-processed, solutions, base-stations locations and other data for quick visualization of projects
- User defined display style configuration for trajectory by type
- Interactive display plots with multiple selection features for overlaying plots
- Collapsible project explorer menu with quick access to properties of various data sets
- Convenient, unified global project settings
- Project management and reporting options
- Batch Manager provides capability for processing large volumes of data with a minimum of user interaction.

POSPac MMS: A Start to Finish Workflow for Direct Georeferencing of Airborne Sensor Data



AN INTUITIVE, EASY-TO-USE AND CUSTOMIZABLE INTERFACE

1. Customize the way you view data
2. View the details of any object in the Properties pane
3. Quickly navigate through your data with the Project Explorer
4. Put commands right where you need them for easy access with customizable menus and toolbars
5. Easily and quickly tab between windows

POSPac MMS: A Start to Finish Workflow for Direct Georeferencing of Airborne Sensor Data

1) IMPORT AND ANALYZE YOUR DATA

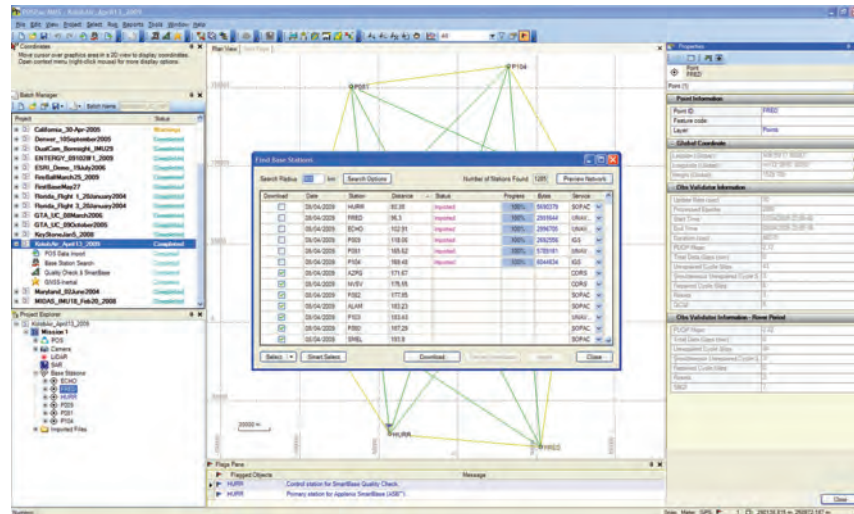
Importing data from your POS AV into POSpac MMS is now easier than ever. Just browse to the logged POS file on your computer or flash card and click go. POSpac MMS automatically analyzes the files and imports what it needs. POSpac MMS will then run an automatic quality check on each and every file and let you know quickly if there are any issues that might affect data post-processing. For more detailed analysis, the real-time position and orientation and Kalman Filter and mission status are easily plotted.

2) DOWNLOAD DATA FROM THE INTERNET

Reference station and precise ephemeris data are imported from the internet in one easy step. With a single mouse click users can search, preview, and download all reference stations in an optimized multi-base network.

Automated Selection of Network: Smart Select

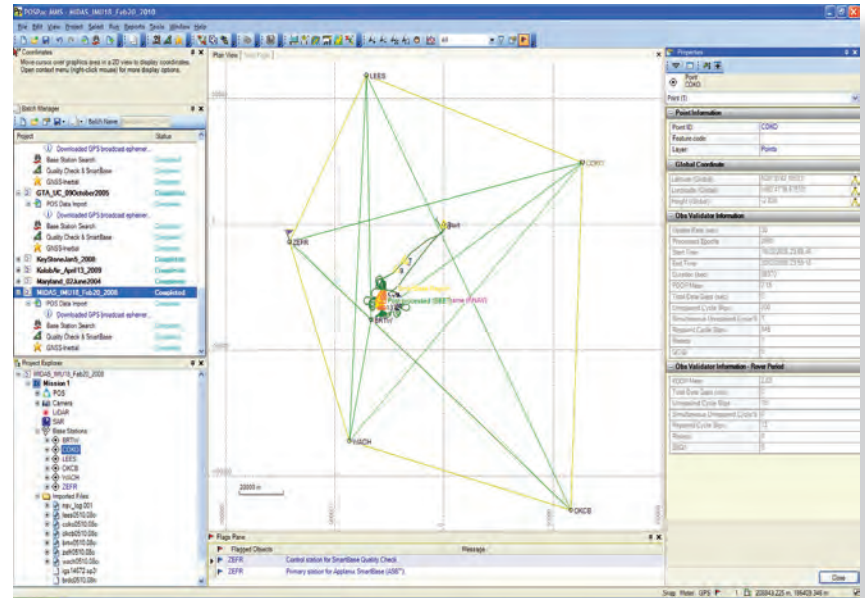
Smart Select automatically selects and downloads the best available network of reference receivers and imports them into the project. Smart Select not only attempts to choose the tightest network fully encompassing the trajectory, it also does a validation of the observation data quality to determine if the stations are suitable for the network.



Easily search, preview and download all reference stations from the internet

3) PROCESS A GNSS-AIDED INERTIAL SOLUTION

As an airborne mapping professional, you know that success of your business relies on producing a high quality product at the geometric accuracy required by the customer, in the most efficient and robust means possible. Aircraft time and ground crews are expensive, so you need the re-assurance that your direct georeferencing solution is the right one for the job; re-flights are simply not an option. Whether you are mapping forest stands in a completely remote region of the world with a sub meter accuracy requirement, or you are mapping highway corridors with your LIDAR where every cm counts, you need the right tool for the job.

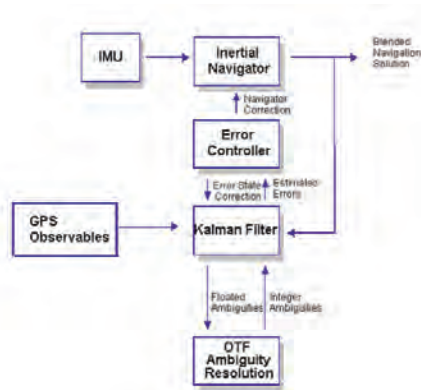


Applanix SmartBase increases the efficiency, accuracy and robustness of mapping and surveying using GNSS on airborne platforms

With its full range of processing options ranging from Inertially-Aided Precise Point Positioning (IAPPP) to Differential GPS+GLONASS to the Applanix SmartBase module and IN-Fusion technology, the GNSS-Aided Inertial Processing Tools supplied in POSPP MMS provide you everything you need... including peace of mind.

INTRODUCING APPLANIX SMARTBASE AND IN-FUSION TECHNOLOGY FOR AN UNEQUALLED LEVEL OF ACCURACY AND PRODUCTIVITY

The GNSS-Aided Inertial Processing Tools in POSpac MMS feature the Applanix SmartBase software module and Applanix IN-Fusion technology, which significantly increases the efficiency, accuracy, and robustness of mapping and surveying using GNSS on airborne platforms. GNSS network and inertial post-processing methods have been re-engineered to work in direct cooperation, reducing or in some cases eliminating the restrictions currently associated with high accuracy GNSS positioning in an airborne environment. Reliable (decimeter level or better) accuracy can be obtained from existing reference station networks without having a dedicated station located close to the project area. Based upon the industry leading Trimble VRS™ technology (adapted for post-processing and developed to use longer distances between reference stations when calibrating for atmospheric errors within a GNSS receiver network), the Applanix SmartBase module uses the data logged from a network of GNSS reference stations to generate a set of GNSS observables corrected for the atmospheric and other geometric errors at the location of the remote receiver in the aircraft. These and the remote receiver observables are then post-processed along with data from the Inertial Measurement Unit using the Applanix IN-Fusion technology, to simultaneously solve for the GNSS ambiguities and position and orientation of the aircraft. The Applanix SmartBase corrections ensure that the error due to atmospheric delays is significantly reduced anywhere within the network of receivers, meaning the correct integer ambiguities can be quickly and reliably computed. The tight integration with the inertial data allows the software to maintain memory of the ambiguities during cycle slips or even full outages.



“The Applanix tightly coupled IN-Fusion technology produces position and orientation measurements from GPS and Inertial data with unequalled accuracy and robustness.”

The Applanix IN-Fusion PPP is a proprietary Inertially-Aided Precise Point Positioning (IAPPP) technology that takes the Precise Point Positioning (PPP) to a whole new level of robustness. Precise Point Positioning (PPP) is an effective GNSS processing technique that uses precise clock and ephemeris information to converge to decimeter level position accuracy without base stations or expensive commercial SBAS subscriptions. Hence it is an ideal, cost effective method of positioning for aerial surveys done in remote areas or where centimeter level accuracy is not required. However, with any loss of GNSS signal, PPP will tend to degrade and then require significant time to re-converge to full accuracy. The Applanix IN-Fusion™ PPP technology overcomes this limitation by using inertial data to mitigate for signal outages and retain full solution convergence before and after the outages. This means high-banked, fast turns can be flown to reduce time in the air for increased productivity, without concern for reduced accuracy.

Higher Accuracy, Improved Robustness, Reduced Cost

The combination of the Applanix SmartBase and the Applanix IN-Fusion technology represent a major shift in operational efficiency for aerial mapping and surveying that provides important new benefits over standard GNSS Kinematic Ambiguity Resolution (KAR). Reliable decimeter level or better accuracy can be obtained from existing reference station networks without the need to set up a dedicated station close to the project area, and the aircraft can be flown with bank angles well above 20 degrees. This has the benefit of reducing the expenditure of conducting a high-accuracy airborne survey, by reducing the costs associated with setting up a reference station infrastructure, and by reducing the time it takes to fly a survey by shortening the duration of the turns. At the same time the robustness of the solution is increased, reducing the cost associated with the need to re-fly a mission. Up to 50 reference stations can be processed at a time, with a minimum of four recommended for accuracy and robustness.

The Applanix SmartBase and IN-Fusion technology currently includes supports for L1 and L2 GPS observables. This will be expanded to include support for additional GNSS observables such as GPS L2C and GLONASS L1 and L2 when they become more readily available.

Rigorous Quality Assurance and Control

Included in the Applanix SmartBase module is the ability to perform a quality check on the reference station data. The quality check module brings the concept of “best survey practices” to the world of airborne mapping. Using rigorous GNSS surveying adjustment algorithms, 18 to 24 hours worth of reference station data are surveyed in to check the quality of both the network coordinates and the raw observations against a control that you specify. Bad reference station data? Bad antenna heights? Bad reference station coordinates? Unlike traditional multiple reference station GNSS processing, each of these errors is detected and then corrected with the quality control step in the Applanix SmartBase module before the remote GNSS data logged in the aircraft is even touched. By the point you start your airborne trajectory processing, you know that your network coordinates, data, and antenna heights are correct, eliminating the uncertainty of having to sort this out during or after the trajectory processing.

Ongoing quality assurance and control of the network coordinates and raw observations is simple with the new user-intuitive interface

Station	Status	Horizontal	Vertical	Total	Time Span	Output Coords
WSLR	OK	0.000 m	0.000 m	0.000 m	23.03 h	Input
sc02	Control	0.000 m	0.000 m	0.000 m	23.83 h	Control
sc05	OK	0.000 m	0.000 m	0.000 m	23.77 h	Input
sc10	OK	0.003 m	0.036 m	0.036 m	23.88 h	Input
sc13	OK	0.004 m	0.029 m	0.029 m	23.88 h	Input
sc15	OK	0.000 m	0.000 m	0.000 m	23.88 h	Input
sc16	OK	0.019 m	0.027 m	0.033 m	23.88 h	Input

Choose any of the available actions or click 'Continue' to proceed with the suggested action. The 'Output Coords' column contains the recommended coordinate setting for the next action.

Select a new control station from the results table.

4) COMPUTE THE EXTERIOR ORIENTATION OF YOUR IMAGES

An accurate GNSS/Inertial position and orientation solution is only just the beginning for Direct Georeferencing of airborne mapping cameras. In order to input the data into photogrammetry software, it must be transformed into Exterior Orientation (EO) with respect to a local mapping frame and projection, and the proper calibration parameters (IMU boresight, datum shift) must be computed. With this in mind, the experts at Applanix have created a set of industry leading Photogrammetry Tools that provide everything you need to ensure the highest level of productivity and accuracy. They include:

Calibration

- IMU to Camera boresight
- Datum shift

Mission Specific Quality Control

- Boresight check and repair
- Datum shift check and repair
- Camera calibration check and repair
- GNSS base station coordinates check and repair
- EO check

Generation of Direct Exterior Orientation

- EO for each image in user specified datum and projection

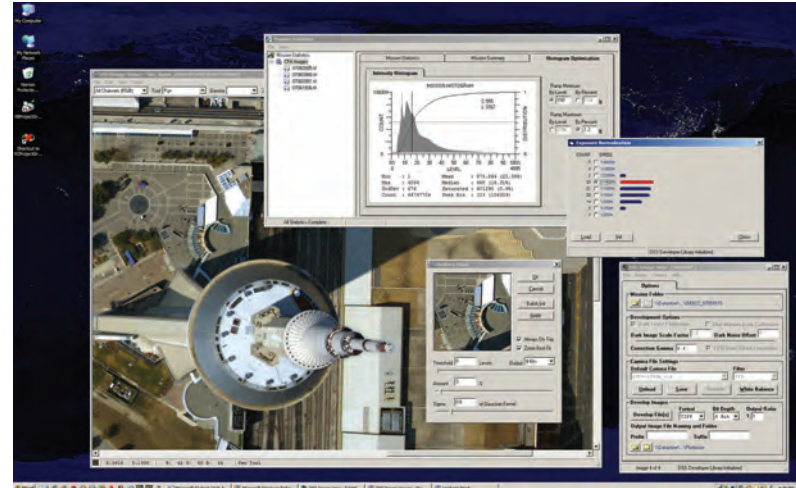
Calibrate IMU to Camera Boresight and Local Datum Shift

Boresight angles are the physical misalignments of the IMU with respect to the camera. The local datum shift is the residual constant offset that is often present in the mathematical transformation used to go from one datum to another. These need to be calibrated to an accuracy better than what is required to georeference the imagery. To do this Applanix has created a unique and powerful approach that uses automatic image point matching and a traditional photogrammetric bundle adjustment to solve for both the boresight angles and datum shift directly in the adjustment process.

Perform Mission Specific Quality Control

Unlike Aerial Triangulation that forces the EO solution to be consistent with Ground Control Points (GCP) and hence can absorb any residual camera, boresight or datum calibration errors, Direct Georeferencing relies on the system calibration and direct EO to be accurate in order to achieve the final ground accuracy. While the calibration of mapping cameras is stable, changes can occur over time due to a number of factors such as handling and age. Ongoing quality assurance and control of the calibrations

parameters is hence crucial for success. This is done quickly and easily by using a few overlapping images from each mission and checking the system calibration parameters using the automatic point matching and bundle adjustment. This ensures you achieve the highest quality results each and every mission.



Utilize DSS Tools to manage data and produce directly georeferenced orthophotos from your DSS.

5) PRODUCE ORTHOPHOTOS AND PLOTTER READY IMAGERY FROM YOUR DSS

The DSS Tools provides everything you need to manage data and produce directly georeferenced orthophotos from your DSS. Simply point to the raw image files, POS AV file, and an existing DEM, and a powerful batch RapidOrtho processing module takes over to produce full-resolution or sub-sampled orthophotos automatically corrected for radiometric lens falloff, shutter effects, lens distortion and other effects. Or simply run ImageView to produce individual color corrected images ready for input into any 3rd party Photogrammetry Software package.

6) COMPUTE A SMOOTHED SOLUTION FOR YOUR SYNTHETIC APERTURE RADAR (SAR)

SAR motion compensation requires the exact line-of-sight displacement of the radar antenna to be measured during an aperture window with the least amount of high frequency error possible. SAR Tools has been provided to remove the effects of filter resets during the SAR aperture windows.

INTEGRATED TOOLS AND NEW TECHNIQUES FROM ONE COMPLETE SOLUTION

POSPac MMS represents an easy step in airborne data post-processing with an integrated functionality for today's professionals using Applanix integrated inertial/GNSS technology. Take advantage of the new powerful tools and techniques designed to provide complete processing solutions from mission startup to project completion.

SYSTEM REQUIREMENTS

The minimum computer requirements for running POSPac™ MMS are:

CPU	Pentium 3 at 800 MHz or equivalent
Memory	512 MB RAM
Operating System	Microsoft Windows® XP Professional or Windows 7
Free Disk Space	400 MB for installation, 1 GB for navigation data, 10 GB for photogrammetric applications
Screen Resolution	1024 X 768 pixels
Regional Options	English (US)
USB Port	2 X USB 1.1 ports for security keys, optional USB 2.0 port for DSS External Drive Enclosure
PC Card Reader	For reading POS data
Internet Access	For downloading Microsoft Framework® during installation and other program operations

The recommended computer requirements for running POSPac™ MMS are:

CPU	Pentium 4 (32 bits) at 2 GHz or equivalent
Memory	1 GB RAM
Operating System	Microsoft Windows® XP Professional (32 bits) or Windows 7 Professional
Free Disk Space	400 MB for installation, 4+ GB for navigation data, 40 GB for photogrammetric applications
Screen Resolution	1028 X 1024 pixels
Regional Options	English (US)
USB Port	2 X USB 2.0 ports for security keys, optional USB 2.0 port for DSS External Drive Enclosure
PC Card Reader	For reading POS data
Internet Access	For downloading Microsoft Framework® during installation and other program operations
User Interface	Several commands in 2D and 3D view modes



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