GXP® Sensor Model Solutions

At the heart of photogrammetry, sensor models incorporate complex equations relating the positions of points within a region, such as a specific building in North America, to their positions on images acquired by sensors. In addition, these models enable the estimation of parameters specifying the position, attitude, and movement through time of the respective sensor.

Sensor models expedite rigorous error propagation, so that measurements on images result not only in positions, angles, and distances, but also in estimates of the accuracy of these derived quantities. These models are essential not only to image registration, but to all subsequent stages of the photogrammetric workflow, including terrain generation, feature extraction, and visualization.

Adhering to prevailing international standards, GXP software is renowned for its wealth of sensor models, supporting numerous electro-optical, infrared, multispectral, hyperspectral and synthetic aperture radar and LiDAR sensors. Many GXP sensor models are rigorous (i.e., they mathematically model the physical characteristics of the sensor), providing a degree of accuracy far above standard models which generally fit the physical system but don't replicate its inner structure.

Multiple sensor models often operate simultaneously in GXP software, facilitating a powerful fusion of data to maximize the accuracy of information while enabling advanced exploitation of a rapidly growing population of image sources worldwide.

Photogrammetric sensor models developed by Geospatial eXploitation Products™ (GXP®) provide a geometric representation of how light is reflected off of the object of interest, delivered through the air to a camera (sensor), and then converted into pixels for visualization.

This approach applies equally to active sensors, such as LiDAR and SAR, which transmit energy to the object to be measured and then receive the reflected signal.

GXP sensor models support accurate determination of key measurements and advanced geospatial workflows.

- Ground coordinates
- Distance measurements
- Height measurements
- Feature extraction
- Triangulation
- Terrain generation
- Orthorectification
- 3-D Modeling
- Error propagation

GXP® Geospatial Solutions to ensure a safer world

GXP supports the full life-cycle of sensor model development including the following:

Design & Development
Design, development, and testing of the sensor model, including development of synthetic image data when actual data is unavailable.

Verification
Rigorous testing using ground truth to determine accuracy. All test results are analyzed and addressed by an expert team of photogrammetrists and identified issues are addressed appropriately.

Validation Support
Comprehensive support during the entire validation process including document preparation, technical support throughout testing, and development of recommendations.

Sensor models utilized in SOCET GXP®

- **Agenzia Spaziale Italiana**
  - COSMO-SkyMed
  - COSMO-SkyMed complex
- **Airbus**
  - Pléiades A/B
  - SPOT 1/2/3/5/6/7
  - TanDEM-X
  - TanDEM-X complex
  - TerraSAR-X
  - TerraSAR-X complex
- **Canadian Space Agency**
  - RADARSAT
  - RADARSAT-2
  - RADARSAT-2 complex
- **DigitalGlobe®**
  - GeoEye-1
  - IKONOS (RPCs)
  - QuickBird
  - WorldView-1/2/3
- **European Space Agency**
  - Sentinel-1A/B
  - Sentinel-2A
- **Harris**
  - ENVI Header Format: read georeferencing from .hdr file
  - Initialize sensor model from ENVI Standard Image format
- **Hexagon Geosystems**
  - Leica ADS40/80/100 pushbroom sensor (Level 1)
- **ImageSat International**
  - EROS-B
- **Indian Space Research Organization**
  - CartoSat (RPCs)
  - Chandrayaan-1 TMC
  - RISAT-1 complex
- **Japan Aerospace Exploration Agency**
  - ALOS AVNIR-2
  - ALOS PALSAR
  - ALOS PRISM (rigorous)
  - ALOS PRISM (RPCs)
  - ALOS-2 PALSAR-2
- **Korea Aerospace Research Institute**
  - KOMPSAT-2
  - KOMPSAT-3
  - KOMPSAT-5
- **NASA**
  - ASTER
  - Landsat
- **National Space Organization**
  - Formosat-2
- **Planet Labs**
  - RapidEye
- **Terra Bella (Google)**
  - SkySat
- **U.S. government formats**
  - Arc Standard Raster Product (ASRP)
  - Community Sensor Model (CSM) support for user-developed sensor models (2.0; 3.0.2)
  - Compressed ARC Digitized Raster Product (CADRG)
  - Controlled Image Base (CIB®)
  - Digital Point Positioning Data Base (DPPDB)
  - Generic Point-Cloud Model (GPM, formerly ULEM)
  - MSP-supported sensors
  - NCDRD
    - GeoEye-1
    - WorldView-1/2/3
  - SENSRA Frame
  - SENSRB Frame
  - USGS DOQ
  - USMSD
- **VisionMap**
  - A3
- **Generic**
  - 2-D polynomial
  - 3-D polynomial
  - Direct Linear Transformation (DLT)
  - Four-corner
  - Frame advanced
  - Identity
  - Ortho
  - Rational Polynomial Coefficients (RPCs)
  - Replacement Sensor Model (RSM) generic capability
  - Enhancement to support planetary mapping

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