SensorCAD™

SENSOR SYSTEM MODELING & SIMULATION TOOL

SensorCAD streamlines the system engineering of electro-optical sensor missions by using parameter-driven models to predict sensor system performance. These models are based on 50 years of experience modeling, building, and deploying space-based, airborne, and ground-based sensors.

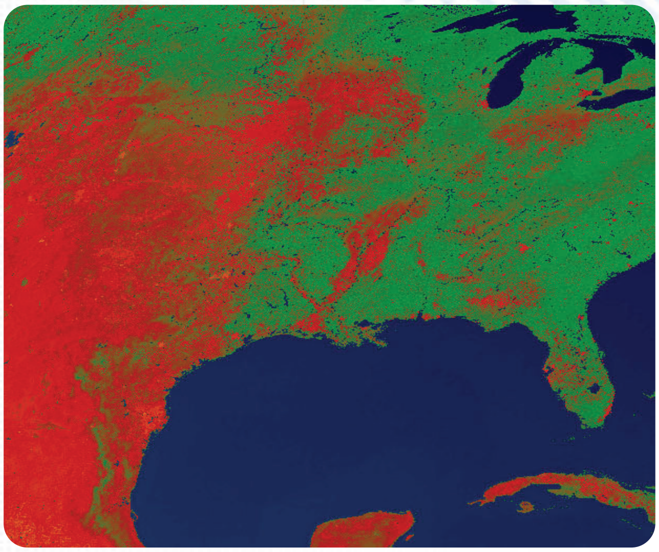
SensorCAD processes changes to mission parameters rapidly enough to bring depth to proposal efforts. SensorCAD is also detailed enough to aid in the definition and flowdown of mission-level requirements to sensor subsystem requirements.

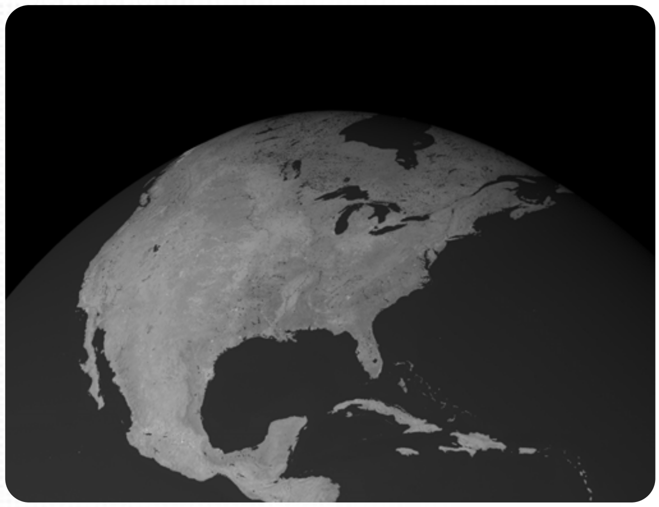
SensorCAD features a simple, graphical user interface to allow users to input changes to the mission configuration and run a new scenario in a matter of minutes. Users control sensor, target, and environmental properties through the GUI.

SensorCAD generates synthetic input scenes and expected sensor output based on sensor, target, and environmental properties defined by the user through a simple graphical interface.

SensorCAD uses a standard output, enabling users to easily create and share sensor configurations and components with team members.

SensorCAD is available directly from Space Dynamics Laboratory as a stand-alone application and as the STK/EOIR plug-in for Satellite Toolkit (STK) from Analytical Graphics, Inc. (AGI). SDL can build custom applications based on both SensorCAD and the STK/EOIR plug-in on request.





SensorCAD is designed for use over a broad range of applications, including:

- Ballistic Missile Defense
- Space Situational Awareness
- Tactical Surveillance
- Planetary and Environmental Sciences
- Simulating Earth-Based Observatories

Space Dynamics Laboratory
Utah State University Research Foundation

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RESULTS SensorCAD generates a digitized pixel array representing the sensor output image depicting all objects in the field of view, accounting for diffraction and various sources of random noise.

SCENARIO OBJECTS

Vehicles	Satellites	Targets	Missiles	Celestial Bodies
up to 6	up to 16	up to 6	up to 6	Sun, 8 Solar System planets, Earth's moon, star field

SENSOR PARAMETERS

SENSOR SYSTEM DESCRIPTION

SensorCAD supports up to six four-band sensors simultaneously covering a spectral range of 0.28–28 µm. SensorCAD allows users to determine sensor performance in one of two ways: directly specifying sensor performance parameters via the high-level interface or specifying subsystem parameters via the standard interface. SensorCAD uses subsystem parameters to compute the sensor system performance.

HIGH-LEVEL INTERFACE—PERFORMANCE PARAMETERS

Spatial Parameters
Field of View
Pixel count (vertical/horizontal)

Spectral Parameters
Wavelength Band
Wavelength Intervals

Optical Parameters
F/#
Effective Focal Length
Diffraction Wavelength
Image Quality
Longitudinal Defocus

Radiometric Properties
Units
Sensitivity at one or more integration times
Dynamic range at one or more integration times
Current integration time

Other Parameters
Sensor type
Field of regard
Pointing jitter
Position on parent body

COMPUTED PERFORMANCE METRICS

Range to Target
Target Radiance/Irradiance
Background Radiance/Irradiance
Scene Photon NER/NEI
Total NER/NEI
Signal to Noise Ratio

STANDARD INTERFACE—SUBSYSTEM PARAMETERS

Optical System Parameters
Entrance pupil diameter
Effective focal length
Transmittance
Effective temperature

ADC Parameters
Number of bits
Full-scale voltage
Noise

Focal Plane Array Parameters
Pixel count (vertical/horizontal)
Pixel pitch
Detector optically active area
Detector temperature
Detector quantum efficiency
Detector resistance-area product
PV detector type (choice of 4)
Integration mode
Integration time
Readout noise

COMPUTED PERFORMANCE METRICS

Signal to Noise Ratio
Signal to Background Ratio
Noise Equivalent Radiance
Noise Equivalent Flux Density
Signal and Noise Constituents
Spatial Frequency Cutoff
Airy Disk Diameter

POINTING & TRACKING

SENSOR POINTING IS ACCOMPLISHED BY :

Sensor within a defined Field of Regard
Parent satellite/vehicle to which the sensor is attached.
Combination of above

TRACKING MODES DESIGNATE POINTING CHARACTERISTICS

Pushbroom scanning
Inertial pointing
Tracking designated targets

SYNTHETIC SCENE GENERATION

INPUT IMAGES ARE BASED ON

Positions and orientations of objects in scenario
Sensor line of sight and Field of View

PHYSICAL RADIANCE UNITS CALCULATED BASED ON

Self radiance
Reflection, atmospheric transmission/scattering
Surface optical properties in detector spectral range
Object thermal models, blackbody radiation, or measured spectra

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