Ondulus Suite provides the realism needed for research, design, and the immersion required for mission training.

Visit our website: presagis.com
Ondulus LiDAR can simulate either commercial LiDAR sensors, or ones with customized settings.
Ondulus IR gives simulations and training scenarios a critical component: physics-based infrared sensors.

Ondulus LiDAR simulates a wide range of LiDAR sensors in order to create high quality point clouds in a virtual environment.

Sensor vision is one of the most important advantages on today’s battlefield. Building on the success of Ondulus Radar and Ondulus IR, Presagis has developed Ondulus NVG.

Ondulus Radar delivers the ability to add high-fidelity, high-performance, physics-based radar sensor simulation into a wide variety of applications.
BENEFITS & FEATURES

**Real-time & Physics-based**
Radiation, cooling, complex and composite materials, and other calculations are built-in, realistic, and high-fidelity. Our unique physics-based approach allows for affordable, real-time simulations which are dynamic and changeable, which is perfect for research and design.

**Fully Customizable**
Open architecture allows users to customize sensors to meet their specific requirements. Sensors models can also be extracted from manufacturer data sheets. Ondulus IR is compliant with the EMVA (European Machine Visual Association) 1288 standard.

**Supports OGC CDB Format**
To maximize reusability interoperability, Ondulus IR supports OGC CDB. Also, through OGC CDB, Ondulus IR users can develop rich ground material databases that can cover the whole earth, and offer multi-user and multi-resolution points of view to enable even the most stringent IR applications.

**Wide Export Capabilities**
Developed in Canada, Ondulus IR is a product that can be integrated in any solution, allowing it to be deployed and supported almost anywhere in the world.

In order to properly calculate light reflection, Ondulus IR uses physically-based rendering (PBR).
Ondulus IR is well equipped to dynamically calculate light reflections, thermal radiation, loading, cooling, as well as conduction and convection.

Computation is available for any time of day, any time of year, under any atmospheric conditions and at any location on the planet and also takes into account the energy exchanged between the sun and different materials. Part of the Presagis M&S Suite, Ondulus IR is designed to reduce costly integration time and streamline the development process. Additionally, Ondulus IR can easily be mounted on virtual vehicles, ships, aircraft, helicopters, or UAVs.

Built on a modular, open architecture, simulation developers can easily replace default models with their own or even write their own GPU shaders. Ondulus IR was designed with computational performance in mind. This translates to higher-density scenes and wider field of view than most other solutions on the market.

Real-time high-quality materials-based infrared sensor simulation.

- Materials & environment aware.
- User controllable Hot Spots to simulate real-time temperature.
- User can specify light sources and types
- Unified database & material-classification workflow.
- Single correlated database for visuals, sensors & CGF with OGC CDB.
- Unlimited area coverage.
- Dynamically control sensor parameters through user interface or via API.
- Simulate multiple sensors at the same time (multiple channels).

Customizable Hot Spots let users simulate real-time temperature signatures on any model.
COMPLEX MATERIALS SUPPORT

Ondulus IR offers support for complex composite materials usually comprised of several layers of different base materials and are categorized as:

**Terrain:** for all terrain materials, includes surface layers (e.g., concrete road, grass field, mountain rocks) and sub-layers (e.g., soil, sand, limestone).

**Culture:** for all building materials, includes surface layers (e.g., asphalt, roof, brick wall, glass window), insulation layers (e.g., fiberglass, glasswool, air), and inner layers (e.g., wood, fiberboard).

**Water:** for all water surfaces (e.g., ocean, lake, river) the thickness represents the water depth which is taken from the bathymetry data of a database.

**Clouds:** for all types including 2D, 3D, and SilverLining clouds produced in Vega Prime.
DUAL SENSORS: PHOTON & THERMAL

Two Detectors. One Simulator
In order to accommodate the different types of noise and dependencies encountered at different wavelengths and temperatures, Ondulus IR refined its sensor into two distinct detectors:

- Photon for long wavelength IR and lower operating temperatures
- Thermal for very long wavelength spectral ranges

Use Datasheets or Specs
With an extremely high degree of customization, each detector can be specifically configured using datasheet information, or actual product specifications.

Accurate Physics-Based Modeling
Ondulus IR sensor models have been validated with the National Optics Institute (INO) to ensure the sensors' accurate physics-based modeling.

Sensor System
Ondulus IR users have full control of a sensors systems including:
- Lens
- Lens Focus
- Digital Zoom
- Detector
- Electronics
- Displays

Fully Configurable
Both the photon and thermal detectors can simulate and configure the following attributes:
- Blurring, noise, NEP, NETD
- Dark current (photon only)
- Adjust temperature range (for MWIR and LWIR simulations)
- Automatic Gain Control (AGC)
- Non-uniformity effects
- Cooled and uncooled detectors (photon only)

Visual Studio 2015 (VC 14) Support
API developers can now use a more recent version of Microsoft Visual Studio tools.
Physically-based
Ondulus LiDAR employs physically-based rendering so that the sensor captures accurate physical information such as materials, "bounced" energy. Ondulus LiDAR’s laser reflection model accurately interacts with materials and face orientations.

Multiple Scan Patterns
Ondulus LiDAR includes classic and complex scan pattern types.

Supports OGC CDB Format
In addition to supporting most industry-standard formats, Ondulus LiDAR supports OGC CDB which allows users to manage a single database with all sensor and 3D views. This enables users to develop rich ground material databases that can cover the whole earth, and offer multi-user and multi-resolution points of view.

Wide Export Capabilities
Developed in Canada, Ondulus LiDAR is a product that can be integrated in any solution, allowing it to be deployed and supported almost anywhere in the world.

Supported Scanners
Simple
• Oscillating mirror (zigzag ground pattern)
• Rotating polygon (parallel ground pattern)
• Nutating mirror (elliptical ground pattern)

Risley Prism
• Single pair
• Double pair

Multi-Beam LiDAR
• Up to 128 lasers
• Configurable laser offsets
• Variable sensor rotation speeds
The newest member of the Ondulus family of sensor products, Ondulus LiDAR is a physics-based LiDAR simulator.

The software consists of a LiDAR sensor (the simulator) and a LiDAR viewer.

**Sensor**
Simulating scanner or direct laser beam (visible or IR), Ondulus LiDAR was designed to generate a high-quality point clouds that closely resemble the point clouds produced by real LiDAR sensors in terms of density of points as well as their position and intensity.

LiDAR returns are geo-referenced and use accurate GPS and IMU information.

Ondulus LiDAR also allows users to develop integrations within an existing LiDAR system.

**Viewer**
The LiDAR Viewer application allows users to display consumed transmitted data, and the ability to view point clouds in context.

**Framework**
Using the Ondulus framework, Ondulus LiDAR is built on an open and flexible architecture that supports the replacement of systems for customization.

**Sensor Communication**
Out of the box, Ondulus LiDAR is equipped with an LCM-based communication library, which uses the Opal2 data model (Neptec). This is the default communication library used, by both the Ondulus sensor and viewer.

Presagis provides the full source code and users can implement their own communication library to be used with other systems and protocols.
BENEFITS & FEATURES

**Real-time and Physically-based**
Radiation, cooling, and other calculations are built-in, realistic, and accurate, and do not need to be “faked” or interpolated. Richer, More Immersive Training
Complex and composite materials are supported to further increase the realism of sensor views.

**Fully Customizable**
Open architecture allows users to replace or customize sensors to meet their specific requirements.

**Richer, More Immersive Training**
Complex and composite materials are supported to further increase the realism of sensor views.

**Supports OGC CDB Format**
In addition to supporting most industry-standard formats, Ondulus NVG supports OGC CDB which allows users to manage a single database with all sensor and 3D views. This enables users to develop rich ground material databases that can cover the whole earth, and offer multi-user and multi-resolution points of view.

**Wide Export Capabilities**
Developed in Canada, Ondulus NVG is a product that can be integrated in any solution, allowing it to be deployed and supported almost anywhere in the world.

**Physically-Based Rendering**
Ondulus NVG provides night vision views of a dynamic scene containing detailed terrain, building and water materials, as well as, moving platforms and characters.

Ondulus NVG (Night Vision Goggles) is inspired by physically-based rendering, meaning that a scene’s lighting is re-calculated based on light sources and information, as well as materials.

Ondulus NVG permits OTW views as well as NVG views with variable specular highlights. NVG mode allows you to control the level of specular highlights or eliminate them completely.
### Modular Architecture
Built on a modular, open architecture, simulation developers can easily replace default data with their own or even write their own GPU shaders. Ondulus NVG is designed and built following a Modular Open Architecture approach and leverages only Open Standards which can integrate/interoperate easily with other software using these industry standards.

### Debugging Tools
Ondulus NVG provides several debugging options, such as: Information on textures and materials. The ability to inspect and modify light sources. The ability to toggle lighting components.

### Unprecedented Control
Giving users a high-degree of control, Ondulus NVG is equipped with many configurable parameters, including:

- Light Amplification
- NVG Color
- Digital Zoom

All Ondulus NVG features described above can be

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### Active/Passive Illumination
Ondulus NVG supports both passive and active illumination sources with a user-defined power.

**Active infrared illumination** - used to intensify illumination in low-light areas, or penetrate fog - is “seen” in Ondulus NVG just as it is in real-life. To remain realistic, active illumination is only visible in NVG view. Furthermore, active illumination can be sourced from any (external) location, i.e.: helicopter-mounted.

### Enhanced Realism
Uses physically-based rendering to simulate both out-the-window (OTW) and night-vision-goggles (NVG) views to create realistic, immersive effects:

- **Noise**: Simulates the visual artefacts often seen in low-light conditions
- **Light Blooming**: Simulates the visual effect seen in NVG from light sources
- **Vignetting**: Recreates the peripheral drop-off common in NVG
- **Black Spots**: Recreates the effect seen on older or damaged sensors
- **Secondary Reflections**: Increases realism when viewing reflective or water surfaces.
**BENEFITS & FEATURES**

**Full Control**
Full control of every radar parameter (such as transmitter power, frequency, pulse width, etc.) means you can match operations to your requirements.

**Wide Performance Range**
Impressive 64-bit computational performance permits use in very high-density scenes and scenarios.

**Supports OGC CDB format**
To maximize reusability interoperability, Ondulus Radar supports OGC CDB.

**How Ondulus Radar Helps**

Ondulus Radar users can model and develop their own simulated radar simulations, performance settings, and behaviors associated to common types of manufactured radar.

Ondulus Radar is part of an end-to-end modeling and simulation framework that includes:

- Database and 3D modeling tools
- Terrain material classification tools
- Computer Generated Forces (CGF)
- Flight Dynamics and modeling

Part of the Presagis M&S Suite, Ondulus Radar can simulate the behavior of both ground-based radar at a given geographic location and radar onboard a simulated vehicle or aircraft. In a research or testing environment, this permits a greater understanding of how visibility, distance, mobility and speed affects your applications.

**Wide Export Capabilities**
Developed in Canada, Ondulus Radar is a product that can be integrated in any solution, allowing it to be deployed and supported almost anywhere in the world.
**Fully Configurable Radar Parameters**

Ondulus Radar offers Application Programming Interface (API) control of parameters such as transmitter power, frequency and pulse width as well as control of antenna pattern and gain to best match your specific operation and performance requirements under different atmospheric and marine conditions.

**Track Entities and Chaffs**

Track entities and chaff definitions can be manually created or automatically imported from STAGE. Definitions support DIS entity type, radar cross section and OpenFlight 3D geometry. Ondulus Radar also offers native network interoperability with most and simulation engines on the market allowing easy integration into larger federated systems. Combined with VAPS XT, Ondulus Radar can be packaged to bring maximum realism and provide the operation modes required for task training (e.g. environmental conditions), research and development test bench.

<table>
<thead>
<tr>
<th>GROUP</th>
<th>MODES INCLUDE</th>
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</thead>
<tbody>
<tr>
<td>Base</td>
<td>RBGM: Real Beam Ground Map, Wx: Weather, DBS: Doppler Beam Sharpening</td>
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<tr>
<td>Searching</td>
<td>MTI: Moving Target Identification, GMTI: Ground Moving Target Indication (supported in RBGM and Spot SAR), RWS: Range While Search</td>
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<tr>
<td>Tracking</td>
<td>TWS: Track While Scan, STT: Single Target Track</td>
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<tr>
<td>SAR</td>
<td>iSAR: Inverse Synthetic Aperture Radar, SpotSAR: Spot Synthetic Aperture Radar, StripSAR: Strip Synthetic Aperture Radar</td>
</tr>
<tr>
<td>Navigation</td>
<td>TA: Terrain Avoidance, AGR: Air-to-Ground Ranging</td>
</tr>
</tbody>
</table>
Ondulus Radar Effects

- Strong-Reflections
- Radar emission status
- Ownship altitude and altitude effects
- Range and atmospheric attenuation
- Antenna beam pattern
- Refraction and earth curvature effects
- Radar shadowing
- Terrain, feature and target masking
- Far shore brightening
- Wind sea state and precipitation
- Terrain, feature and targets aspect effects
- Sidelobe effects
- Surface material effects (reflectivity, directivity)
- Occulting effects
- Chaff effects

Ondulus Radar Parameter & Signal Effects

- Range Gate Stealer and False Target Generator: Spot Noise, Barrage Noise, Swept Noise, Range Gate Stealer and False Target Generator
- Jammers management: Spot, Barrage, and Swept
- Antenna (scan rate, beam patterns, gimbal limits and turnaround)
- Radar Resolution
- Range Scales
- Pulse Length Effects
- Receiver Noise
- Scan Conversion Effects
- Geometric Distortion
- Frequency Band
- Receiver Gain
- Stabilization
- Receiver Detection
- Circular and Sector Scan
- Vertical Bar Scan
- Sensitivity Time Control (STC)
- PPI and B-Scan Displays
DEVELOPER FEATURES

- API Entities creation via network
- Increased access to transmitter and emission properties
- Make changes to radar configuration parameters in run-time
- API access to Engine Logger
- XML parameters tuning for:
  - Materials & Features
  - Entities & Chaffs
  - Sea Clutter
- New Extended Samples

- Improved Realism:
  - Strong reflection + vegetation
- Bipolar Radar Cross Section tables
- HLA Evolved / RPR FOM 2.0
- Wider area coverage (64 Bit-OS)

Visual Studio 2015 (VC 14) Support:
API developers can now use a more recent version of Microsoft Visual Studio tools.

Linux Support:
Developers now have access to the API, engine, and samples in the Linux operating system.