Epsilon™
Radar Cross Section (RCS) Prediction Software

The most rigorous, accurate and easy to use RCS solver in its class
Epsilon™ is a software package that predicts the Radar Cross Section (RCS) of electrically large targets directly from a computer model.

**Radar signature management**

Radar signature management is required by clients who design platforms (e.g., aircraft, ships or land vehicles) or radar systems. Designers of military platforms need to minimise RCS to reduce the probability of detection by radar based sensors. Conversely, radar and radar simulator operators require sensitivity analysis of radar systems against predetermined targets.

In all cases, the predicted RCS data can be critical to a design or analysis so the choice of RCS prediction software is paramount.

Epsilon™ is a highly versatile tool which accurately models real life scenarios, enabling clients to rapidly evaluate a target’s radar signature and investigate how that signature varies according to the shape and orientation of their design. This allows various design options to be assessed in order to achieve the most cost effective solution.

**Applications**

Typical applications for Epsilon™ include:

- Conventional radar cross section predictions
- Optimisation of new platform concepts for stealth
- Improvement and retro-design of existing platforms
- Generation of models for physical level simulation
- Imaging of radar targets

Epsilon™ has been used on a variety of radar targets. Wind farms, for example, have been analysed to determine their effect on radar performance.

Other examples include:

- Major platforms: aircraft, ships, tanks, spacecraft
- Secondary field equipment: trucks, generators, stores
- Weapons and weapon release systems
- Antennas
- Buildings and structures

Epsilon™ can also be embedded within simulation tools to provide highly accurate radar representations of targets, for engagement analysis.
Features and benefits

Epsilon™ is more than a theoretical tool. It offers considerable scope to tailor a target’s response to the environment and to a given waveform to ensure realistic RCS data is obtained.

Epsilon™ uses highly accurate model geometry, handles a variety of material surfaces, and includes automatic multiple scattering. Compared with other tools, which require multiple scattering to be completed manually, Epsilon™ saves our clients significant work and removes the possibility of human error in identifying surface interactions.

| Accuracy                  | • Accurate model geometry used — far superior than a faceted approach  
|                          | • Automated multiple scattering determines which surfaces interact  
|                          | • Material modelling options ensure real-world results  
|                          | • Near-field predictions possible by entering a radar-to-target range  
| Speed                    | • Shading algorithm reduces computation time by removing obscured surface areas  
| Usability                 | • User friendly Windows® project based interface  
|                          | • Data output in text files ready for importing into spreadsheet software  
|                          | • Screenshot of project windows can be saved for inclusion into reports  
| Analysis                  | • Bistatic/multi-static analysis for investigations into non-conventional radar  
|                          | (e.g. passive radar)  
|                          | • Scattering statistics  
|                          | • Diagnostics which identify target regions requiring attention  

Support

Epsilon™ is developed and supported by Roke. We have an intimate knowledge of how to use the software and offer a range of support packages to suit our client’s needs — depending upon their requirements and familiarity with the radar signature domain.

• On-site installation  
• Supply of hardware  
• 2 day/5 day training courses  
• Radar signature management consultancy  
• Porting to other platforms  
• Annual support and upgrades.

Licensing and availability

Epsilon™ is available under licence, subject to export control, or for use during stealth consultancy, counter stealth studies and any aspect of radar cross section technology or radar imaging.
Outline technical specification

<table>
<thead>
<tr>
<th>Interfaces</th>
<th>Windows® Application Programming Interface (API) – to link to third party simulation software Script files – for batch run processing</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAD</td>
<td>Compatible with industry standard CAD interfaces – Patran FEM, AutoCAD DXF, 3D Studio, and IGES. Integrated model preparation tool</td>
</tr>
<tr>
<td>Model geometry</td>
<td>Parametric cubic No maximum geometry size</td>
</tr>
<tr>
<td>Materials</td>
<td>Each surface patch of the CAD model is assigned a material property Material options include Perfect Electrical Conductor (PEC); lookup table of reflection coefficients</td>
</tr>
<tr>
<td>Methods</td>
<td>• Geometrical Optics (GO) • Physical Optics (PO) • Physical Theory of Diffraction (PTD) • Geometrical Theory of Diffraction (GTD) • Multiple scattering (automated) • Shooting bouncing ray bundles • Diffusing ray optics • Shading</td>
</tr>
<tr>
<td>Analysis</td>
<td>• Radar imaging – a full phasor-vector result is calculated. There is considerable scope for imaging the target using any component, or linear combination of components, of the scattering matrix • Super resolution processing – embedded super resolution processing algorithms for: 1D (HRR); 2D (ISAR); 2.5D (ISAR); and 3D (ISAR) • Reverse translator – scattered field contributions painted back onto the CAD model • Ray history plots – visualisation of the calculated multiple scattering plots • Bistatic and multi-static modelling • Bulk signature prediction – for signature metric evaluation • High-Range Resolution Range Profile (HRRP) – for target recognition and high bandwidth analyses</td>
</tr>
<tr>
<td>Outputs</td>
<td>Data: ASCII Graphics: Encapsulated postscript</td>
</tr>
<tr>
<td>Hardware</td>
<td>Standard Windows® desktop PC (porting to other platforms is available) Parallel processing possible across any standard computer network</td>
</tr>
</tbody>
</table>