

# SigSimRT

Signature & Atmospherics Library for Sensors & Out-the-Window Visuals

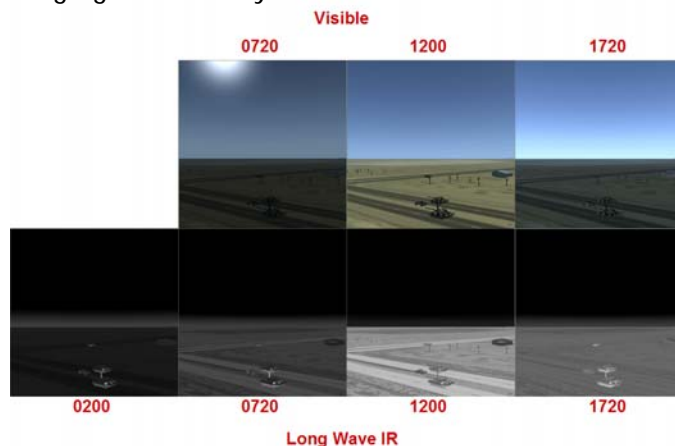
*SigSimRT is an advanced signature synthesis and atmospheric propagation runtime library for radiometrically-correct sensor displays and Out-the-Window (OTW) visuals.*

SigSimRT provides on-the-fly physics-based modeling over the 0.2-25.0  $\mu\text{m}$  spectrum (UV, visible, near-IR, thermal-IR) and for arbitrary RF frequencies. SigSim's ultra-fast algorithms and common material/property-attributed Synthetic Environment make it ideal for real-time multi-sensor, OTW, CGF/SAF, and Hardware-In-The-Loop (HWIL) applications.

## Scene Graph Rendering Interface

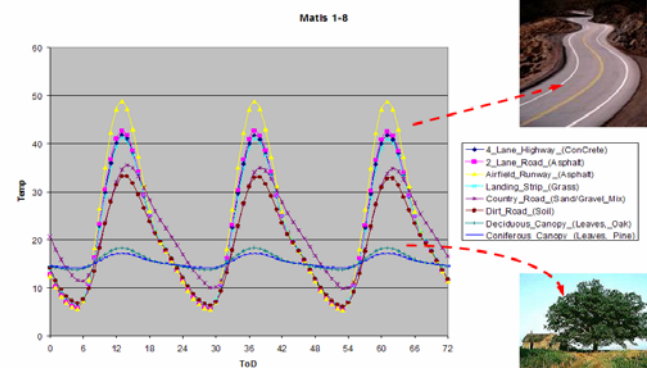
SigSimRT provides easy-to-use data structures and API methods to directly supply scene graph rendering engines such as OpenSceneGraph, OGRE, or a custom image generator with the scaled spectral or passband-integrated radiances, emissive contributions, and reflectivities; broken down into ambient, diffuse, and specular.

SigSimRT allows changes in atmospheric state or weather conditions *on-the-fly*, and provides real-time updates for the thermal emissions (temperatures), light source irradiances and line-of-sight atmospheric. SigSimRT atmospheric modeling includes transmittance, thermal path radiance and scattering -- all completely correlated across sensor bands for the correct relative behavior. JRM provides an OSG-based example with source code and GPU shaders that illustrate the use of the SigSimRT API to aid in the addition of sensor simulation to a particular image generation system.



## Real-time Thermal Emission & Reflectance

SigSimRT has ultra-fast, full-transient thermal model algorithms that respond on-the-fly to changes in boundary conditions, such as ambient wind-speed and air temperature, engine-state, Mach number, rain-rate, time-of-day and surface-normal-dependent solar loading, sky loading, etc.



Responding to the time-of-day, atmospheric condition, weather and object states, SigSimRT gives the right thermal response. Therefore, SigSimRT correctly models effects such as the diurnal cycle phenomena of "thermal cross-over" at dusk and thermal inversion of vegetation with the background at night. SigSimRT also supports various BRDF models.

## Common, Material/ Property-Encoded Synthetic Environment

In addition to a common atmospheric data-model, SigSimRT employs a common terrain and object data-model with the innovative *Material Systems Concept* (supported in a SEDRIS EDCS). Material systems allow the assignment of material configurations from a comprehensive library, and associated boundary conditions to texels, vertices and/or facets in the database.

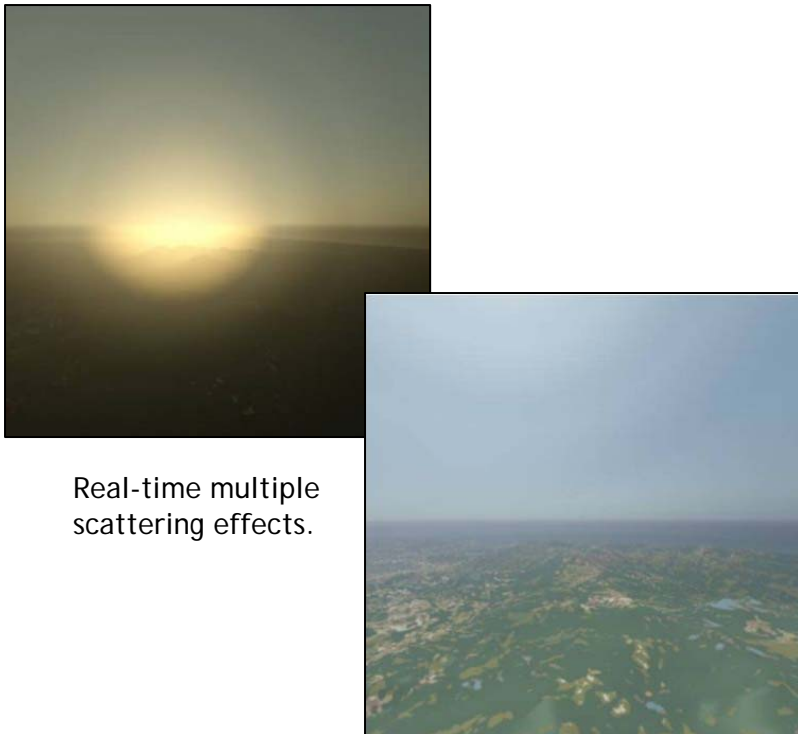
In this manner, fast SigSimRT algorithms retrieve the intrinsic physical properties and conditions such as density, thermal conductivity, specific heat, BRDF, RCS, scatter-center tables, wind speed, engine-state, etc. to synthesize the correct pass-band signature for EO, IR or RF sensors.

### Real-time Light Source Modeling

For any 3D location, time, date and atmosphere/weather condition, SigSimRT quickly provides all the natural source quantities necessary for accurate lighting, reflectance and thermal loading, including

- Solar position, direct/diffuse spectral irradiance
- Lunar position/phase, direct/diffuse spectral irradiance
- Stellar constellation positions and spectral irradiances
- Downwelling sky and cloud spectral irradiances
- Upwelling earthshine spectral irradiance

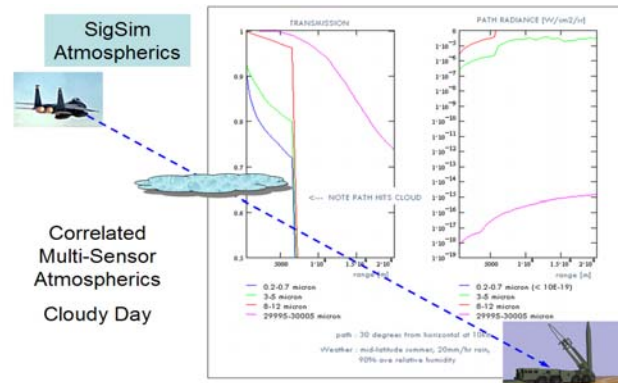
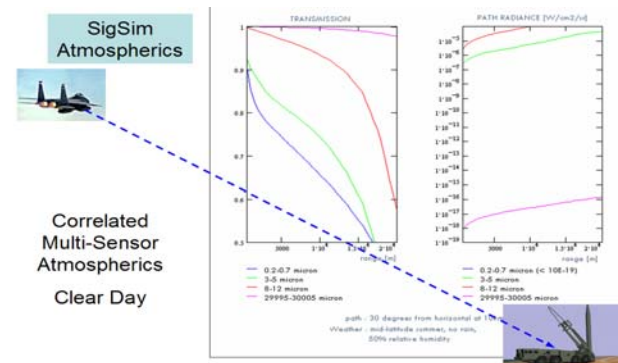
In addition, SigSimRT quickly provides the correct spectral radiance from man-made light sources, including tungsten, sodium, mercury, neon, and polymetallic lamps.



Real-time multiple scattering effects.

### Real-time EO/IR/RF Atmospherics

SigSimRT uses innovative, extremely-fast path-integral/transport algorithms based on Modtran & Radtran-atmospheric physics licensed from AFRL. These algorithms operate on a common atmospheric data model, allowing the user to assign such parameters as the pressure, temperature, molecular species concentrations and weather state at any position in the ellipsoidal atmospheric model.



For More Information Contact:

Russ Moulton  
[rmoulton@jrmtech.com](mailto:rmoulton@jrmtech.com)  
540-842-4585



JRM Technologies  
150 Riverside Parkway, Suite 209  
Fredericksburg, VA 22406  
540-371-6590  
[www.jrmtech.com](http://www.jrmtech.com)