



Australian Government
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 Science and Technology

VIRSuite Real-time Visible and Infra-red scene generator

VIRSuite is a software application for the generation of visible and infrared scenes in real-time. This software was developed by the Defence Science and Technology (DST) Group for the simulation, analysis, development and evaluation of electro-optical systems in a range of complex scenarios and environments.

Originally developed for high performance Hardware-in-the- Loop (HWIL) simulations, this scene generation system has a strong record of use in developing and testing real world systems such as the ASRAAM imaging infrared seeker. Over time the functionality of VIRSuite has been extended beyond the air domain to the land, urban and maritime environments.

Example applications of VIRSuite include:

- ▶ real-time scene generation for closed-loop HWIL testing of missile seekers
- ▶ digital (offline) simulation of electro-optical systems for:
 - simulation/evaluation of current systems including imaging weapons, JSF Electro-Optical Distributed Aperture System (EODAS), UAV EO/IR systems, and
 - research and development of future technologies such as LADAR 3D imaging systems and advanced Automatic Targeting and Recognition systems.

Key Features

High performance

From its inception VIRSuite has been designed to leverage the computing power of commercial Graphics Processing Units. Recently VIRSuite has been redesigned to use the commercial graphics and simulation engine 'Unreal Engine 4' to harness the rapid developments in rendering technology. This enables VIRSuite to run at 'real-time' frame rates making it suitable for Hardware or Human in the Loop (HWIL) simulations and large-scale offline simulations.

Detailed multi-band scenes

In VIRSuite objects are defined as three-dimensional models with material models applied to the surface. These material models are defined spectrally, meaning that the same model can be rendered in the visible spectrum for sensors that operate in the human-visible band, and in the infrared bands for infra-red sensors. VIRSuite allows the wave-band to be switched in real-time during the simulation, or multiple bands can be rendered simultaneously. The use of Unreal Engine 4 as the foundation of the capability enables users to build highly detailed scenes using models developed in standard 3D modelling packages.

Credibility

VIRSuite has been developed and used for over 10 years for the test and development of the ASRAAM imaging infrared seeker. VIRSuite was calibrated using imagery from flight trials and validated using real-world seeker telemetry.



The technology

VIRSuite is now built on top of the commercial software framework 'Unreal Engine 4' by Epic Games which is provided as full source code and can be extended by creating software components called 'plug-ins'. DST Group has developed a core plug-in called SpecLib to add spectral radiometry calculations to the underlying rendering engine. DST Group has also added an atmospheric model based on the world standard MODTRAN library.

The SpecLib plug-in allows the user to specify material surface properties such as emissivity and index of refraction as quantities that vary across the electromagnetic spectrum. The user can also define sensor models with a spectral response that is then used when determining the effective radiance. The spectral response of the sensor is used to calculate band-averaged radiance images and therefore the scene will appear differently to sensors that operate in different wavebands such as visible EO cameras, mid-wave infra-red (MWIR) sensors and long-wave infra-red (LWIR) sensors.

VIRSuite can be used as a pure scene generator using a network interface specified using Google Protocol Buffers. The interface allows external applications written in any language to create and update and consume scenes over TCP/IP. Alternatively, users can leverage other components of the Unreal Engine 4 framework such as rigid-body physics, Artificial Intelligence and behaviour scripting to build simulations and scenes entirely with VIRSuite, effectively adding high-fidelity multi-band sensors to the standard Unreal Engine 4 system.

Partnering opportunities

DST is seeking industry partners to collaborate in developing the capability. We are also looking to develop research partnerships with academia and industry in areas including thermal modelling, sensor modelling, ocean physics modelling and verification and validation.

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