Virtual Reality Scene Generator™ (VRSG™) Radar

MetaVR Virtual Reality Scene Generator™ (VRSG™) Radar enables the simulation of a radar system to be built upon the VRSG rendering engine, using Metadesic™ tiles, culture, and moving models. VRSG Radar uses the capabilities of modern commercial graphics accelerators to solve real-time radar simulation problems that historically have required extensive custom hardware and software, at great expense.

VRSG Radar is suitable for building radar simulations such as the F-16 Digital Radar Land Mapping System (DRLMS), synthetic aperture radar (SAR) displays for Unmanned Aerial Vehicles (UAV) or other such equipped platforms.

VRSG Radar assists in constructing a radar simulation by modeling the processes of the real radar system. Developers can create a radar host system that collects the raw radar return data from VRSG Radar and presents the data in a format suitable for the system being modeled. VRSG Radar handles the complexity of modeling the beam as it travels through space, impacts objects, and simulates the amount of energy that would be returned to the radar antenna.

Note: VRSG Radar is a component of VRSG Metadesic for rendering sets of whole-earth Metadesic tiles; it is not available in VRSG for rendering flat-earth MDX databases.

Requirements

The hardware requirements for running VRSG Radar are similar to that of VRSG itself; it requires a DirectX 9-capable video card with a 32-bit per color pixel pipeline such as commercial 3D graphic cards from ATI or nVidia.

VRSG Radar requires VRSG version 5; it visualizes any set of Metadesic tiles that you can view in VRSG Metadesic.

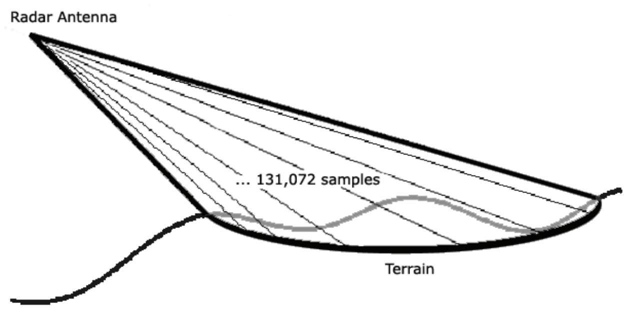
How VRSG Radar works

VRSG Radar works in conjunction with a user-developed Radar Host. The Radar Host models the position and orientation of the radar system, as well as the orientation of the beam relative to the platform hosting the radar system. As the Radar Host sweeps the beam in azimuth, it sends a request to VRSG Radar for the returned raw radar data corresponding for the current radar position, orientation, beam azimuth, beam dimensions, and maximum range. VRSG Radar responds with the set of summed intensities across the quantized range space. The Radar Host in turn processes this raw radar return data for display purposes.

The Radar Host must quantize the beam sweep in azimuth into discrete "looks" it sends to VRSG Radar for processing. The fidelity in azimuth is related to the beam sweep rate and the speed in which VRSG Radar and the radar host can process each look.

VRSG Radar can typically support frame rates up to 300 Hz using modern PC hardware, so a beam sweep rate of 6 degrees per second can yield an azimuth resolution of as fine as 0.02 degrees per look.

For each radar look requested by the Radar Host, VRSG Radar quantizes the beam's vertical field-of-regard (FOR) into 131,072 samples. VRSG Radar casts 131,072 rays out into the scene distributed across the beams FOR and intersects these rays with database and moving model geometry, as shown in the following diagram:



At the first point along the ray where the terrain tile(s) or model geometry is intersected, VRSG Radar calculates the amount of energy that would be returned; it does so by considering the incident angle of the beam with respect to the local surface normal, in conjunction with the reflectivity of the intersected material. All this is taken into consideration in simulating the amount of energy that would be returned to the radar antenna.

The range interval requested by the radar host is quantized into a set of range bins. The Radar Host requests the number of range bins using the Radar ICD. The number of range bins can vary from 256 to 4098 depending on the application. VRSG Radar returns to the host an array of intensities, where each entry represents the summation of all intensities of all the 131,072 samples that fall into that particular range bin. It is this array of summed intensities that the radar host processes into a displayable form. Because this approach mimics how a real radar system works, subtle radar characteristics such as shadows and bright spots on front-facing objects are a natural byproduct of the implementation.

Quantizing 131,072 samples 300 times per second is over 40 million rays cast per second. Although this might seem to be an unachievable amount of processing, VRSG takes advantage of the power of DirectX 9 programmable vertex and pixel shaders to make this possible on a low-cost Windows PC platform.

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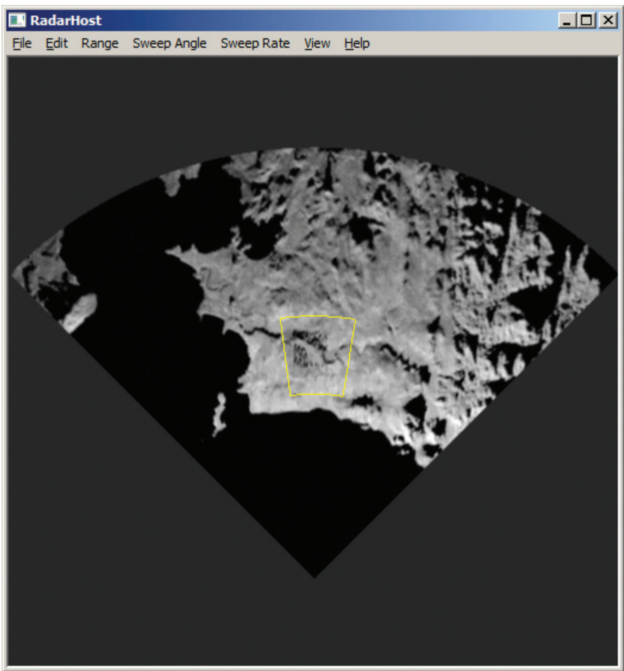
VRSG Radar uses the same Metadesic .MDS terrain tiles as the out-the-window channels, maintaining perfect correlation with visual display. Users might need to modify certain textures to augment their reflectivity in the radar spectrum, but the databases will remain geometrically correlated.

Example Radar host application

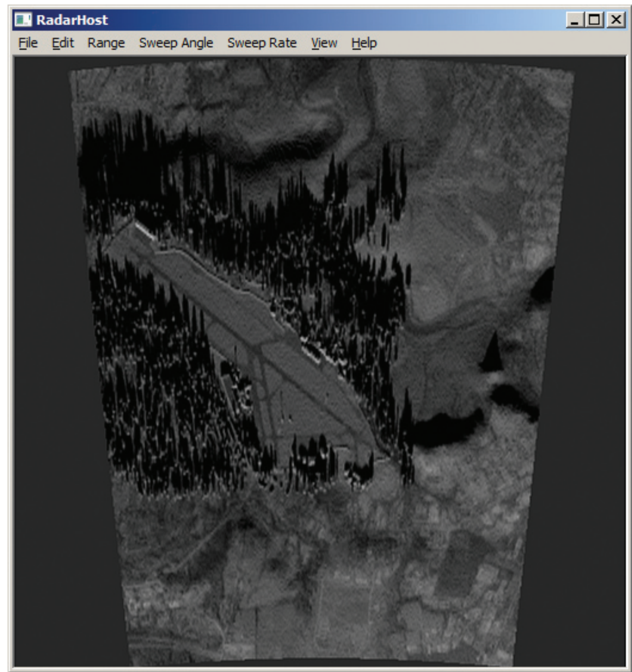
MetaVR provides an example Radar Host application with full source code which illustrates how to communicate with VRSG Radar and prepare returned Radar data for display.

You can use this example application as a starting point for a new application, or as an example for how to embed the functionality into an existing application.

The DRLMS exemplar radar host illustrates the simulation of a radar system similar to that used by the F16 digital radar land mapping system. The images below are actual screen captures of the DRLMS example Radar Host in action:



The image above shows MetaVR's DRLMS Radar Host example application, in which the simulated Radar uses a 60 degree sweep angle, a range of 20 nautical miles, on MetaVR's virtual Burlington Vermont (BTV) airfield, using commercial off-the-shelf personal computers.



This image shows in MetaVR's DRLMS Radar Host example application of the corresponding zoom mode of the image to the left, on MetaVR's virtual Burlington Vermont (BTV) airfield.

For more product information, pricing, and ordering, see MetaVR's web site at www.metavr.com or send email to sales@metavr.com.