

Radar raw data Simulation: AEROPVS018

vsTASKER, developed by VirtualSim, is a powerful SDK used to generate C++ code for complex operational and defense simulations. It pairs with **vsRAD** to simulate raw radar data, extracting parameters like azimuth, range, and Radar Cross Section (RCS) from defined environments to visualize real-time echoes and tracking.

How the vsTASKER & vsRAD Ecosystem Works

- **Scenario Definition (vsTASKER):** You build scenarios by defining radar platforms (stationary or moving), target dynamics (aircraft, UAVs, ships), terrain elevation (DTED), and navigation charts (S57). vsTASKER simulates the physical positioning and motion of all entities.
- **Raw Signal Generation:** The engine computes signal returns based on physical properties, line-of-sight, and Radar Cross Section (RCS) libraries. It then sends this detection telemetry over shared memory or LAN.
- **Data Visualization (vsRAD):** vsRAD acts as the dedicated, OpenGL-based C-code visualizer. It accepts the incoming radar raw data parameters and converts them into displayable echoes, supporting various sweep modes (PPI, AR, B) and real-time moving object incrustation.

Capabilities for Radar Data

- **Performance Modeling:** Integrates with complex wave propagation and specific radar modules (like those from OKTAL-SE) to yield decibels per angle and range.
- **Data Extraction:** Outputs synthetic baseband/IQ signals or data matrices that can be fed into Digital Signal Processing (DSP) units or Data Fusion systems.
- **Batch Operations & Machine Learning:** Supports heavy background processing and Monte Carlo statistical analysis, useful for both training operators and validating tracking algorithms over millions of runs.

Review the vsTASKER Features and the vsRAD Toolkit to see how the SDK integrates with your specific systems.

To provide a more tailored answer, let me know:

- What specific **type of radar** are you trying to simulate (e.g., Airborne SAR, Maritime Coastal, MTI)?
- Are you looking to generate raw I/Q signal data for **DSP processing**, or just visualizing tactical radar tracks?

vsTASKER is a visual simulation software that allows developers and defense contractors to model complex scenarios and generate synthetic baseband radar signals. By defining specific hardware and environmental parameters, it can accurately replicate physical phenomena like MTI (Moving Target Indication) and SAR (Synthetic Aperture Radar) data.

Here is how vsTASKER handles raw radar data simulation:

- **Scenario Setup:** vsTASKER creates the virtual environment, positioning the radar system (e.g., coastal, airborne, or space-based) and defining the motion of targets, like aircraft or maritime vessels, utilizing real-world maps and charts (such as S57).
- **Signal Generation:** It features toolkits like **vsRAD** to generate complex in-phase/quadrature-phase (I/Q) raw data instead of just processed backscattered power.
- **Physical Modeling:** The software integrates physical properties—such as Doppler shifts, multipath propagation, and antenna radiation patterns—into the synthetic echoes.
- **Algorithm Validation:** The simulated raw data is fed directly into Digital Signal Processing (DSP) and data fusion units, allowing engineers to test and validate detection algorithms without needing physical test flights.
- You can read more about how this software is implemented by consulting the official vsTASKER Features page or checking out their Radar Simulation for Maritime Surveillance portfolio example.

If you are currently working on a project, tell me:

- What **type of radar** are you simulating (e.g., SAR, MTI, or Naval surveillance)?
- Are you looking for information on specific **output formats** (like I/Q data)?

I can provide more detailed information on vsTASKER's SDK and programmatic API!

vsTASKER is a high-performance simulation engine used to set up complex, real-time tactical environments for generating synthetic radar raw data. Instead of executing the heavy electromagnetic physics calculations directly, vsTASKER functions as the overarching orchestration environment. It defines the scenario, generates platform/target dynamics, tracks line-of-sight, and passes this high-fidelity metadata to external physics models to synthesize actual raw IQ data or baseband signals.

□ Architecture of a vsTASKER Radar Simulation

A typical radar raw data simulation utilizing vsTASKER operates on a split architecture:

- **Scenario Orchestration (vsTASKER):** Handles the 3D environment, coordinate systems, multi-layered terrain, and flight trajectories of platforms or targets.
- **Radar Logic & Kinematics:** Computes real-time beam positioning, antenna patterns, and scan mechanics using vsTASKER's automated C++ code generation.
- **External Physics Engine:** A specialized plugin or custom C++ callback (often provided by third parties like Alyotech or via COTS signal processors) that processes the physical reflections, Doppler shifts, clutter, and thermal noise.
- **Visualization (vsRAD):** Captures the output data and maps it onto visual radar displays like Plan Position Indicators (PPI) or B-Scopes

The Raw Data Simulation Workflow

[vsTASKER Scenario] —(Trajectories & Beam State)—> [Physics Engine]

|

[Target Detection / DSP] <—(Raw I/Q Signal Data)———|

1. **Scenario Initialization:** You configure the 3D globe or local tactical map within vsTASKER GUI. You place the radar host platform (e.g., a ground station, ship, or aircraft) and define target trajectories.

2. **Kinematic & State Update:** During runtime, vsTASKER calculates the precise 3D position, velocity vectors, and attitudes of all entities at each time-step.
3. **Beam Intersection Logic:** The software tracks the radar's electronically or mechanically steered beam. It determines exactly which targets or terrain patches fall into the beam's instantaneous illumination footprint.
4. **Data Handoff:** vsTASKER packages this state data (ranges, velocities, aspect angles, and Radar Cross Section characteristics) and pushes it through a shared-memory segment or API callback.
5. **Raw Data Generation:** The coupled physics engine uses this data to simulate the baseband complex In-phase/Quadrature (I/Q) signals. It accounts for phase delays, Doppler modulations, and multipath interference.
6. **DSP Injection:** The resulting raw digital stream is injected directly into a digital signal processing (DSP) hardware-in-the-loop setup or algorithm validator to test target detection capabilities.

□ Key Capabilities & Applications

- **Massive Statistical Testing:** Because vsTASKER supports high-speed batch execution, engineers run millions of simulated scenarios with varying target shapes and paths to gather data for AI or data fusion validation.
- **Multi-Sensor Simulations:** It seamlessly pairs raw radar simulations with parallel physical models for Electro-Optical (EO), Infrared (IR), Moving Target Indication (MTI), and Synthetic Aperture Radar (SAR) systems.
- **Interoperability:** Code generated by vsTASKER natively supports HLA/DIS protocols, allowing the radar raw data generator to interact directly with broader distributed military simulation systems.

If you are developing a specific application, please share:

- Are you simulating a **Pulse-Doppler**, **SAR**, or **Phased-Array** radar?

- What **external physics library or language** (e.g., C++, MATLAB) are you linking to vsTASKER?
- Are you intending to run this simulation in **real-time** or as an **offline batch processor**?

With these details, I can provide specific C++ integration architecture patterns or scenario setup steps.

Radar raw data Simulation

by VirtualSim

The purpose of this proof of concept is to be able to display a static 5 Ghz radar image with real-time incrustation of moving objects.

For this, we are using a C Band radar simulator module from OKTAL-SE to get a raw data output of received dB per angle and ranges. The model illuminates a 3D database representing the airport of Blagnac (Toulouse). The radar is set at the current exact position of the real radar.

vsRAD is then used to import and display the raw data. A special module has been written for this purpose. The raw data is converted into displayable and adjustable image by a dedicated algorithm.

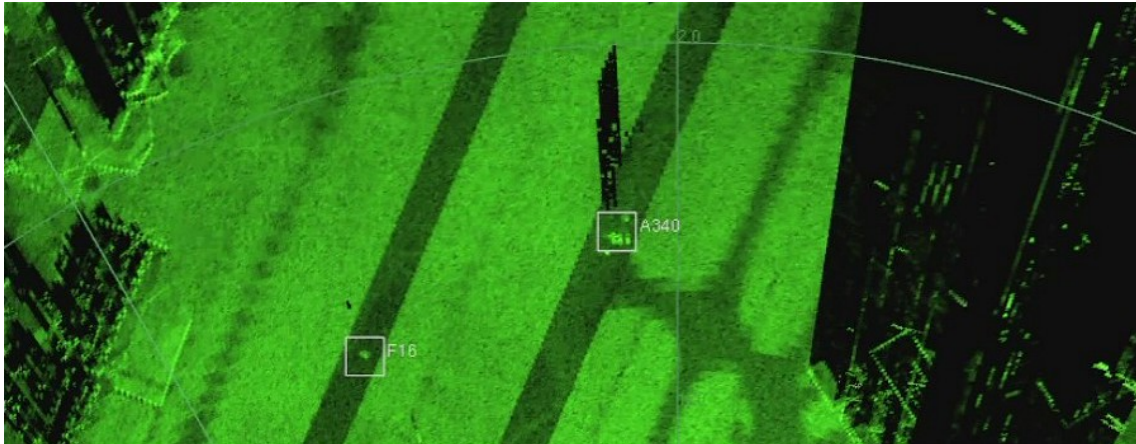
Two 3D models have also been illuminated by the radar at different angles (F16 and A340). vsRAD was able to extract the signal of each scan and build a library to be used at runtime.

For the simulation, vsTASKER is used to setup the scenario, position the radar and simulate the motion of the two aircraft. The simulation engine is connected to vsRAD. When the vsTASKER radar is detecting an entity, its azimuth, distance and orientation are sent to vsRAD which extracts from the library the closest image to merge it with the background.

What was needed:

- SE-RAY-RADAR from SE-Workbench, OKTAL-SE
- Blagnac 3D OpenSceneGraph databasew

- vsRAD for the display
- vsTASKER for the simulation
- Google Map import



OS & HARDWARE SUPPORT

INDUSTRY APPLICATION

--	--

Note: ** Specifications are copied from manufacturer data. Please contact before buying.