SNEAK (Sensor / Network Electronic Attack Kit)

OpCoast’s SNEAK (Sensor/Network Electronic Attack Kit) provides physically-realistic analysis and optimization of RF sensing and jamming for Electronic Warfare (EW) missions over complex urban and other forms of terrain. The analysis is achieved through the coupling of a 3D visualization of the mission scene to sophisticated RF modeling and simulation tools. Thanks to features not found in other EW tools, SNEAK supports dynamic, time-driven analysis where multiple RF sensors and emitters can move throughout a mission scene, change their operating states, and interact with each other. SNEAK’s sensor modeling includes effects of RF receiver front-end filters while accounting for background, jamming and other emitter noise.

SNEAK’s patent-pending ray trace and jamming analysis is now implemented on off-the-shelf Graphics Processor Units (GPUs) to enable extremely rapid modeling of jammer effects, even in complex multipath environments. Such speed makes SNEAK suitable not only as a general purpose Electronic Warfare planning tool for use in the field, but also as an embedded process for intelligent jammer systems that leverage the scene model data.

SNEAK’s unique RF propagation analysis allows multiple, intermingled generations of reflected and diffracted rays. SNEAK’s GPU-accelerated ray trace algorithm enables the real-time computation of multipath propagation of communications signals and jammer energy and their combined impacts on RF devices – even in large-scale complex urban environments. Multipath signal trajectories are dynamically computed and displayed as transmitters, receivers, and jammers move through scene.

**RIGHT:** Multipath ray tracing between transmitter and receiver in an urban environment

SNEAK’s advanced sensor and jammer models accurately capture realistic device behaviors. Scanning, multiband sensors of various types can be readily modeled by defining appropriate parameters. Similarly, jammers of various types can be defined. These devices can employ custom 3D frequency-dependent antenna profiles and be attached to moving platforms, both ground based and airborne. Furthermore, any device can have parameters defined for one or more states, and these states can change during the course of a simulation. For example, a jammer can be turned off during part of the simulated time. In addition to computing traditional analog jammer to signal energy ratios (J/S), SNEAK is geared towards modern digital communication analysis, and performs bit-error-rate (BER) computations for various modulations as well as for user defined error-rate tables.

**RIGHT:** A multiband sensor’s detection of an emitter in the distance, depicted by the red arrow. SNEAK’s sensor viewer (inset) mimics displays found on real sensors. This is useful for training.
Network jamming analysis is possible for architectures that cover both hub-and-spoke/point-to-multipoint and peer-to-peer networks. Examples of the former are cell phone or LTE networks while examples of the latter are sensor networks and 802.11 in ad hoc mode. Military radio networks will also fall into these categories. SNEAK can assess the combined effects of more than one jammer, where the jammers are situated at multiple locations and operate in either a synchronized or independent manner.

RIGHT: SNEAK’s simulation control window provides visualization control of rays, jammer effects, Area of Interest, as well as control of optimization, simulation speed and other adjustments.

Built-in optimization enables user-defined variables to represent ranges of tunable operating parameters of jammers, receivers, transmitters, device locations / orientations, etc. Flexible goal specifications drive optimization towards mission-critical objectives, thanks to SNEAK’s use of well tested and proven optimization algorithms.

Advanced data import including import of DoD’s LIDAR data formats and widely used 3D antenna pattern formats. Through the use of auxiliary tools, LIDAR data is converted into files suitable for use in SNEAK, which support full 3D representations. RF material properties and visual attributes can be assigned to these 3D data as well. For antennae, raw data at multiple frequencies are converted into both a visual representation and into SQL for database loading. This database is then accessed by SNEAK at runtime.

LEFT: A LIDAR area is selected for import. Terrain and buildings are imported into SNEAK. A 3D antenna pattern is depicted.

SNEAK has broad application in both military and commercial sectors. It provides unique features to wireless systems developers as well as in deployed scenarios that require rapid propagation assessments. SNEAK was developed under an US Army CERDEC/Intelligence and Information Warfare Directorate SBIR, contract number W15P7T-07-C-H407.

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