The use of simulation to understand high-energy radiation detection phenomena, assist in radiation detection hardware design, and prepare concepts of operations is not a novel approach. Simulations allow broad-scoped studies to be performed before devoting significant resources into the development of instruments, or the execution of a test campaign. For high-energy radiation transport, there are multiple codes that can be employed that accurately simulate the underlying physics. The main drawback of such codes has been their usability; the amount of time it takes to acquire the requisite knowledge necessary to run the most trivial of scenarios is oftentimes overwhelming. Even with expert knowledge, it takes time to set up the various simulation runs needed to thoroughly study a problem.

SWORD was designed specifically to address these issues. It was initially developed by the U.S. Naval Research Laboratory in 2006 for the Domestic Nuclear Detection Office of the Department of Homeland Security.

Interaction with SWORD begins with the geometry builder, which is a CAD-like interface where users may graphically construct their instruments and surrounding environment using a set of primitive shapes, assigning radiation emission and/or detector properties to the created geometries. For a more expedient setup of a desired scenario, SWORD also includes an extensive standard library, which includes several commercial off-the-shelf detectors, land/rail/sea/air vehicles, buildings, environmental objects (ISO containers, trees) and spectra (naturally occurring radioactive materials, sea and terrestrial backgrounds). With SWORD, the creation of highly complicated, full-scale operational scenarios can be constructed on the timescale of minutes to hours. The geometry builder can also process geographic information system (GIS) shape files for ingesting entire cities for use in simulations.
All user-developed projects may be shared with other SWORD users, being combined and modified as desired; as a result, the time to create a high-fidelity model will only be expended once, at which point it can be instantly dropped into other simulations for immediate use. SWORD projects may then be used to run simulations using the following transport codes: Geant4 (CERN), MCNP6/X (LANL), and Denovo (ORNL). Simulation through Denovo is accomplished through the ADVANTG interface (ORNL).

SWORD also provides analysis tools for processing the results from the simulation. These include spectrum generation and display and analysis of simulated detected spectra, as well as imaging capabilities for Compton, Coded Mask, and radiography instruments. The spectra are stored in ANSI N42.42 format, while the images are stored in NASA FITS format. While SWORD provides viewers for the outputs, users may also use commonly-available tools such as Peak Easy, Cambio, or DS9 to view and process simulation results.

SWORD provides users with an efficient and effective framework for conducting high-energy radiation simulations. While version 5.0 of SWORD (available from RSICC) is fully functional, SWORD is under continuous development, including extensions in functionality as well as expansion of the standard library. Improvements currently underway include integration with parts of GADRAS (SNL) as they port their code to Linux. Also under development are output conversions to KML for viewing both heat maps and particle tracks from simulation.