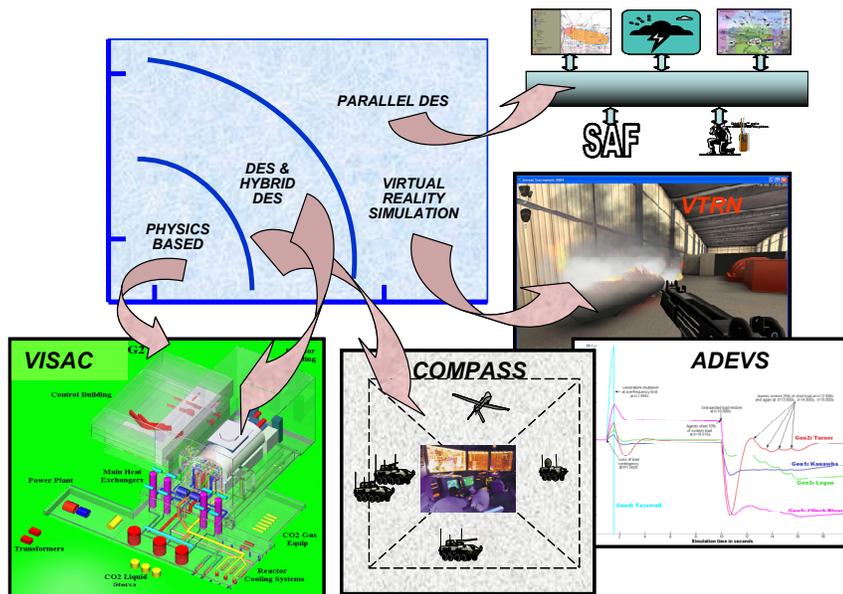


## Scientific Computing within the ORNL Modeling and Simulation Group: **System-of-Systems Simulation**

The ORNL Modeling and Simulation Group (MSG) develops sophisticated numerical solutions for a wide range of scientific, engineering, and operational applications. MSG's core competency is computational physics and engineering, and within this context we have extensive expertise modeling complex and highly-integrated system-of-systems (SoS). This extremely versatile problem-solving expertise includes the following.

- The use of commercial and public-domain dynamic-discrete-event-simulation software for the analysis of highly-integrated human-mechanical systems operating across complex and uncertain *mission-equipment-environment* problem spaces. This software library includes *ADEVS*, *ARENA*, *MICROSAINT*, *EXTEND*, *OPTQUEST*, and *PROOF2D*.
- Development of the *VISAC* facility-vulnerability software suite for the evaluation of vulnerabilities at nuclear, chemical, and biological facilities worldwide for a wide variety of attacks and/or industrial accidents.
- Development of the *VTRN* software suite for the analysis of complex human-mechanical systems using on- and off-line intelligent-virtual-reality simulations. The *VTRN* suite includes the *Visual Training Resource Network Code*, *Visual Interactive Site Analysis Code*, *UNREAL* gaming engine by Epic, *Game Distributed Interactive Simulation* engine by Valve, and live-to-virtual bridges to the U.S. Army's McKenna MOUT Site.
- Development of scalable parallel-DES numerical engines for the analysis of next-generation high-performance SoS's such as future defense systems, critical infrastructures, and transportation systems. Focus areas include parallel-DES algorithms, component-based simulation frameworks, & integration of HLA-compliant components. The current emphasis is communications-dependent networks, and simulation expertise includes network and subsystem emulation, wireless channel modeling, visualization, and sonification.

These applied scientific computing capabilities, alone or coupled with MSG's physics-based modeling expertise, represent an extremely versatile modeling and simulation resource for a broad range of R&D, industrial, homeland defense, and military applications. We welcome the opportunity to discuss your potential applications and ways MSG can contribute to a solution.



*MSG's suite of complexity-specific analysis software allows the integration of design data, expert knowledge, programmatic objectives & constraints, operational criteria, & technical uncertainties into a coherent analysis framework to examine the non-linear performance of even the most complex highly-integrated system-of-systems for both scientific & programmatic decision making*