



US Army Corps  
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Engineer Research and  
Development Center

Ongoing Research

# High-Fidelity Ground Platform and Terrain Mechanics Modeling (Cold Regions)

**Problem** The unique technologies and high-speed complex terrain negotiation expected with the Future Combat System (FCS) and Future Force (FF) exceed the abilities of current design tools in the areas of mobility, structural durability, and crew performance. Snow, ice, frozen/thawing ground, low temperatures, blowing snow, etc., dramatically affect materiel, system performance, and operations on the battlefield. However, these effects are not often represented in Army design and analysis tools. As simulations increasingly predominate FCS design and soldier training, the absence of winter effects will diminish the use of the products and the experience base of the soldiers. Design engineers and Army leaders must have access to realistic simulations that enable our forces to use the effects of cold weather and winter conditions to the greatest advantage.



*Virtual terrain (top, middle) compared to actual photograph (bottom).*

**Description** The U.S. Army's High-Fidelity Ground Platform and Terrain Mechanics Modeling (HGTM) Army Technology Objective (ATO) is developing methods to facilitate the creation and application of high-fidelity real-time ground platform mobility and terrain models. HGTM is a collaboration between the U.S. Army Research, Development and Engineering Command (RDECOM) and the U.S. Army Engineer Research and Development Center (ERDC) involving four organizations: RDECOM Tank-Automotive Research, Development and Engineering Center (TARDEC), RDECOM Army Research Laboratory (ARL), ERDC Geotechnical and Structures Laboratory (GSL), and ERDC Cold Regions Research and Engineering Laboratory (CRREL).

CRREL's portion of the ATO will provide the Army with definitions for the mechanisms controlling vehicle performance on cold regions terrain and the development of methods to incorporate the effects of cold regions terrain on vehicle performance. The research, which began in FY03, is scheduled to continue through FY06.

**Expected Products** The TARDEC-ERDC-ARL ATO will develop software to simulate FCS ground platforms on all-season terrain using a physics-based approach. This versatile simulation software will enable 1) performance assessment of FCS platform concepts and 2) studies of moving vehicle operations and mitigating factors.

The software will model mechanical behavior of the terrain and contact between the vehicle and ground for a range of scales and resolutions, from finite element modeling of snow-tire interaction to full vehicle dynamics models and groups of vehicles in force-on-force war-gaming simulations.

**Potential Users** The proponents for this ATO are two U.S. Army Training and Doctrine Command (TRADOC) organizations: the Unit of Action Maneuver Battle Lab (UAMBL) at Fort Knox, Kentucky, and the Maneuver Support Center (MANSCEN) at Fort Leonard Wood, Missouri. Military ground platform technology developers and weapon system designers also will use this technology.

**Projected Benefits** The HGTM products will benefit the Army's Future Combat Systems (FCS) program by providing reduced risks associated with the aggressive use of Simulation Based Acquisition throughout the acquisition life cycle. The modeling and simulation technologies are applicable to warfighter in-the-loop virtual experiments investigating methods of mitigating the effects of motion on soldier performance, for the development and evaluation of conceptual manned and unmanned ground platform dynamic performance and mobility, and as a component of embedded simulation and training systems.

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