

Corps of Engineers Research Addresses Training Range Sustainability

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Among the Army's most urgent issues is to ensure that training ranges remain sustainable for both current and future generations. The U.S. Army Engineer Research and Development Center (ERDC), comprising the U.S. Army Corps of Engineers' (USACE's) laboratories, researches all facets of military land sustainability. Three important initiatives include unexploded ordnance (UXO) detection, range risk prediction and encroachment modeling.

A photograph of a soldier in a green uniform operating a machine gun mounted on a tank. The tank is olive green and has several large wheels visible. The background is a clear blue sky.

UXO items consist of large munitions such as 105mm and 155mm projectiles; medium munitions including 60mm and 81mm mortars and 70mm (2.75 inch) rockets; and a variety of smaller munitions including grenades and submunitions. New detection systems are helping live-fire range controllers detect and remove UXO more efficiently and effectively. (U.S. Army photo by Mike Roddin.)

UXO Detection Technology at Standardized Demonstration Sites (SDSs)

Traditional technologies used to detect buried UXO on closed, transferring and transferred military ranges cannot reliably discriminate between UXO and natural or man-made clutter. As a result, some 75 percent of range remediation costs are associated with removing non-UXO anomalies. Efficient, cost-effective remediation of UXO from ranges is an Army priority.

ERDC teamed with the Army Environmental Center (AEC), Aberdeen Test Center (ATC), MD, and USACE's Huntsville Engineering and Support Center, AL, to address this requirement. The team is developing and evaluating new, innovative detection systems and UXO discrimination algorithms with the goal to provide 95-98 percent detection of ordnance and 75-90 percent rejection of clutter.

To test these new technologies under standardized conditions, demonstration sites were created at Aberdeen Proving Ground (APG), MD, and Yuma Proving Ground (YPG), AZ.

These sites are used to evaluate

and compare government and commercially developed UXO detection, discrimination and positioning systems under controlled and well-documented conditions. SDSs provide consistent, scientifically defensible scenarios.

The APG and YPG site areas are about 8 hectares (20 acres) and 7 hectares (17 acres), respectively, and are divided into calibration, blind grid, open field, mogul and wooded (APG) or desert extreme (YPG) areas. Each site contains

targets buried at different depths and orientations. Some locations have multiple targets such as UXO near UXO, UXO near clutter and multiple clutter targets. Many targets were installed using an angle auger to decrease disturbance of site soils. Thus, the soil above a buried target is undisturbed, giving no surface indication to UXO detection system operators that the systems are traversing near or over targets.



An ATC employee conducts a Geophex GEM-3 equipment demonstration at the APG SDS. (U.S. Army photo by Rick Fling, ATC.)

Standard UXO targets buried in the calibration area are representative of target anomalies found at the SDS. Calibration targets were buried at varying depths and orientations for each type of standard target. The calibration areas also have UXO buried near other UXO or clutter (natural and man-made). The UXO items consist of large munitions such as 105mm and 155mm projectiles; medium munitions including 60mm



YPG employees conduct a Geonics EM-63 equipment demonstration at the YPG SDS. (U.S. Army photo by Rick Fling, ATC.)

and 81mm mortars, 57mm projectiles and 70mm (2.75 in.) rockets; and small munitions comprising 20mm and 40mm projectiles, 40mm grenades and submunitions.

Numerous UXO detection systems are currently undergoing evaluation at the UXO technology SDS. During FY04, 122 UXO detection systems were demonstrated at APG and YPG. The work is being conducted as a partnership of the Army Environmental Quality Technology (EQT) program, the DOD Strategic Environmental Research and Development Program (SERDP) and the Environmental Security Technology program. More information about UXO detection and discrimination technology development is available at: <http://el.erd.c.usace.army.mil/uxo/index.html>.

Information on the Standardized UXO Technology Demonstration Site program and results of technology demonstrations are available at <http://www.uxotestsites.org>.

Range Design Risk Evaluation Model™ (RDREM)

ERDC has developed a range design risk evaluation tool for live-fire ranges to help installations identify environmental compliance risks along with ramifications to range sustainment, and select mitigation strategies to reduce risk. RDREM targets high-priority environmental issues that impact mission sustainment and captures risk factors from previous information, research and demonstrations.

RDREM considers resource characteristics for locating a proposed or operational range, including vulnerabilities external to the proposed site that may be affected. These characteristics can be data such as weather, soil, vegetation and habitat, or they can come from geographic information system (GIS)

RDREM models the risks of siting new training facilities in particular locations, such as this live-fire urban training site currently under construction at Fort Campbell, KY. (U.S. Army photo by Dana Finney, ERDC.)



overlays or model output from soil erosion or trafficability studies. The characteristics can also be entered through a set of structured questions to the model.

The model applies a particular range's characteristics to the resources in the selected site to derive a representation of the impact construction and/or standard range operation might have on the resources. The potential for mitigation to reduce impacts and risk is added to the equation. A measure of risk to range sustainability, however, is more than a mapping of physical aspects and impacts. The installation's external environment — including the local community, regulators and local and national interest groups — also plays a role. So does the installation's capacity to manage both physical and external aspects of range operation.

RDREM works as an expert system, layered over a GIS, that responds to information about a proposed range

project at one or more potential locations. Up to 15 risk criteria can be selected for the system to analyze. Users can provide additional weighting to individual risk criteria if they feel a particular issue or environmental impact warrants special significance at their installation.

Risk calculations for each criterion are presented in a matrix of risk criteria against range activities for construction and operation. The level of risk is depicted as red, amber or green in the matrix. The model then provides a range project map at the proposed site showing where potential risks are located, such as cultural

resources, wetlands and important habitat. A text report follows that discusses each risk issue and the rationale for its particular rating. The text report also provides mitigation strategies that could be employed to reduce a risk rating.

RDREM calculates and reports the risk level for various issues. Resolving

Resolving risk prior to range construction — typically through planning and design changes — is the key to ensuring successful long-term range use and lower overall operating costs.

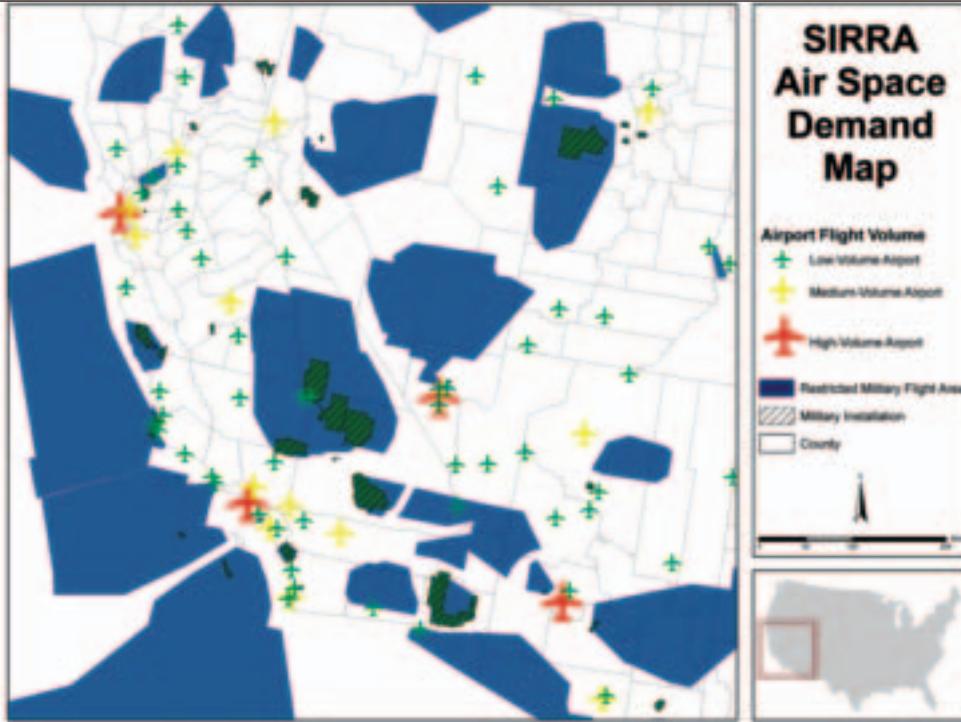
risk prior to range construction — typically through planning and design changes — is the key to ensuring successful long-term range use and lower overall operating costs. RDREM's benefits relate to cost avoidance against future compliance and mission impact. This includes costs associated with mission operation constraints, relocation and any reduced operational tempo.

Applied research to develop the tool is complete. AEC is testing RDREM during 2005. Field-testing at installations, in part through range project planning charrettes, is also planned to obtain user interface review and feedback. The work is being conducted as part of the Army EQT program.

New Tool Assesses Encroachment Risks

An ERDC-developed Web-based tool draws on national databases to gauge the region surrounding a military installation's future sustainability in light of encroachment risk factors. Called "Sustainable Installations Regional Resource Assessment" (SIRRA™), it helps planners make decisions that will avoid or limit constraints to DOD activities.

SIRRA assesses an installation's regional sustainability based on nine sustainability issues: air; energy; urban development; threatened, endangered and sensitive species; locational issues (e.g., seismicity); water; economics; quality of life; and infrastructure. These issues are analyzed through GIS maps produced from nationally maintained databases owned by agencies such as the U.S. Census Bureau, Geological Survey, Environmental Protection Agency (EPA) and Federal Aviation Administration. SIRRA shows both national and regional results, allowing installation, local and regional planners to collaborate on decisions



Competition for scarce resources such as airspace can lead to encroachment at DOD installations as depicted by this SIRRA assessment.

in collaboration with the Army Environmental Policy Institute's effort to support the Army's Strategy for the Environment through development of a regional sustainability assessment methodology. The SERDP funded early SIRRA development efforts.

An ERDC Technical Note for SIRRA is available on the Construction Engineering Research Laboratory's (CERL's) Web site at: http://www.cecer.army.mil/TechReports/Jenicek_SIRRA_TN/Jenicek_SIRRA_TN.pdf.

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with long-term benefits. Such cooperative dialogue is critical to heading off potential encroachment problems.

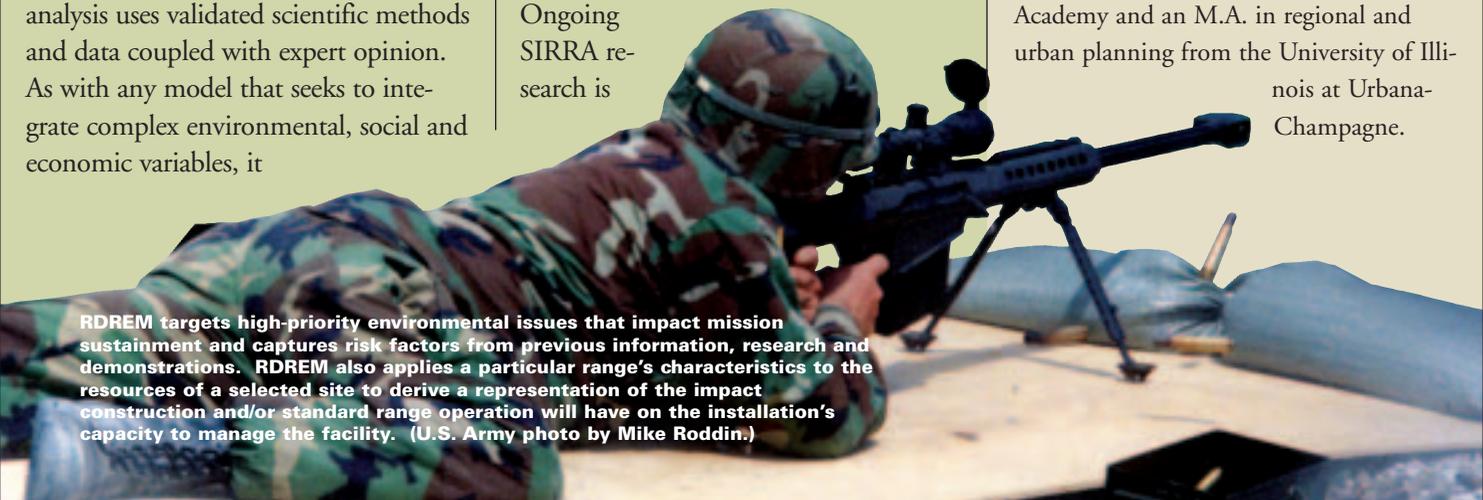
Each sustainability issue includes indicators that contribute to the risk. For example, quality of life weighs elements such as crime rate, housing, healthcare, educational opportunities and commuting times. Air sustainability assesses risk from noise complaints and noncompliance with EPA criteria for pollutants.

SIRRA allows planners to list results using red, amber or green to show high, medium or low sustainability risk. The analysis uses validated scientific methods and data coupled with expert opinion. As with any model that seeks to integrate complex environmental, social and economic variables, it

has limitations depending on how it is used. SIRRA alone does not provide Army leaders with answers but it does contribute a very important element as DOD integrates all factors influencing and predicting installation sustainability.

SIRRA Version 1A was released in July 2004 and is producing regional sustainability assessments for 308 DOD installations in CONUS. SIRRA has already supported several important efforts, such as providing auditable data for the Army stationing analysis. An enhanced version of SIRRA is due out in July 2005.

Ongoing SIRRA research is



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