Chapter 6
Military Geography Research Notes

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ABSTRACT

Military Geography is a subject that has interested many people for centuries. Military professionals, academics and historians have studied the impacts of physical and human landscapes on military operations in great detail. Today, interfacing with geographic information science and technology, applied geospatial research and the follow-on implementations thereof have greatly impacted the full range of military and homeland security operations. Complex uses of geospatial applications across many domains, in both the physical and social sciences, have become increasingly necessary. These include rapid data collection from disparate satellite, aerial, and terrestrial collection platforms, coupled with human intelligence, with follow-on injection into data bases registered to different security levels. Responsive data distribution from which integrated automated and manual geospatial analysis has also been conducted. Products generated from these data, systems and applications have enabled multiple services and agencies to "see" terrain as a common operating picture (COP).

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They often include representatives from defense and intelligence agencies and commands, augmented by their supporting commercial industry partners. In this, we find both basic and applied research being done. As a representative example, in the United States, a number of Department of Defense organizations are involved in this work. A small sample of these include: the Army Geospatial Center (AGC), with specific focus on the Corps of Engineers' Engineering Research and Development Center's (ERDC) embedded Topographic Engineering Center (TEC); U.S. Northern Command (USNORTHCOM); and the Office of the Deputy Under Secretary of Defense, Installations & Environment. These organizations (all contributors to this publication) work to enable the "seeing" of terrain as linked to their required command missions. These research notes are intended to give a representative glimpse into the breadth and complexities of the geospatial applications currently being developed and implemented by such organizations as solutions for military and homeland security operations.

One of the most active areas of applied geospatial research is found in support to today's warfighter. The growing importance of geospatial information and geographic information systems (GIS) to military success has made it a critical data commodity, key to establishing a geospatial foundation that supports U.S. Department of Defense (DoD) operations. Today, geospatial information goes well beyond simple (paper) maps; it includes the presentation and establishment of overlaid information in context with all other spatial and temporal information to provide a common operating picture, situational awareness and actionable information within a variety of theaters. This information additionally supports logistics, training, range, and installation management as well as modeling and simulation activities. Often applying commercial-off-the-shelf (COTS) technologies, the AGC provides timely, accurate and relevant geospatial information, capabilities and domain expertise for enterprise implementation in support of full-spectrum operations (primarily for the U.S. Army) in enabling geospatial information dominance of the modern battlespace. Their work recognizes that warfighter success depends heavily on location and spatial relationships and geographical data and information. They provide soldiers with the data, analytic tools, information and decision framework capabilities to ensure superior situational awareness, arming them with information superiority so they can accurately and quickly gauge effects on personnel, platforms, sensors, and systems.

In addition to COTS applications, ERDC routinely leverages its Topographic Engineering Center (TEC) to conduct both basic and applied geospatial research in support of military operations. An example of this type of work includes developing new techniques to manage large data sets. "Big data" is a growing problem in DoD (and other organizations as well) as increased numbers of sensors collect higher resolution data sets. In this, geospatial data can be enormous in size and tedious to process efficiently on standard computational workstations. As investigated by TEC, distributing the processing tasks through highly parallelized processing reduces the burden on the primary processor and processing times can drastically shorten as a result. ERSI's ArcGIS, while widely used in the military, does not natively support multi-core processing or utilization of graphic processor units (GPUs). However, the ArcPy Python library included in ArcGIS 10 provides geospatial developers with the means to process geospatial data in a flexible environment that can be linked with GPU application programming interfaces (APIs). TEC's research demonstrated that extending a custom desktop geospatial model of spatial similarity for remote soil classification can take advantage of both standard ArcPy/ArcGIS geoprocessing functions and custom GPU kernels, operating on an NVIDIA Tesla S2050 equipped with potential access to 1792 cores.