

ARMY ITAM GIS: Automating Standard Army Training Map Production

Douglas Willets

ITAM Western Regional Support Center, Center for Environmental Management of Military Lands, Colorado State University, Fort Collins, CO

Paul Dubois

U.S. Army Environmental Center, Aberdeen Proving Ground, MD

The Integrated Training Area Management Program's GIS Regional Support Centers (RSC) support production of military installation training maps for 115 Army installations. For smaller sites, this task requires data development and map layout, and the RSC are available for technical support to larger installations, which have onsite GIS operators. In order to streamline this production task, the RSC designed and implemented a standard process. ArcGIS was used to create an ITAM template. The template allows the user to insert a SDSFIE-compliant geodatabase into an ArcMap document while ensuring proper layout and symbolization. A customized ArcMap GUI allows the user to use simple wizards to create custom conversion graphs, north arrow with declination and convergence information, slope guide, scale bar(s), projection parameters, and military grid reference system (MGRS) information.

Introduction

The U.S. Army Environmental Center (USAEC) is responsible for providing and managing environmental technical support to the Integrated Training Area Management (ITAM) Program in accordance with AR 350-4. Enterprise GIS functions as the foundation support element to provide spatial data and application support for all ITAM components, and to ensure effective mission support.

The ITAM GIS Regional Support Centers (RSC) provide GIS technical support to 115 installations that encompass 125 installations, sub-installations, and training sites. The Western RSC (WRSC) is located at Colorado State University and the Eastern RSC (ERSC) is located at Fort A.P. Hill, VA. The primary mission of the RSCs is to increase the utility and cost effectiveness of GIS in support of the ITAM Program, its components, and their application. There are two levels of installation RSC support: (1) Full support for installations with no on-site ITAM GIS operator (generally Category III and Category IV installations); and (2) Partial support for installations with an on-site GIS operator (generally Category I and Category II installations).

A primary function of the ITAM GIS Program is the production of installation training maps for all ITAM sites. In order to ensure these maps are consistent between the RSCs and partially supported installations, a standard cartographic layout was needed. ESRI's ArcMap was used to create a standard ITAM map template. This template allows the

GIS operator to insert a Spatial Data Standard for Facilities, Infrastructure, and Environment (SDSFIE) compliant geodatabase while ensuring proper layout and symbolization. This paper will discuss the development of the ITAM geodatabase structure, the ITAM ArcMap template, and the utilization of the template by ITAM GIS operators.

The ITAM Geodatabase Structure

A standard data structure was needed in order to take full advantage of an ITAM ArcMap template. In February 1993, the Department of Defense contracted the CADD/GIS Technology Center of Vicksburg, MS to develop a set of GIS standards for the Air Force, Army, Navy, and Marine Corps. The current release is the Spatial Data Standard for Facilities, Infrastructure, and Environment version 2.22. All ITAM GIS data is required to comply with SDSFIE under DAIM-MD (AR 210-20). The use of SDSFIE ensures consistency between installations and allows for the scalability of GIS across multiple installation, regional, Army Major Command (MACOM), and Army wide data queries.

A list of required features was developed by the RSCs (Table 1). If applicable, geospatial data must be developed for these features and displayed on all ITAM produced installation training maps. Using the required feature list and the ESRI MultiUser Geodatabase Builder component of SDSFIE, a model ITAM personal geodatabase was created (Figure 1). The SDSFIE Geodatabase Builder automates the creation of all feature datasets, feature classes, and associated subtypes and domains for selected features. The Builder also allows the user to add object classes and create relationship classes in an existing geodatabase.

ITAM GIS operators are able to easily create an installation personal geodatabase by uploading existing data (coverages, shapefiles, CADD, and/or tables) into the model geodatabase. Additional feature classes may be added to the geodatabase using the Geodatabase Builder provided they are an SDSFIE defined entity type. When used in conjunction with the ITAM ArcMap template, the installation personal geodatabase will allow the GIS operator to create an ITAM standard installation training map with minimal of effort.

The ITAM ArcMap Template

ITAM installation training maps are to be consistent and based on existing military cartographic standards (i.e. NIMA and DMA military installation maps). Therefore, a 1:50,000 scale ArcMap template was developed for use by ITAM GIS operators. Map elements, symbology, marginalia elements and layout mimic existing NIMA and DMA maps. The ITAM 1:50,000 scale ArcMap template allows RSC GIS operators and on-site GIS operators at 67 partially supported installations to produce a consistent series of installation training maps following a standardized process.

The 1:50,000 scale ITAM ArcMap template allows the GIS operator to set an installation personal geodatabase as the data source. All applicable required data layers will be

displayed using the correct ITAM styles. In the case of feature classes displayed by attribute values, features will display correctly, provided the feature class is SDSFIE compliant and uses the defined domain values. Additional feature classes may be added to the map document. The majority of additional feature classes likely to be included on an installation training map have an associated symbol in ITAM.style, which is included with the ArcMap template.

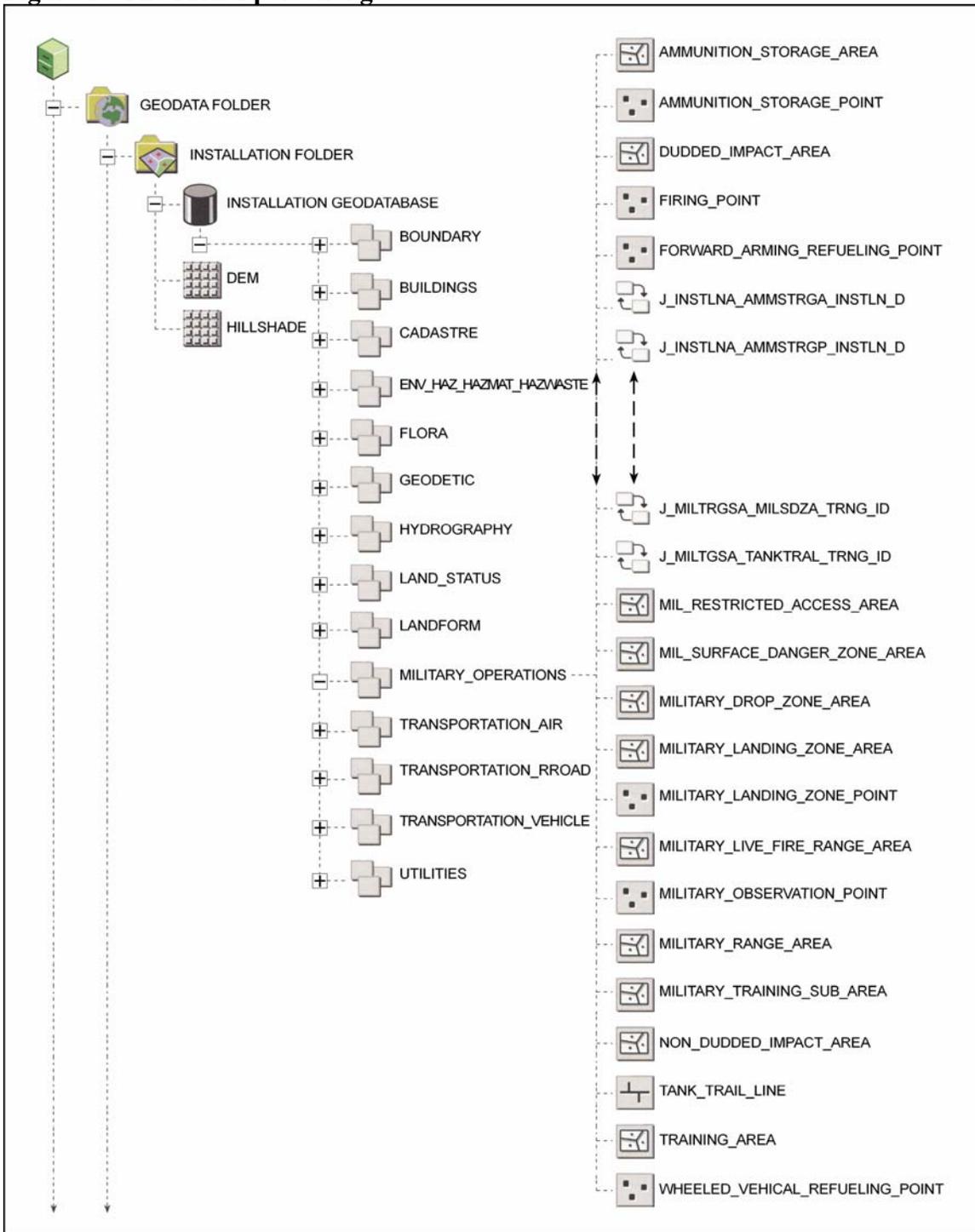
A custom map tools graphical user interface (GUI) was created by RSC developers. The GUI allows users to create map elements such as conversion graphs, north arrows, scale bars, slope guides, projection parameters, and military grid reference system (MGRS) information specific to each map.

Table 1. Required features and SDSFIE entity names

FEATURE	SDSFIE ENTITY NAME
Airfield Surface Site (runway, helipad, etc.)	airfield_surface_site*
Buildings	structure_existing_site*
Control Point	ngs_control_point or control_point
Elevation Contour Lines	elevation_contour_line
Flora General Vegetation Area	land_vegetation_area
Hazardous Materials Storage Sites	hazardous_materials_storage_location_site*
Installation Boundary	installation_area
Military Ammunition Storage Sites	ammunition_storage_area
Military Drop Zone	military_drop_zone_area
Military Firing Point	firing_point
Military Forward Arming & Refueling Point	forward_arming_refueling_point
Military Impact Area, Dudded	dudded_impact_area
Military Impact Area, Non-dudded	non_dudded_impact_area
Military Landing/Pickup Zone	military_landing_zone_area
Military MOUT/MAC Site	Part of live fire or non-firing range feature class
Military Observation Points	military_observation_point
Military Range (Live Fire)	military_live_fire_range_area
Military Range (Non-firing)	military_range_area
Military Restricted Access Area	mil_restricted_access_area or land_restriction_area
Military Surface Danger Zone	mil_surface_danger_zone_area
Military Tank Trail	tank_trail_line
Military Training Area	training_area
Military Training Sub Area (Sub Training Area)	military_training_sub_area
Military Wheeled Vehicle Refueling Point	Non-SDSFIE feature
Political Jurisdiction Area (boundaries)	political_jurisdiction_area
Railroad Centerline	railroad_centerline
Raster -- Digital Elevation Model	Non-SDSFIE feature
Raster -- Hillshade	Non-SDSFIE feature
Road Centerline	road_centerline
Spot Elevation Points	spot_elevation_point
Surface Water Body Area	surface_water_body_area
Surface Water Course Area	surface_water_course_area
Surface Water Course Centerline	surf_wat_course_centerline
Transmission/Electrical Lines	electrical_cable_line
USGS Quadrangle Boundary	usgs_quad_area
Wetland Area	wetland_area

* Site indicates the feature exists as both a point and polygon feature class.

Figure 1. The ITAM personal geodatabase



Using the ITAM ArcMap Template: An Overview

The following section provides an overview of the steps taken by ITAM GIS operators to create an installation training map using the ITAM ArcMap template. An instruction document is provided with delivery of the template to all ITAM GIS operators. This

document provides detailed instructions for all steps in the installation training map creation process. GIS operators at partially supported sites may receive technical support from the appropriate RSC if they experience problems during the map creation process.

- Step 1. Load data into model ITAM geodatabase. The model geodatabase was created in UTM zone 15 North WGS84 meters. Prior to loading existing data, the spatial reference must be modified to match that of the installation. After data has been loaded, feature classes that are not applicable to the installation are deleted from the installation personal geodatabase.
- Step 2. Start a new ArcMap document using the ITAM template.
- Step 3. Set the data source to the installation personal geodatabase. Only one feature class needs to be set, all others will update automatically.
- Step 4. Set the data extent and scale. ITAM installation training maps are targeted at a scale of 1:50,000. For some smaller ITAM sites, scales of 1:25,000 and 1:12,500 are used. A spatial bookmark is created to allow the GIS operator to return to the desired map layout after panning the data frame.
- Step 5. Add/remove feature classes. Non-applicable feature classes are removed from the ArcMap document table of contents. Additional feature classes are added and symbolized using the ITAM style included with the template deliverables.
- Step 6. Modify map marginalia information to reflect the installation. Information modified in this step includes installation name, state, MACOM, map sheet, edition, data currentness, disclaimer information, and the map legend.
- Step 7. Set the data source for the marginalia data frames. Only one feature class needs to be set, all others will update automatically. Marginalia data frames include a location diagram, a USGS quadrangle index, and an elevation guide.
- Step 8. Add a UTM grid using the data frame properties dialog.
- Step 9. Rotate the data frame to reflect the angle of convergence for the installation. The angle of convergence represents the angle between grid north and true north. The value for an installation is found using the custom map tools interface.
- Step 10. Label appropriate map features. Detailed instructions on labeling are included in the template instruction document. Text symbols for all map features are included in the ITAM style included with the template deliverables.
- Step 11. Add a latitude/longitude graticule to the map. The latitude/longitude graticule should not be rotated with other map elements. Prior to creating the graticule, the rotation angle is cleared. The latitude/longitude graticule is created using the data frame properties dialog and converted to a graphic. The data frame is then rotated back to the proper angle of convergence.
- Step 12. Add a conversion graph, north arrow, slope guide, scale bar(s), projection parameters, and military grid reference system (MGRS) information using the custom map tools GUI.

Conclusions

The introduction of ESRI's ArcGIS has vastly simplified the process of map production standardization. Through the use of a standardized personal geodatabase structure, an ArcMap template, and a detailed creation process, ITAM GIS operators are able to produce a consistent series of installation training maps at two Regional Support Centers and onsite at 67 partially supported installations.

Works Cited

CADD/GIS Technology Center. *Spatial Data Standard for Facilities, Infrastructure, and Environment (SDS-FIE release 2.22)*. Vicksburg, MS. 2002.

CADD/GIS Technology Center. *Spatial Data Standard for Facilities, Infrastructure, and Environment (SDSFIE) and Facility Management Standards for Facilities, Infrastructure, and Environment (FMSFIE) Data Model and Structure*. Vicksburg, MS. 2002.

CADD/GIS Technology Center. *Spatial Data Standards for Facilities, Infrastructure, and Environment (SDSFIE) and Facility Management Standards for Facilities, Infrastructure, and Environment (FMSFIE) History of Development and Benefits*. Vicksburg, MS. 2002.

Headquarters Department of the Army. *AR 350-4 – Integrated Training Area Management (ITAM)*. Washington, DC. 1998.

Headquarters Department of the Army. *DAIM-MD (AR 210-20) – Data Standards for Computer Aided Drafting and Design (CADD), Geographic Information Systems (GIS) and Related Technologies*. Washington, DC. 2001.

Headquarters Department of the Army. *Integrated Training Area Management*. Online: <http://www.army-itam.com/home.jsp>

Headquarters Department of the Army. *MIL-STD-2410(DMA) – Department of Defense Standard Practice: Mapping, Charting & Geodesy Reproduction and Printing*. Washington DC. 1995.