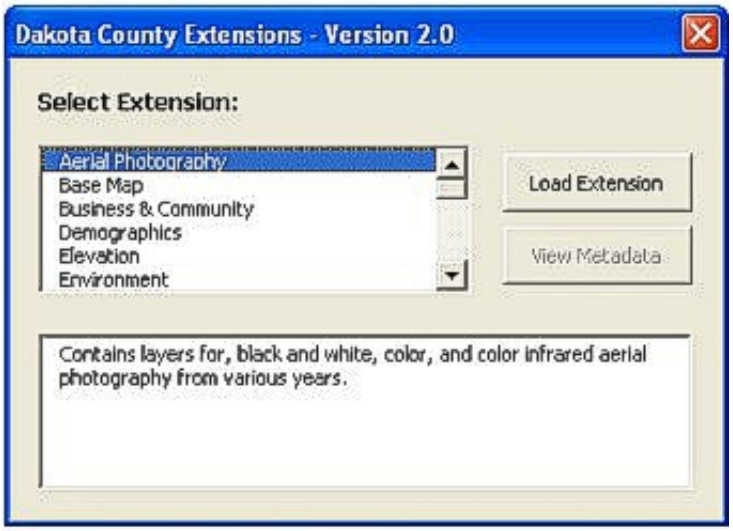
Spring 2009 - Desktop GIS: Dakota County GIS Extensions in ArcMap

By Dan Castaneda

In the past, the Office of GIS has created desktop extensions for the County's desktop GIS software packages, starting with ArcView 3. These extensions have helped GIS users access County data and perform simple tasks within the user interface, which could be a bit overwhelming for the beginning or even the average user. The extensions' primary purpose was to help users load data from our databases into ArcMap. In our on-going attempt to help GIS users work with the latest desktop software, ArcMap, the Office of GIS has updated our desktop extensions.

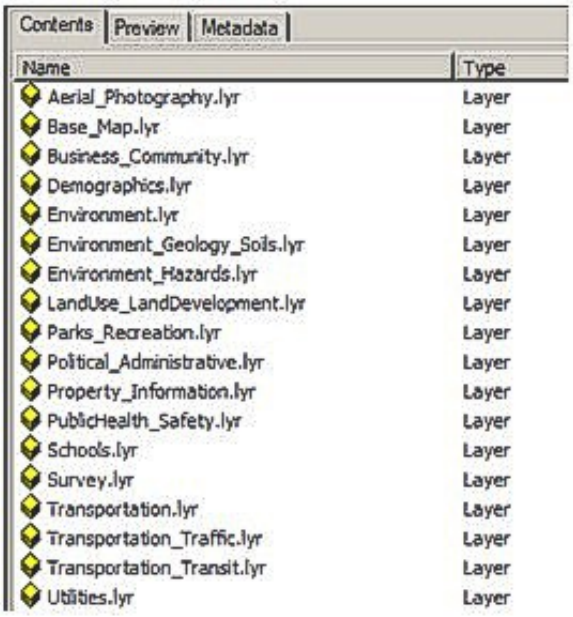
The Office of GIS utilizes different technologies to help distribute our data to as many users as possible. As our desktop GIS software users undoubtedly know, most of our datasets already appear in Dakota County GIS (DCGIS), our web-based GIS application. ArcMap users need more than just the view and query options available in DCGIS; they need to load the data into ArcMap so they can use it for analysis and map-making. Finding the data on the server has always been a challenge, though, which is why we created the data-loading extensions in the first place. Users could simply select the extension with the appropriate data in it and it would be loaded into ArcMap for them – no need to dig around on the server searching for the right files. Now, in an attempt to keep things simple for our users, we have modified the extensions that pull data from our geodatabase to appear the same as the layer organization in DCGIS. These new data extensions are in the form of layer files, which will add the data from the proper source and with the proper symbology. The folders and the layers inside the folders will appear the same order in ArcMap as they do in DCGIS.



After a user chooses an extension to load, the layers will appear in the Table of Contents in ArcMap, with the first layer visible. Users will also notice that the symbology from the web to the desktop has also remained the same. This will become useful in eliminating errors or confusion when two or more users are communicating about the same data while using the different technologies.

Using layer files to distribute data will also help ArcMap users steer clear of the geodatabase, which may cause confusion. Users will not have to try and figure out our naming conventions, or be overwhelmed by the amount of layers that appear inside of the geodatabase. By accessing our data through the layer files, it ensures that the user is accessing the correct dataset, and that it is displayed correctly in their map document.

This is one method the Office of GIS is using to help distribute our data, while making it easy for our users. The Office of GIS is also investigating other methods for data distribution. Recently, we have been creating ArcGIS Server services and want to explore all of the opportunities available through Server. These included cached base maps, WMS, WFS, and WCS services, KML services, and will also include live data services, to name a few. We hope to be implementing some of these technologies in the near future in order to continue providing our data in convenient, efficient manners.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Spring 2009 - GIS 101: Paper Maps - A Thing of the Past?

By Kent Tupper

In today's world of computer technology and electronic data we may overlook the value of some low-tech solutions. One of these solutions in the world of GIS is a paper map. With the advent of high speed Internet and wireless networking we may tend to believe that an electronic map is the only way to go. That may be true in an office, with access to a computer, electric power sources, and a network, but let's look at a different scenario.

You are at the site of a natural disaster where an EF4 tornado has struck. There is no access to electric power; cell towers in the area are gone, or jammed with calls. You are

an emergency responder on foot, and you find someone in need of medical assistance. You need to identify a location that has become unrecognizable, a place that looks totally different from the way it looked a few hours earlier. How can you let other emergency responders know your location, and how will they be able to find that location on the ground? Fortunately, you have a map of the area in your pocket with valuable street information that references the United States National Grid system. Using your Romer Scale you determine your grid location and radio the local command center. With that USNG location a helicopter can be dispatched with medical assistance to your area.

Not everyone may have access to a computer at all times. Conditions may be such that computer use is not practical. If you drop a paper map, or a brick falls on it, you still have a precision instrument; more than likely that will not be the case with a computer.

Paper maps are easy and inexpensive to produce and distribute. Paper maps have long been an effective tool in communicating geographic information, and will continue to be for the foreseeable future.


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Spring 2009 - Department Spotlight: Dakota County Traffic Unit "Keeps Moving" Through Using GIS Capabilities

By Kristi Sebastian, PE, Traffic Engineer, Dakota County Transportation Department

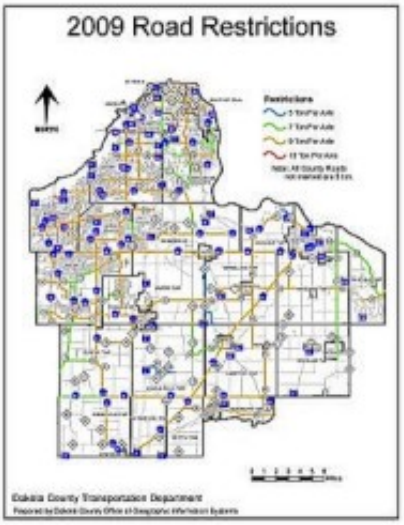
The Traffic Unit of the Dakota County Transportation Department has been using GIS for many years. Recently, Traffic staff members have made concerted efforts to create and maintain traffic data in GIS databases to improve efficiencies of their work and allow data to be more readily available to other agencies and road users.

Large project undertaking: Installing and maintaining traffic signs are critical to providing motorists with information for safety and mobility. Having the ability to track and keep sign information in a geographical format allows staff to manage the signs in the most efficient manner. Creating a field sign inventory system has been a long term objective of the traffic section, to manage the sign materials and develop a proactive plan for sign replacements. This year, sign staff began working with GIS staff to create a sign database within a GIS. The inventory system involves inventorying all the signs on county roads in Dakota County. At this time, staff is using a Trimble GeoExplorer and a wireless camera to collect data in the field. A number of attributes for each sign are collected, including type of sign, the direction the sign is facing, the date it was installed and the material type. Having this data in a GIS will help us with future budgeting for sign replacement; provide a better understanding of areas requiring sign replacement due to damage or vandalism; and, provide the ability to assess when sign replacement is required for various types of signs. For example, staff will be able to query the database for signs of a specific age facing a specific direction and target them for replacement. This data can then be given to field staff in the form of a map with all signs requiring replacement highlighted for easy identification of location and sign type.

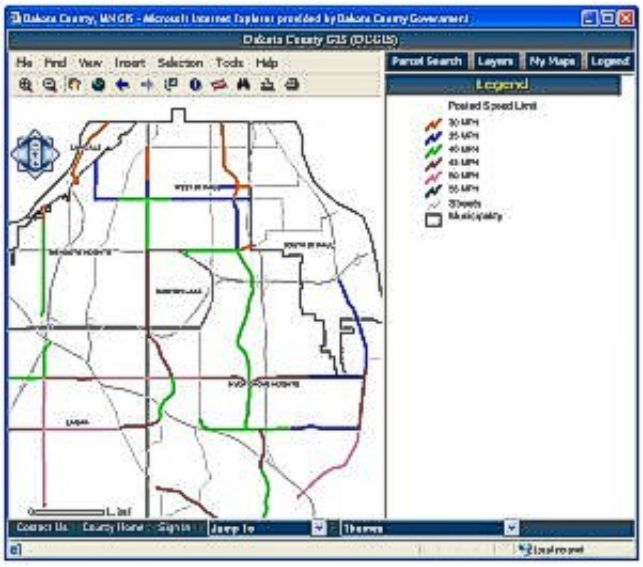
The final product of this project will be a web map that includes the ability to identify the sign information through clicking on an icon of the specific sign type (icon of a stop sign, speed limit sign, or other sign type) to obtain the sign data. Staff will need to update the sign inventory system each day after repairing or replacing signs. Maintenance of the sign inventory system will be critical to the success of the database long term. Without continuous updates, the system will quickly become antiquated with old information and will not serve as the valuable resource it is envisioned to be.

A considerable amount of staff time will be involved in the initial set-up of the database. To ensure that the project is yielding a positive benefit, the traffic group will assess the time required to collect a specific length of the highway system to determine on average how many hours the entire project will take. That information will help assess the project's viability system-wide compared to all other demands on the traffic maintenance group's time. This assessment may mean delaying full implementation of the project until seasonal staff or other resources can be allocated to roll the project out fully and complete the data collection.

GIS data in use daily within the traffic area: One successful collaborative effort between the Traffic Unit and Office of GIS is the creation of the spring load restrictions map for distribution to truckers and local law enforcement. The map is distributed in paper and electronic versions. Weight limits are placed on county roads during the spring based on Mn/DOT materials testing to protect the integrity of the road service. Providing users with a map of the specific weight limit for each county road enables route decisions to be made based on the restrictions.



The speed limits on the county roads in Dakota County are another GIS layer available to all city and county staff via DCGIS. The information includes color coding for each speed zone with links to the actual MnDOT Authorization Letters establishing the posted speed and specific limits of the speed zone. This online information allows county and city staff easy access to the speed limit information for inquiries.



Another group of layers available to staff include traffic signal information. This group of layers entails details of the various components of traffic signal systems including signal detectors, hand holes and interconnects, pads, pedestals, poles and signals. The signal as-built drawings for the intersection can also be pulled up from DCGIS making the data readily available to users. Currently, Traffic staff are collaborating with the Dakota County Information Technology Department on a trial project to utilize the fiber network system to create an Ethernet link for communication between signal systems and the office. Downloading data from the signals connected to the fiber optic network is considerably faster than with the existing modems.

A look to the future: Recently the GIS unit worked with the state to place collision data onto the Dakota County GIS system. The traffic group sees many other applications for GIS including an application with Traffic counts program data. This application would be used for retrieving turning count data for easy access for inquiries, and for tying daily count information to segments for use in computing a collision rate for various segments and to intersection data for assessment of safety data in consideration of traffic volume. While it is envisioned that creating this project will involve some time in setting up the segments and tying the volume data to the system for use in calculations, having the data in a GIS format will ultimately allow the data to be accessible quickly and with considerably less manual review and calculation than the current method of tabulating crash data, summing traffic volume data and computing collision rates. This project will, in the long-term, be more efficient and open the door for much more extensive assessment of the collision data than can be done with current tools.

Spring 2009 - Tech Talk: Implementing the National Grid in Minnesota

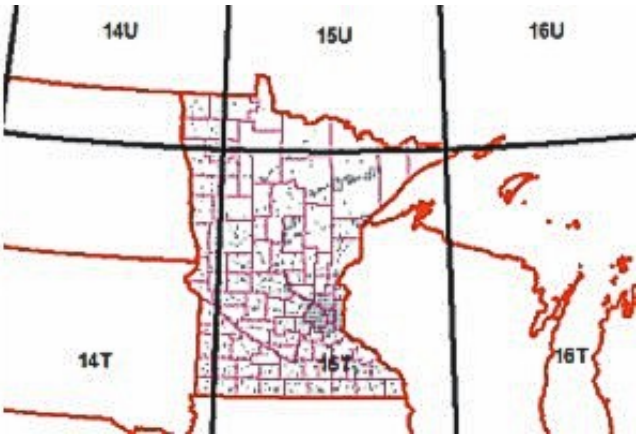
By Randy Knippel

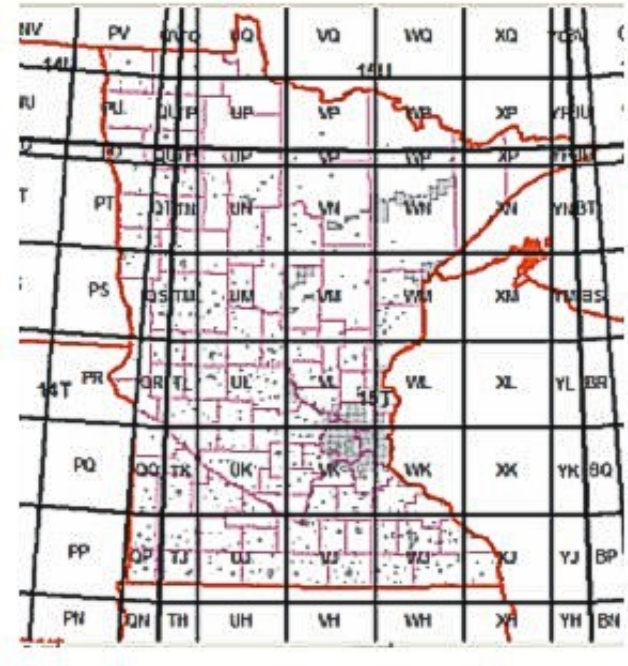
The U.S. National Grid (USNG) is currently proposed as a Minnesota standard. It was established as a federal standard in 2001 (FGDC-STD-011-2001) and describes specific details of the use and cartographic presentation of a grid system that is uniform for the entire United States. Several states have already adopted it as a standard, as well.

The primary benefit of the USNG is the creation of an interoperable location referencing system across jurisdictions. By definition, the USNG defines a unique grid reference for any point. In a sense, a USNG reference at any degree of precision is a unique geographic identifier for an area.

Grid Zone Labeling System

The USNG, which is identical to the Military Grid Referencing System (MGRS) over all parts of the United States, divides UTM zones (6 degrees of longitude) into "Grid Zone Designations" (GZD) of 8 degrees of latitude, named alphabetically from south to north.

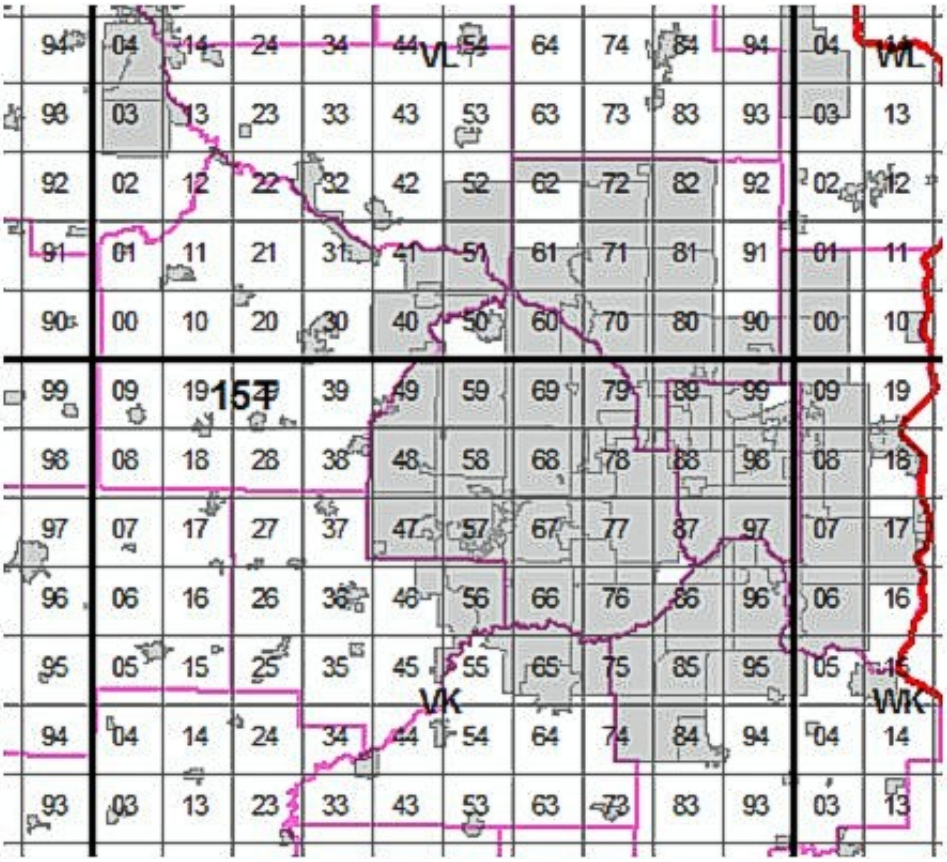




Further, the 100Km grid lines form squares that are labeled alphabetically from west to east and south to north within each UTM zone.

This labeling is continuous across grid zone boundaries from south to north, repeating as necessary. It is also continuous from west to east, requiring only 8 characters per zone (at the equator). This means that the alphabetic designation for any given 100Km square is not repeated in two grid zones in any direction.

The grid can be further subdivided to describe smaller and smaller areas.



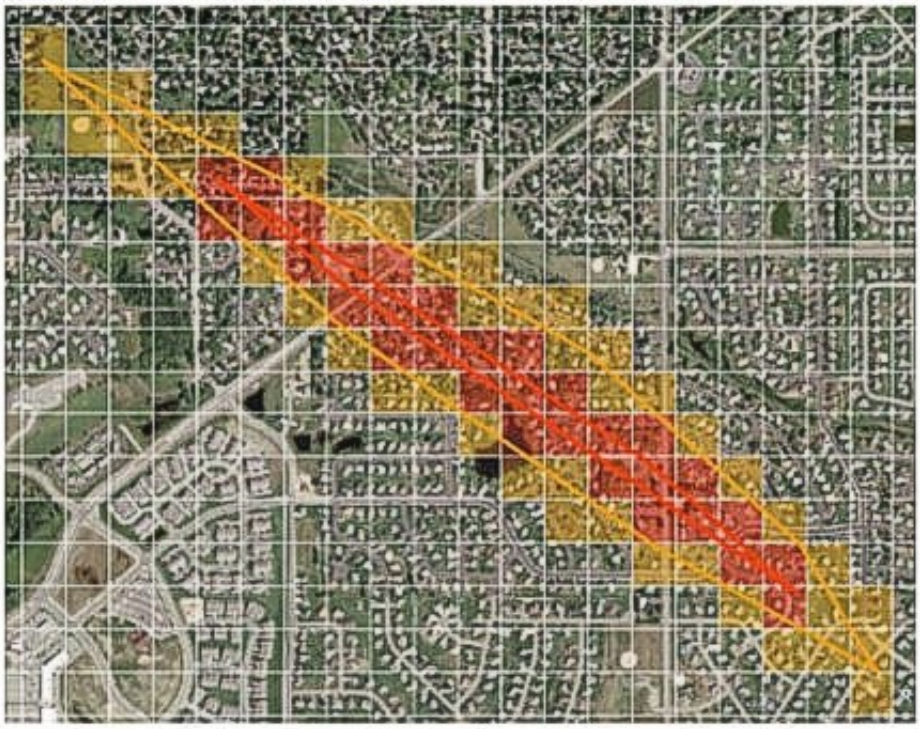
Efficient, Concise Locations

With a little training, emergency responders will intuitively know that “VK” means a 100Km square. They will also know that the numeric portion of a USNG reference will always contain an even number of digits, each representing greater precision within the 100Km square. Therefore, “VK85” intuitively means a 10Km square (as shown above), “VK8354” a 1Km square, and so on until the full 10-digit, 1-meter designation (“VK 83405 53354” – spaces optional).

Conversely, when operations are contained by Minnesota (or even the north central part of the United States), simply saying “VK” is unambiguous and clearly means something in the southern part of the Twin Cities metro area. In this way, the National Grid provides for efficient, concise location references.

Easily Scaled Resolutions

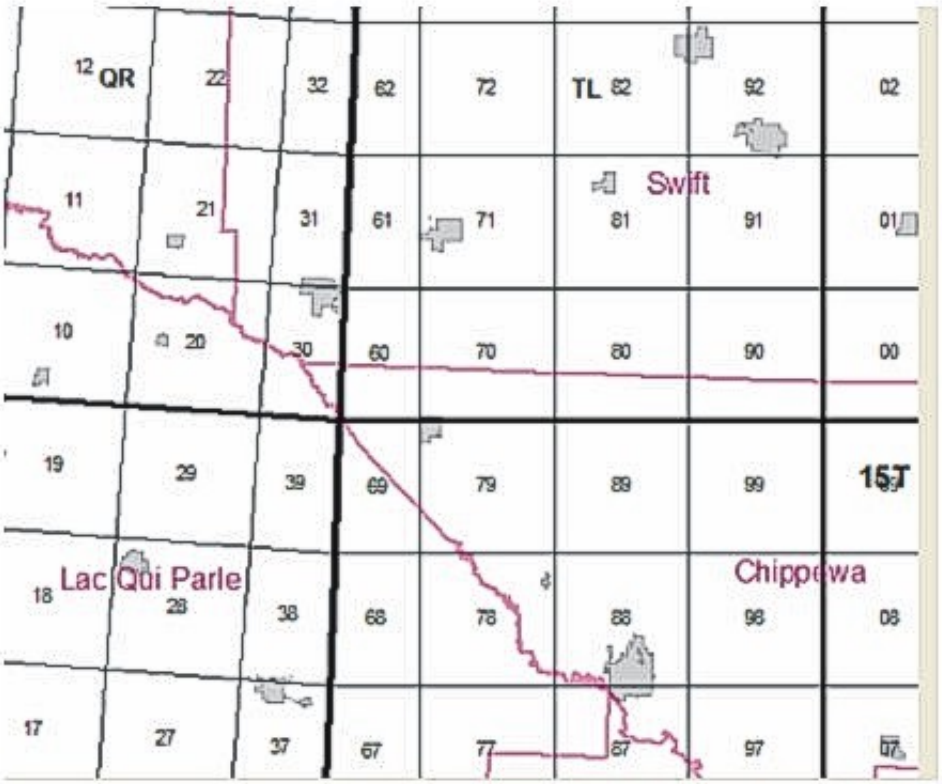
The Grid also creates a convenient mechanism for tracking resources and status of a response and recovery effort. Based on the extents of the effort, grid cells can be easily selected at varying resolutions of 10,000, 1,000, 100, or even 10 meters and used to record activities that are later represented on maps to provide regular updates to everyone involved. High-resolution squares (10-meter) can be easily aggregated to lower resolution squares (1000-meter) to represent a broader perspective for high-level planning.



Grid Zone Boundaries in Minnesota

The National Grid presents some special cases along UTM zone boundaries. Since the USNG reference is a unique geographic identifier for an area, grid zones cannot be extended beyond the UTM zone boundary. This would create confusion and maps that were not interoperable with other maps. For example, in Minnesota, we cannot simply extend grid zone 15T to cover the entire state. (This is often done in statewide GIS datasets that show Minnesota in one digital file with UTM “extended Zone 15” coordinates rather than in separate files with Zones 14, 15 and 16 coordinates).

However, this means that along the grid zone boundary, partial grid cells exist at all levels of precision.



This creates some interesting cartographic challenges. Essentially, grid lines need to be shown from both grid zones and any measuring related to the grid must be performed relative to the grid zone in which the point of interest is located. Maps based on the grid are presented using the UTM zone appropriate for the GZD.

While this may seem awkward, it preserves the integrity of those map products and grid references derived from them. Cartographically, this is accomplished by treating the grid as a series of polygon or line data layers, projected to the map display.

Printed Maps Remain Critical

Maps are the foundation of GIS. However, the tendency is to focus on high-tech interactive, web-based, and mobile applications. While these will continue to be important, the National Grid and lessons learned from recent disasters strengthen the need to also create high-quality printed maps that are interoperable between jurisdictions at various scales to support both large and small events.

A map with a hole in it is still a precision instrument. A laptop with a hole in it is a paperweight.

For additional information on the U.S. National Grid, see:
• The Federal Geographic Data Committee USNG website:
• An unofficial website containing specific similarities and differences between UTM, MGRS, and the USNG
• The National Search And Rescue Committee (NSARC) Georeferencing Information for SAR Responders (ground, air, and sea)