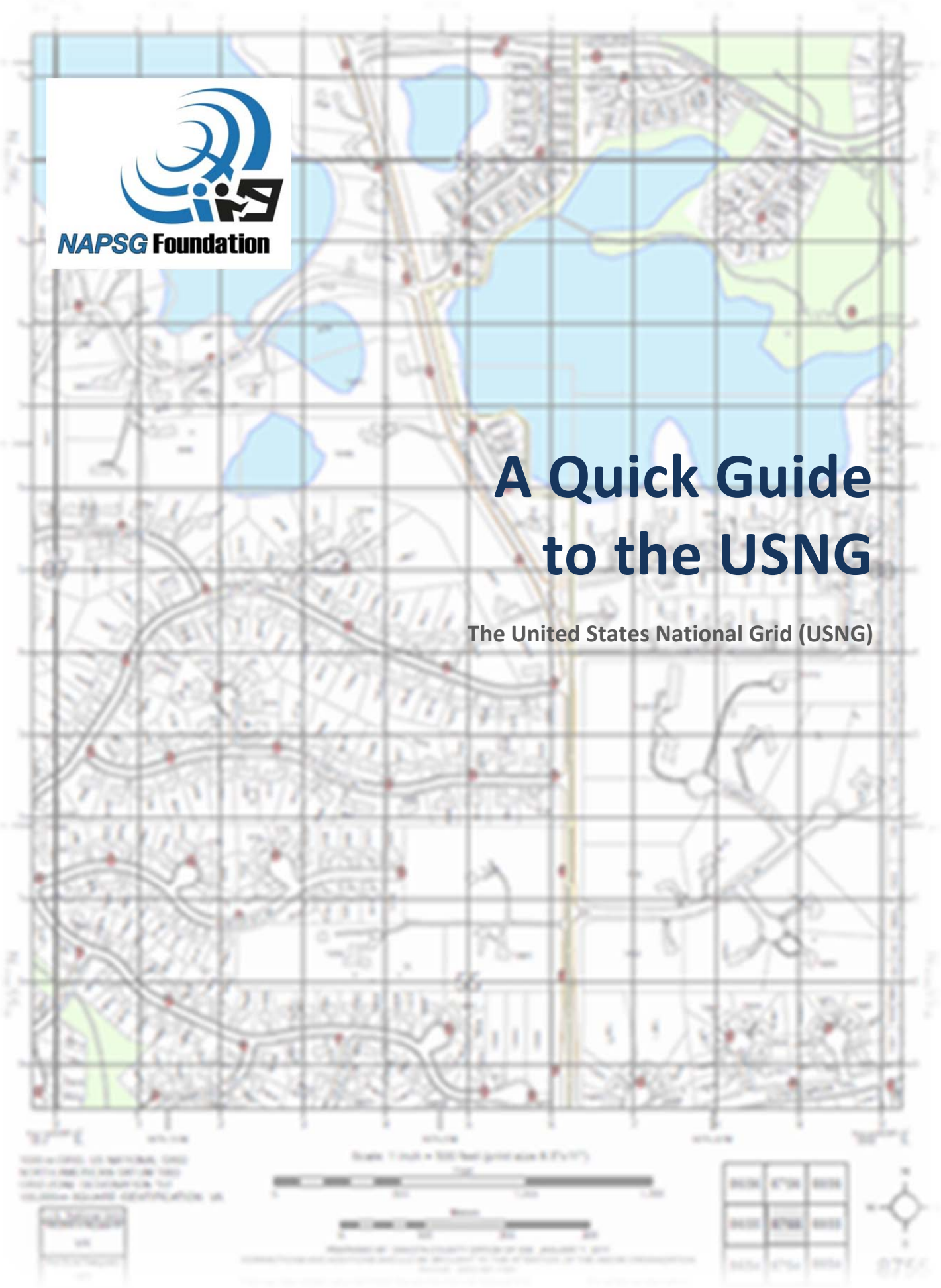


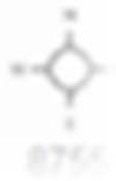


A Quick Guide to the USNG

The United States National Grid (USNG)



6030	6730	6030
6030	6730	6030
6030	6730	6030



Disclaimer

DISCLAIMER: This document was prepared by the National Alliance for Public Safety GIS (NAPSG) Foundation for informational purposes only. This is not an official document. While every reasonable precaution has been taken in the preparation of this document, NAPSG assumes no responsibility for errors or omissions, or for damages resulting from the use of the information contained herein.

The information contained in this document is believed to be accurate. However, no guarantee is provided. Use this information at your own risk. Do not use this document as a legal citation to authority.

DRAFT

Introduction

Delayed responses, misrouting of emergency resources, miscommunication, and complexities that almost defy effective management: these represent the frustrations of emergency responders. However, there is a solution that can successfully minimize or even eliminate these location issues altogether. It's called the United States National Grid, or simply "USNG."

The USNG can pin point a position when and where conventional location references like street addresses are not in place, such as after a hurricane or tornado (as shown at the right). The USNG creates a nationally consistent language of location by providing a grid reference system that is (1) seamless across jurisdictional boundaries; (2) interoperable with traditional location services; and (3) common among local, state, federal, and military emergency response agencies. To aid disaster response personnel, where time is of the essence, the U.S. Department of Homeland Security (DHS) has proposed that the USNG be used to increase the interoperability of location services by providing a nationally consistent grid reference system.



For example, the United States National Grid can support, among many other things:

- A search team that needs to direct a rescue team into an area that has no street signs or an area in which they are unfamiliar;
- An Incident Commander needing to break a large incident perimeter into manageable parts, in order for them to be **communicated** easily across multiple disciplines; or
- A consistent, measurable component to support operational progress and standardized situation reporting.

The USNG does not replace dispatch. Rather, it enhances dispatch functionality during response – especially when first responders are either unfamiliar with local streets or when road signs have been destroyed. It does so by enabling user-friendly position referencing based on an established grid system in use by both military support and civil authorities.

The USNG puts all of us on the same page, across all emergency responders through to everyday citizens, by creating a nationally consistent language of location. The USNG is easy to learn, easy to teach, and easy to use.

How to Use This Guide

This guide is designed to provide information about the USNG and create an understanding for the reader of the value and steps necessary to implement the USNG at a state, regional, or local level for the following audiences:

- Executive Directors and Decision Makers
- Incident Commanders, Emergency Management, and First Responders
- GIS Practitioners and Technicians

The guide is divided into the following key areas:

- **United States National Grid Overview**
- **USNG Basics** - Explains the basics of the grid, the background, and a brief description of the grid components and its use.
- **Guidance Steps** - Provides steps to be taken to ensure successful implementation. From governance documents supporting the USNG adoption to training at the first responder-level in the correct use of the USNG, this section of the guide discusses areas to consider when implementing the grid.
- **Reference Links** - Provides the various audiences with links to reference material supporting the various steps for implementation of the USNG. The material reference includes examples of best practices along with documents from agencies around the country who have implemented the USNG.

United States National Grid Overview

The United States National Grid is a standard grid reference system that quickly enables multi-agency and multi-jurisdictional emergency service agencies to precisely locate incidents using paper maps and/or electronic applications. It is recognized nationally and by many states as a standard cartographic tool that universally defines geographic coordinates and facilitates fast, unambiguous, and repeatable means of communicating locations. It is easy to learn and it provides precise calculations between locations.

Based on the widely used UTM (Universal Transverse Mercator) Coordinate system developed in the 1940s during World War II and the Military Grid Reference System (MGRS) used by all NATO forces and the National Guard, the USNG became the national standard for civilian purposes in 2001 and is the only nationally recognized coordinate system in the United States.

In May 2009, Federal Emergency Management Agency (FEMA) Director Craig Fugate set agency-wide implementation of the USNG as a near-term priority. The National Search and Rescue Committee (NSARC), representing multiple federal agencies, designated the grid as the primary system for conducting land-based search and rescue.

The United States Geological Survey (USGS) recently produced a new map series called the US-Topo, which incorporates the USNG as the primary reference system. Additionally, the National Geospatial-Intelligence Agency (NGA), which supports DHS, will only produce USNG-based products for United States disaster events.



[ADD LIST OF STATES?]

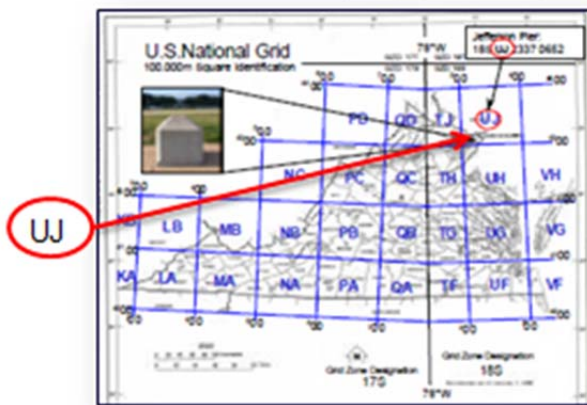
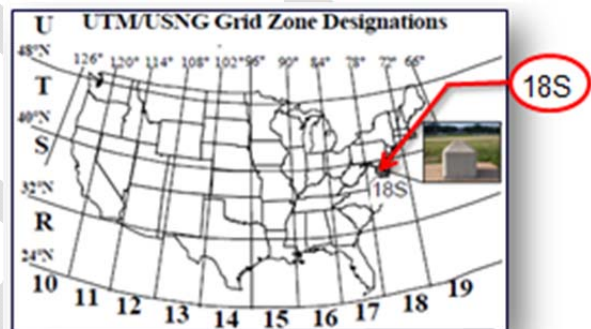
USNG Basics

The USNG uses a string of up to 15 characters to describe a precise location. Fewer characters can be used to represent less precision or to simplify location description in smaller areas. It can also be easily divided into three components. The USNG is read like this: the first three characters are a combination of two numbers and a letter representing a Grid Zone Designation (GZD); the next two alphabetical characters represent a 100,000 meter (100 kilometers or 100K) square; the remaining portion is entirely numeric and will always have an even number of digits. This portion is based on standard X and Y (Easting and Northing) coordinates of the UTM coordinate system, which is in meters.

In the following example, the last eight digits identify a point with a precision of 10 square meters approximated within a 1,000 meter grid.

Grid Zone Designation (GZD):
 6° x 8° longitude zone / latitude band.
 100,000-m Square Identification:
 Grid Coordinates:
 Read right, then up.

18S UJ 2337 0651



In most localized situations, once the grid zone and 100K square are well known by everyone involved and completely contain the area of operation, they can be dropped to eliminate redundancy. This flexibility then leaves only the grid coordinates and makes location references much simpler. Coordinate digits can also be truncated, in pairs from both the X and Y elements, to represent the precise location being described. Truncated locations identify the southwest corner of a grid square of a size representing its precision.

- 18S UJ = 100,000 meter square (or 100 Kilometers or 100Km)
- 18S UJ 2 0 = 10,000 meter square (or 10 Kilometers or 10Km)
- 18S UJ 23 06 = 1000 meter square (or 1 Kilometer or 1Km)
- 18S UJ 233 065 = 100 meter square
- 18S UJ 2337 0651 = 10 meter square

Benefits

- Provides unambiguous context for location.
- Scalable to meet the needs of small local areas and regions, as well as large-scale national events and disasters.
- Uses only the level of refinement necessary to adequately describe a location.
 - 1m = an individual person
 - 10m = a team, a large vehicle, a small home
 - 100m = city lot, large building, a football field
 - 1000m = city block, a neighborhood
 - 10,000m = a city
- Improves interoperability and military support to civil authorities, and reduces operational friction, thus, facilitating crisis and disaster response at all levels, from local through to federal.
- Universally defines geographic coordinates and facilitates fast, unambiguously, and provides a repeatable means of communicating locations.
- Simple, standardized, easy-to-learn and use.
- Provides a universal location reference system that is not dependent on landmarks, street signs, or knowledge of the community.
- Applies to existing data in any well-known coordinate system and does not require it to be transformed from coordinate systems used for engineering and survey applications. [clarify language and state why this is good thing]

Guidance Steps

Standardized mapping coordinates and map products based on the USNG, coupled with training to develop basic map reading and land navigation skills, create a low-cost and easily distributed common operation picture. A successful implementation of the USNG within an organization or organizational structure requires a strategic alignment of governance, training and education, integration in operational procedures, technology, and routine use (as with any public safety tool).

Governance

For the USNG to be effective, appropriate governance is required to establish it as a location referencing standard, incorporated into all map products and emergency training. It has been adopted by multiple federal agencies (FEMA, DHS, NGA, USGS) and several states (Florida, Missouri, North Carolina, Minnesota, others).

The following initial steps should be taken when introducing USNG into your agency or jurisdiction:

- Provide clear direction to your organization;
- Incorporate USNG into your organization's policy documents;
- Update organization policy manuals to reflect USNG policy;
- Incorporate USNG into the organization publications – e.g., address directory, letterheads, and business cards;
- Provide visibility of policy to industry partners and citizens;
- Look to establish MOUs and MOAs with partnering agencies or neighboring jurisdictions; and
- Incorporate USNG with existing and new mutual aid agreements.

Standard Operating Procedures

Adopting the USNG in standard operating procedures promotes consistent application and supports public safety mission objectives. In order to do so, it requires that user agencies to:

- Incorporate into administrative and emergency operations;
- Include USNG attributes in data collection and base data;
- Develop map books with USNG as one of the base elements;
- Integrate USNG as the map standard for incident map products;
- Incorporate into preplan map documents;



- Add USNG to incident dispatches – without replacing addresses; and
- Change agency map books to employ USNG and replace any proprietary or alternate grids.

Training and Education

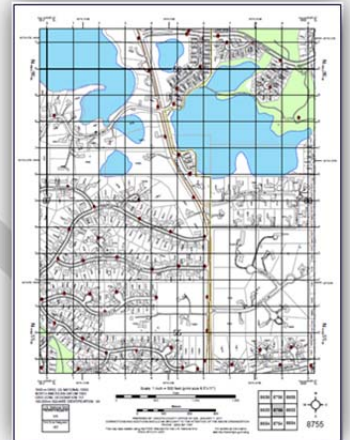
An education policy must be both developed and implemented that explains the benefits of the system and how to use it.

Emergency management and responder training should include teaching basic skills in how to read a map and measure distance using a map, as well as how to describe locations using USNG terminology. Training should include basic instructions on how to use related location technology such as GPS (Global Positioning System) receivers and smart phones, and how to properly determine, record, and relate locations in USNG terms.

Training should also be expanded to include other personnel who may become involved in disaster situations like public works, businesses, volunteer organizations, and the general public.

Training and education objectives should incorporate:

- Support at the organizational level;
- Conducting table top and operational exercises utilizing USNG;
- Inclusion of USNG in all exercises;
- Utilization of free or low cost tools;
- Ensuring technical staff are properly trained to support USNG; and
- Inclusion of supporting agencies, including non-governmental.



Training opportunities

- Incorporate the USNG into the National Incident Management System (NIMS) and the Incident Command System (ICS) and all operational exercises:
 - Require that locations be recorded and communicated in USNG terms to supplement existing terms such as address, intersections, and latitude and longitude;
 - Include USNG on incident specific maps;
 - Incorporate use of USNG into Planning Section maps/GIS responsibilities; and
 - Require USNG coordinates in operational and division briefing maps.



Other training considerations

- Train volunteer organizations where appropriate;
- Integrate USNG into school curricula (e.g., Geoscience courses - ensure that numerous practical applications are included in the curriculum);
- Enlist support from GPS vendors;
- Provide web based training (e.g., target first responders and general public); and

- Utilize university centers for information and user support.

Maps

Maps are a key component of USNG implementation. Recommendations for implementing the USNG into your mapping operations are presented below:

- Include USNG on all maps-
 - Park maps
 - Trail maps
 - County/state highway maps
 - City street maps
 - Specialty maps (snowmobile, bike, hiking)
- Incorporate USNG into parks and trails-
 - Add locations to park and trail signage
 - Use USNG locations to identify features and facilities in guidebooks and pamphlets
- Create GeoPDF maps for added interactive functionality-
 - USNG location display
 - Measuring
 - Selective layering and annotation
- Encourage incorporation of USNG on commercial maps, map products, and websites;
- Incorporate USNG map atlases so they are available to be issued to incoming mutual aid;
- Include USNG map atlases in public safety and utility company vehicles;
- Engage each jurisdiction's GIS department to create maps and map atlases with USNG; and
- Establish and document USNG locations for significant addresses and Points of Interest (POI).



Technology

Computer Aided Dispatch (CAD) systems, Mobile Data Computers (MDCs), Automatic Vehicle Location (AVL), GPS, GIS, Firefighter/Law Enforcement Personnel Tracking/Accountability Systems, and smart phones are all examples of computing technology that provide maps and locations. The USNG needs to be a consideration in all of these to create interoperability among them. Many of these systems have configuration options for supporting the USNG or its military equivalent (the Military Grid Reference System). Others will be supporting it directly in the future. System suppliers and integrators may also be able to configure their systems with USNG.

- Begin using free USNG web tools as training aids and start referring to positions routinely with USNG coordinates;
- Integrate USNG with street address and E911 databases;
- Specify full USNG functionality in any/all mapping and dispatch software purchases;
- Supplement latitude and longitude with USNG to avoid problems with lack of interoperability and conversion error;
- Include USNG capability when purchasing new GPS devices. If your current GPS devices do not have USNG, check for Military Grid Reference System as an option on the device; and



- Integrate the USNG into Automatic Vehicle Location and Computer Aided Dispatch-
 - Set systems to provide automatic display of USNG location of assets
 - Provide tools to determine locations in USNG terms

DRAFT

Reference Links

This area of the guide provides links to reference material supporting the various steps needed to implement the USNG. It is divided up for different audiences to ensure the successful implementation of the USNG. The material referenced includes best practice examples from agencies around the country that have implemented the USNG.

Executive Directors and Decision Makers

Implementing the USNG requires a certain amount of expertise with maps and GIS. GIS tools exist that can streamline map production to incorporate the USNG. Not all public safety agencies will have adequate resources with this expertise. However, since the intent is to create greater consistency for map products and location descriptions across jurisdictions, collaboration with surrounding jurisdictions or State and Federal government partners can provide a pool of GIS resources and reduce duplicative efforts. Therefore, it is also important to consider including GIS resources in mutual aid agreements.

Examples of agencies that have implemented the USNG and how it affects their operations:

- Executive summary
 - http://www.fgdc.gov/usng/educational-resources/Map_USA_USNG_20081231.pdf
- State standards
 - Minnesota:
 - <http://mn.gov/oet/policies-and-standards/geospatial/gis-pages/us-national-grid.jsp>
 - North Carolina:
 - http://www.ncgicc.org/Portals/3/documents/US_National_Grid_TACRecommendation.pdf
 - Florida:
 - <http://www.floridadisaster.org/gis/usng/>
 - Missouri:
 - http://sema.dps.mo.gov/maps_and_disasters/gis.asp

Incident Commanders, Emergency Management, and First Responders

A primary objective of any USNG implementation is to increase the effectiveness of everyone involved through the use of maps and mapping technology. Including basic map reading and land navigation along with consistent location descriptions can enhance emergency training and exercises. These skills can also be reinforced through their use in daily activities. Below are references to USNG implementations nationwide.

SOG's and Use Cases:

- Skagit County, WA: https://www.fgdc.gov/usng/educational-resources/Skagit%20County%20USNG%20Poster_r.pdf

- Florida Division of Emergency Management (includes links to counties in Florida with USNG maps): <http://www.floridadisaster.org/gis/usng/>
- Florida Field Operations Guide: <http://www.floridadisaster.org/FOG/FLFOG.pdf>
- Using the United States National Grid poster: <http://www.floridadisaster.org/gis/usng/>
- Fireman's Association of State of New York: <https://docs.google.com/file/d/0B3UROkg-gGTaTKNVUkFNRktnREE/edit>
- Fire Apparatus Magazine: <http://www.fireapparatusmagazine.com/articles/print/volume-18/issue-1/features/united-states-national-grid-a-geospatial-tool-for-the-toolbox.html>
- Florida Fire Service Magazine: https://docs.google.com/file/d/1zyALH-9X3JjQB-eLBAXiYi_okBsS4-uqzpn2xzHP29mcYoHiyvVMUpn9bbg/edit?pli=1
- <https://docs.google.com/file/d/0B3YvFeOt6bs5U1RkcU0yb1YtdFE/edit?pli=1>
- USFA: http://www.usfa.fema.gov/downloads/pdf/coffee-break/cc/cc_2012_1.pdf
- Statter911: http://statter911.com/files/2010/01/Start_using_US-National-Grid1.pdf

Reference Links

- Index map for continental United States: http://www.fgdc.gov/usng/educational-resources/Map_USA_USNG_20081231.pdf
- How to read a United States National Grid (USNG) Spatial Address: <http://www.fgdc.gov/usng/how-to-read-usng/index.html>
- Other reports and articles: <http://www.fgdc.gov/usng/articles-reports/index.html>
- Also look for mobile apps for your mobile device such as GPS Toolbox, GridNav, MyMGRS, milGPS, GPS Motion X, GeoCam, Theodolite, and others. Search for other apps with related keywords like USNG, MGRS, and GPS.

GIS Practitioners and Technicians

Maps are the foundation of any USNG implementation. The USNG provides a framework for creating maps that are consistent across jurisdictions and disciplines. While GIS systems and software are increasingly providing sophisticated tools to support the USNG, these tools should not be considered inherently correct in all situations. Care must be taken to ensure USNG information is provided and represented accurately and explicitly (as with all data inputs).

Additionally, local jurisdictions must work together to further standardize map scale, content, page size, presentation, and accessibility. Consider contacting GIS staff in other agencies, neighboring cities, towns, and counties to collaboratively develop USNG maps and map series. If you have any troubles identifying other agencies, please contact NAPS Foundation for assistance. Coordinating with other agencies will provide maps for public safety that are seamless across participating jurisdictions, and it also reduces the overall cost of developing and maintaining maps and increases availability of GIS staff to support you in a crisis.

- Training Aids
 - <http://www.globalsecurity.org/military/library/policy/army/fm/3-25-26/ch4.htm>
 - http://www.amerisurv.com/PDF/TheAmericanSurveyor_USNationalGrid-Cavell_June2005.pdf
- Mapping, Grid, and Data Tools

- U.S. National Grid Tools for ArcGIS:
<http://www.esri.com/software/arcgis/extensions/usng>
- U.S. National Grid map service on ArcGIS Online:
http://maps1.arcgisonline.com/ArcGIS/rest/services/NGA_US_National_Grid/MapServer
- Emergency Management Maps:
http://resources.arcgis.com/en/help/localgovernment/10.1/index.html#/What_is_Emergency_Management_Maps/028s00000037000000/
- Fire Station Wall Map:
http://resources.arcgis.com/en/help/localgovernment/10.1/index.html#/What_is_Fire_Station_Wall_Map/028s00000082000000/
- Fire Run Book:
http://resources.arcgis.com/en/help/localgovernment/10.1/index.html#/What_is_Fire_Run_Book/028s000000nv000000/
- Reference Information and Examples
 - National Geospatial-Intelligence Agency (NGA)
 - https://www1.nga.mil/ProductsServices/GeodesyandGeophysics/Documents/TM8358_1.pdf
 - http://earth-info.nga.mil/GandG/coordsys/geoarticles/pdfs/Article017_MGRS.pdf
 - <http://earth-info.nga.mil/GandG/coordsys/mmr201.pdf>
 - <http://earth-info.nga.mil/GandG/publications/tm8358.1/tr83581b.html#ZZ26>
 - Federal Geographic Data Committee (FGDC)
 - General resources: <http://www.fgdc.gov/usng>
 - How to: <http://www.fgdc.gov/usng/how-to-read-usng>
 - Detailed mapping standards: http://www.fgdc.gov/usng/educational-resources/Map_USA_USNG_20081231.pdf
 - National Search And Rescue Committee (NSARC)
 - Georeferencing Information for SAR Responders:
http://www.uscg.mil/hq/cg5/cg534/nsarc/Georeferencing_info.asp
 - Georeferencing matrix:
http://www.uscg.mil/hq/cg5/cg534/nsarc/CIS_georef_matrix.doc
 - Esri
 - Introducing the United States National Grid:
<http://www.esri.com/news/arcuser/0705/usng1of2.html>