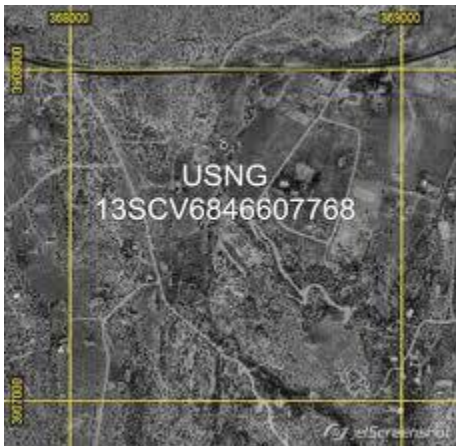




# Implementation Guide to the USNG



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# Implementation Guide to the US National Grid

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# Implementation Guide to the USNG

## **Introduction**

Delayed responses, misrouting of emergency resources, and miscommunication due to location language complexities represent the frustrations of emergency responders across the whole community. 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 is a point and area reference system that can describe a position or area of operations when and where conventional location references like landmarks or street signs are not in place, such as after a hurricane, flood, or tornado (as shown at below). The USNG supports mission tasking during and after an incident and serves as an efficient and effective preparedness tool. It can be used to support planning efforts, including mutual aid and resource allocation planning, for clearly defined areas prior to an incident. The USNG creates a nationally consistent language of location by providing a grid reference system that is seamless across jurisdictional boundaries and interoperable with traditional location services.



The United States National Grid can support, among other things:

- A search team that needs to direct a rescue team into an unfamiliar area or an area that has no street signs
- An Incident Commander needing to break a large incident perimeter into manageable parts so that operational areas can be clearly defined and communicated easily across multiple disciplines and jurisdictions
- Pre-incident planning to determine potential resource needs and to facilitate mutual aid coordination and deployment
- A consistent, measurable means to support operational progress and standardized situation reporting
- Dispatch functionality and interoperability during response, particularly when emergency responders are either unfamiliar with local streets or when road signs have been destroyed

The USNG puts the entire community on the same page, from emergency responders to the general public, by creating a simple, unambiguous method for describing a 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 to help the reader understand the value of and steps necessary to implement the USNG for the whole community. The audience for the document include:

- Executive Level Decision Makers
  - City/County Managers, Elected Officials, Executive Directors, State Officials
- Public Safety Leaders and Executives
  - Emergency Managers, Police Chiefs, Fire Chiefs, Incident Commanders
- Emergency Responders
  - Search and Rescue Personnel, Firefighters, Law Enforcement, Mass Care Personnel
- GIS Practitioners and Technicians
  - GIS Analysts, Field Data Entry Technicians, GIS Supervisors
- Citizens interested in learning about the USNG

The guide is divided into the following key areas:

- United States National Grid Overview—Provides a description, brief background, and status of the USNG
- USNG Basics—Explains the basic components, the terminology, and how to read and understand a USNG coordinate
- Implementation Guidance—Provides steps to be taken to ensure successful implementation, from governance documents supporting USNG adoption to training in the correct use of the USNG. This section discusses considerations in five key areas when implementing the grid
- Reference Links—Provides readers with links to reference material supporting implementation of the USNG. The materials 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 area and point grid reference system that quickly enables multi-discipline and multi-jurisdictional emergency service agencies to precisely locate incidents and universally communicate locations using paper maps and/or electronic applications. It is recognized nationally and is used throughout many communities. The USNG is often safer to use than other systems, such as Latitude/Longitude (Lat/Lon). Lat/Lon can be communicated in multiple formats that can lead to misunderstandings. The USNG has one format that reduces the possibility for error.

To ensure maximum operational readiness when time is of the essence, the U.S. Department of Homeland Security (DHS) has designated that the USNG be used to increase the interoperability of location services by providing a nationally consistent grid reference system.

Based on the widely used Universal Transverse Mercator (UTM) Coordinate system developed in the 1940s 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.

The Federal Emergency Management Agency (FEMA) has made agency-wide implementation of the USNG a 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.

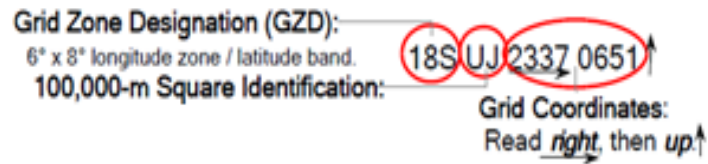
The United States Geological Survey (USGS) produced a new map series called the US-Topo, which incorporates the USNG as the primary reference system. Additionally, the National Geospatial-Intelligence Agency (NGA), which supports DHS, will only produce USNG-based products for United States disaster events.



**USNG Basics**

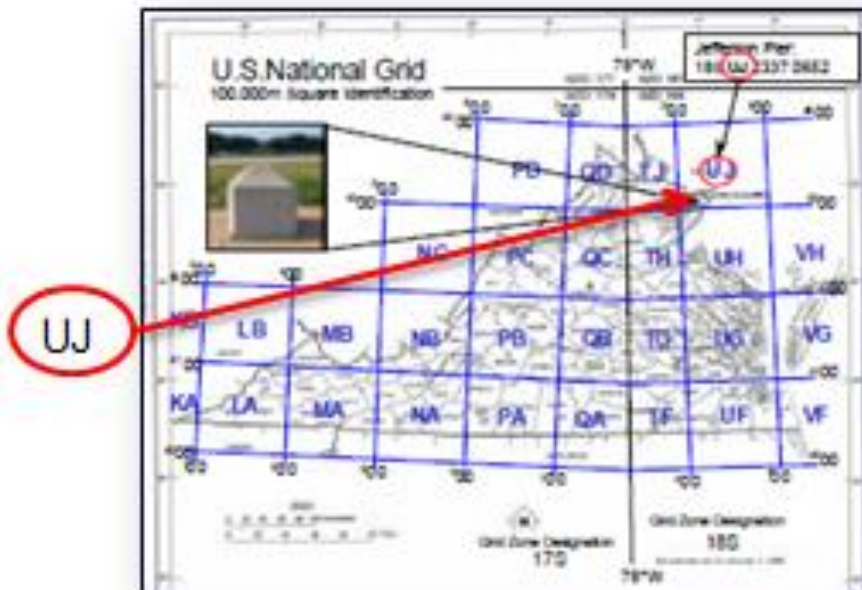
The USNG uses a string of up to 15 characters to describe a precise location. A USNG coordinate is divided into three components and is read like this: the first three characters are a combination of two numbers and a letter representing a Grid Zone Designation (GZD); the next two alphabetical characters 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. The number of characters used can be adjusted to meet specific precision requirements of a situation or to simplify communicating location in smaller areas that do not cross GZDs or 100,000 meter squares.

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





18S



UJ



In most localized situations, once the Grid Zone and 100K meter 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 precision of the 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 – about 62 square miles)
- 18S UJ 2 0 = 10,000 meter square (or 10 Kilometers or 10Km – about 6.2 square miles)
- 18S UJ 23 06 = 1,000 meter square (or 1 Kilometer or 1Km – about .62 square miles)
- 18S UJ 233 065 = 100 meter square
- 18S UJ 2337 0651 = 10 meter square

- Benefits
- Provides a universal location reference system
  - Not dependent on landmarks, street signs, or knowledge of the community
  - Provides unambiguous context for location
  - Simple, standardized, easy to learn and use
  - 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 when used as an area reference system:
    - 1m = an individual person
    - 10m = a team, a large vehicle, a small home
    - 100m = a city lot, large building, a football field
    - 1,000m = a city block, a neighborhood
    - 10,000m = a city
  - Improves interoperability and military support to civil authorities
  - Universally defines geographic coordinates or areas of operation

### **Implementation Guidance**

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 environment. 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 for your agency or jurisdiction, appropriate policies and guidance that establish it as your location-referencing standard, are required.

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

- Provide clear direction to your organization on the need to use USNG
- Update organization policy manuals and standard operating procedures (SOPs) to reflect USNG policy
- Incorporate USNG into the organization publications (e.g., email signatures, address directory, letterheads, and business cards)

- Provide visibility of policy to industry, partners and citizens
- Incorporate USNG into existing and new mutual aid agreements, MOUs and MOAs with partnering agencies or neighboring jurisdictions



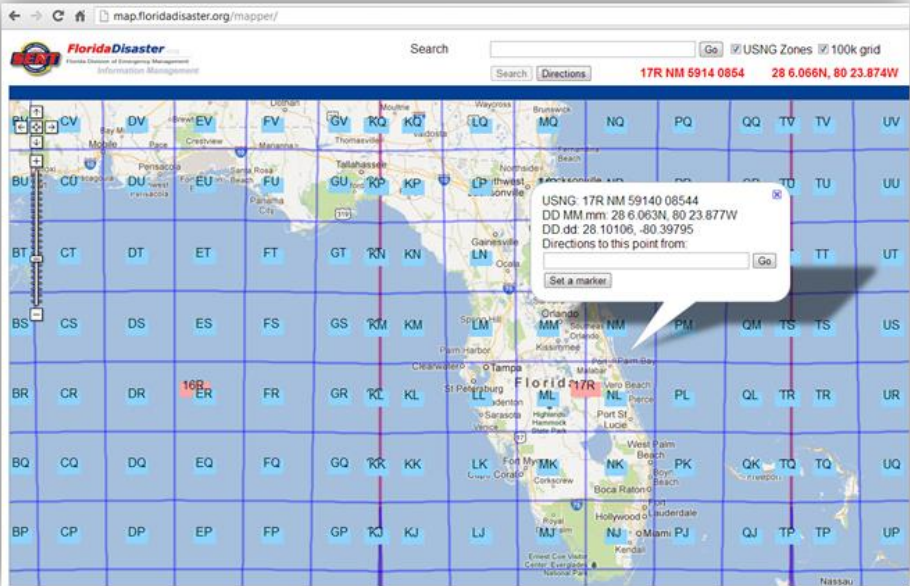
### Standard Operating Procedures

Adopting the USNG into standard operating procedures promotes consistent application and supports public safety mission objectives. In order to do so, organizations should:

- Incorporate USNG in administrative and emergency operations
- Include USNG attributes into data collection and base data
- Develop map books with USNG as one of the base elements
- Integrate USNG as the map standard for planning and incident map products as well as other non-map products used by decision makers (such as preplans, briefing documents, situation reports, etc.)
- Add USNG to incident dispatches, in addition to street addresses
- Change agency map books to show properly labeled USNG grid lines
- Eliminate all use of alternate or proprietary grids

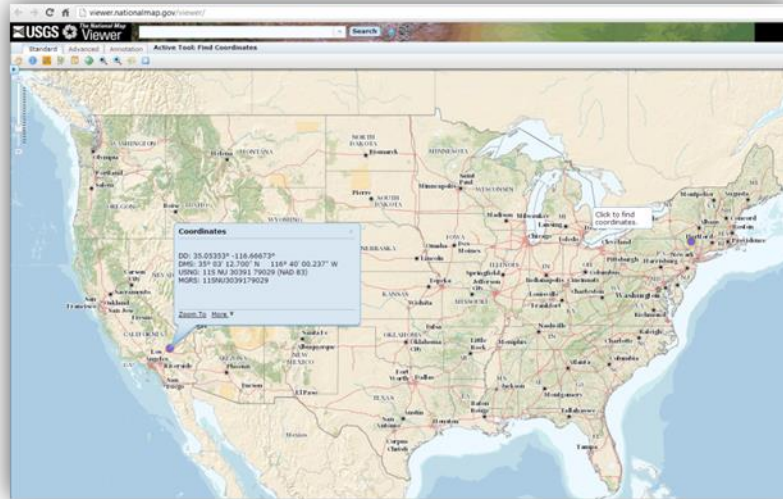
Training and Education

A training program must be developed and implemented that explains the benefits of the USNG and how to use it.



Public safety and emergency management training should include teaching basic map reading skills, including distance measurement, and describing locations using USNG terminology. Training should also include instruction on the use of the grid with location technologies such as GPS (Global Positioning System) receivers, web tools, and smart phones. Agencies should look to expand their training audience to include personnel who may become involved in disaster situations, (e.g., public works, businesses, volunteer organizations, and the general public.)





Training and education objectives should incorporate:

- Support at the organization level
- Inclusion of USNG in all exercises
- Utilization of free or low cost tools such as
  - [USGS - National Map Viewer](#)
  - [Florida Division of Emergency Management - Incident Mapper](#)
  - [USNG on a Google Map](#)
- Ensuring that technical staff are properly trained to support USNG
- Inclusion of supporting agencies, including non-governmental
- Incorporate the USNG into all training, including National Incident Management System (NIMS), Incident Command System (ICS), and all operational exercises:
  - Require that locations be recorded and communicated in USNG terms to supplement existing terms such as street address, intersections, and latitude and longitude
  - Include USNG on all maps used
  - Incorporate use of USNG into Planning Section maps/GIS responsibilities
  - Require USNG coordinates and grid lines in operational and division briefing maps

*Training Opportunities and 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)
- Provide web-based training (e.g., target first responders and general public)
- 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 grid lines 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 into commercial maps, map products, and websites
- Develop 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
- Encourage each jurisdiction's GIS department to create maps and map atlases with USNG

- Establish and document USNG locations for significant addresses and Points of Interest (POI) including critical infrastructure, key resources, and vulnerable populations



#### 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 should 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 in the near future. System suppliers and integrators may also be able to configure their systems with USNG. To enable systems configuration: 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



- 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

### Reference Links

This area of the guide provides links to reference material supporting the various steps needed to implement the USNG. It is divided into three sections 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.

*Links last updated: September 2013*

Executive Level  
Decision Makers

The role of the executive level decision makers is to provide clear guidance and direction to incorporate USNG into policies and procedures to aid in the utilization of USNG.

*Example agencies  
implementing the USNG  
and how it affects their  
operations*

- Executive summary
  - Federal Geographic Data Committee (FGDC):
    - [FGDC—Executive Summary USNG Supporting Public Safety, Commerce, and the General Public](#)
- State standards
  - Minnesota:
    - [Minnesota IT Policies and Standards Services—USNG](#)
  - North Carolina:
    - [North Carolina Geographic Information Coordination Council—USNG Standard](#)
  - Florida:
    - [Florida Adopts USNG as Standard](#)
  - Missouri:
    - [Missouri Department of Public Safety—State Emergency Management Agency—USNG](#)

Public Safety  
Personnel and  
Emergency  
Responders

The role of public safety personnel and emergency responders is to assist with implementation of the USNG into daily operations.

*Standard Operating  
Guidelines and Use  
Cases*

- [Skagit County, WA—USNG Educational Poster](#)
- [Florida Division of Emergency Management \(includes links to counties in Florida with USNG maps\)](#)
- [Florida Field Operations Guide: Florida's Approach to All Hazards Incident Management](#)
- [FloridaDisaster.org: Using the United States National Grid - Educational poster](#)
- [United States National Grid: A Geospatial Tool for the Toolbox](#)
- [Florida Fire Service Magazine: Configuring Hardware for the United States National Grid](#)
- [Florida Fire Service Magazine—USNG: It's Time to Stop Adopting and Start Implementing](#)

- 
- [USFA—FEMA: Coffee Break Training—United States National Grid](#)
  - [Statter911.com: Fire Service: Start Using the USNG](#)
- Reference Links*
- [FGDC: Index Map for Continental United States](#)
  - [FGDC: How to read a United States National Grid \(USNG\) Spatial Address](#)
- GIS Practitioners and Technicians
- The role of GIS practitioners and technicians is to incorporate USNG in all mapping products.
- Training Aids
    - [Grids and Coordinates](#)
    - [American Surveyor—A Guide to Using the USNG](#)
  - Mapping, Grid, and Data Tools
    - U.S. National Grid Tools for ArcGIS: [ArcGIS Extensions—USNG](#)
    - U.S. National Grid map service on ArcGIS Online: [ArcGIS Online NGA USNG](#)
    - Emergency Management Maps: [ArcGIS.com—Emergency Management Maps](#)
    - Fire Station Wall Map: [ArcGIS.com—Fire Station Wall Map](#)
    - Fire Run Book: [ArcGIS.com—Fire Run Book](#)
    - USNG Map Books: [Dakota County Minnesota—Fire Map Books](#)
  - Reference Information and Examples
    - National Search And Rescue Committee (NSARC)
      - [United States Coast Guard—Georeferencing Information for SAR Responders](#)
      - [United States Coast Guard—Catastrophic Incident - Georeferencing Methods](#)
      - [United States Coast Guard—Georeferencing Matrix](#)
    - National Geospatial-Intelligence Agency (NGA)
      - [NGA—Basic Geodesy](#)
      - [NGA—The difference between UTM and MGRS](#)
      - [NGA—Grid Reference Systems](#)
    - Federal Geographic Data Committee (FGDC)
      - [General Resources: USNG](#)
      - [How to Read the USNG](#)
      - [FGDC—Educational Resources](#)

- ESRI
  - [Detailed Mapping Standard: USNG](#)
  - [Introducing the United States National Grid](#)