

The US National Grid (USNG): A Simple and Powerful Geospatial Tool

Information Sheet 4 in this series.

FGDC-STD-011-2001

From www.fgdc.gov/usng

The Problem. In a time of growing location based services (i.e. Global Positioning System, etc.), need to support homeland security/emergency services, the general public, and commercial activities with better geospatial information capabilities, we had no standard, nationally consistent map grid. *For example:* Washington, DC maps for consumers. - 35 maps, 30 different atlas grids. - Same street names, but different grids, none of which work with GPS. - No universal map index.




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The Solution. US National Grid (USNG). This standard established a nationally consistent grid reference system, just as all street maps use a common set of street names. USNG provides a seamless plane coordinate system across jurisdictional boundaries and map scales; it enables precise position referencing with GPS, web map portals and hardcopy maps. Unlike latitude and longitude, the USNG is *simple* enough that it can be taught and effectively used at the 5th grade level. It enables a practical system of *geoadresses* and the *universal map index*.

| Point of Interest | Street Address | USNG Grid: | Telephone: |
|--------------------------|-------------------------------|------------|------------|
| | | 18S UJ | (202) |
| Subway Sandwich & Salads | 2030 M St., NW | 2256 0826 | 223-2587 |
| Subway Sandwich & Salads | 1412 Good Hope Rd., SE | 2781 0387 | 889-5888 |
| Subway Sandwich & Salads | 3504 12 th St., NE | 274 112 | 526-5999 |
| Subway Sandwich & Salads | 1500 Benning Rd, NE | 2815 0757 | 388-0421 |

Three purposes of the USNG on larger-scale maps:

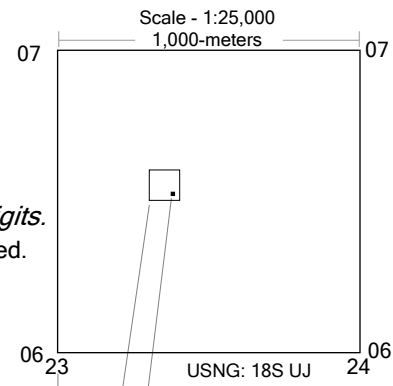
- Provide a N-S baseline for measuring direction.
- Provide visual scale and to measure distance.
- Provide a standard XY convention to describe locations.

→ **Organization and abbreviation of a USNG grid value.**
 Complete USNG value: 18S UJ 2337 0651 - World wide unique.
 Without Grid Zone Designation (GZD): UJ 2337 0651 - Regional areas.
 Without GZD and 100,000-m Square ID: 2337 0651 - Local areas.

A flexible reference system: Use the precision you require, truncate insignificant digits.
 2 to 10-digits -- each additional digit pair improves precision by an order of magnitude squared.

How we graph locations with the grid: Read *right*, then *up*.

Locating the Jefferson Pier at: 18S UJ 23371 06519




Four digits: 23 06 Locating a point within a 1,000-m square.
 Requires two more characters than the classic atlas grid (i.e. A3), yet seamlessly ties into a standards based, globally extent, locally optimized grid reference system.

Six digits: 233 065 Locating a point within a 100-m square (football field size).
 Think, "23.3 06.5" Another digit pair guides the eye to 1% of the 1,000-m grid square.

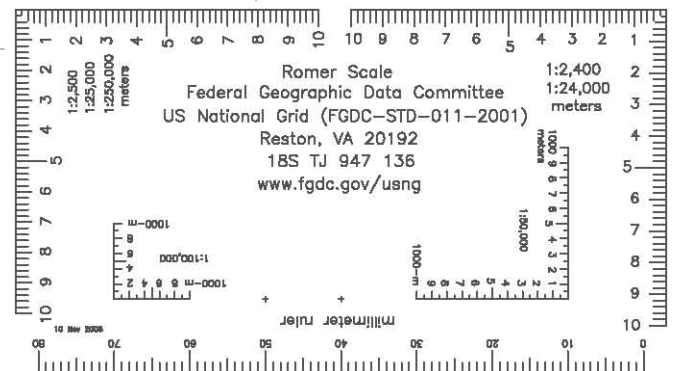
Eight digits: 2337 0651 Locating a point within a 10-m square (modest size home).
 Adding another digit pair allows easy measurable, discrimination of 1 / 10,000 of the grid square.
 This is too precise for visual estimation, but is easily and accurately measured with a Romer Scale.

Ten digits: 23371 06519 Locating a point within a 1-m square (manhole cover size).
 Another pair of digits allows discrimination of 1 / 1,000,000 of the grid square.
 This is far too precise for measurement on a map of this scale.
 It is useful on maps larger than ~ 1:5,000 using a Romer Scale.

- The USNG enables a nationally consistent language of location, optimized for local applications.
 6 and 8-digit grids: The most commonly used formats in a local setting.

 Consumer GPS receivers (<\$100) can locate a USNG point position to within 4-meters half of the time, and to within 8-meters 95% of the time.

Examples of use include in New Orleans, LA during Hurricane KATRINA response, and adoption by Skagit County, WA, Clark County, CO, the State of Florida, FEMA Urban Search and Rescue (US&R), USGS, Census Bureau, DoD, Garmin, Magellan GPS, ESRI, Delorme, and others.



Example Points of Interest (POI) Map Index: Washington, DC

Edition: November 6, 2006

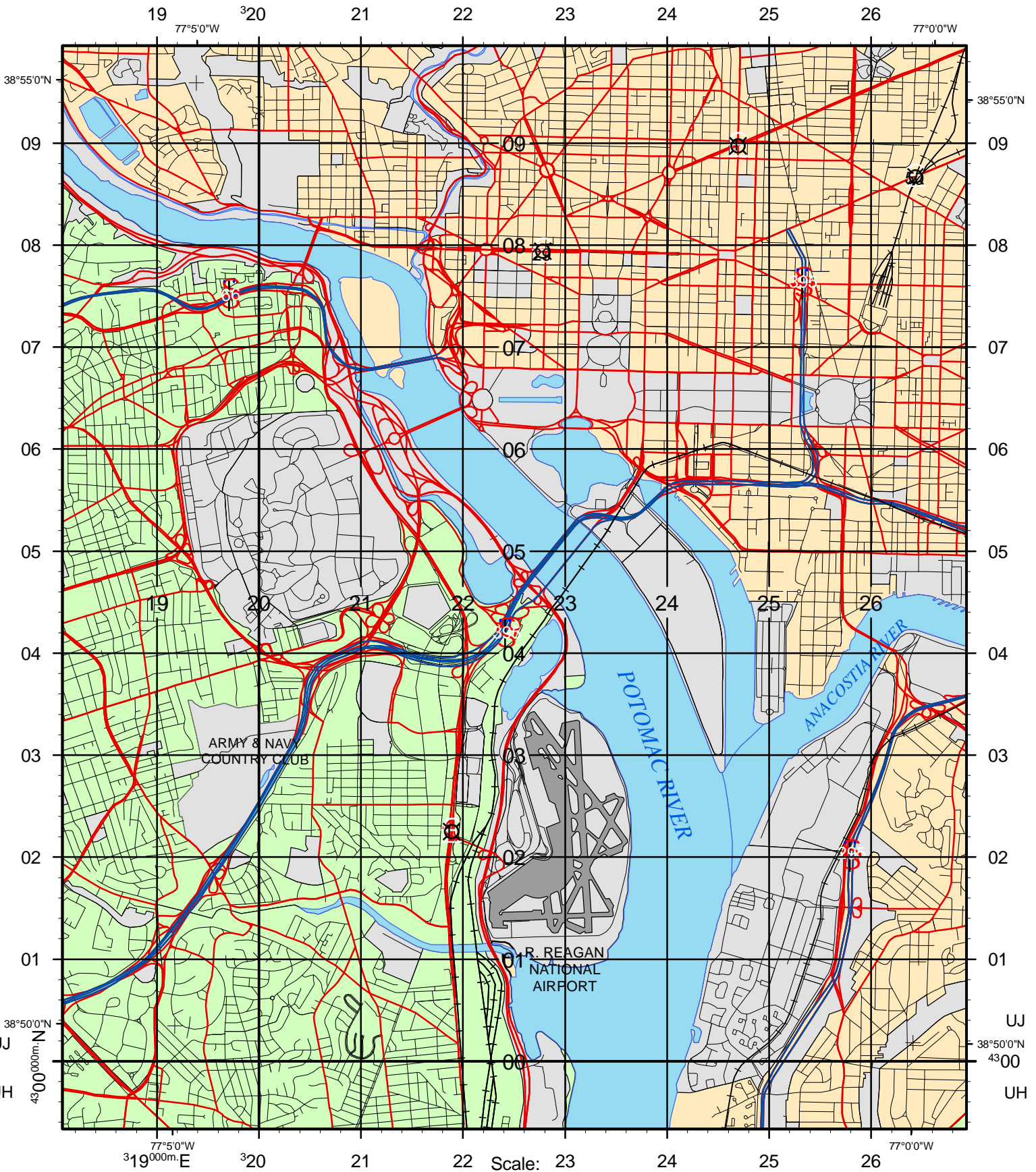
This POI Map Index provided for demonstration purposes. Grid values obtained from Washington, DC GIS web site: <http://dcatlas.dcgis.dc.gov/mar/>

| # | Point of Interest | Street Address | USNG Grid: 18S UJ | Telephone: (202) |
|----|---|--|----------------------|---------------------|
| 1 | National Geographic Society | 1145 17 th St., NW | 2327 0823 233 082 | 857-7000 |
| 2 | Typical Residence | 1717 Willard St., NW | 2321 0948 | |
| 3 | National Postal Museum | 2 Massachusetts Ave., NE | 2585 0739 259 074 | 633-5555 |
| 4 | National Building Museum | 401 F St., NW | 2503 0736 250 074 | 272-2448 |
| 5 | DC World War Memorial | Independence Ave. SW | 2276 0628 | |
| 6 | President Franklin Delano Roosevelt | Pennsylvania Ave., NW | 24502 06903 | |
| 7 | Subway Sandwich & Salads | 3801 Nebraska Ave NW, Nebraska Ave Complex, Bldg 14 | 1935 1213 | 362-8992 |
| 8 | Subway Sandwich & Salads | 5028 Wisconsin Ave NW | 1947 1390 | 686-9870 |
| 9 | Subway Sandwich & Salads (Per Subway web site.) | Federal Bldg #2, Box 2029, Food Court, Washington DC | 204 042 | (703) 920-7916 |
| 10 | Subway Sandwich & Salads | 800 21st Street NW, Marvin Center Loading Dock | 2247 0766 | 994-1801 |
| 11 | Subway Sandwich & Salads | 2033 K St NW | 2255 0801 | 833-1363 |
| 12 | Subway Sandwich & Salads | 2030 M St NW | 2256 0826 | 223-2587 |
| 13 | Subway Sandwich & Salads | 2010 P St NW | 2265 0871 | 530-0698 |
| 14 | Subway Sandwich & Salads | 2469 18th St NW | 2296 1013 | 667-2251 |
| 15 | Subway Sandwich & Salads | 1129 18th St NW | 2298 0822 | 862-9840 |
| 16 | Subway Sandwich & Salads | 1776 G St NW | 2299 0743 | 898-0520 |
| 17 | Subway Sandwich & Salads | 1666 K St NW | 2327 0789 | 223-8720 |
| 18 | Subway Sandwich & Salads | 1444 I St NW | 2373 0775 | 289-4301 |
| 19 | Subway Sandwich & Salads | 1401 K St NW | 2377 0796 | 898-5784 |
| 20 | Subway Sandwich & Salads | 1100 New York Ave NW | 2418 0771 | 289-7709 |
| 21 | Subway Sandwich & Salads | 1201 Tuckerman Street NW | 2431 1513 | 291-7800 |
| 22 | Subway Sandwich & Salads | 709 H St., NW | 2462 0762 | 842-2273 |
| 23 | Subway Sandwich & Salads | 406 1st St., SE | 2604 0590 | 547-7827 |
| 24 | Subway Sandwich & Salads | 430 8th St., SE | 2698 0567 | 547-8200 |
| 25 | Subway Sandwich & Salads | 3504 12th St NE | 274 112 | 526-5999 |
| 26 | Subway Sandwich & Salads | 1213 Brentwood Rd NE | 2752 0980 | 529-8206 |
| 27 | Subway Sandwich & Salads | 1412 Good Hope Rd SE | 2781 0387 | 889-5888 |
| 28 | Subway Sandwich & Salads | 1500 Benning Rd NE, Hechinger Mall | 2815 0757 | 388-0421 |
| 29 | Subway Sandwich & Salads | 3950 Minnesota Ave NE | 3090 0687 | 398-3222 |
| 30 | Subway Sandwich & Salads | 4518 Benning Rd SE | 3203 0624 | 575-2889 |

Inclusion of any specific commercial POI in this example list does not imply endorsement by any government organization.

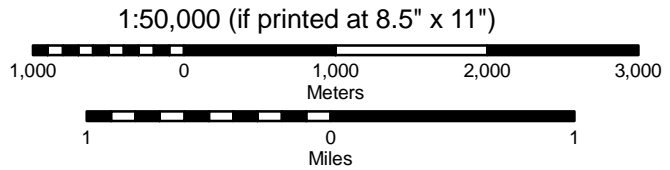
Washington, DC

(USNG Demonstration Map)



1,000-m GRID, US NATIONAL GRID
 NORTH AMERICAN DATUM 1983
 GRID ZONE DESIGNATION: 18S
 100,000-M SQUARE IDENTIFICATIONS: UJ & UH

| U.S. National Grid | |
|-----------------------|------|
| 100,000-m Square ID | UJ |
| | 4300 |
| | UH |
| Grid Zone Designation | 18S |



2005
 G-M ANGLE
 9° 30' (169 MILS)

TO CONVERT A GRID
 AZIMUTH TO A MAGNETIC
 AZIMUTH ADD G-M ANGLE

GRID
 CONVERGENCE
 1° 1'E (18 MILS)

TO CONVERT A MAGNETIC
 AZIMUTH TO A GRID AZIMUTH
 SUBTRACT G-M ANGLE



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For additional information:
 see www.fgdc.gov/usng

Reading US National Grid (USNG) Coordinates: "Read right, then up."

Information Sheet 1 in this series.

FGDC-STD-011-2001

From www.fgdc.gov/usng

The example below locates the Jefferson Pier at USNG: 18S UJ 23371 06519.

| U.S. National Grid | |
|-----------------------|------------------|
| 100,000-m Square ID | |
| UJ | ⁴³ 00 |
| UH | |
| Grid Zone Designation | 18S |

A USNG value has three components.

Some maps may give this leading information in a grid reference box.

Grid Zone Designation (GZD):

6° x 8° longitude zone / latitude band.

100,000-m Square Identification:

18S UJ 2337 0651

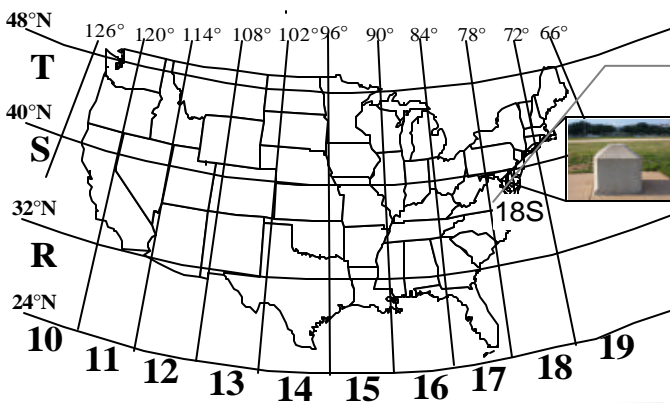
Grid Coordinates:

Read right, then up.

"Read right, then up."

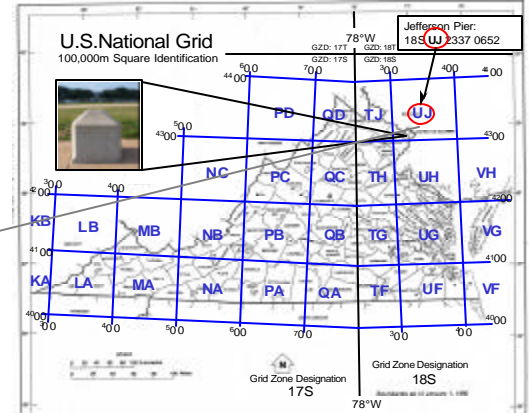
USNG values have three components as seen above. The GZD gives a USNG value world-wide context with 60 longitudinal zones each 6° wide. Zones 10 - 19 cover the conterminous U.S. as seen below left. UTM zones are divided into 8° latitudinal bands. Together these make up 6° x 8° Grid Zone Designations (GZD). Example: 18S

U UTM/USNG Grid Zone Designations



Example:

18S UJ



GZDs are further subdivided into large squares with 100,000-m Square Identifications. In this example, the Jefferson Pier is located in UJ. These squares are organized and lettered so they do not repeat themselves but every 18°, which is approximately 1,000 miles in the mid-latitudes. The illustration at above right depicts the organization of 100,000-m Square ID's over a particular state -- Virginia in this case. In the conterminous U.S. a given value such as UJ 2337 0651 is unique out of the entire state it is located in, as well as all surrounding states.

- Grid lines are identified by **Principal Digits**. Ignore the small superscript numbers like those in the lower left corner of this map.

Reading USNG Grid Coordinates.

- Coordinates are always given as an even number of digits (i.e. 23370651).

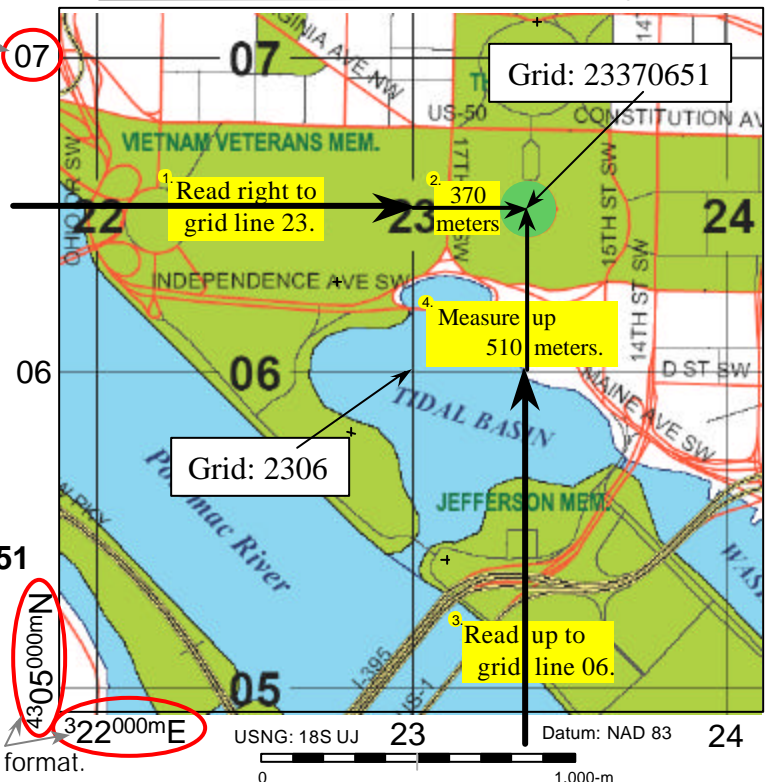
- Separate coordinates in half (2337 0651) into the easting and northing components.

¹ - Read right to grid line 23. ² Then measure right another 370 meters. (Think 23.37)

³ - Read up to grid line 06. ⁴ Then measure up another 510 meters. (Think 06.51)

A complete reference is: 18S UJ 2337 0651

| Grid: | Point of Interest: | |
|-----------|------------------------|---|
| 228 058 | FDR Memorial: | + |
| 231 054 | George Mason Memorial: | + |
| 2338 0710 | Zero Milestone: | + |
| 2275 0628 | DC War Memorial: | + |
| 222 065 | Lincoln Memorial: | |



UTM format.

USNG: 18S UJ 23 06 Datum: NAD 83 24

Ignore the small UTM superscript numbers that are provided for reference purposes. UTM numerical values are best suited for determining direction and distance as in surveying. USNG alpha-numeric values are best suited for position referencing because they can be given as only grid coordinates in a local area and with only the precision required for a particular task.