

Understanding and Implementing the US National Grid

A training course designed to provide geospatial professionals the understanding and skills to support emergency responders and decision makers with US National Grid-based spatial products and emergency workers with familiarity of the US National Grid and geospatial products and knowledge and skills about their use.

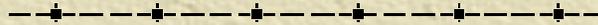


Talbot Brooks, Director

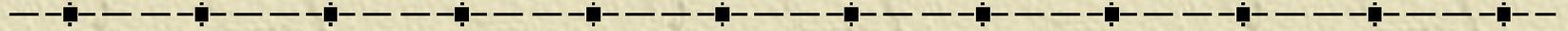
Center for Interdisciplinary Geospatial Information Technologies
Delta State University



Part I: Getting On the Same Page



Lesson 1 Learning outcome objectives

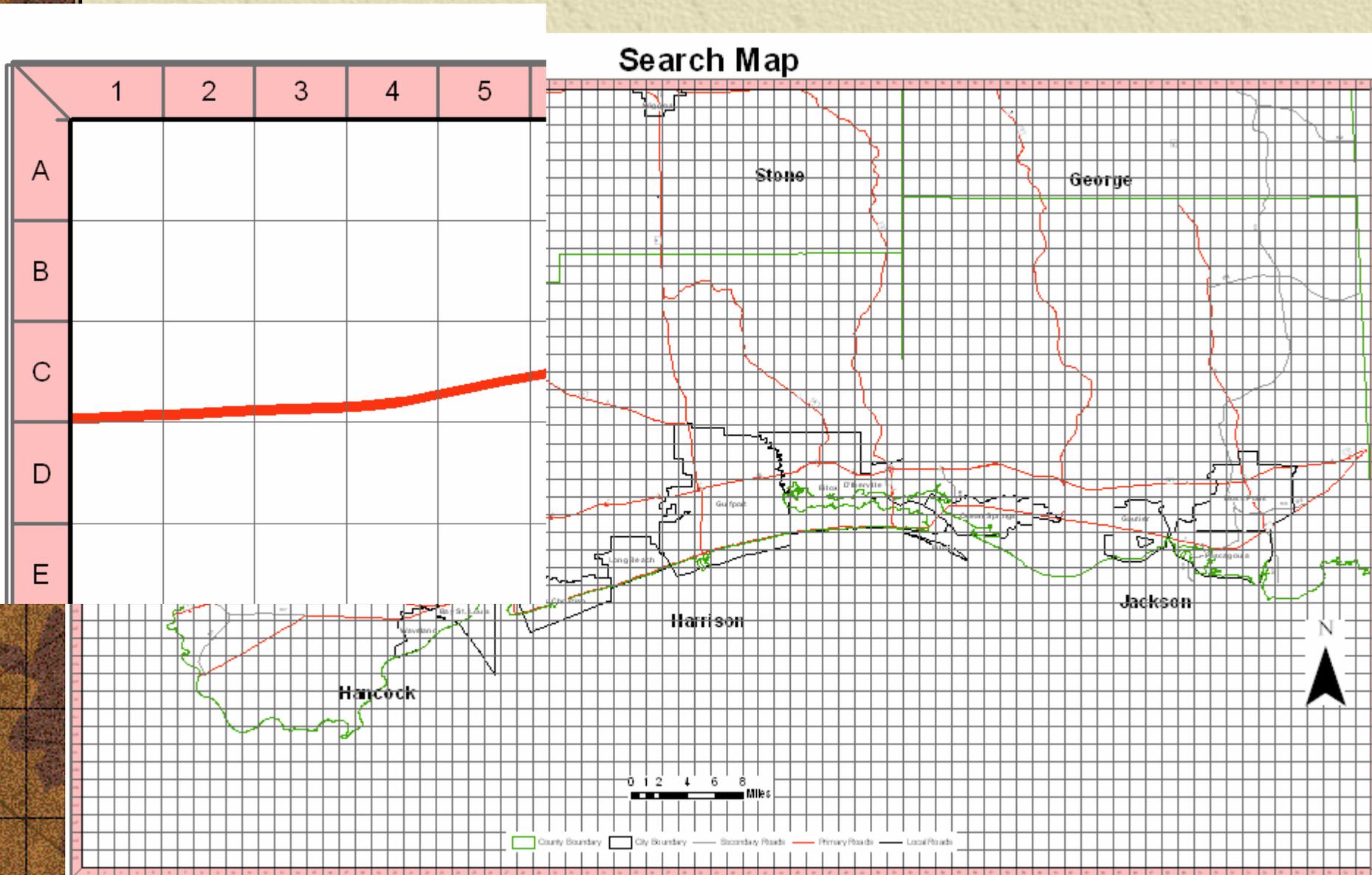


- ✦ The importance of the US National Grid
- ✦ Enabling documents and supportive Federal agencies
- ✦ Training objectives

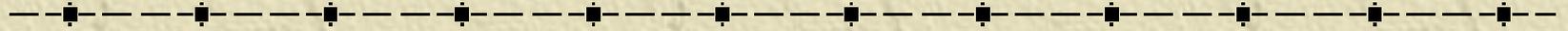
“Who am I and why am I here?”

- ✦ On 27 August 2005 I was tasked by the Bolivar County, MS Office of Emergency Management to find 2-4 people with solid computer skills to respond to the Mississippi Emergency Management Agency’s Emergency Operations Center in Jackson to help prepare written documents in support of the Hurricane Katrina operation.
- ✦ We were soon tasked by MEMA to help provide map support using “that GSI stuff” for emergency responders and decision makers.
- ✦ One of the very first products we were tasked with making was a map for search and rescue. The specifications were that it should contain streets with a 1-mile x 1-mile grid squares that could be uniquely addressed. The extent of the map should cover the three coastal counties (Jackson, Harrison, and Hancock).

So we made 250 of these and had them laminated and sent to the field...

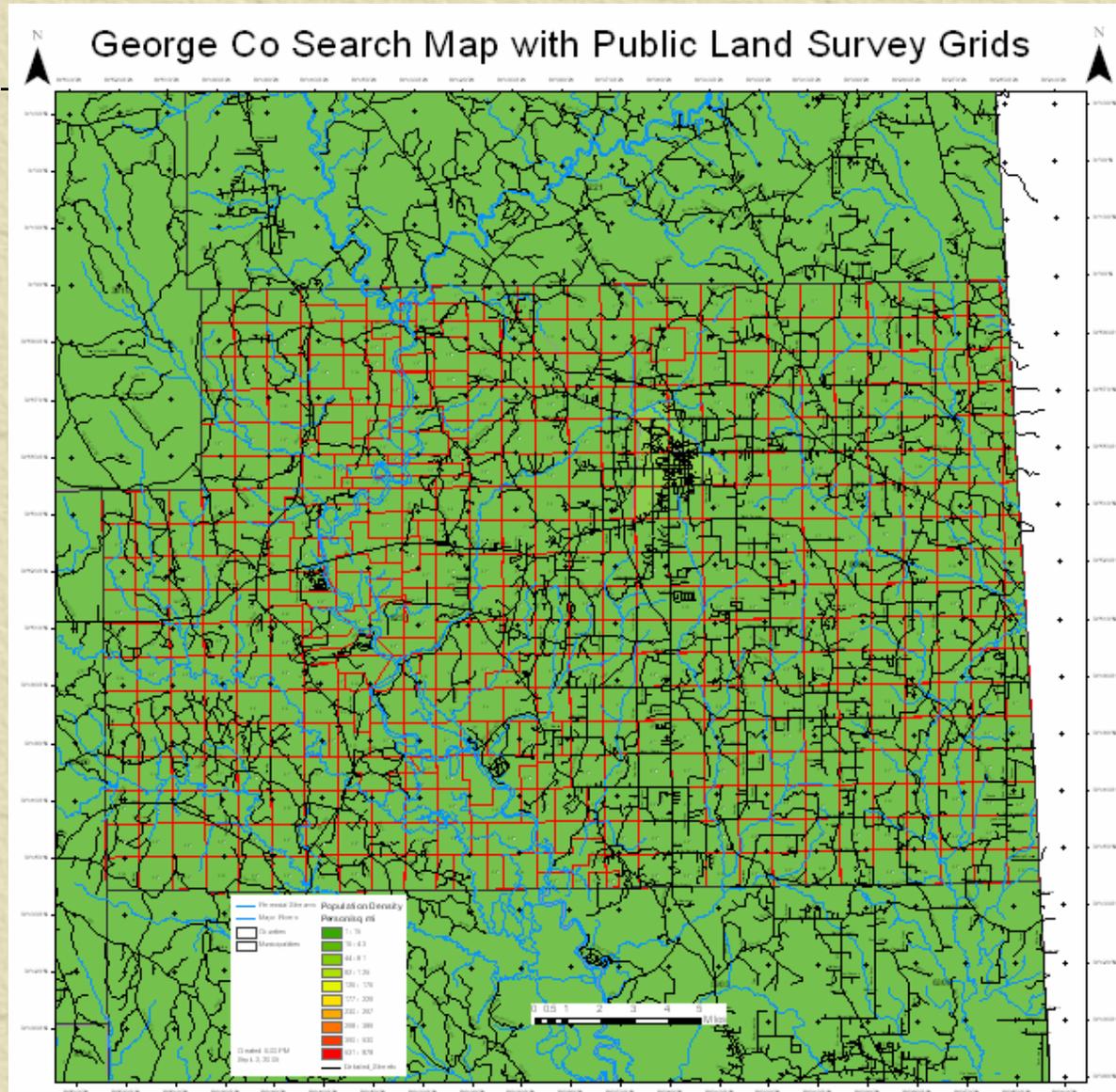
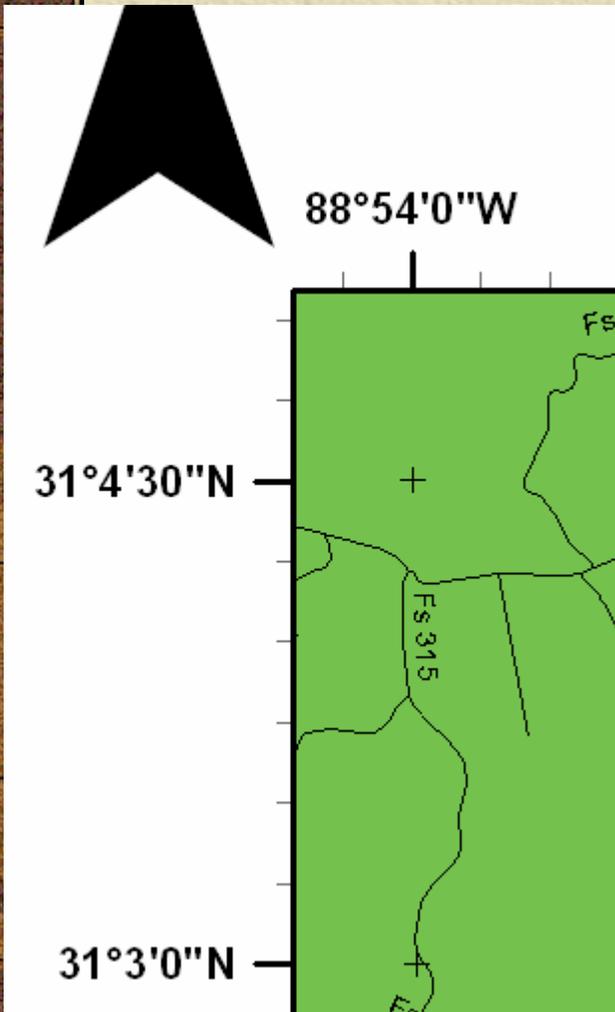


Two days later...



- ✦ Katrina had made landfall and the devastation exceeded most expectations
- ✦ The search area was expanded to include Stone, Lincoln, George, and Pearl River counties.
- ✦ I realized very quickly that I had screwed up. How was I to expand the map to encompass the new search area without altering the grid ID's being used already?

I'll use PLSS – what genius! (NOT!)



There is a better way...

✦ It's called the US National Grid and it would have greatly facilitated the solution to a lot of other problems:

- ✦ Reporting of locations for evac, SAR activities, recoveries, etc...
- ✦ It was already being used by 70,000 emergency responders – we call them the MILITARY
- ✦ Comes complete with ready made grid boxes
- ✦ Solves many other problems for emergency managers by allowing them to manage an event using maps to provide a **common, spatially-based, operational framework.**

Recommended solution using US National Grid to create 1km x 1km grid squares (contact DSU for procedure as it is involved and not straight forward – especially when working at zone junctions, but still preferable to any other lat/long or other grid system.

The 1km x 1km grids may be used as the basis for 4km x 5km map pages (ideal for 8.5" x 11" printing). Because each page is based on USNG, each page may be assigned both a local page number and a universally unique and standardized USNG page number.

Map Book Page Index

As created for
Sunflower County 911 Office, Mississippi



Indianola - Moorhead

This map book and all contents are the intellectual property of Delta State University and the Center for Interdisciplinary Geospatial Information Technologies. Critical infrastructure data courtesy US Dept. of Homeland Security HSP data set.

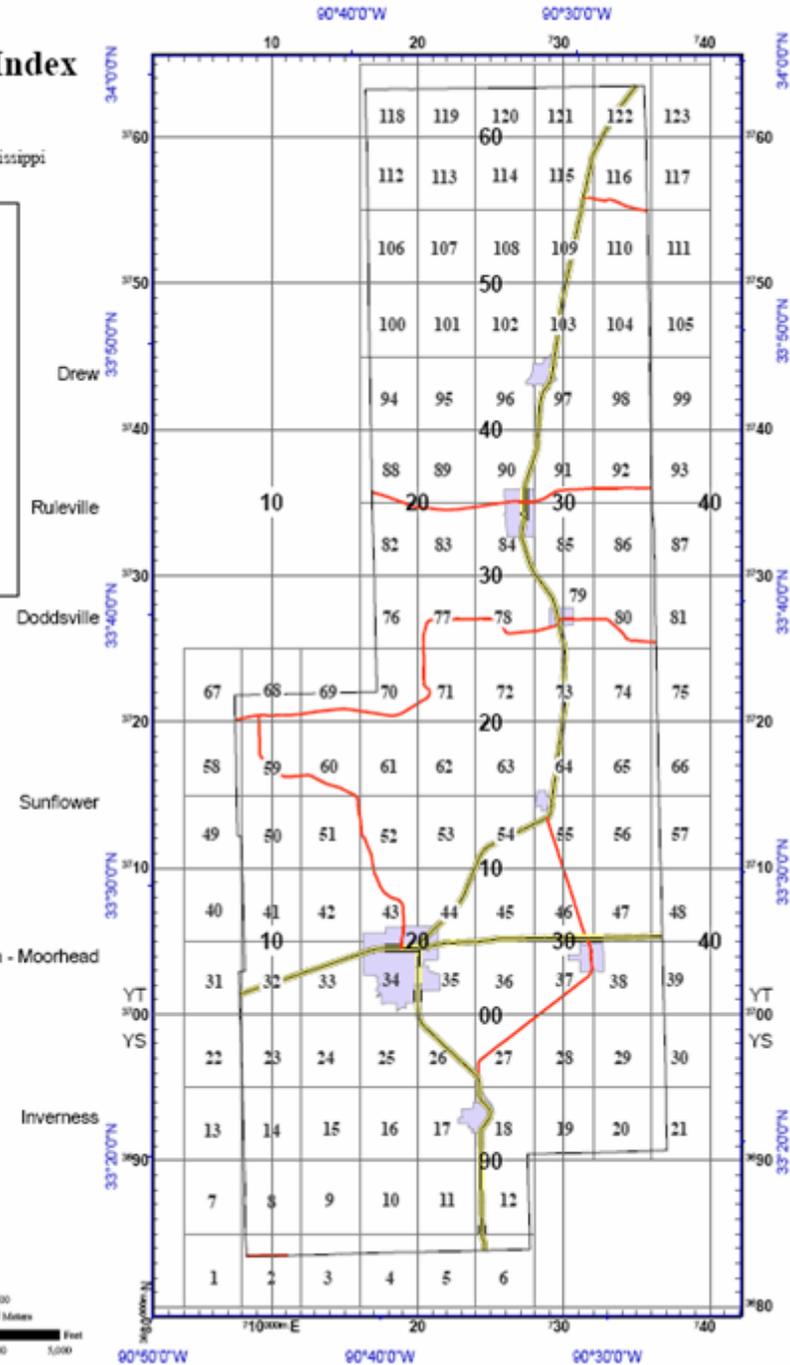
Version 1, September 2006

US Nat'l Grid
Zone = 15S
100,000-m
Square ID
YT
YS

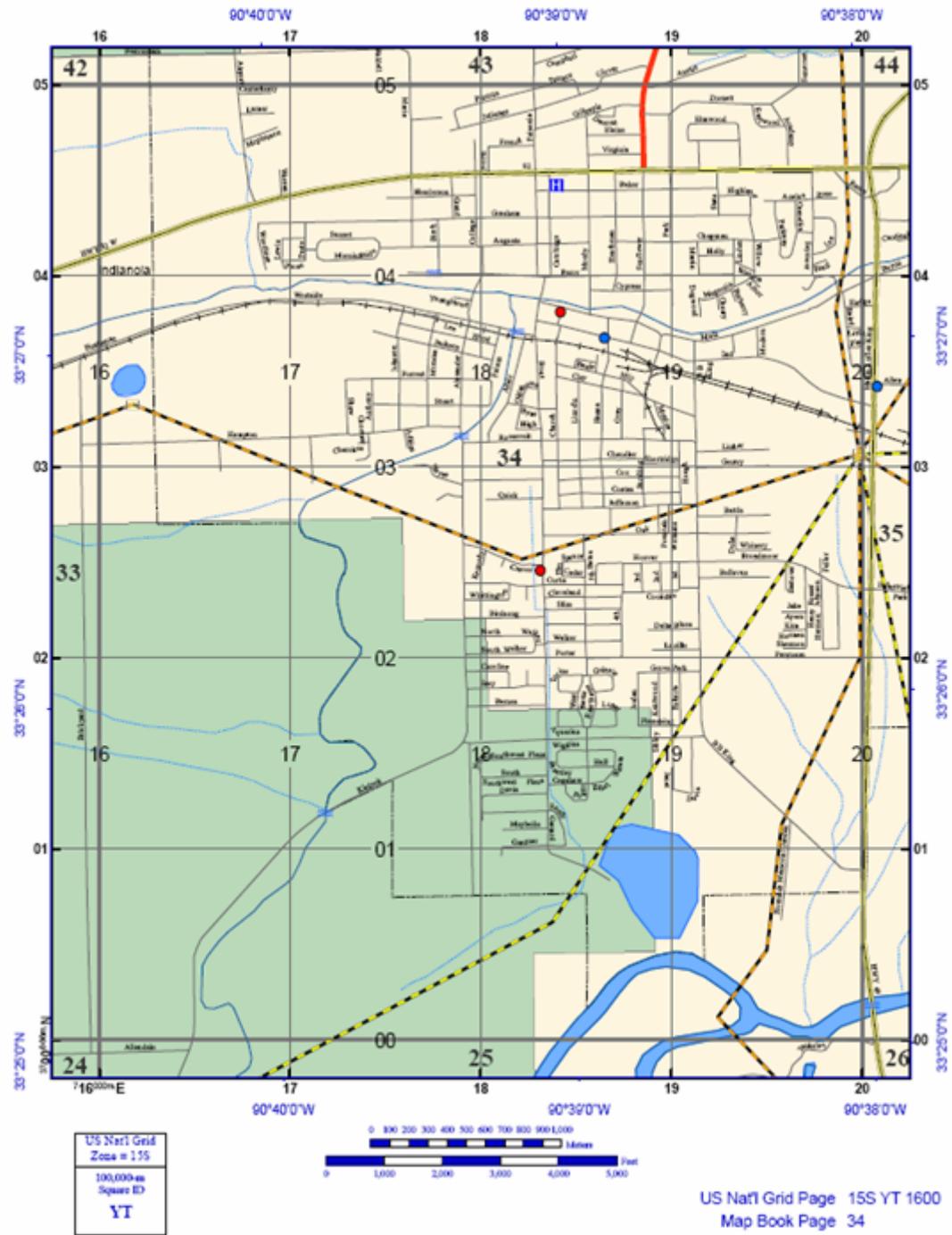
0 100 200 300 400 500 600 700 800 900 1,000
Meters

0 1,000 2,000 3,000 4,000 5,000
Feet

1:350,000



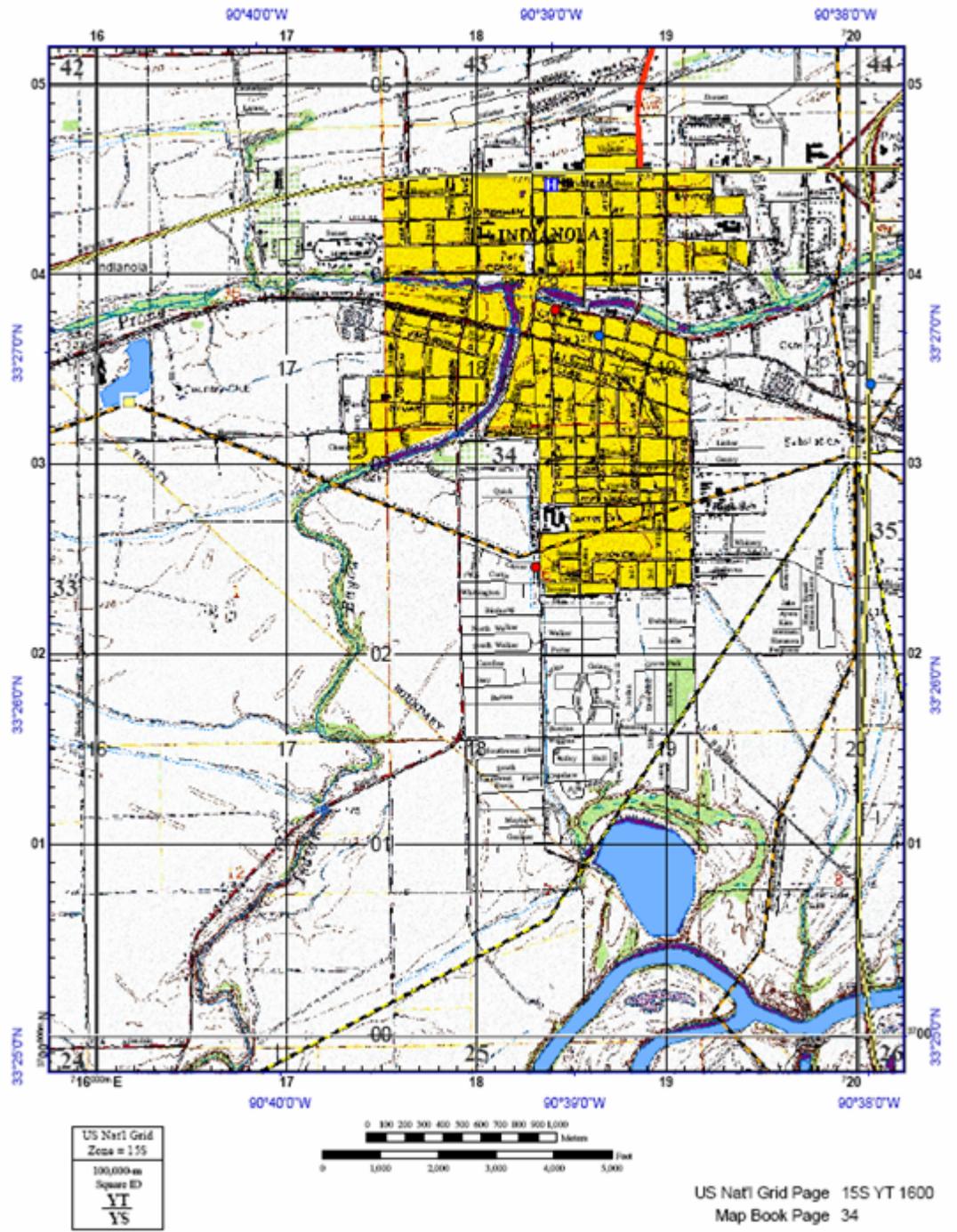
Sample USNG-based map Book page created using 4km x 5km assemblies of 1km x 1km USNG grids with layers for critical infrastructure. Background polygon layer is Electric utility Service Areas. Note that both a local page number and USNG page number are provided.

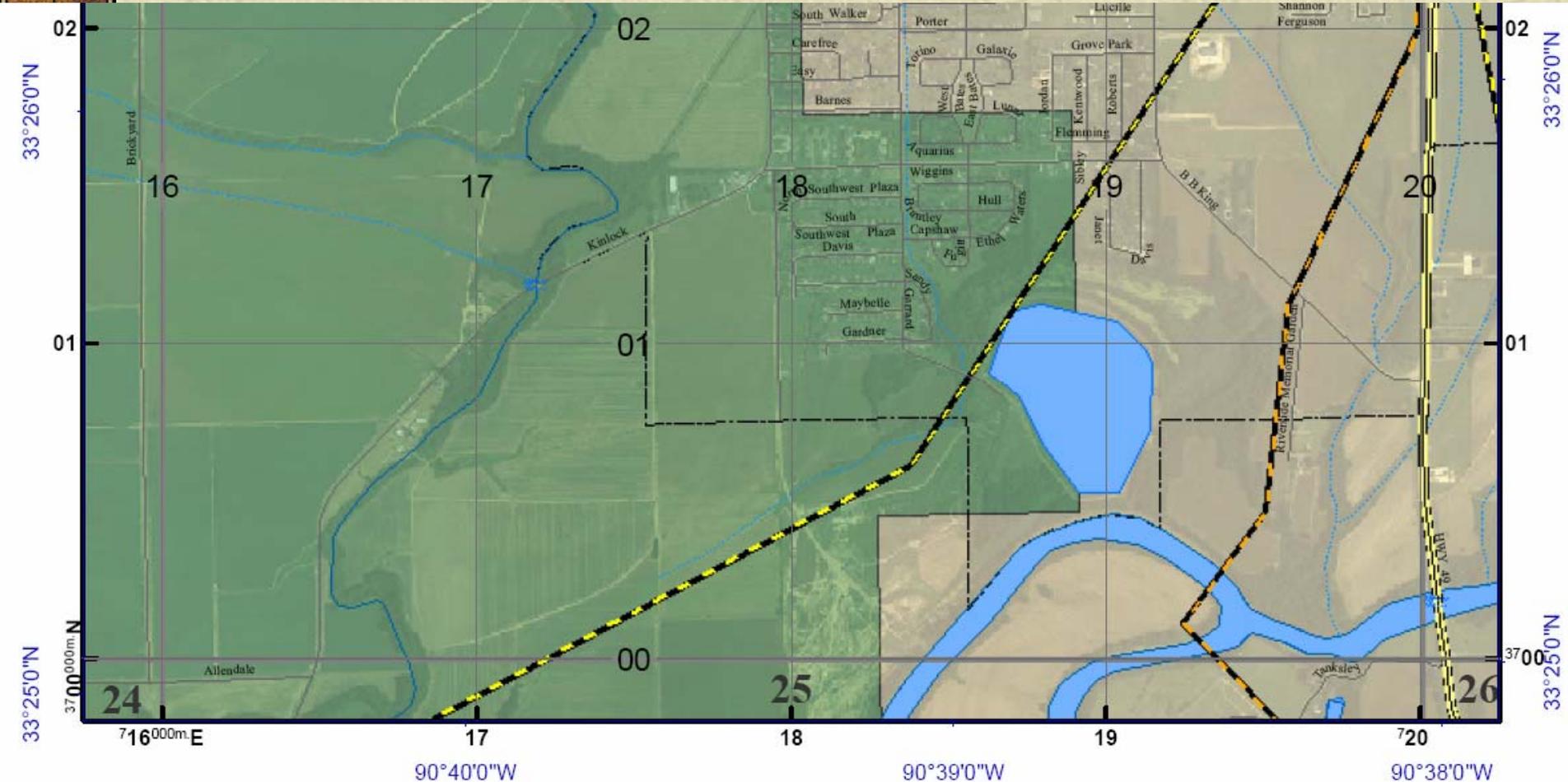
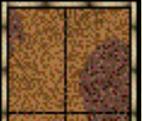


Similar map book page construct as shown in previous slide, but this one is using 1-m NAIP imagery. The blue marks around edge are NOT a dms graticule, but rather simply ticks every 30" for referencing purposes only (some refuse to acknowledge that USNG is the way to go and lat/long may be needed if coordinating agencies don't "get it")



Similar map book page construct as shown in previous slide, but this one is using 1:24,000 USGS topographic map as the background layer (Topo's in our area have not been updated since the 1960's)





33°26'0"N
33°25'0"N

33°26'0"N
33°25'0"N

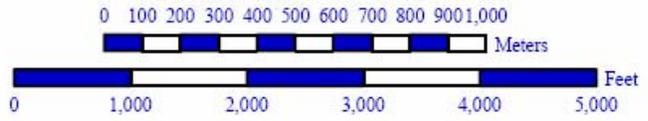
716000m E

90°40'0"W

90°39'0"W

90°38'0"W

US Nat'l Grid
Zone = 15S
100,000-m
Square ID
YT



US Nat'l Grid Page 15S YT 1600
Map Book Page 34



Why not use Lat/long, state plane, 5' grids, 2.5' grids, UTM, etc...?

✦ Latitude/longitude

- Many different position reporting formats
- Just how far is 1 minute of longitude anyway?
- Ever tried to fix a position to within 10-m using a paper map and DMS?

✦ But we have GPS!!!

- Which works great when you're not
 - In heavy weather
 - An urban environment
 - In a time of National crisis when the system gets shut off
- And is fantastic if
 - Can remember the “-” sign when plotting longitudes
 - You like to lug around batteries
 - Enjoy watching football on 13” black and white TV’s
 - Can manage not to lose it while slogging through the mud but still can afford to give one to every person involved in a rescue.

✦ **But the #1 REASON IS THAT THE US NATIONAL GRID IS A NATIONAL STANDARD!**



Federal Emergency Management Agency

Washington, D.C. 20472

APR 26 2001

Julie Binder Maitra
Standards Coordinator
US Geological Survey
590 National Center
Reston, Virginia 20192

Subject: FEMA's Recommendation on the Proposed US National Grid Standard

Dear Ms. Binder Maitra:

The Federal Emergency Management Agency (FEMA) supports the adoption of the US National Grid (USNG) as a standard for horizontal reference mapping in the United States. The FEMA program offices anticipate that use of this system for identifying locations among emergency management personnel and agencies will help save lives, reduce the costs of disaster, and enhance preparedness, response, recovery, and mitigation efforts. Particularly valuable is its compatibility with the system used by the National Guard and others, the Military Grid Reference System (MGRS). The USNG standard also appears reasonably compatible with current capabilities of the Global Positioning System (GPS), and has the potential to be quite effective as a locational tool if future GPS devices adopt the standard. FEMA recommends that the FGDC adopt the USNG system as the horizontal reference system for all general-purpose mapping.

Sincerely,

A handwritten signature in black ink, appearing to read "Michael K. Buckley". The signature is fluid and cursive, with a long, sweeping tail that loops back under the name.

Michael K. Buckley, P.E., Director
Technical Services Division
Mitigation Directorate

From: Perry, JohnJ [JohnJ.Perry@dhs.gov]

Sent: Sunday, May 07, 2006 6:17 PM

To: FEMA HSCenter; FEMA-NRCC; Gray, Richard; Pawlowski, Michel; Lokey, William; pmhr@nga.mil; Bonifas, Michelle; Michelle.D.Bonifas; Whitney, Mark; russ.johnson@esri.com; David Kehrlein; chrish@adobe.com; plee@terragotech.com; Garratt, David; Greg Turner; Reborchick GS14 Michael E; Terry GG13 Neri G; Schouviller Maj William J; Barnard, Robert; Cotter, Daniel; Eustis, Mark T; Lohuis, Kimberly; Ridley, Dave; Ingargiola, John; McAfee, Scott; Oliver, Clifford; Perry, JohnJ; Piesen, Ann; Rooney, Paul; Springett, Alan; Douglas, Drew; Henriques, William D; Oporto, Frank; Reff, Barry; Valdivia, Freddy; Weiner-Leandro, Leslie; Workman, Joseph; Algeo, Laura; Berry, Glenn; Changa, Frank; Lawson, David; Longenecker, Herbert; Rory Sutton; Spoelman, Seth; Weschler, Paul; Anderson, Jeff; Andy Damalas; Atkins, Gary; Bishop, Sally; Bumby, Ginger; Bushnell, Jon; Cacanindin, Vince; Campos, Eva; Carol Perry; Cheshier, Ruth; Christina Finch; Coons, Albert; Darby, David H; Delmedico, Nicholas; Donna Glover; Emrich, Christopher; Ewing, Melvin; Finch, Christina; Frank Changa; Franke, Bob; Franke, Pam; Freddy Valdivia; Gene Maak; Glover, Donna; Gustafson, Lynn; Gustafson, Lynn C.; Kelly, David; Maak, Gene; Martinson, Eric; Mary Meade; MD; Meade, Mary; Montgomery, Michael; Nick Delmedico; Philip Ulbrich; Price, Mark; Rusti Liner; Steve Colman; Toland, Joseph; Ulbrich, Phillip; Valerie Anderson; Wilson, Philip D; Frasher, Jessyca; Iandoli, Joseph; Jordon, Jo; Klugow, Richard; Langhelm, Ron; Lundy, William; McLane, Lauren; Rourke, Erik; Storey, Rebecca; Whitmer, Douglas; Hernandez, Alex; amaroluisnamaro@yahoo.com; Matos, Antonio; dylia.ocio@hotmai.com; edi.rosas@usace.army.mil; hector.a.gonzalez@dhs.gov; jaime.cruz@usace.army.mil; Ayala, Jose; Quinones, Jose; Brooks, Lathette; Gumbs, Leonard; lhermand@ogp.gobieron.pr; Lopez Jimenez, Jorge; marcial.garay@saj02.usace.army.mil; mcruz@cdc.gov; Bryce, Michael; miguel.cordero@med.va.gov; ninoprusar@yahoo.com; omayra.valencia@saj02.usace.army.mil; oneill.carlos@epa.gov; Olivera, Orlando; Alonso, Ricardo; Pinheiro, Ronald; rosin3@hotmail.com; stanley.brown@gsa.gov; yaquino@gemead.gobierno.pr; zona5@coqui.net; breauxp@wwdb.org; Bruce Davis; clark_ja@bellsouth.net; Bausch, Douglas; Berman, Eric; Bob Pierce; Crowell, Mark; Damalas, Andreas; Dan Cotter; dnash@oem.nyc.gov; Dudley, Erin; Ed Kramer; EST-ESF05PLNC; Hicks, Charles; John Evers; Mark Eustis; Mooney, Patrick; Luttrell Stephen Ctr AF/ILEI; Clark, Debra; Clark, Marsha; George, Denise; Glover, Muriel; Gray, Richard; Green, Matthew; Kyle, Sheila; Mann, Pleasant; Price, Bruce; Tinker, Rick
Subject: USNG requirement

ALCON

I want to remind everyone of the importance of promoting the use of the U.S. National Grid (USNG) among our Federal, State and local partners; specifically, its importance for disaster preparedness, response, and recovery applications.-

1.. The US National Grid has been the Federal standard since its adoption by the Federal Geographic Data Committee (FGDC) <http://www.fgdc.gov/usng/index.html> in February

of 2001 http://www.fgdc.gov/standards/projects/FGDC-standards-projects/usng/fgdc_std_011_2001_usng.pdf.

2.. In 2005, the Department of Homeland Security (DHS) recommended that any DHS grant submission reference the use of a nationally defined coordinate system for all spatial referencing, mapping, and reporting.

3.. In the Senate report released April 27, 2006 on Katrina (<http://hsgac.senate.gov/index.cfm?Fuseaction=Links.Katrina>), under Recommendations, page 22, Recommendation 50, it states in part, "The plan should also provide for a unified communications network, a common grid reference system, and ..."

4. The US National Map uses the National Grid
<http://nmviewogc.cr.usgs.gov/viewer.htm>

5. Review a myriad of other reasons and quotes (Hurricane Katrina) etc regarding the USNG from the following URL:
<http://www.emergencymanagement.org/>

I've just uploaded an outreach tutorial / sample CD provide by Tom Terry which contains the following:

- 1.. Functional Requirements for the US National Grid (USNG) Implementation in GIS Software;
- 2.. A "Read First" directory including a Teaching Kit with instructions and illustrative files;
- 3.. Additional material including presentations from past conferences, articles, policy letters and instructions on adding grids and graticules in ESRI software.
4. Examples of maps in a format called GeoPDF with the USNG.

(A company named TerraGo <http://www.terragotech.com> wrote a program called "MAP2PDF" which

produces a portable mapping format called GeoPDFs. Anyone with their free plug-in and Adobe Acrobat

Reader can view maps, turn layers on and off, query attributes, display coordinates and the grid)

The CD consists of 14 directories with 126 files totaling 287 Mb. It's located on:

1. Internal HQ FTP <ftp://166.112.193.65/> Perry/US_National_Grid/

2. External HQ FPT <ftp:gismaps.fema.gov> /jperry/US_National_Grid
-
3. TI line to Bethesda
DRT_IN\Perry_John\USNG
4. HSIN / EM portal [https://eoc.jries.dhs.gov/](https://eoc.jries.dhs.gov/Documents/US_National_Grid)
[Documents/US_National_Grid](https://eoc.jries.dhs.gov/Documents/US_National_Grid)

Please contact me if you do not have access to any of these four sites.

All future map products should include the USNG and saved as a GeoPDF.

Thank you.

JP

John J. Perry

GIS / Remote Sensing Coordinator
FEMA HQ / Response Division / 202G
Department of Homeland Security
500 C St., SW
Washington, DC 20472
johnj.perry@dhs.gov
1072690@skytel.com
office: 202.646.2817
cell: 202.360.6642
stu III: 202.646.3562
fax: 202-646-2901
class. fax: 202-646-2516
pager: 800-759-8888
pin#: 1072690

From: Charlie Challstrom [mailto:Charlie.Challstrom@noaa.gov]

Sent: Friday, July 26, 2002 11:09 AM

Subject: NGS Policy on U.S. National Grid

The following is National Geodetic Survey Policy --

The National Geodetic Survey, NOAA, supports the adoption of the U.S. National Grid (USNG). It is a Federal Geographic Data Committee standard (FGDC-STD-011-2001) developed to improve public safety, commerce, as well as to aid the GPS end-user. We are proud to have supported this endeavor, and continue to support it in our products and services. For example, our Geodetic Tool Kit at:

<http://www.ngs.noaa.gov/TOOLS/>

has an entry "U.S. National Grid":

<http://www.ngs.noaa.gov/TOOLS/usng.html>

that provides interactive conversions and authoritative software for USNG conversions.

In addition, we plan to have a USNG option for data sheet retrieval through our interactive, map interface ("Go To ..." option) at:

http://www.ngs.noaa.gov/newsys_ims/NgsMap2/viewer.htm

and will be adding USNG outputs to our data sheets and to our OPUS output.

NGS notes that a grid is not identical to a curvilinear coordinate system. Rather, a grid system can complement the underlying system of latitude and longitude. NGS also notes that the USNG can be expressed with a least count of 1 meter. Section 1.3 "Applicability" of the USNG standard (FGDC-STD-011-2001) contains important information on USNG application. And, to place usage of the USNG in perspective, unaugmented GPS point positioning can deliver about 5-6 meter accuracy, and augmented GPS pseudorange positioning down to about 1 meter accuracy.

For questions on NGS support of the USNG, please contact:

Dr. Dennis G. Milbert

Chief Geodesist

NOAA, National Geodetic Survey, N/NGS

1315 East-West Hwy., SSMC3, Room 8635

Silver Spring, MD 20910-3282

phone: 301-713-3222 x144

fax: 301-713-4315

internet: Dennis.Milbert@noaa.gov

-Signed --

Charles W. Challstrom

Director, NGS, NOAA

MEMORANDUM

September 23, 2003

To: Geography Senior Staff

From: Barbara J. Ryan /s/ *Barbara J. Ryan*
Associate Director for Geography

Subject: Support and Promotion of the U.S. National Grid

I want to remind everyone of the importance of promoting the use of the U.S. National Grid (USNG) among our Federal, State, and local partners, particularly its importance for disaster readiness, response, and recovery applications.

The Federal Geographic Data Committee (FGDC) adopted the USNG as a National Spatial Data Infrastructure (NSDI) standard in December 2001 as FGDC-STD-011-2001. That same month, John Marburger, the Director of the Office of Science and Technology Policy, identified the implementation of the USNG as one of the three most important immediate steps that the Government could take to improve homeland security. In June 2002, we revised the technical specifications for our primary series maps to make the USNG our primary grid. It is also our policy to implement NSDI standards in *The National Map*. Pursuant to that policy we have implemented some initial support for the grid in *The National Map* viewer. We have also entered into a verbal agreement with the National Geodetic Survey to promote the implementation of the USNG especially among State and local agencies.

Like all standards, the USNG will be truly effective only if widely implemented. Support for the grid in *The National Map* is an important early step, but it is only one. Public education and promotion are equally important. So I am asking that the regions take steps to assure that support for the USNG is included when presenting information about *The National Map*. Regional and local conferences are key opportunities to promote the USNG, especially when we are discussing the importance of *The National Map* for emergency response applications. I am also asking that we look for ways to include information about the USNG in the educational materials we provide to the public.

Thank you for your continued support with this very important aspect of *The National Map*.

Training objectives

- ✦ Understand the needs of emergency responders and decision makers and how they operate when activated
- ✦ Understand projections and coordinate systems within the ArcGIS software environment
- ✦ Understand the US National Grid as demonstrated by an ability to:
 - Navigate using a map, compass, and map protractor with a USNG overlay
 - Be able to construct a map with a USNG overlay using ArcGIS
 - Be able to plot data using USNG
 - Create advanced mapping products (*eg.*, map books, zone junction maps, etc...) using the USNG