OPUS Overview and Updates

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What is OPUS

OPUS, the **On-line Positioning User Service**, is a growing set of applications offering web-based access to the tools and resources provided by the NGS.

- OPUS-S . . . . . static processing
- OPUS-DB. . . . . data base and publishing
- OPUS Projects… manage and process networks

Reviewing each of these individually…

Overview

- Online Positioning User Service (OPUS) to:
  - Provide access to the US National Spatial Reference System (NSRS).
  - Provide accurate, reliable and consistent geodetic coordinates.
  - Provide coordinate accuracies to within a centimeter.
  - Provide GPS solutions in a timely fashion.

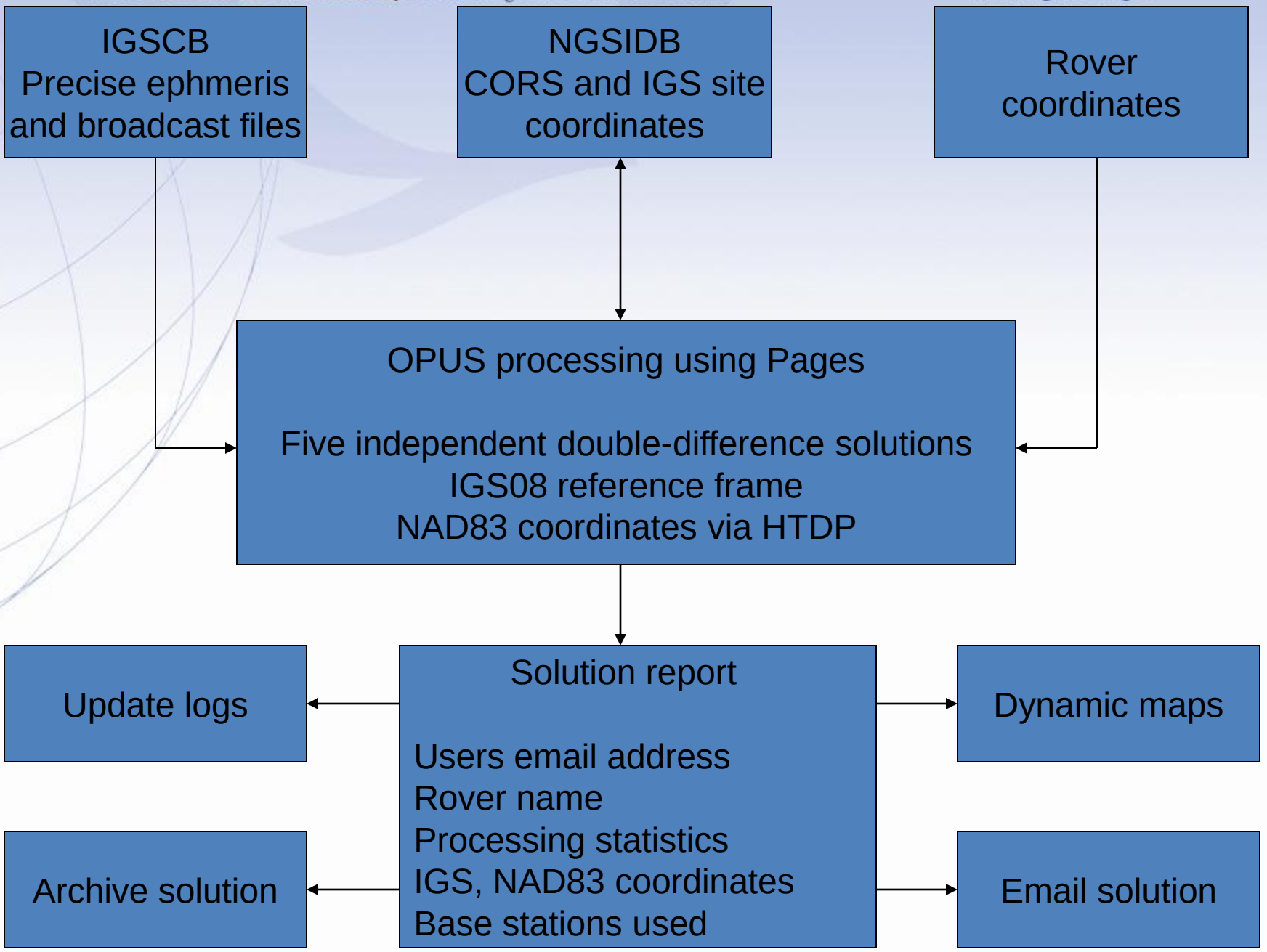
OPUS-S Concepts

- Compute rover (user's receiver) location.
- Retrieve ancillary information.
  - Broadcast and precise ephemeris files from IGS Central Bureau.
  - CORS and IGS site coordinates from NGSIDB.

- Performs five independent double-difference solutions in the IGS08 reference frame.
- Compare and average the best three sets of results.

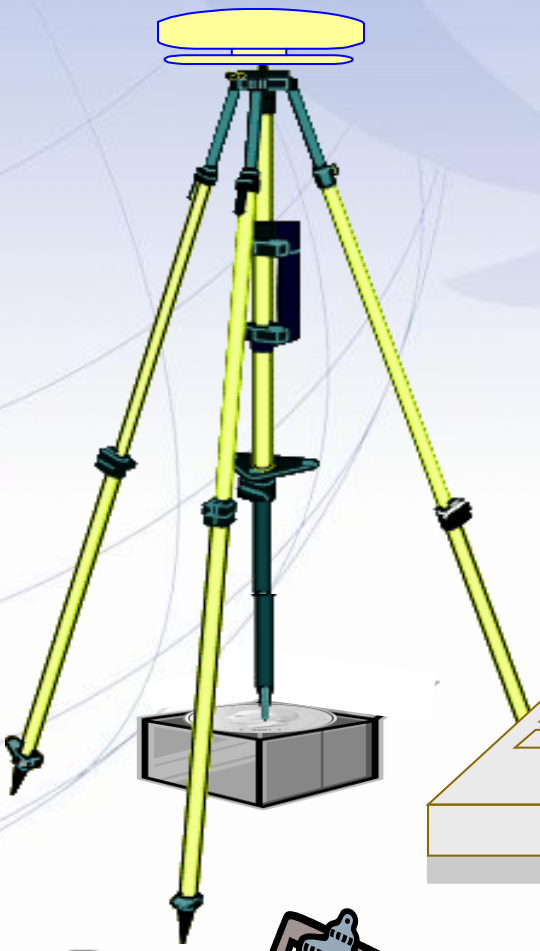
OPUS-S Concepts

- Generate NAD83 coordinates using HTDP3.2
- Email solution to the user.
- Archive solution, update logs and plot rover position on dynamically generated maps.


IGSCB
Precise ephmeris and broadcast files
NGSIDB
CORS and IGS site coordinates
Rover coordinates
OPUS processing using Pages
Five independent double-difference solutions
IGS08 reference frame
NAD83 coordinates via HTDP
Update logs
Solution report
Users email address
Rover name
Processing statistics
IGS, NAD83 coordinates
Base stations used
Dynamic maps
Archive solution
Email solution

OPUS Coordinates

- IGS08 coordinates - at day of observation.
- NAD83 (2011) coordinates – epoch Jan 1, 2010
- UTM coordinates with appropriate zone.
- SPC - State plane coordinates.
- Orthometric heights – Geoid12A.



Online Positioning User Service

OPUS-DB

geodesy.noaa.gov/OPUS/

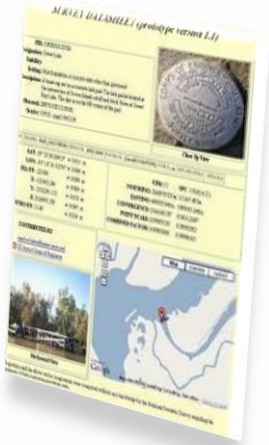
JGE 2011v1

Geodetic Standard Data

- IGS & NGS base stations & site information files
- IGS antenna calibrations & satellite orbits & reference frames
- UNAVCO's teqc converter
- PAGES baseline processor
- Geophysical models
- NGS geodetic toolkit

Mark Description

Options:
Projects & Publishing



Publishing OPUS Solutions

Upload to OPUS using options > publish

- 4+ hour GPS data file
  - Verify antenna type, height, and plumb, fixed height tripod recommended

- Permanent mark of public interest
  - Durable, stable setting with good satellite visibility
  - Description & photos to aid future recovery

- High-quality OPUS-S solution
  - ≥ 70% observations used
  - ≥ 70% ambiguities fixed
  - ≤ 3 cm RMS
  - ≤ 4 cm peak-to-peaks, lat. & lon.
  - ≤ 8 cm peak-to-peak, ellipsoid height

OPUS-DB Publishing vs Bluebooking

- Benefits
  - Fast, cheap, easy
  - Homogeneous, consistent, reliable
  - Maintained from RINEX data; can re-process

- Limitations
  - GPS data only
  - Tied to NSRS via CORS
  - No redundancy
  - Reduced oversight
  - Field logs not archived

PID: BBCD57
Designation: FOUR CORNERS 2010
Stamping: COLORADO UTAH ARIZONA NEW MEXICO 1992
Stability: Monument will probably hold position well
Setting: Mat foundation or concrete slab other than pavement
Description: THE STATION IS THE CENTER OF AN 8-INCH DIAMETER BRASS USDOI/BLM DISK MARKING THE POINT COMMON TO COLORADO, UTAH, ARIZONA, AND NEW MEXICO. IT IS LOCATED AT THE NAVAJO NATION'S FOUR CORNERS MONUMENT, MANAGED BY THE NAVAJO PARKS AND RECREATION DEPARTMENT, TEL: 928-871-6647. THE FOUR CORNERS MONUMENT INSTALLED IN 1992 (NGS PID: AD9256, NOW CONSIDERED DESTROYED) WAS REMOVED AND THE DISK RESET IN 2010 DURING RECONSTRUCTION OF THE MONUMENT AND VISITOR PLAZA. THE DISK WILL EVENTUALLY BE STAMPED "2010."
Observed: 2010-07-07T22:39:00Z
Source: OPUS - page5 1009.28

Close-up View

REF_FRAME: (CORS96)	EPOCH:	SOURCE:	UNITS:	SET PROFILE	DETAILS
NAD_83	2002.0000	NAVD88 (Computed using GEOID09)	m		

LAT:	36° 59' 56.31568"	± 0.027 m
LON:	-109° 2' 42.62051"	± 0.011 m
ELL HT:	1460.802	± 0.003 m
X:	-1664599.638	± 0.015 m
Y:	-4821995.076	± 0.009 m
Z:	3818181.565	± 0.023 m
ORTHO HT:	1481.544	± 0.016 m

	UTM 12	SPC 3003(NM W)
NORTHING:	4096544.982m	666054.142m
EASTING:	673944.597m	722137.487m
CONVERGENCE:	1.17671173°	-0.72935591°
POINT SCALE:	0.99997275	1.00005994
COMBINED FACTOR:	0.99974356	0.99983074

CONTRIBUTED BY

william.stone
National Geodetic Survey

Horizon View

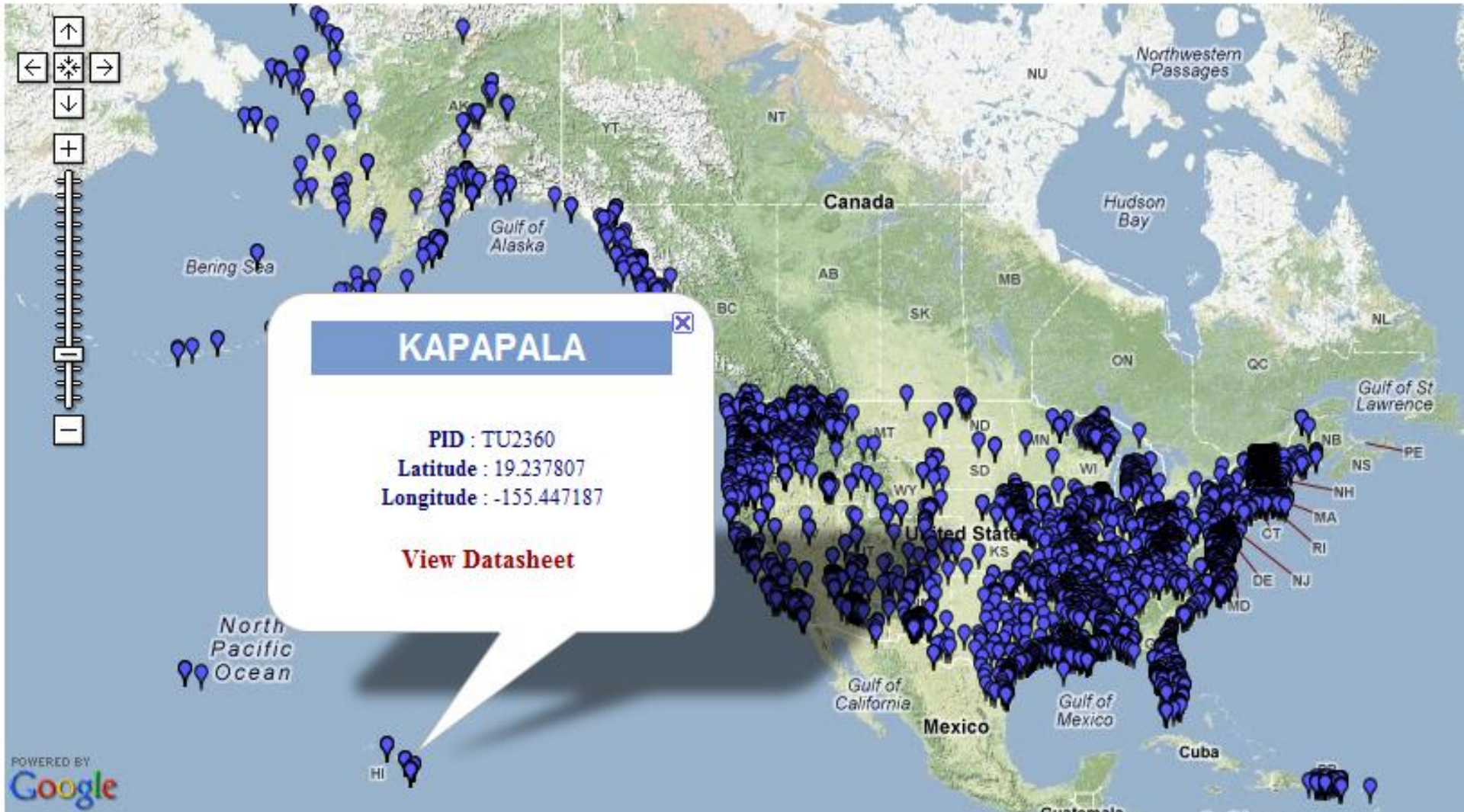
www.ngs.noaa.gov

Publishing Criteria:

- NGS-calibrated GPS antenna
- > 4 hour data span
- > 70% observations used
- > 70% fixed ambiguities
- < 0.04m H peak-to-peak
- < 0.08m V peak-to-peak

OPUS-DB - Published Solutions

Browse map to locate and access datasheets



OPUS Projects

- A Little OPUS-Projects History.
- What Is OPUS-Projects?
- The OPUS-Projects Interface.
- How Good Can I Do With OPUS-Projects?

OPUS Projects - History

The success of OPUS clearly demonstrated the value of web-based tools for some activities. This begged the question, could a web-based utility be made for a more complex task such as an airport or height modernization survey?

In these cases, one or more survey crews would be occupying one or more marks over several hours or days in a manner consistent with predefined project specifications.

OPUS Projects - History

The "wish list" for such a web-based utility included:

- Visualize and organize multiple, related data submissions.

- Process all or subsets of the data according to user specifications.

- Offer the results in useful forms and formats.

- Do all this as simply as possible.

OPUS Projects - History

But do we *really* need another OPUS flavor?

The practical answer is probably yes.

The NGS and other groups have a history of project's whose specifications can't be entirely supported by OPUS.

The academic answer is probably yes.

As good as OPUS does, and that is very good, sacrificing simplicity for flexibility can improve results - at least in some cases.

What Is OPUS Projects

OPUS-Projects gives users web-based access to simple visualization, management and processing tools for multiple sites and multiple occupations.

These tools include:

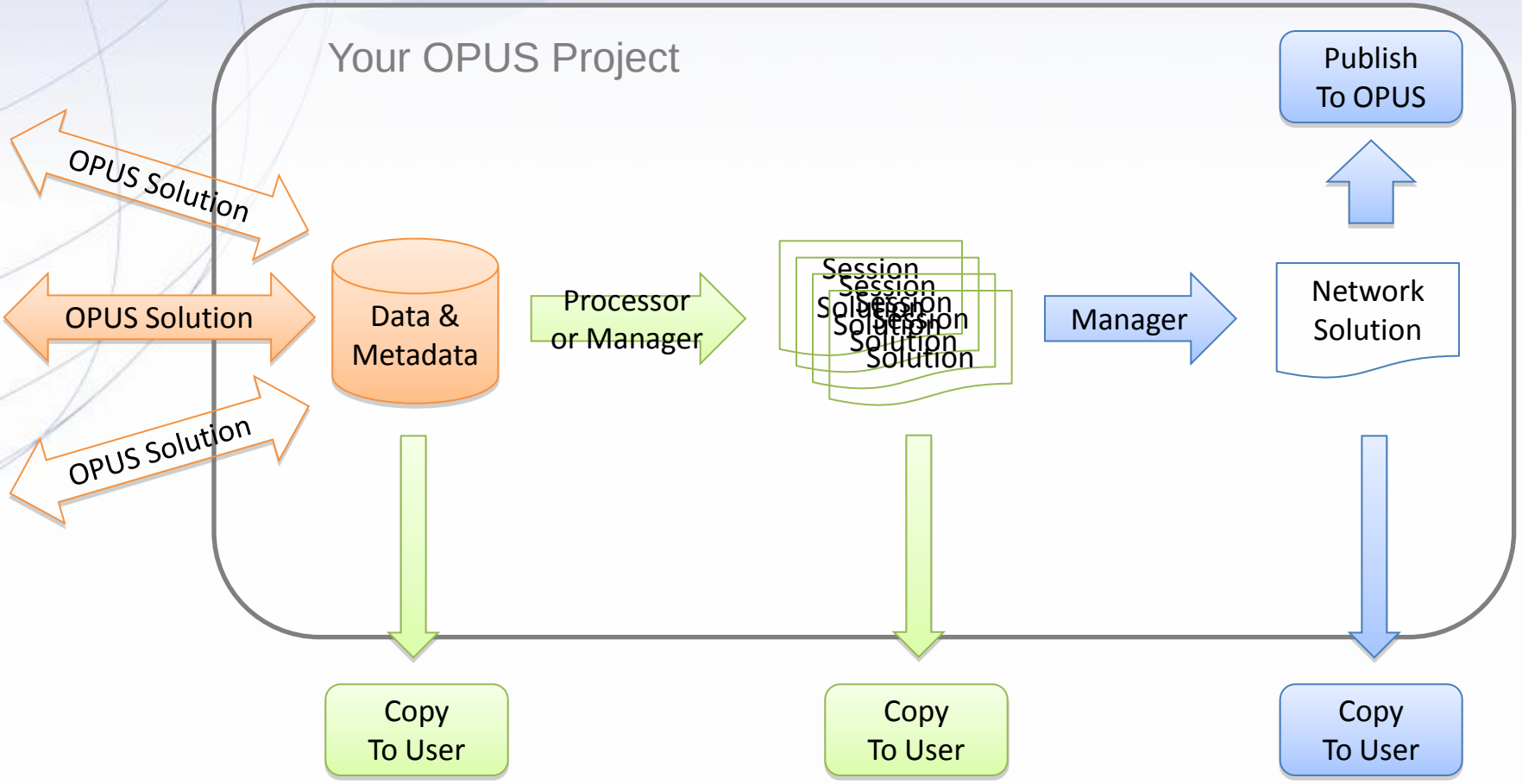
- The advantages of data uploading through OPUS.
- Data visualization and management aids.
- Enhanced data processing using the PAGES suite.
- Solution visualization aids.
- Seamless connectivity with other OPUS tools.

What Is OPUS Projects

OPUS-Projects exists in a hierarchical structure

1. Create . . . . . creates a project.
2. Upload . . . . . data submission.
3. Session . . . . . session review & processing.
4. Manage . . . . . network adjustments.
5. OPUS-Projects czar for general support.

What Is OPUS Projects



OPUS Projects Interface

It's probably easier to show the interface than describe it, so let's walk through some of the basic steps in creating and reviewing a project.

Please be aware …

OPUS-Projects is actively being developed. The information shown here reflects many, but not all of the recent and pending changes.

OPUS: Online Positioning User Service

National Geodetic Survey

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OPUS Projects
View Published Solutions

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Upload your Data File

Tie your GPS observation to the National Spatial Reference System.
[what is OPUS?] [FAQs]

* **Email address** - your solution will be sent here.

Browse...

* **Data file** of dual-frequency GPS observations. [sample]

Antenna type - choosing wrong may degrade your accuracy.

0.0 meters above your mark.
Antenna height of your Antenna's Reference Point.

Options to **customize** your solution.

Upload to RAPID-STATIC
for data > 15 min. < 2 hrs.

Upload to STATIC
for data > 2 hrs. < 48 hrs.

process your solution.

Sample Solutions

- * required fields
- We may use your data for internal evaluations of OPUS use, accuracy, or related research.

OPUS Projects

National Geodetic Survey

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OPUS Projects gives users web-based access to simple management and processing tools for projects involving multiple sites and multiple occupations. The advantages of OPUS Projects are:

- Data uploading through OPUS.
- Customizable data processing via the PAGES software suite.
- Visualization and management aids.

Create a new project.

Create **RESTRICTED** to trained project managers. If you have completed OPUS Projects training, you are registered and may create a new project. All others, see the **Training Schedule**.

Configure, edit, and process individual network sessions.

Session **Project Identifier**:

Session Keyword:

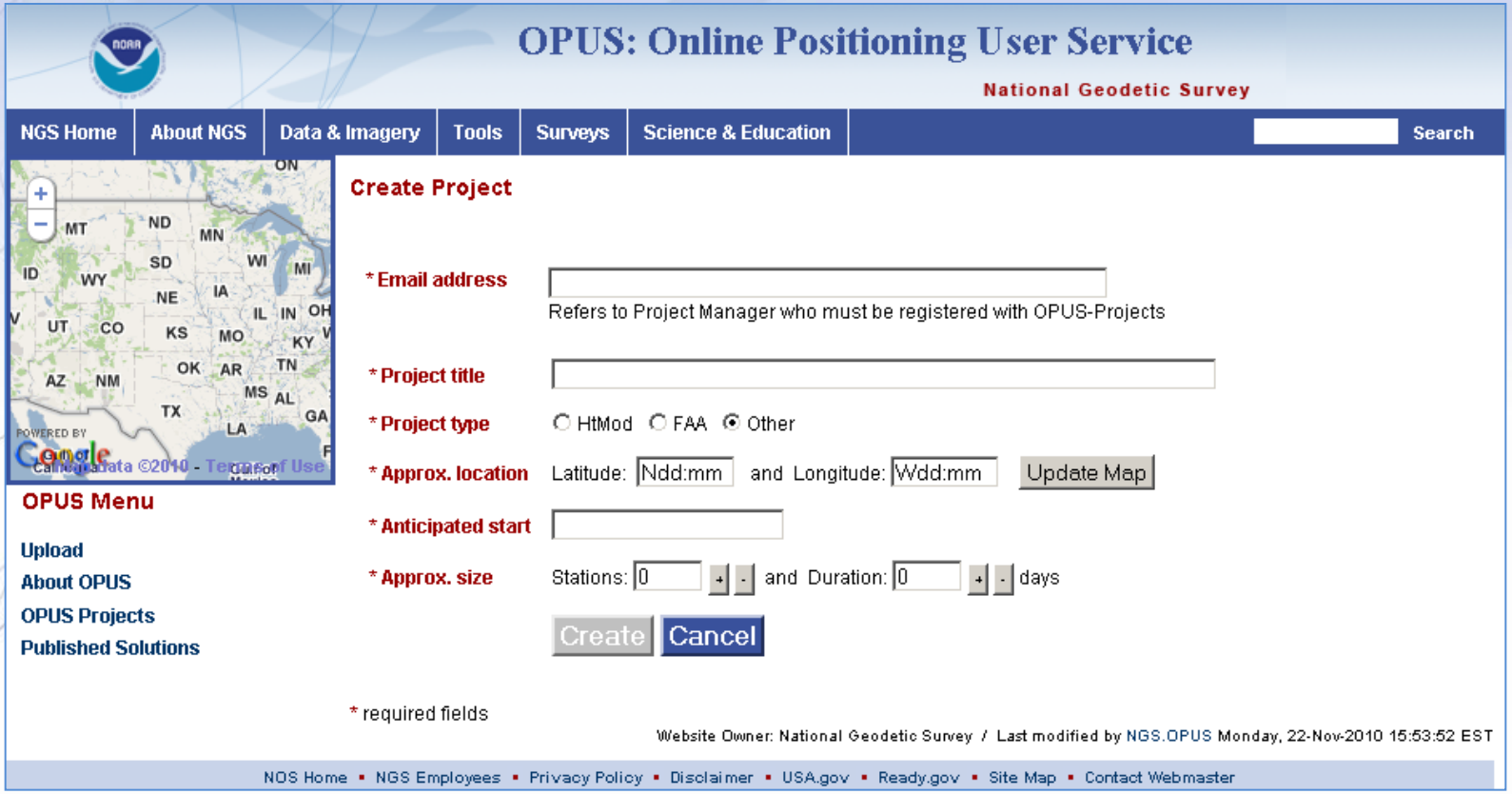
Your Email:

Manage, edit, process, and publish the project.

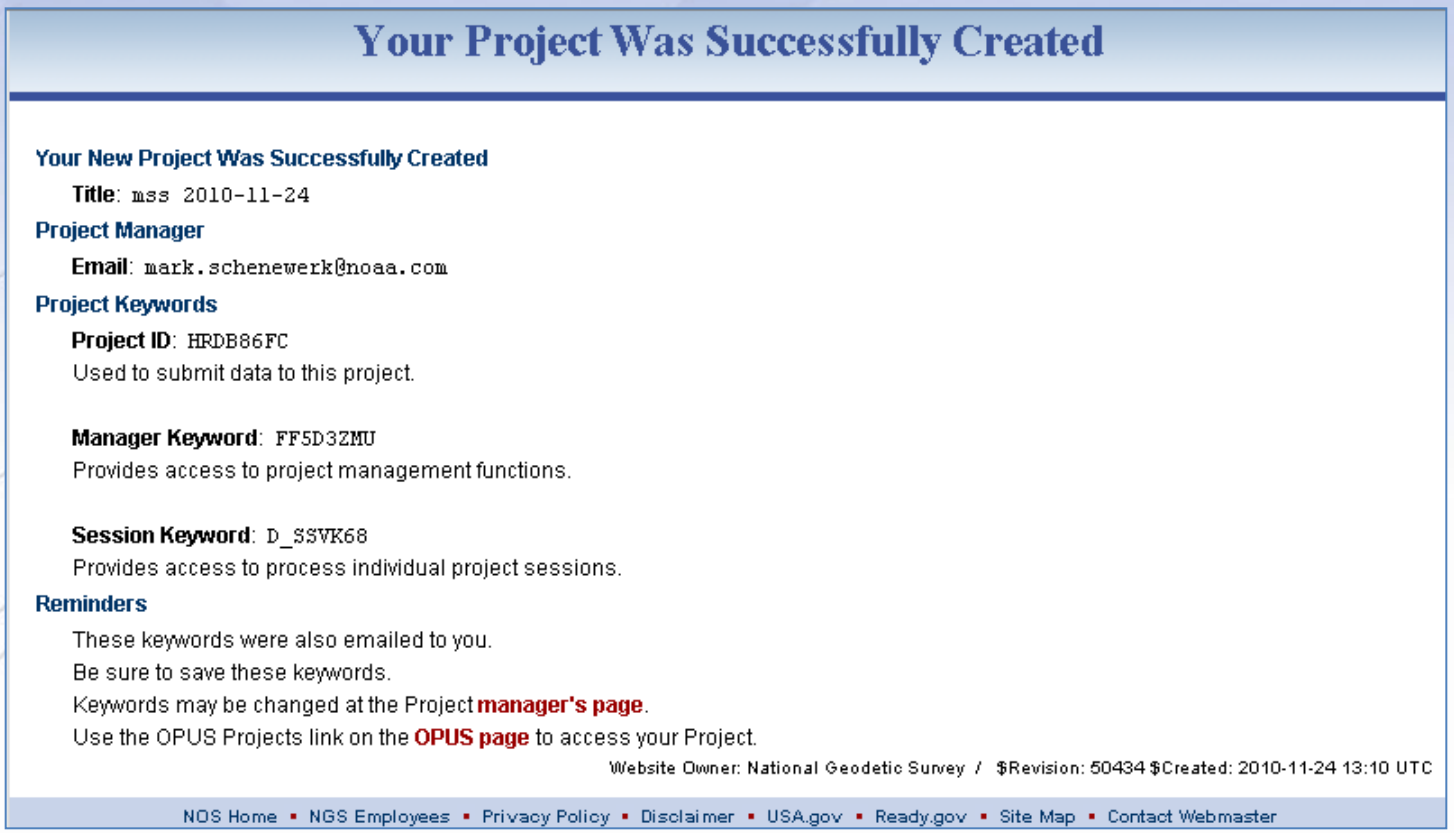
Manage **Project Identifier**:

Manager Keyword:

Website Owner: National Geodetic Survey / Last modified by the OPUS Projects Team



You'll be taken to the project creation and registration page where you'll enter your email, a title for, the type of, the approximate location of, start date for and size of your project.



Your Project Was Successfully Created

Your New Project Was Successfully Created

Title: mss 2010-11-24

Project Manager

Email: mark.schenewerk@noaa.com

Project Keywords

Project ID: HRDB86FC

Used to submit data to this project.

Manager Keyword: FF5D3ZMU

Provides access to project management functions.

Session Keyword: D_SSVK68

Provides access to process individual project sessions.

Reminders

These keywords were also emailed to you.

Be sure to save these keywords.

Keywords may be changed at the Project **manager's page**.

Use the OPUS Projects link on the **OPUS page** to access your Project.

Website Owner: National Geodetic Survey / $Revision: 50434 $Created: 2010-11-24 13:10 UTC

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After a moment, the introduction to your newly created project is displayed. You'll also receive an email with this information.

Uploading Data to a Project

The second step is to "Upload" data files to your project.

At this time, this is done through OPUS-S implying the same restrictions:

- Your data must be dual frequency pseudorange and phase P1 (or C1), P2, L1 and L2.
- A minimum 2-hours data span for each submission.
- A collection rate of 1, 2, 3, 5, 10, 15 or 30 seconds.

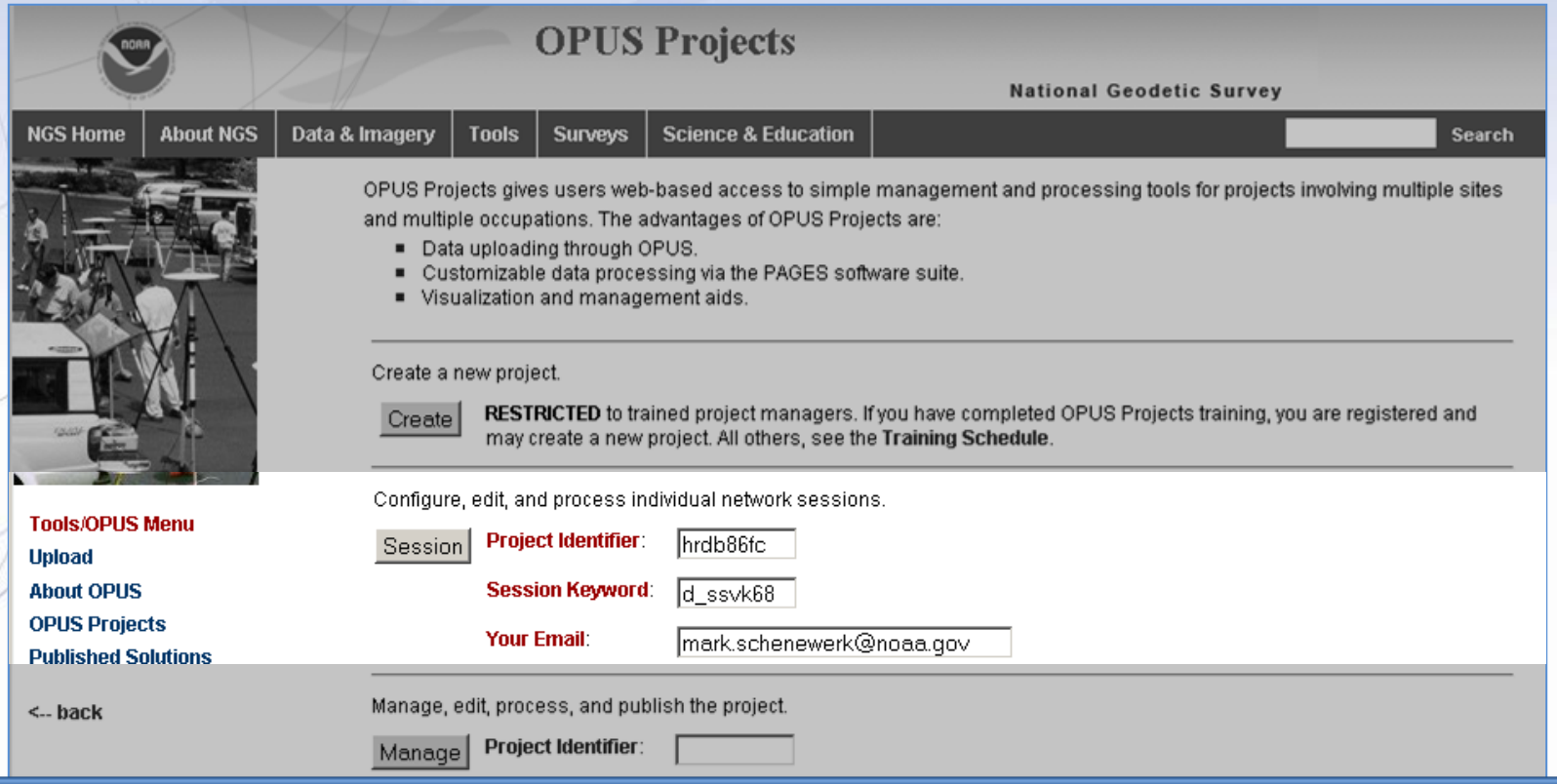
View and Process a Session

OPUS-Projects groups the data into *sessions*.

Sessions are groups of site occupations that overlap significantly in time. Note that

- a site may appear in more than one session.
- as new data are submitted, the definitions of the sessions may change.

Now that some data has been submitted to the project, processing can begin.



This time we'll enter through the Session login on the OPUS-Projects gateway page.

OPUS Projects BETA - "Training data set 1"

National Geodetic Survey

NGS Home | About NGS | Data & Imagery | Tools | Surveys | Science & Education | Search

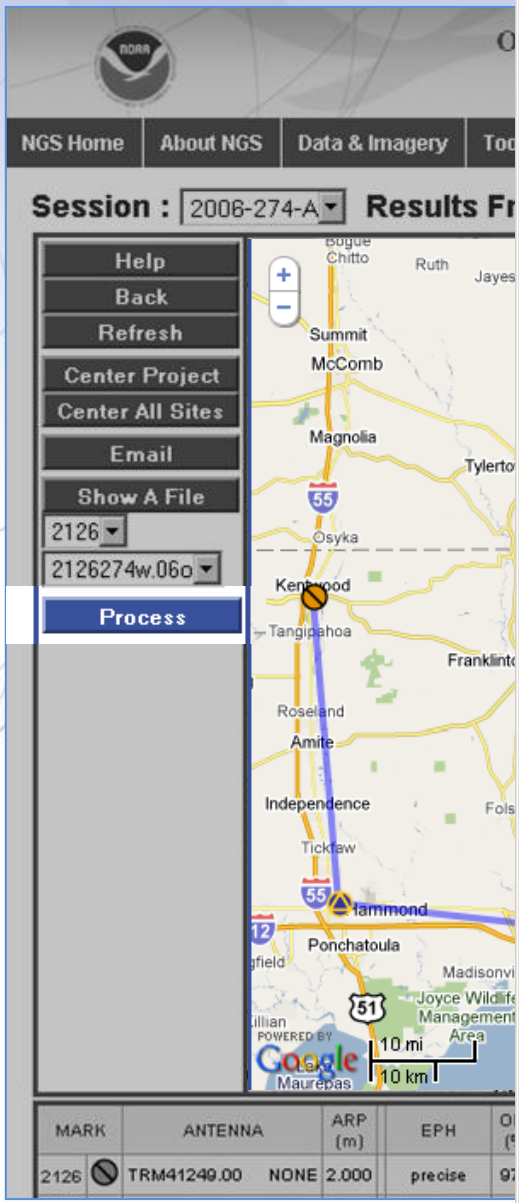
Session : 2006-274-A **Results From :** OPUS

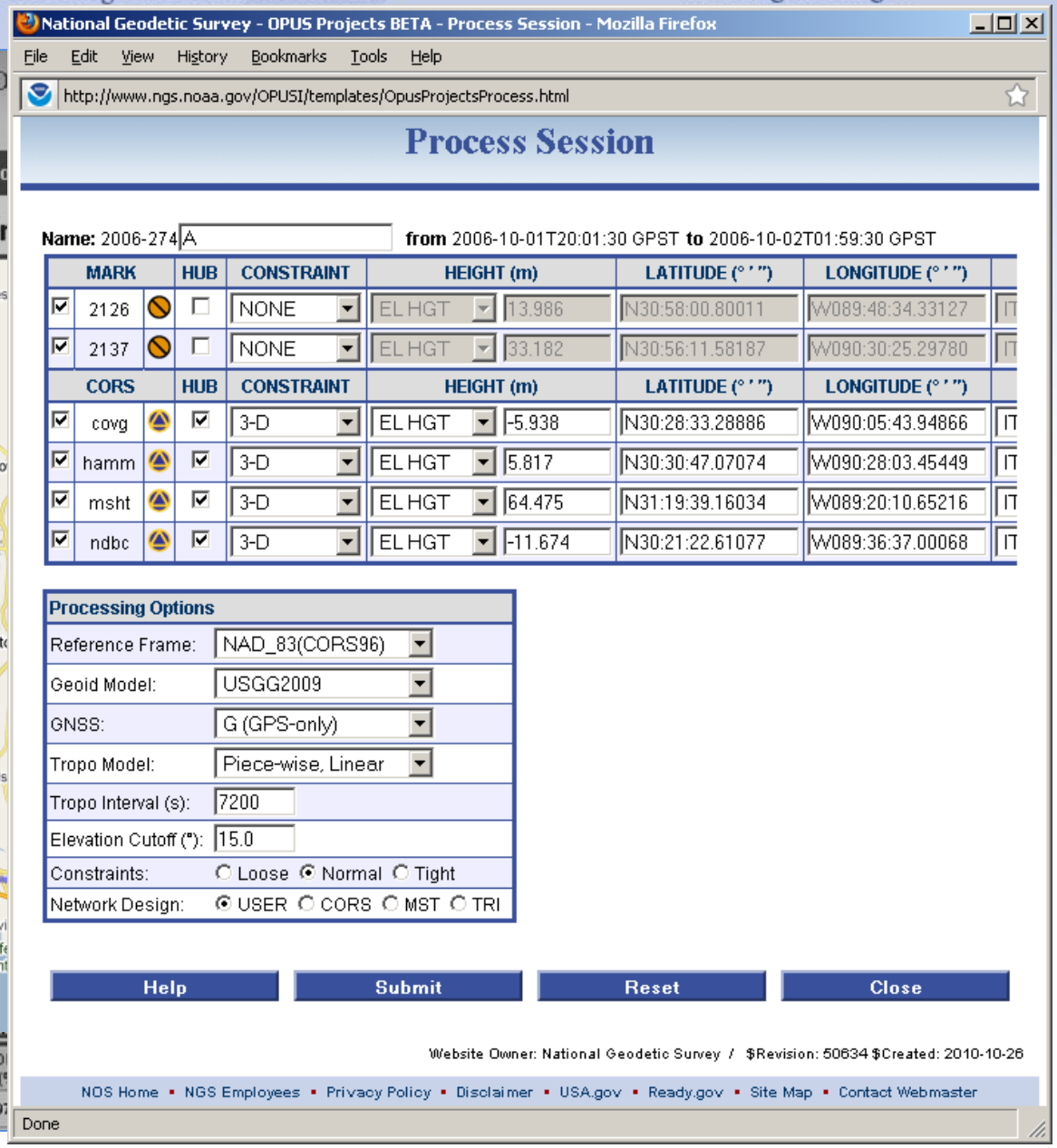
Help
Back
Refresh
Center Project
Center All Sites
Email
Show A File
2126
2126274w.06o
Process

MARK
2126
2137

CORS
covg
hamm
msht
ndbc

MARK	ANTENNA	ARP (m)	EPH	OBS (%)	FIXED (%)	RMS (m)	LAT (m)	LON (m)	HGT (m)	UPLOADED (UTC)	OBSERVER
2126	TRM41249.00 NONE	2.000	precise	97.7	69.0	0.013	0.015	0.024	0.104	2010-10-14T14:48	Mark.Schenewerk


NGS Home
About NGS
Data & Imagery
Session : 2006-274-A
Results Fr
Help
Back
Refresh
Center Project
Center All Sites
Email
Show A File
2126
2126274w.06o
Process
Summit
McComb
Magnolia
Osyka
Tangipahoa
Roseland
Amite
Independence
Tickfaw
Hammond
Ponchatoula
Madisonvi
Joyce Wildlife Management Area
10 mi
10 km
Google
MARK
ANTENNA
ARP (m)
EPH
2126
TRM41249.00
NONE
2.000
precise


National Geodetic Survey - OPUS Projects BETA - Process Session - Mozilla Firefox
File Edit View History Bookmarks Tools Help
http://www.ngs.noaa.gov/OPUSI/templates/OpusProjectsProcess.html
Process Session
Name: 2006-274A from 2006-10-01T20:01:30 GPST to 2006-10-02T01:59:30 GPST
MARK HUB CONSTRAINT HEIGHT (m) LATITUDE (° ' ") LONGITUDE (° ' ")
2126 NONE EL HGT 13.986 N30:58:00.80011 W089:48:34.33127
2137 NONE EL HGT 33.182 N30:56:11.58187 W090:30:25.29780
CORS HUB CONSTRAINT HEIGHT (m) LATITUDE (° ' ") LONGITUDE (° ' ")
covg 3-D EL HGT -5.938 N30:28:33.28886 W090:05:43.94866
hamm 3-D EL HGT 5.817 N30:30:47.07074 W090:28:03.45449
msht 3-D EL HGT 64.475 N31:19:39.16034 W089:20:10.65216
ndbc 3-D EL HGT -11.674 N30:21:22.61077 W089:36:37.00068
Processing Options
Reference Frame: NAD_83(CORS96)
Geoid Model: USGG2009
GNSS: G (GPS-only)
Tropo Model: Piece-wise, Linear
Tropo Interval (s): 7200
Elevation Cutoff (°): 15.0
Constraints: Loose Normal Tight
Network Design: USER CORS MST TRI
Help Submit Reset Close
Website Owner: National Geodetic Survey / $Revision: 50634 $Created: 2010-10-26
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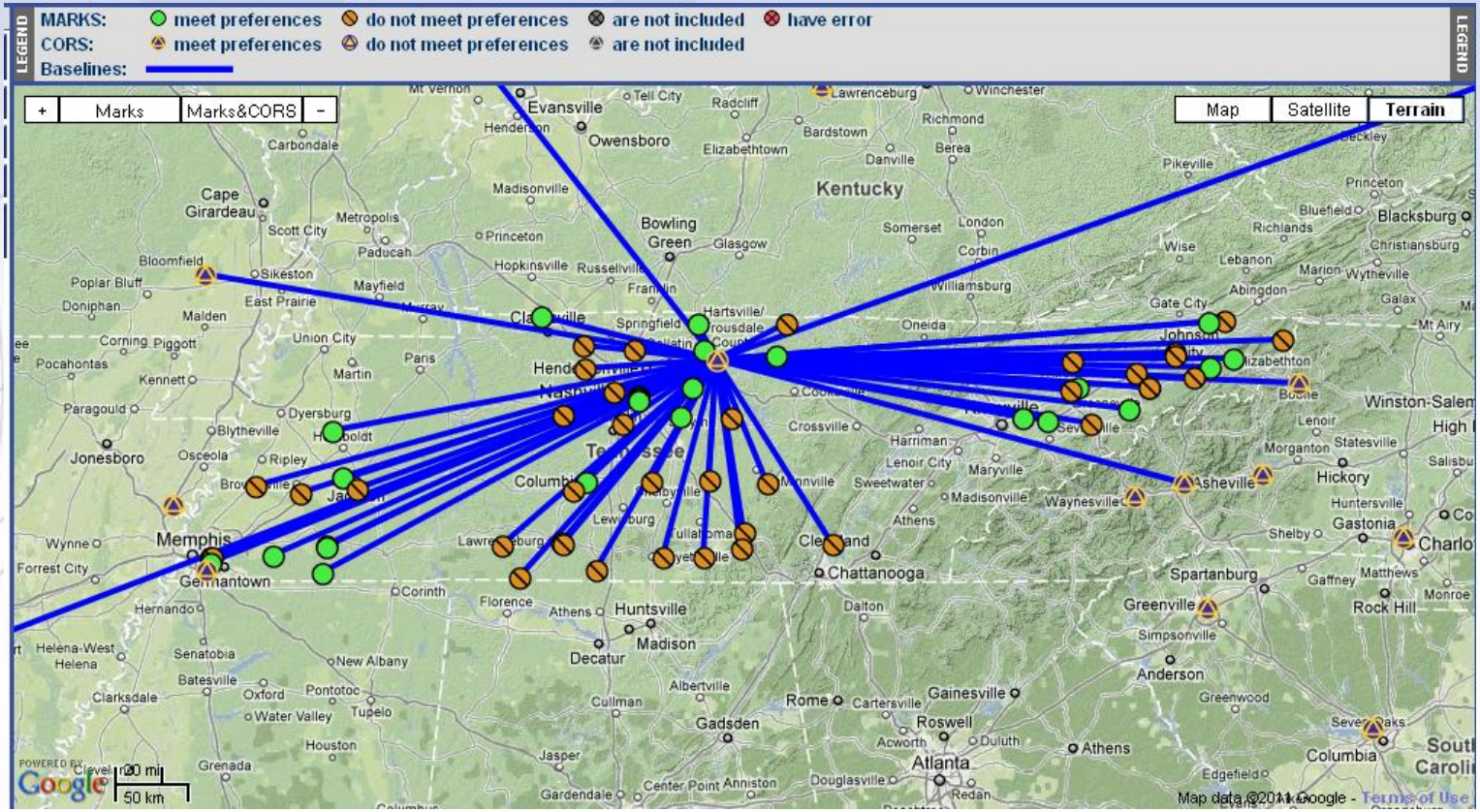
Done

Processing Strategy


LEGEND
MARKS: meet preferences do not meet preferences are not included have error
CORS: meet preferences do not meet preferences are not included
Baselines:
LEGEND
+ Marks Marks&CORS -
Map Satellite Terrain
Kentucky
Memphis
Germantown
Chattanooga
Huntsville
Madison
Decatur
Atlanta
Asheville
Greenville
Spartanburg
Anderson
Columbia
Gainesville
Rome
Gadsden
Jonesboro
Paducah
Bowling Green
Owensboro
Evansville
Nashville
Knoxville
Winston-Salem
Charlotte
Rock Hill
Columbus
Tupelo
Corinth
Florence
Dalton
Athens
Douglasville
Gardendale
Center Point
Anniston
Cullman
Albertville
Jasper
Houston
Grenada
Oxford
Batesville
Clarksdale
Helena-West Helena
Senatobia
New Albany
Pontotoc
Water Valley
Hernando
Forrest City
Wynne
Blytheville
Osceola
Ripley
Dyersburg
Paragould
Kennett
Pocahontas
Corning
Piggott
Poplar Bluff
Doniphan
Malden
Bloomfield
Sikeston
East Prairie
Mayfield
Union City
Martin
Paris
Scott City
Metropolis
Carbondale
Cape Girardeau
Madisonville
Hopkinsville
Russellville
Glasgow
Somerset
London
Corbin
Williamsburg
Harriman
Crossville
Lenoir City
Maryville
Sweetwater
Madisonville
Waynesville
Hickory
Morganton
Statesville
Lenoir
Boone
Gastonia
Shelby
Gaffney
Matthews
Monroe
Simpsonville
Greenwood
Seneca
Roswell
Acworth
Duluth
Cartersville
Calhoun
Dalton
Lawrenceburg
Winchester
Richmond
Berea
Danville
Elizabethtown
Bardstown
Radcliff
Tell City
Mt Vernon
Pikeville
Princeton
Bluefield
Blacksburg
Christiansburg
Wytheville
Abingdon
Gate City
Johnson City
Oneida
Mt Airy
Galax
Wise
Lebanon
Marion
Richlands
Beckley
Franklin
Springfield
Hartsville/Trousdale
Lewisburg
Columbia
Shelbyville
Murfreesboro
Cleveland
Athens
Huntsville
Decatur
Florence
Corinth
Tupelo

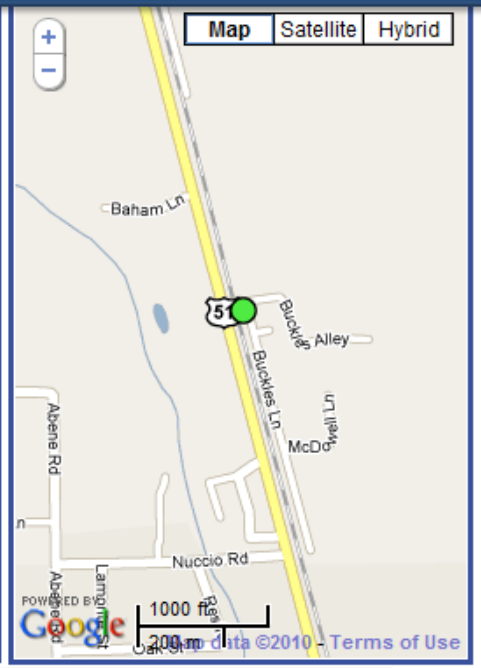
Below the summary by occupation are the coordinate and status summary tables.

Coordinate Source: network-final

REF FRAME:	ITRF2000 (2006.7552)		NAD_83(CORS96) (2002.0000)	
LAT:	N30:35:23.60927	±0.001 m	N30:35:23.59010	±0.001 m
EAST LON:	E269:30:47.26256	±0.001 m	E269:30:47.28806	±0.001 m
WEST LON:	W090:29:12.73744	±0.001 m	W090:29:12.71194	±0.001 m
EL HGT:	-8.792	±0.007 m	-7.421	±0.007 m
X:	-46695.480 m	±0.000 m	-46694.813 m	±0.000 m
Y:	-5495062.789 m	±0.001 m	-5495064.275 m	±0.001 m
Z:	3226832.681 m	±0.001 m	3226832.871 m	±0.001 m

ORTHO HGT: 19.491 m ±0.013 m [USGG2009]

COORDINATE SYSTEM:	SPC 1702 LA S	UTM 15
NORTHING:	231955.817 m	3386842.986 m
EASTING:	1081182.799 m	740977.296 m
CONVERGENCE:	0.42324519°	1.27952542°
POINT SCALE:	0.99997843	1.00031642
COMBINED FACTOR:	0.99997960	1.00031759
U.S. NATIONAL GRID:	15RYP4097786843(NAD 83)	

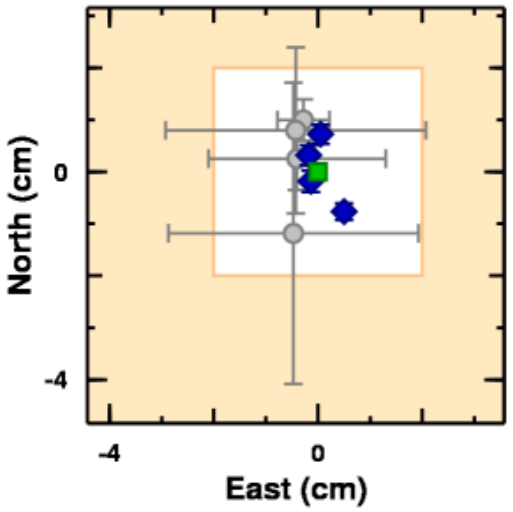


File		Antenna		ARP (m)	Eph	Obs (%)	Fixed (%)	RMS (m)	Lat (m)	Lon (m)	Hgt (m)	SOLUTION
2123275u.06o		TRM55971.00	NONE	2.000	precise	93.9	92.2	–	0.001	0.001	0.007	network-final
2123276g.06o		TRM55971.00	NONE	2.000	precise	93.9	92.2	–	0.001	0.001	0.007	network-final
2123276s.06o		TRM55971.00	NONE	2.000	precise	93.9	92.2	–	0.001	0.001	0.007	network-final
2123277g.06o		TRM55971.00	NONE	2.000	precise	93.9	92.2	–	0.001	0.001	0.007	network-final
Preferences					BEST AVAILABLE	≥80.0	≥80.0	≤0.025	≤0.020	≤0.020	≤0.040	Preferences

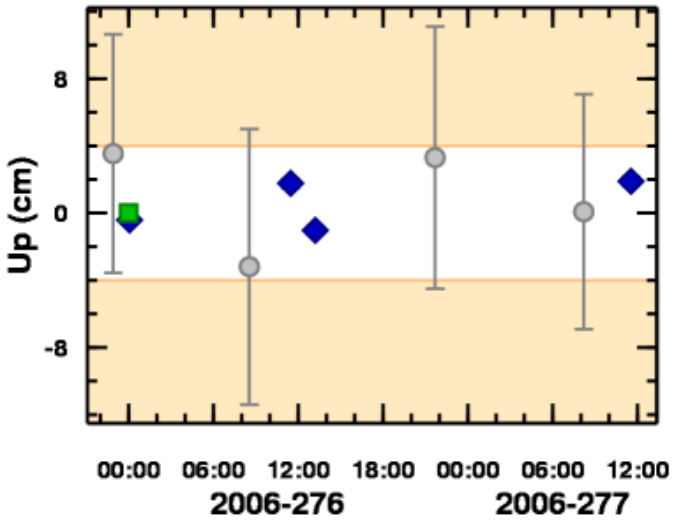
Preferences	BEST AVAILABLE	≥80.0	≥80.0	≤0.025	≤0.020	≤0.020	≤0.040	Preferences

Plotted Solution Results From All Sources

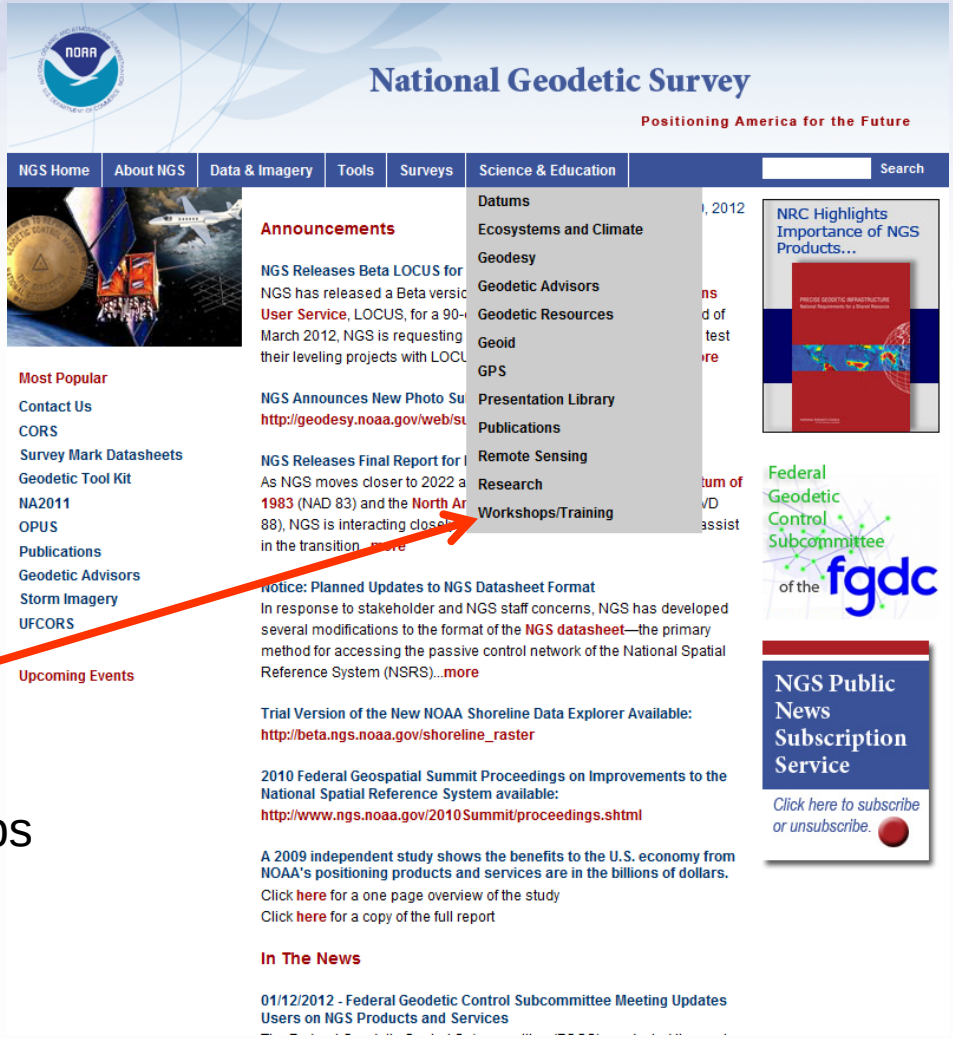
NETWORK SOLUTION	EAST (cm)	NORTH (cm)
network-final	0.0 ±0.0	0.0 ±0.1
SESSION SOLUTION	**EAST (cm)**	**NORTH (cm)**
2006-275-B	0.5 ±0.0	-0.8 ±0.2
2006-276-A	-0.1 ±0.0	-0.2 ±0.2
2006-276-B	0.0 ±0.0	0.7 ±0.2
2006-277-A	-0.2 ±0.0	0.3 ±0.2
OPUS SOLUTION	**EAST (cm)**	**NORTH (cm)**
2123275u.06o	-0.3 ±0.5	1.0 ±0.4
2123276g.06o	-0.4 ±2.5	0.8 ±1.6
2123276s.06o	-0.5 ±2.4	-1.2 ±2.9
2123277g.06o	-0.4 ±1.7	0.3 ±0.6
The (0, 0) point represents W90:29:12.737 by N30:35:23.609.		



NETWORK SOLUTION	EPOCH	UP (cm)
network-final	2006-10-02T23:59:45 GPST	0.0 ±0.1
SESSION SOLUTION	**EPOCH**	**UP (cm)**
2006-275-B	2006-10-03T00:03:57 GPST	-0.4 ±0.2
2006-276-A	2006-10-03T11:27:49 GPST	1.8 ±0.3
2006-276-B	2006-10-03T13:12:34 GPST	-1.0 ±0.2
2006-277-A	2006-10-04T11:32:25 GPST	1.9 ±0.2
OPUS SOLUTION	**EPOCH**	**UP (cm)**
2123275u.06o	2006-10-02T22:54:28 GPST	3.5 ±7.1
2123276g.06o	2006-10-03T08:32:38 GPST	-3.2 ±8.2
2123276s.06o	2006-10-03T21:41:02 GPST	3.3 ±7.8
2123277g.06o	2006-10-04T08:11:45 GPST	0.1 ±7.0
The UP 0 point represents -8.79205 m.		



OPUS WORKSHOP TRAINING



Check here for upcoming OPUS-Projects Workshops

OPUS Overview and Updates

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