OPUS:
Online Positioning User Service

http://www.ngs.noaa.gov/OPUS/
ngs.opus@noaa.gov
What is OPUS?

- On-line Positioning User Service
- Fast & easy access to the NSRS (National Spatial Reference System) for GPS users
You’ve got mail!

OPUS solution
Subject: OPUS solution: doro128o.03o 000384055
From: opus@ngs.noaa.gov
Date: 2:28 PM
To: joe.evjen@noaa.gov

FILE: doro128o.03o 000384055

NGS OPUS SOLUTION REPORT
=========================

USER: joe.evjen@noaa.gov               DATE: October 20, 2005
RINEX FILE: doro128o.03o               TIME: 18:28:23 UTC

SOFTWARE: page5   0411.19 master30.pl   START: 2003/05/08 14:29:00
EPHEMERIS: igs12174.eph [precise]       STOP: 2003/05/08 20:22:00
NAV FILE: brdc128o.03n                  OBS USED: 12128 / 12305 : 99%
ANT NAME: ASH701975.01A+GP              # FIXED AMB: 57 / 59 : 97%
ARP HEIGHT: 2.0                         OVERALL RMS: 0.018(m)

REF FRAME: NAD_83 (CORS96) (EPOCH:2002.00000)     ITRF00 (EPOCH:2003.35000)

<table>
<thead>
<tr>
<th></th>
<th>X</th>
<th>Y</th>
<th>Z</th>
<th></th>
<th>X</th>
<th>Y</th>
<th>Z</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>592840.506</td>
<td>-4856853.798</td>
<td>4078078.293</td>
<td></td>
<td>592839.863</td>
<td>-4856852.383</td>
<td>4078078.180</td>
</tr>
<tr>
<td>LAT:</td>
<td>39 59 58.25431</td>
<td>0.004(m)</td>
<td>39 59 58.28240</td>
<td>0.004(m)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E LON:</td>
<td>276 57 33.29650</td>
<td>0.004(m)</td>
<td>276 57 33.27682</td>
<td>0.004(m)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>W LON:</td>
<td>83 2 26.70350</td>
<td>0.004(m)</td>
<td>83 2 26.72318</td>
<td>0.004(m)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EL HGT:</td>
<td>208.417(m)</td>
<td>0.008(m)</td>
<td>207.209(m)</td>
<td>0.008(m)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ORTHO HGT:</td>
<td>242.150(m)</td>
<td>0.026(m)</td>
<td>[Geoid03 NAVD88]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Many Flavors of OPUS Planned

- OPUS
  - Lone $$$ receiver, hours of data, no archive

- OPUS-DB
  - Lone $$$ receiver, hours of data, archive results

- OPUS Projects
  - Multiple $$$ receivers, archive results

- OPUS Rapid Static
  - $$$ receiver, minutes of data, no archive

- OPUS GIS
  - $$$ receiver, minutes of data, no archive
Many Flavors of OPUS Planned

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  - ¥¥ receiver, minutes of data, no archive
**OPUS Concept**

- **NGS-modeled antenna**
- **GPS data**
- **observation notes**

**OPUS website**
http://geodesy.noaa.gov/OPUS

**QA/QC**

**your datasheet**
**OPUS → Datasheet Concept**

- **NGS-modeled antenna**
- **GPS data (4+ hours)**
- **Observation notes**
- **Control station photo**
- **Control station description**
  - *optional for “existing” stations.

**OPUS website**

http://geodesy.noaa.gov/OPUS

for registered users

**QA/QC** 2 reviews

**Public datasheet**
Data Flow

1. upload
2. process
3. verify (NGS)
4. verify (agency)
5. publish
Why reinvent bluebooking?
How to Access NSRS

1) Passive monuments
   - Datasheets http://geodesy.noaa.gov/cgi-bin/datasheet.prl

2) Active GPS
   - CORS data http://geodesy.noaa.gov/CORS
   - OPUS processing http://geodesy.noaa.gov/OPUS
How to Maintain NSRS

1) Passive monuments
   - Add observations via BLUEBOOKING
   - Online recovery recvy_entry_www.prl
   - Online GPS observations via OPUS-DB

2) Active GPS
   - Join Cooperative CORS
     http://geodesy.noaa.gov/CORS/Coop/
### Simple is better!

#### A comparison:

<table>
<thead>
<tr>
<th>Files used: (create, sort, maintain)</th>
<th>Required Metadata (input)</th>
<th>Programs used: (learn, run, maintain)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BLUEBOOK</strong></td>
<td><strong>16 files</strong></td>
<td><strong>378 elements</strong></td>
</tr>
<tr>
<td><strong>OPUS-DB</strong></td>
<td><strong>2 files</strong></td>
<td><strong>15 elements</strong></td>
</tr>
<tr>
<td>(GPS data + photo)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **BLUEBOOK**
  - 16 files
  - 378 elements
  - 26 programs

- **OPUS-DB**
  - 2 files (GPS data + photo)
  - 15 elements
  - 1 program (internet browser)
control station requirements

Stable
Permanent
Unique
Recoverable
Safe

control station monument
GPS data requirements

“OPUSable”

4+ hours of dual frequency data
NGS-calibrated antenna
OPUS must achieve:
  ≥ 90% observations used
  ≥ 80% ambiguities fixed
  ≤ 0.02m peak-to-peak horizontal
  ≤ 0.04m peak-to-peak vertical
metadata requirements

- observation notes
- control station photo *
- control station description *

* optional for "existing" stations.

Simplified bluebooking
Rinex File Name: doro1280.03o
Enter the mark’s PID: DG7181 | What's a PID? | Find PID | no PID?

The mark was found in

- Good condition.
- Poor, disturbed, mutilated, requires maintenance.

OPTIONAL comments

RECOVERED AS DESCRIBED WITH THE FOLLOWING CHANGES
-- NO CHANGES.

Your initials: JGE

OPTIONAL photos:

1. C:\DOROTA_1.jpg
2. C:\DOROTA_3.jpg
3. 

Submit To Database  Return to OPUS Menu

Privacy Policy

- The data you provide are reviewed by NGS personnel, are recorded in our database, and are displayed on datasheets.
- Providing this information is voluntary. See also our NOAA Privacy Policy.
Rinex File Name: doro1280.03o

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Type:</td>
<td>D = Disk</td>
<td>DH = Horizontal control disk</td>
<td></td>
</tr>
<tr>
<td>IF Type = &quot;Rod&quot;:</td>
<td>Rod Depth</td>
<td>Sleeve Depth</td>
<td></td>
</tr>
<tr>
<td>Setting:</td>
<td>7 = Set in top of concrete monument</td>
<td></td>
<td></td>
</tr>
<tr>
<td>specific setting:</td>
<td>8' square concrete monument, 9' deep</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Descriptive Comments:</td>
<td>The station is located in the southeast quadrant of the intersection of main street and union road, 12' south from centerline of main street, 12' east from</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(describe the station)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Photo 1:</td>
<td>C:\DOROTA_1.jpg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Photo 2:</td>
<td>C:\DOROTA_3.jpg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Photo 3:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stability:</td>
<td>D = Monumen</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Magnetic:</td>
<td>N = No magnetic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Application:</td>
<td>--- no special use</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Antenna S/N:</td>
<td>3333333</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Receiver S/N:</td>
<td>4444444</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observer Remarks:</td>
<td>nothing int</td>
<td></td>
<td></td>
</tr>
<tr>
<td>END</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
OPUS registry

Registration stores the following:
• Name
• Address
• Agency
• Experience- GPS & OPUS

OPUS website
http://geodesy.noaa.gov/OPUS
for registered users
Online Positioning User Service

1. Enter your email address

2. Enter your DATA file. Now accepting RINEX and selected receiver formats. Data files may also be compressed (ZIP, .zip, .Z, .gz)

3. SELECT antenna type

4. Enter the antenna height

Options

- Select from several options to modify the basic OPUS procedures.

Upload File

Your data must be dual frequency data (L1 and L2) and a minimum of 2 hours of observations is recommended. Your collection rate must be 1, 2, 3, 5, 10, 15 or 30 seconds.
New Registrants

All OPUS submissions to the NGS Integrated Data Base must be reviewed by a registered reviewer. These registered reviewers will complete this form and select their User Name and Password which is needed in order to elect the OPUS Option "Submit to Data Base". Prior to publication in the Data Base, OPUS submissions for that User Name and Password will be emailed to the registered reviewer uniquely identified by that User Name and Password. The reviewer will notify NGS by reply email that 1) all the information is correct and NGS may proceed to publication or 2) corrections are required prior to publication, or 3) withdraw the submission.

To start the registration process, NGS needs to know who will be reviewing the OPUS submissions to the Data Base. Please complete the information below and note that the email address that you enter here is the address to which your OPUS submissions will be sent for review. The information provided here will be kept strictly confidential.

First Name: joe
Last Name: evjen
Title: geodesist
Company/Agency: NGS
Address 1: 1315 east-west highway
Address 2: ssmc3 station 8854
City: Silver Spring
State: Maryland
Phone: 301.713.3194
Email: joe.evjen@noaa.gov

Please enter a User Name and Password for your submissions to the NGS Data Base. You may share this User Name and Password as you wish, however all submissions via OPUS to the Data Base using your User Name and Password will be sent to you at the above email address for review and verification.

Enter Your User Name: joe
Enter Your Password: junkjunk
Re-Enter Your Password: junkjunk

NGS would like to know about your professional qualifications and/or your experience with GPS positioning. This information should convey to us that you understand the relevant elements of precise GPS and geodetic positioning. Registrants should be thoroughly familiar with the content of Using OPUS, PAT22 Report, GPS Manual. Please answer below as appropriate. All responses will be kept strictly confidential.

Describe your professional qualifications (For example, Are you a License Surveyor, What GPS equipment have you used, Year experience with GPS, Previous experience with OPUS, Projects submitted to NGS using "Blue Book", etc ..):
1) I have reviewed the information above as well as the datasheet and photos submitted for this file and verify that this information is correct. Please proceed with this publication.

Name: Gerry Mader

2) This contribution is withdrawn. Do not publish at this time.

Name:
OPUS datasheet

Identical to normal datasheet
PLUS agency attribution
PLUS links to OPUS reports & statistics
Bench mark elevation retained

Position accuracy improved 95 feet!

One more tie between GRS80-NAVD88.
OPUS-DB benefits

• Data submittal
  – fast, cheap, easy
  – consistent, reliable

• Improve maintenance of NSRS
  – Add GPS on bench marks
  – Archive PLSS corners?
  – Archive tidal bench marks
OPUS-DB limitations

- GPS data only
- PAGES software only
- No direct tie to adjacent monuments
- No redundancy
- Reduced oversight
- Idiot-proofing?
- Field logs are not archived
OPUS-DB data quality

- Registered, trained users
- 4+ hours of static GPS
- OPUS error checking
- NGS reviews each submittal
- Datasheet includes:
  - “Caveat emptor” warning
  - Datasheet includes DQA statistics
  - Agency attribution
- Coordinates: first, best, average
Many Flavors of OPUS Planned

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- **OPUS-DB**
  - Lone $$$ receiver, hours of data, **archive results**

- **OPUS Projects**
  - **Multiple** $$$ receivers, archive results

- **OPUS Rapid Static**
  - $$$ receiver, **minutes** of data, no archive

- **OPUS GIS**
  - $$$ receiver, minutes of data, no archive
OPUS Projects

NATIONAL GEODETIC SURVEY

3. Extended Output

Additional information on the OPUS solutions, including the numerical portion of the g-files, is provided in Extended Output.

☐ Standard output is fine. ☑ Yes, I'd like extended output.

4. Submit to Project

OPUS now allows authorized users to submit files to a previously defined project where a project is an effort involving many receivers, operating at several locations within a specified time frame and whose data is to be mutually processed as a network. OPUS is used to provide preliminary solutions for each data file submitted, evaluate the data quality, and assign the data to the appropriate project. The assigned project manager can then process any combination of sessions from the project as a network.

To submit this data file to a project, enter the password assigned by the project manager for the appropriate project.

PasswordProject

Project Name
Many Flavors of OPUS Planned

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- **OPUS GIS**
  - ¥¥ receiver, minutes of data, no archive
OPUS Rapid Static is a new version of OPUS designed to handle short (15 minute) data sets. It uses an entirely new processing engine. Its accuracy, reliability, and failure modes may be different from the original OPUS. This site should be treated as an Operational Prototype.

**OPUS Upload**

1. Enter your email address

2. Enter your DATA file. Now accepting RINEX and selected receiver formats. Data files may also be compressed (ZIP, .zip, .Z, .gz)

3. Select the antenna type

4. Enter antenna height in meters

5. Options
NOTE: Antenna offsets supplied by the user were zero. Coordinates returned will be for the antenna reference point (ARP).

Warning!!! OPUS-RS was able to find a set of reference stations with data suitable for use with your dataset. However, your position does not fall within the polygon enclosing these reference stations. This means that the geographic interpolation algorithms performed within OPUS-RS must instead perform extrapolation. Extrapolation, especially if your position is far from the reference stations, is prone to error. Use this solution with caution.

Distance to polygon enclosing the reference stations is 5 KM

NGS OPUS-RS SOLUTION REPORT
========================
USER: rick.foote@noaa.gov                     DATE: September 01, 2006
RINEX FILE: txar223o.06o                            TIME: 17:34:22 UTC
SOFTWARE: rsgps 0.91 RS23.prl                   START: 2006/08/11 14:01:00
EPHEMERIS: igs13875.eph [precise]                  STOP: 2006/08/11 14:15:00
NAV FILE: brdc2230.06n                        OBS USED:   924 /  1008   :  92%
ANT NAME: TRM41249.00                      QUALITY IND.  40.60/ 10.48
ARP HEIGHT: 0.0                              OVERALL RMS:        0.424
REF FRAME: NAD_83(CORS96) (EPOCH:2002.0000)            ITRF00 (EPOCH:2006.61110)

X:    -659935.002(m)    0.002(m)    -659935.682(m)    0.002(m)
Y:    -5328392.049(m)   0.014(m)       -5328390.624(m)   0.014(m)
Z:      3431593.066(m)   0.008(m)      3431592.908(m)   0.008(m)
LAT:   32 45 32.50006     0.002(m)       32 45 32.51912     0.002(m)
24 hr OPUS vs. 15 min OPUS-RS

\[ \Delta \text{North} \quad 0.0058 \text{ m} \]
\[ \Delta \text{East} \quad 0.0121 \text{ m} \]
\[ \Delta \text{Up} \quad -0.0256 \text{ m} \]

- NGS OPUS SOLUTION REPORT
- USER: rick.foote@noaa.gov  DATE: September 01, 2006
- RINEX FILE: txar2230.06o  TIME: 15:01:54 UTC
- SOFTWARE: page5 0601.10 master28.pl
- EPHEMERIS: igs13875.eph [precise]
- NAV FILE: brdc2230.06n
- ANT NAME: TRM41249.00
- ARP HEIGHT: 0.0
- OBS USED: 52174 / 53338 : 98%
- # FIXED AMB: 130 / 175 : 74%
- OVERALL RMS: 0.023(m)

- REF FRAME: NAD_83(CORS96)(EPOCH:2002.0000)  ITRF00 (EPOCH:2006.6096)
- LAT: 32 45 32.49988  0.013(m)  32 45 32.51893  0.013(m)
- E LON: 262 56 23.00951  0.012(m)  262 56 22.97685  0.012(m)
- W LON: 97 3 36.99049  0.012(m)  97 3 37.02315  0.012(m)
- EL HGT: 144.015(m)  0.023(m)  142.810(m)  0.023(m)
- ORTHO HGT: 171.230(m)  0.034(m) [Geoid03 NAVD88]
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  - Multiple $$$ receivers, archive results

- **OPUS Rapid Static**
  - $$$ receiver, minutes of data, no archive

- **OPUS GIS**
  - $_receiver, minutes of data, no archive
OPUS GIS BETA

1. Enter your email address

2. Enter your DATA file Now accepting RINEX and selected receiver formats.
   - Data files may also be compressed (.ZIP, .zip, .Z, .gz)

3. Select the antenna type
   - NO antenna selected - see FAQ #6

4. 0.0 meters
   - Enter the antenna height

5. Options
   - If desired, select from several options to modify the basic OPUS procedures.

Upload File

Your data must be dual frequency data (L1 and L2) and a minimum of 2 hours of observations is recommended.
Your collection rate must be 1, 2, 3, 5, 10, 15 or 30 seconds.
OPUS-GIS output

- Station #: 1  File: zzyy2230.06o
  - 2006/ 8/11  1: 1: 0  -659935.745  0.286  32 1 32.5158  0.314
  - 2006/ 8/11  2:15: 0  -5328390.873  0.484  -97 3 37.0249  0.260
  - #sec: 4440 #pts: 146  3431592.952  0.401  143.0226  0.558

- Station #: 2  File: zzyy2230.06o
  - 2006/ 8/11  2:15:30  -659935.581  0.281  32 15 32.5078  0.296
  - 2006/ 8/11  2:20: 0  -5328391.041  0.626  -97 3 37.0178  0.292
  - #sec: 270 #pts: 10  3431592.750  0.424  143.0372  0.692

- Station #: 3  File: zzyy2230.06o
  - 2006/ 8/11  2:33:30  -659935.568  0.344  32 33 32.5096  0.266
  - 2006/ 8/11  2:38:30  -5328391.003  0.586  -97 3 37.0175  0.365
  - #sec: 300 #pts: 11  3431592.792  0.361  143.0265  0.623

- Station #: 4  File: zzyy2230.06o
  - 2006/ 8/11  2:41:30  -659935.598  0.488  32 41 32.5175  0.259
  - 2006/ 8/11  2:52: 0  -5328390.395  0.757  -97 3 37.0215  0.431
  - #sec: 630 #pts: 22  3431592.697  0.428  142.4706  0.861

- Station #: 5  File: zzyy2230.06o
  - 2006/ 8/11  2:52:30  -659935.747  0.421  32 52 32.5170  0.280
  - 2006/ 8/11  3:35: 0  -5328390.635  0.682  -97 3 37.0260  0.361
  - #sec: 2550 #pts: 86  3431592.843  0.425  142.7651  0.784