



# Progress at the United States Naval Observatory (USNO) Analysis Center



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## Analysis center history and products

• Have participated in the IGS as an analysis center (AC) since 1997.

• Contribute rapid and ultra-rapid solutions.

### Rapid solutions

• Submitted once/day since 1997.

• Computed using combination of *GIPSY OASIS II* version 2.6 and 4.0 solutions.

### Ultra-rapid solutions

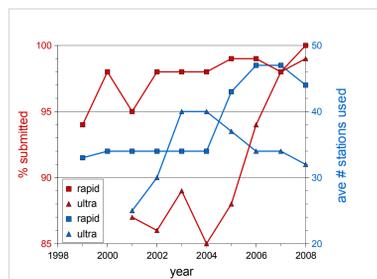
• Feb 2007 – present: submitted four times/day.

• 2000 – Feb 2007: submitted twice/day.

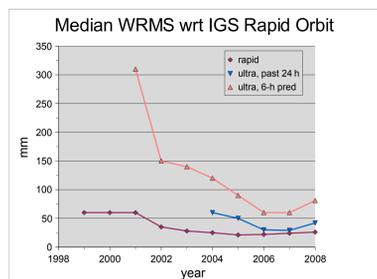
• Computed using *Bernese 5.0* software.

## Quality/consistency of AC products

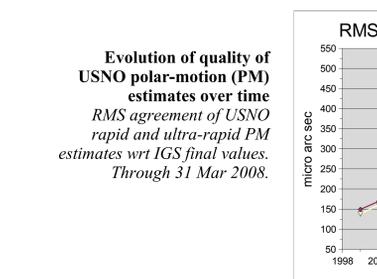
Although there are presently some issues, the quality of USNO products has generally improved over time. Consistency, i.e., percent of expected products submitted, is at an all-time high: 99 and 100% of expected ultra-rapid and rapid products have been submitted in 2008 (through 30 April).



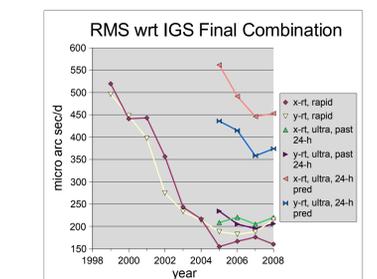
Consistency of USNO submissions; number of stations used  
Percent of expected solutions submitted to IGS, and average number of stations used per solution. Through 30 Apr 2008.



Evolution of USNO orbit quality over time  
Median WRMS of USNO rapid and ultra-rapid orbits with respect to IGS combined rapid orbit. The cause of the recent increase in the RMS in this (and other) ultra-rapid products is not yet known; see bottom of third panel. Through 30 Apr 2008.



Evolution of quality of USNO polar-motion (PM) estimates over time  
RMS agreement of USNO rapid and ultra-rapid PM estimates wrt IGS final values. Through 31 Mar 2008.



Evolution of quality of USNO PM-rate estimates over time  
RMS agreement of USNO rapid and ultra-rapid PM-rate estimates wrt IGS final values. Through 31 Mar 2008.

## Improvements to products

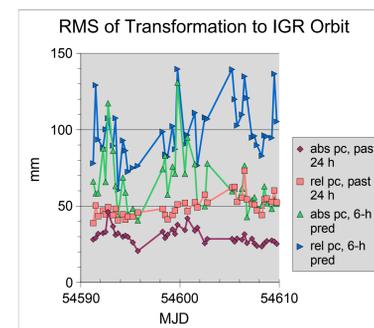
### In progress:

#### Implementation of absolute phase centers:

• **Ultra-rapids:** have implemented locally in test mode since Fall 2007. Need to implement operationally.

• Test products appear to agree more closely with IGS rapid products than existing ultra-rapid products; see below.

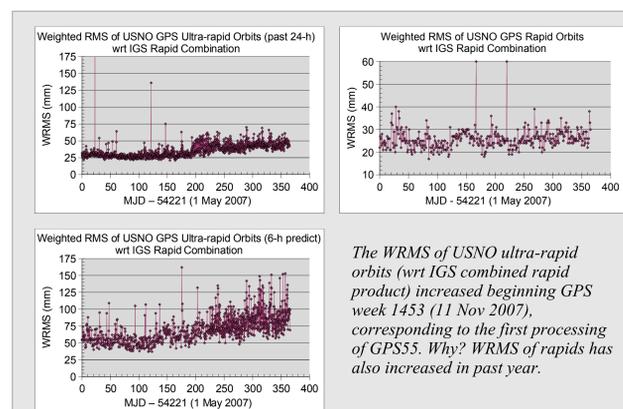
• **Rapids:** will implement when transition of ultra-rapid products is complete.



RMS of 7-parameter Helmert transformation between USNO ultra-rapid orbits and IGS combined rapid orbit. "abs pc" refers to new products under test, the largest change to which is the inclusion of absolute antenna phase-center measurements. "rel pc" refers to the products presently submitted to IGS, which incorporate relative phase center measurements. The RMS of the test orbits are generally superior by a few cm both in the post-processed and predicted part. Data shown: GPS weeks 1478-80 (4-24 May 2008).

### Need to do (continued next panel):

#### Investigate increased WRMS of orbits:



The WRMS of USNO ultra-rapid orbits (wrt IGS combined rapid product) increased beginning GPS week 1453 (11 Nov 2007), corresponding to the first processing of GPS55. Why? WRMS of rapids has also increased in past year.

## Improvements to products, cont'd

### Need to do (cont'd):

• Increase number of stations used in solutions.

• Update models/inputs to processing:

• Rapids: presently combine *GIPSY* v2.6 and v4.0 answers. Need to use common model set.

• Ultra-rapids:

• Add CA-P1 corrections.

• Review *a priori* values used in final clock estimation (already partway addressed in test ultras).

• Both: update to FES2004 ocean loading model.

## Where USNO AC fits within USNO

• AC operated by GPS Analysis Division, one of three comprising USNO Earth Orientation Department (EOD).

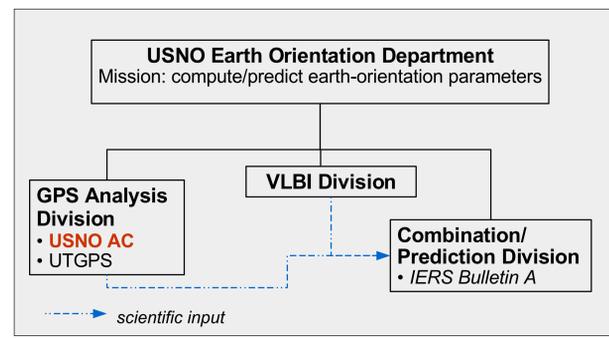
• EOD mission: compute/predict Earth orientation parameters.

• Combination/Prediction Division produces *IERS Bulletin A*, a daily update of past/predicted Earth-orientation values.

• GPS Analysis Division mission: provide GPS-based support to estimation of Earth-orientation parameters.

• Create IGS products.

• Produce daily UT1-like estimate, UTGPS, used to extrapolate UT1 estimates past most-recent VLBI determination. (See J. Tracey poster.)



## Staff members – areas of research

**Paul Barrett:** improving GPS data-processing performance through improved algorithms and software design.

**Victor Slabinski:** improving orbit accuracy through better radiation-force modeling.

**Jeffrey Tracey:** improving accuracy and utility of UTGPS estimates.

**Christine Hackman:** estimating geophysical, time-transfer and geodetic parameters from GPS (and other satellite) measurements.

## For more information

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