C-Nav®

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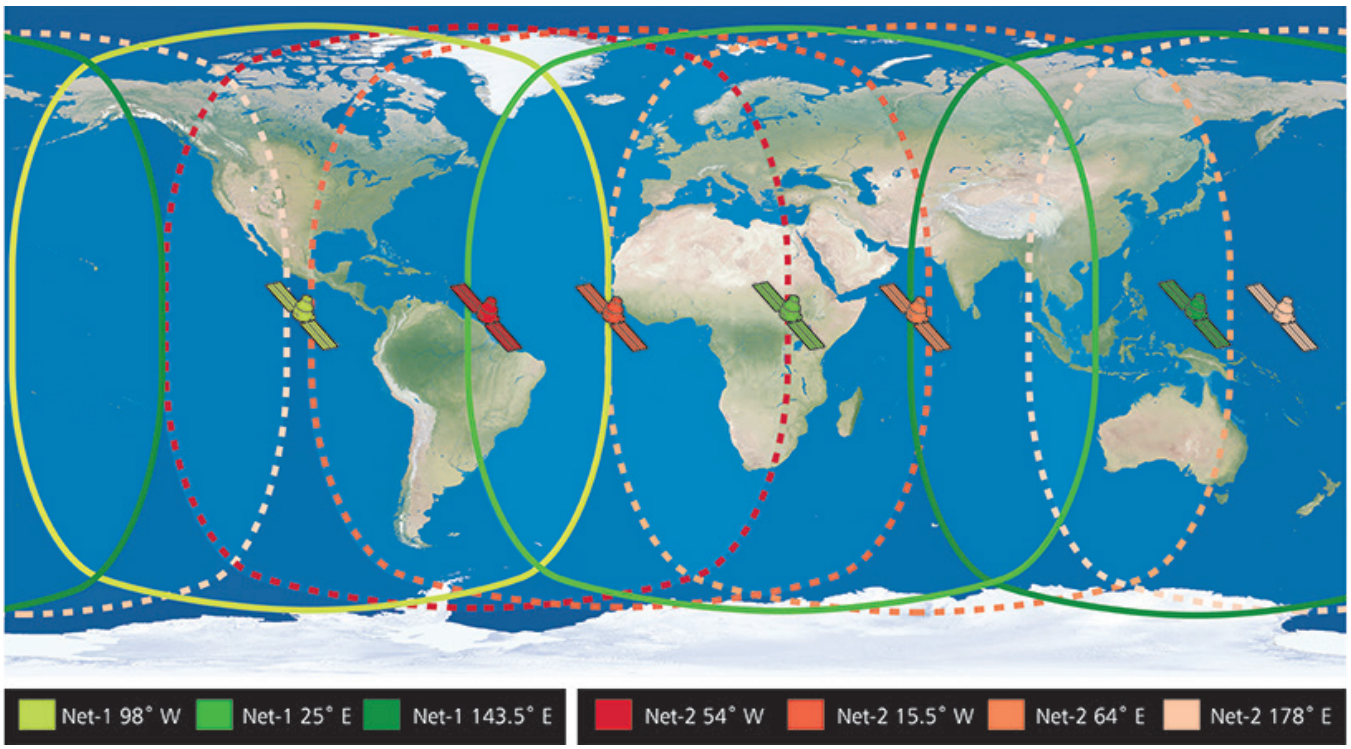
C-Nav® GNSS Correction Services

Precise Point Positioning (PPP) correction technology



FEATURES

Two simultaneous correction messages

7 INMARSAT satellites for L-Band delivery

High reliability and maximum uptime

Connecting What's Needed with What's Next™

OCEANEERING®

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Precise Point Positioning (PPP) Correction Technology

The Oceaneering® C-Nav®PPP correction service offers unparalleled levels of redundancy, integrity, and reliability. This is achieved by using a large reference station network, two processing centers, unique solutions, and delivery options of either 7 INMARSAT satellites or the internet. With 15 years of experience, 150,000 users, and worldwide 24/7 support, our system is unsurpassed.

C-Nav® Services

- **SF2** - C-NavC[1] and C-NavC[2] correction streams at optimum sub-decimeter accuracy from 7 INMARSAT L-Band satellites
- **SF1** - C-NavC[1] and C-NavC[2] correction streams at sub-meter accuracy from 7 INMARSAT L-Band satellites
- **Internet** - C-NavC[2] correction stream available at 1, 15 and 60 second update rates

Features

- C-NavC[1] GPS correction, and C-NavC[2] GPS and GLONASS corrections on satellite-delivered services
- Over 55 dual GPS/GLONASS reference sites
- 10 network monitoring sites
- 6 user-access monitoring sites

Redundancy in Key Areas:

- System performance can be maintained even with a loss of up to 30% of monitoring stations
- Multiple receivers and communications links to processing centers
- Two geographically-separated processing centers with redundant communications links to the INMARSAT uplink sites
- Two unique correction calculation methods available to all users
- 7 INMARSAT satellites send corrections, with a choice of 2 INMARSAT satellites for all users

A PPP Correction System Consists of:

- **Reference network** - measures range to each satellite from multiple locations
- **Processing center** - algorithms are used to compute the clock and orbit errors of each satellite
- **Delivery system** - sends corrections to users
- **User equipment** - uses the correction data to produce high-accuracy, stable-position data

Reference Network

C-Nav GNSS® corrections system satellite tracking stations include a minimum of two active receivers at each site.

- Worldwide network of dedicated sites
- Redundant A and B dual-frequency receivers at each site
- Simultaneous observations to each tracked satellite from typically seven stations
- Secure, multi-routed communication links to processing centers
- Monitoring sites with feedback to the processing centers

Processing Centers

We have two identical processing centers, one in California and one in Illinois. At each processing center, two unique correction solutions are calculated– C-NavC[1]® the GPS-only solution and C-NavC[2] the GPS and GLONASS solution.

- Receives the full complement of C-Nav® reference station data (both A and B receivers)
- Compares the observables from each A and B receiver and independently selects the optimum solution
- C-NavC[1] and C-NavC[2]solutions handle the data cloud independent of each other, producing two independent sets of PPP corrections
- Continuously monitors PPP correctors for quality
- Fed by resilient and spatially diversified communication routing links
- Sends correctors to the Land Earth Station (LES) network for uplink to the C-Nav® INMARSAT satellites (Net-1 and Net-2) and via dedicated servers to the Internet

Delivery Systems

The C-Nav® satellite delivery system has seven geostationary satellites providing global, high-power L-Band signals. A minimum of two satellites are visible to every C-Nav® PPP corrections user. The seven satellite constellation is divided into Net-1 and Net-2 to simplify redundancy settings on the user equipment.

- Correction data from both processing centers are compared and the best is sent to the satellite
- Secure, high-speed cable and VSAT with ISDN backups is used for data flow between the processing centers and the uplink sites
- The INMARSAT satellites are constantly monitored to ensure service continuity and quality
- Backup channel capacity available on adjacent satellites covering the same regions
- Since the expansion of Net-1 and Net-2 to seven satellites, the uptime of the combined system has been 100%

User Segment Receiver Technology

C-NavC[1] and C-NavC[2] subscription service can be used by the C-Nav3050® and C-Nav7000® GNSS receivers. The C-NavC[1] service is used by C-Nav legacy receivers, the C-Nav2050 and C-Nav2000.

Because these receivers are designed by the same experts that developed the correction algorithms, they make optimum use of the data to produce outstanding stable, reliable, and accurate results.

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