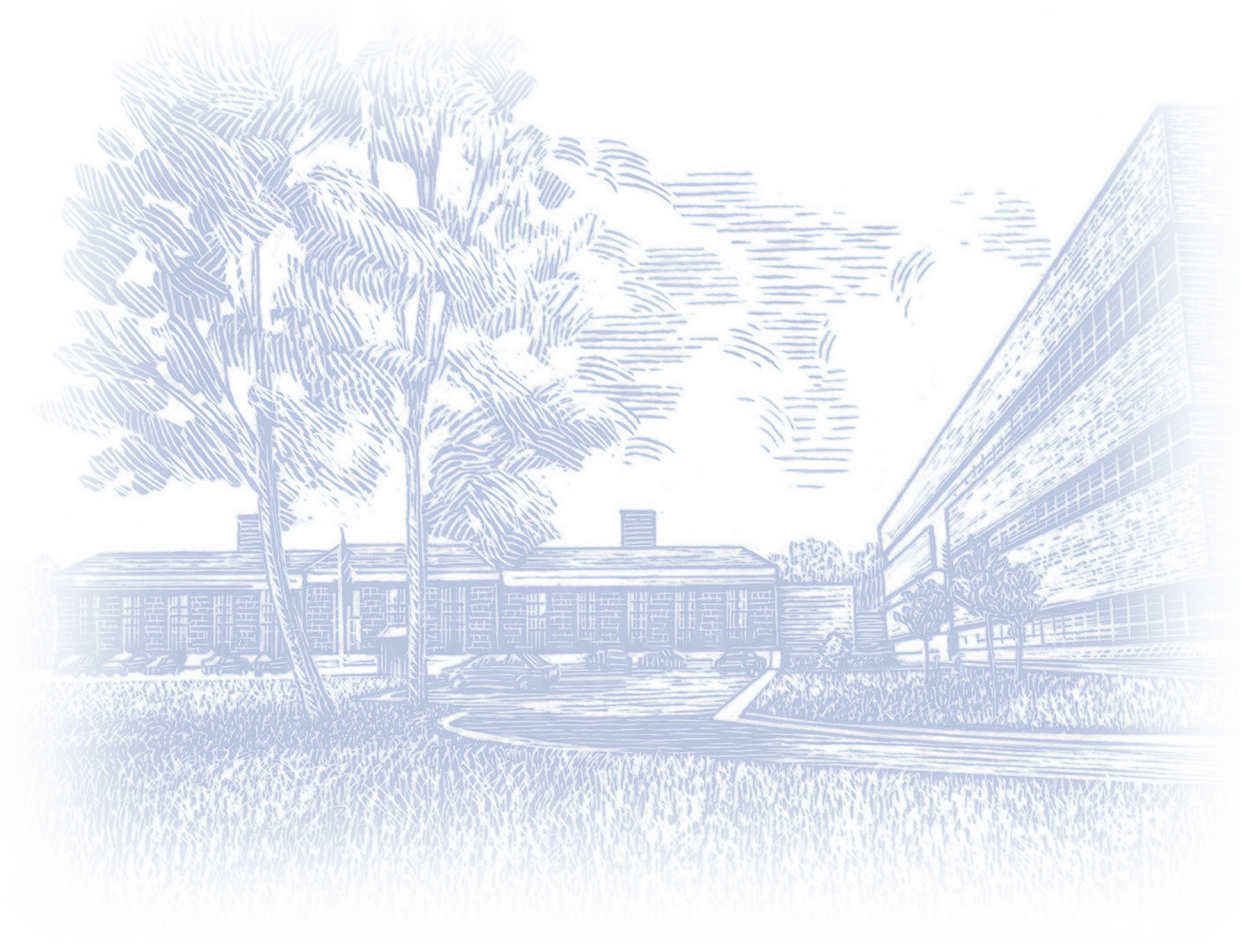
Nationwide Differential Global Positioning System Program Fact Sheet

Publication No.: FHWA-RD-02-072 **January 2002**



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PURPOSE

The purpose of the Nationwide Differential Global Positioning System (NDGPS) is to provide accurate positioning and location information to travelers, emergency response units, and other customers. The system provides 1- to 3-meter (m) navigation accuracy. This will improve collision notification systems, enable cooperative vehicle-highway collision-avoidance systems, and provide more accurate in-vehicle route guidance systems.

DESCRIPTION

Currently, the Global Positioning System (GPS) service offers only 4- to 20-m navigational accuracy. For many land transportation uses, this accuracy is insufficient. NDGPS offers a 1- to 3-m radio-navigational service that meets the needs of many more transportation users. NDGPS improves the accuracy, availability, and integrity of the GPS by constantly monitoring and broadcasting corrections to the GPS service. This is accomplished through a network of ground facilities called reference stations.

Differential GPS uses the fixed location of a reference station to determine the inaccuracy of the satellite signal. The location derived from the satellite signal is compared to the reference station. That difference, or inaccuracy, can then be transmitted to nonstationary receivers. By comparing the inaccuracy to the satellite signal, the nonstationary receivers can then accurately determine their location. The closer to the transmitter, the more accurate the determination. Using current techniques, this correction is most accurate near the NDGPS facilities (approximately 1 m) and degrades up to 3 m at the edge of the coverage area, which is up to 402 kilometers (km) away.

While determining this correction, the NDGPS facilities are also monitoring GPS for anomalous behavior. When this behavior is identified, the NDGPS facilities will broadcast a warning to users not to use that satellite. This warning occurs within 5 seconds of identifying the error. This notification, called integrity, can be thought of as a user's ability to trust the system's output.

FEATURES

- Low Frequency Broadcast: The NDGPS service employs a low radio frequency broadcast technique. This technique has been used for many years in both maritime and aviation applications to ensure coverage throughout a large geographic area and through obstructions between the broadcast site and the user's equipment.
- Dual Frequency Receivers: The NDGPS service uses dual frequency GPS receivers to generate accurate and stable corrections. The 95 percent value is better than 1 m at the broadcast site.
- Integrated Precipitable Water Vapor: The National Oceanic and Atmospheric Administration's Forecast System Laboratory in Boulder, CO, is measuring precipitable water vapor in the atmosphere. GPS receivers installed for the primary purpose of performing basic measurements and generating corrections are used to measure satellite signal delay. Data taken from these measurements is then correlated with the precipitable water vapor present in the atmosphere and data taken from other equipment installed at each NDGPS broadcast site to measure temperature, barometric pressure, humidity. This data is fed into the National Weather Services forecast models, providing improved short-term weather forecast for all users, including transportation departments.
- Tectonic Plate Monitoring: Each NDGPS site incorporates accurate survey reference station antennas. Working with the University Navstar Consortium, NDGPS provides long-term monitoring of the tectonic plates. Academia, Industry, and Government use this information to determine the drift rate of the continental plates.

SPECIAL USES

- Many State departments of transportation use NDGPS to map their transportation infrastructure. For instance, surveying even small sections of road using traditional techniques used to require a number of days; a complete road inventory could take years. With NDGPS, the same road segment can be surveyed and all pertinent data recorded in a matter of hours.
- NDGPS is capable of mapping wetlands and locating endangered and threatened species. Offering unparalleled accuracy, even in rough terrain and forests, NDGPS allows biologists and other investigators to monitor these species more effectively.
- NDGPS also has been used by police agencies to identify accident locations, and NDGPS reference stations are being used to monitor plate tectonics (the movements of the Earth's crustal plates).

ACCOMPLISHMENTS

Current Activities

FHWA, in cooperation with other Federal, State, and local organizations, is deploying sites across the country. Please refer to the U.S. Coast Guard's Web page (http://www.navcen.uscg.gov/ADO/DgpsSelectStatus.asp) for specific coverage and deployment information.

FUTURE ACTIVITIES

NDGPS meets many users' needs today; however, greater accuracy will benefit more users in the future. To make NDGPS more accurate, researchers are currently developing an enhancement to NDGPS. The future system is called High Accuracy-NDGPS, and it will obtain navigation accuracy at the centimeter level. With the nationwide availability of 10-centimeter navigation accuracy or better, collision avoidance, lane keeping, and other applications will become available on a widespread basis, saving countless lives every year.

A test version of the High Accuracy-NDGPS is being made available at the Hagerstown, MD, NDGPS facility. The signal will be available for approximately 1 year and can be received by anyone with appropriate receiver equipment operating within approximately 322 km of the Hagerstown facility.

PARTNERS

The NDGPS program is implemented jointly with the Department of Transportation's Federal Highway Administration, Federal Railroad Administration, and Office of the Secretary of Transportation; the Department of Homeland Security's U.S. Coast Guard; the Department of Commerce's National Geodetic Survey and Forecast Systems Laboratory; and the Department of Defense's Air Force and Army Corps of Engineers.