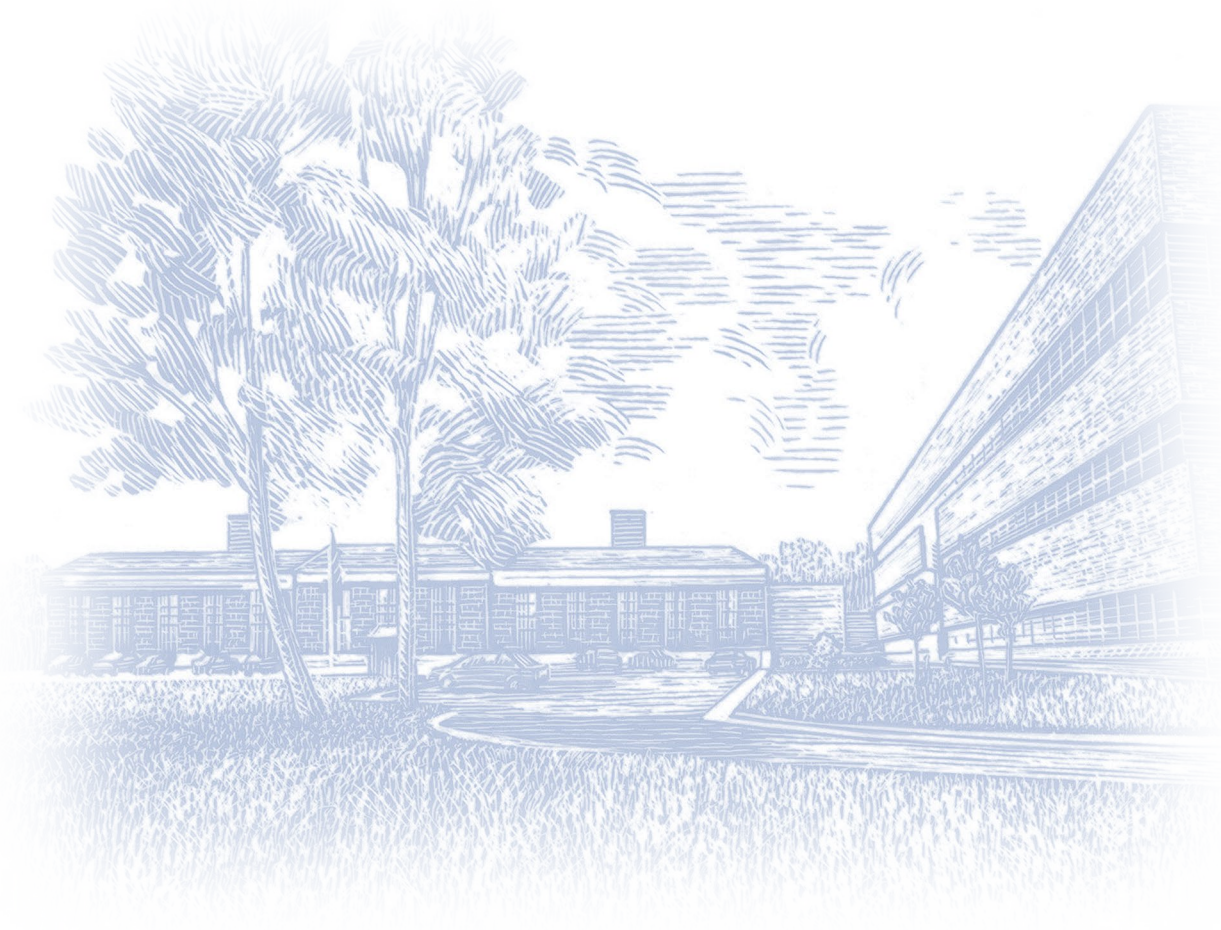
High Accuracy-Nationwide Differential Global Positioning System Program Fact Sheet

Publication No.: FHWA-RD-03-039 **January 2003**



U.S. Department of Transportation
Federal Highway Administration

Federal Highway Administration
Turner-Fairbank Highway Research Center
6300 Georgetown Pike, McLean, VA 22101

Purpose

The High Accuracy-Nationwide Differential Global Positioning System (HA-NDGPS) program provides the capability to broadcast corrections to the Global Positioning System (GPS) over long ranges to achieve a better than 10 centimeter (cm) (95 percent) accuracy throughout the coverage area. HA-NDGPS is currently undergoing a research and development phase. The signal is available for test purposes from Hagerstown, MD, and soon Hawk Run, PA. Application of this technology will provide advanced safety features for transportation, including lane departure warning, intersection collision warnings, and railroad track defect alerts. It also could be used for economic enhancements such as precision container tracking and automated highway lane striping.

Background

Currently, the GPS service offers a 4- to 20-meter (m) navigational accuracy. For many land transportation uses, this accuracy is insufficient. The Nationwide Differential Global Positioning System (NDGPS) offers a 1- to 3-m radio-navigational service that meets the needs of many more transportation users.

HA NDGPS Description

Because greater precision is needed to support many of the safety enhancements envisioned for the future, the U.S. Department of Transportation, in conjunction with the Interagency GPS Executive Board, is supporting the development of HA-NDGPS to provide 10 cm horizontal and 20 cm vertical (95 percent) corrections to users. HA-NDGPS uses the infrastructure employed by the NDGPS service to broadcast these corrections. The addition of a diplexer and transmitter allow the existing infrastructure to broadcast the additional signal, keeping implementation costs very low. Additionally, the signal will be monitored to ensure it is providing the accuracy needed to meet safety-of-life applications.

Features

- **Low Frequency Broadcast:** The HA-NDGPS service employs a low radio frequency broadcast technique that has been used for many years in both maritime and aviation radio navigation systems to ensure coverage throughout a large geographic area and through obstructions between the broadcast site and the user's equipment. As a nonline-of-sight communication link, it is very robust in urban and rural terrain where higher frequency broadcasts are blocked and become unusable.

- **Quad-Frequency Receivers:** The HA-NDGPS service uses quad-frequency receivers to enable interpolation between broadcast sites. This allows for faster code and carrier phase resolution, enabling dynamic navigation solutions in seconds rather than minutes. The accuracy throughout the coverage area is better than 10 cm horizontal (95 percent).

- **Improved Atmospheric Corrections:** During average (quiet) atmospheric conditions, the changes the ionosphere over the Continental United States, and the changes in temperature, pressure, and moisture in the lower atmosphere, are usually small. Under these circumstances, existing methods to correct for excess signal delays caused by the ionosphere and troposphere over short to moderately long baselines work reasonably well. During significant space and tropospheric weather events, however, the changes that are seen in the ionosphere and troposphere can vary greatly, leading to rapid changes and large errors in GPS accuracy. Research is underway to better model and predict these changes and will be incorporated into the HA-NDGPS research program.

Accomplishments

Current Activities

FHWA currently is involved in the testing and implementation of this proposed system. Additional information will be available at https://www.fhwa.dot.gov/research/tfhrc/its/ndgps/index.htm.

Future Activities

A test version of the HA-NDGPS is being made available at the Hagerstown, MD, and Hawk Run, PA, NDGPS facilities. The signal will be available for approximately 1 year and can be received by anyone with appropriate receiver equipment operating within approximately 322 kilometers of the Hagerstown and Hawk Run facilities. Application developers are encouraged to learn more about this testing and to determine the ability of the technology to meet safety application requirements.

Partners

The HA-NDGPS program is implemented through funding made available from the Interagency GPS Executive Board and jointly with the U.S. Department of Transportation's Federal Highway Administration; the Department of Homeland Security's U.S. Coast Guard; and the U.S. Department of Commerce's National Geodetic Survey and Forecast Systems Laboratory.