

# Modernizing NGS's Approach to GNSS Processing

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## SUMMARY

The mission of the U.S. National Geodetic Survey (NGS) is to “define, maintain and provide access to the National Spatial Reference System (NSRS).” Since the advent of GPS in the late 1970s, Global Navigation Satellite Systems (GNSSs) have become dominant tools that NGS uses to maintain the NSRS and that our stakeholders use to access it. An example of the former is NGS’s activities as an Analysis Center contributing ground station coordinates and velocities as well as GPS satellite orbits to the International GNSS Service (IGS). For the latter, NGS operates the Online Positioning User Service (OPUS) which provides hundreds of thousands of processing solutions every year to surveyors in the United States and across the world. In these tasks, NGS primarily uses internally-developed software called the Program for the Adjustment of GPS Ephemerides (PAGES), but this software is “showing its age” because of its limited capability to only process the legacy L1 and L2 GPS signals.

As the Galileo and BeiDou constellations become fully operational, GPS and GLONASS modernize, and regional constellations such as QZSS and NavIC come online, there will soon be over 140 satellites available for position determination. This results in improved satellite geometry that presents the potential to improve upon single constellation positioning and shorten the requisite session lengths, particularly in areas with limited sky view. New signals provide the opportunity to move beyond the dual-frequency GPS-only processing algorithms and incorporate triple-frequency methods for ambiguity fixing and ionospheric corrections. In order to use these available resources and support smarter surveying, NGS is developing new software that will replace the existing PAGES software suite for position and orbit determination, taking advantage of all the available signals and satellites in view. This software will be extensible and written in modern programming languages for easier maintenance. Ultimately, these efforts will provide multi-GNSS capability for OPUS, for monitoring of the NOAA Continuously Operating Reference Station (CORS) Network,

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and for GNSS orbit production for the IGS. This presentation provides an update on the development progress of the new software.

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