

# **Geoid Modeling at NOAA's National Geodetic Survey as 2022 Approaches**

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**Key words:** Positioning; Reference frames; Reference systems; Geoid; Gravity

## **SUMMARY**

In anticipation of new geometric and vertical reference frames in 2022, NOAA's National Geodetic Survey (NGS) has been conducting new surveys and developing new methodologies that will lead to these new reference frames. This paper will focus on the geoid modeling developments at the NGS to support this new vertical frame, which will be accessed through GNSS positioning and a gravimetric geoid model. This will include the current methodology and status of geoid modeling along with results of our latest geoid models. Since the early 1990's, the NGS has been developing various geoid models to provide access to the National Spatial Reference System within the United States. These geoids models can be classified into one of two types: hybrid or gravimetric. The primary purpose of the hybrid models is to provide access to the current national vertical datum, NAVD88. The gravimetric models have relied on contributions from satellite gravity missions (GRACE, GOCE, and others), topographic surface elevations, and terrestrial gravity to provide access to a geopotential surface. In the past decade, airborne gravity data from the GRAV-D project have supplemented the existing terrestrial and space-based gravity data and allowed the geoid models to approach 1-cm accuracies. The GRAV-D data have been crucial to observe the gravity field at intermediate wavelengths between 20 – 500 km and in geographical areas where surface gravity observations are insufficient for geoid modeling (e.g. due to lack of spatial coverage, systematic errors, etc.). As of November 2016, the GRAV-D project has collected gravity data over more than half of the United States, and its contribution to geoid modeling has been implemented in a series of experimental geoid models (xGEOID). The xGEOID models have been produced annually since 2014 and provide a continually improving model and perspective on what the ultimate model will look in 2022. The xGEOID models are spherical harmonic models constructed with all available gravity sources: present-day satellite gravity, terrestrial gravity, and airborne gravity. Each annual xGEOID is actually two separate models: an 'A' model without the GRAV-D data and a 'B' model with contributions from GRAV-D data. The xGEOIDA and

xGEOIDB models provide a quantitative means of assessing how much the GRAV-D data improves the accuracy of the geoid model. The latest iteration in this series, xGeoid17, is in the final stages of development with an anticipated beta-release on June 30, 2017.

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