

Issue 34 October 2023

NSRS Modernization News

For all issues of **NSRS Modernization News**, visit:
geodesy.noaa.gov/datums/newdatums/TrackOurProgress.shtml

GRAV-D Reaches 100%

Congratulations!

On September 14, 2023, the GRAV-D mission flew the last of its planned 4,234 flight lines, bringing the number of planned lines flown to 100%! Congratulations to all members of the GRAV-D team—past and present—who, over the course of the last 16 years, have made this possible!

How'd we get here?

In 2007, NGS officially began planning to re-define the vertical datum of the United States using a gravimetric geoid model. To support this, they acquired their first airborne gravimeter, and published a ten-year plan, announcing the beginning of the GRAV-D (Gravity for the Re-definition of the American Vertical Datum) project, a bold initiative to canvas the entire civilian-populated regions of the United States with an accurate, consistent air-borne gravity dataset, capable of supporting a centimeter-accurate geoid model. Now, after five gravimeters, 18 aircraft and 16 years, all planned flight lines have been flown at least one time.

What's next?

Does that mean we are done? No, there are two big reasons the mission continues. The first is that a small percentage of flight lines collected in the last 16 years have issues that prevent them from fulfilling their role in an “accurate, consistent” dataset. We are attempting to re-fly all of those lines before the end of 2023. The second reason is that we long ago recognized that the geoid over North America could be improved if airborne data could be collected over areas that fall outside the original plan. Our geoid model would be improved by data collection over the

Rocky Mountains in Canada and Mexico and over the Caribbean islands, with an especially significant impact in areas neighboring the collection sites. However, as NGS had to define a “finish line” for the data set that would go into GEOID2022, the gravity collected in these areas will not be used in the initial roll-out of GEOID2022, but will be used to improve future updates to it.

Multi-epoch Least-squares Adjustment Papers

Two papers, outlining the Multi-epoch Least-squares adjustment (ME-LSA) problem have been published:

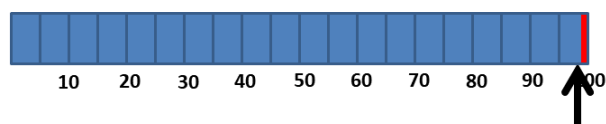
- [NOAA Technical Report NOS NGS 79](#)
- [NOAA Technical Report NOS NGS 80](#)

These papers, particularly #79, show how observations collected over many years can be projected through time to a single adjustment epoch, in preparation for a least-squares adjustment (LSA). This procedure will be at the heart of both OPUS and reference epoch coordinate (REC) estimates in the modernized NSRS. Both papers are highly theoretical, so additional papers are being written that provide details on implementation.

GRAV-D progress last quarter: **up 0.4% to 100.0%**

Ahead of Schedule!

Recently: North Dakota



Schedule: 98.0%