Theme Strategic Plan for Geodetic Control

Theme Lead: Dr. Yan Wang
Theme Lead Agency: National Geodetic Survey, NOS, NOAA
Executive Theme Champion: Juliana P. Blackwell
Executive Champion Agency: National Geodetic Survey, NOS, NOAA

NGDA Datasets in **Geodetic Control**

Geodetic Control NGDA Datasets	Dataset Manager Agency
Continuously Operating Reference Stations (CORS)	Dr. Giovanni Sella, NGS, NOS, NOAA
Airborne Gravity (GRAV-D)	Monica Youngman, NGS, NOS, NOAA
Geodetic Control Information on Passive Marks	Krishna Tadepalli, NGS, NOS, NOAA
Geoid Models	Dr. Yan Wang, NGS, NOS, NOAA

Airborne Gravity (GRAV-D)

Goal 1
The goal of collecting airborne gravity is to better understand the fundamental connection between Earth's gravity field and established height systems. The specific goal of the Gravity for the Redefinition of the American Vertical Datum (GRAV-D) project is to collect and process high quality airborne gravity data to support modeling of the Earth's geoid, which will serve as a zero reference surface for all heights in the nation. Accurate heights are critical to many scientific endeavors, but of particular importance to understanding and protecting low-lying coastal ecosystems.

Objective 1
In FY15 complete cumulative airborne gravity data collection for 53% of the United States and territories.

Anticipated Outcomes
Improved geoid models based on airborne gravity data collection

Actions 1.1.1
a) In FY16 Quarter 1 complete airborne gravity data collection for 46% of U.S. and territories
b) Process airborne gravity data collected in FY16 Quarter 1 within three months

Actions 1.1.2
a) In FY16 Quarter 2 complete airborne gravity data collection for 47% of U.S. and territories
b) Process airborne gravity data collected in FY16 Quarter 2 within three months

Actions 1.1.3
a) In FY16 Quarter 3 complete airborne gravity data collection for 49% of U.S. and territories
b) Process airborne gravity data collected in FY16 Quarter 3 within three months

Actions 1.1.4

a) In FY16 Quarter 4 complete airborne gravity data collection for 53% of U.S. and territories
b) Process airborne gravity data collected in FY16 Quarter 4 within three months

Objective 2
In FY15 complete cumulative airborne gravity data collection for more than 60% of mainland Alaska (excluding the Aleutians). Other locations that will be targeted are the southwest coast of the United States (border between the United States and Mexico), the southeast coast of the United States (northern Florida, Georgia and South Carolina), the northwest coast (Oregon and Washington), and the southern Rocky Mountains (Colorado and New Mexico).

Anticipated Outcomes
New airborne gravity data is available in Alaska and coastal areas of CONUS

Actions 2.1.1
a) Plan and collect airborne gravity data in Alaska
b) Review, process and make data available to geoid modeling team

Actions 2.1.2
a) Plan and collect airborne gravity data in southwest United States
b) Review, process and make data available to geoid modeling team

Actions 2.1.3
a) Plan and collect airborne gravity data along United States/Mexico border
b) Review, process and make data available to geoid modeling team

Actions 2.1.4
a) Plan and collect airborne gravity data along southeast United States
b) Review, process and make data available to geoid modeling team

Actions 2.1.5
a) Plan and collect airborne gravity data along Oregon and Washington coasts
b) Review, process and make data available to geoid modeling team

Actions 2.1.6
a) Plan and collect airborne gravity data in the Rocky Mountains
b) Review, process and make data available to geoid modeling team

External Factors, Challenges, and Opportunities

The following external factors could impact completion of airborne gravity data collection specified in goals 1 and 2.
a) Weather – high winds / turbulence, storms
b) Equipment – aircraft availability, sensor availability, equipment failures
c) Personnel – priority of projects and personnel tasks, pilots
d) Agency mission priorities

The National Geodetic Survey seeks to collaborate with local (governmental, commercial and academic) partners throughout the GRAV-D project. Partners that are willing to support airborne or terrestrial surveys or to monitor local variations in the gravity field are critical components of GRAV-D.

Continuously Operating Reference Stations (CORS)

Goal 1
Maintain current density of stations and ensure accuracy of metadata with station owners and operators.

Objective
The primary objective of CORS is to define, maintain and provide access to the geometric component (Latitude, Longitude, Ellipsoid Heights) of the National Spatial Reference System (NSRS). Since 95% of the stations in the CORS network are independently owned and operated, it is essential that the site owners maintain their stations. Sharing equipment changes with NGS is important because antenna changes and cables or receiver changes can result in coordinate changes which then impact all users of the data.

Anticipated Outcomes
Improved accuracy of the NSRS and related products and services

Actions 1
Maintain good relationship with site owners and operators to ensure continued sharing of data. Provide clear and simple guidance to support their operations and assistance when possible with troubleshooting based on experience of NGS and other operators.

Action 2
Provide improved automated tools to flag inconsistencies and inform station operators of this information and demonstrate impact of changes as well as NGS abilities to detect the changes.

Goal 2
Encourage continued upgrade of equipment to include additional GNSS constellations beyond GPS

Objective
The CORS network requires GPS signals to be tracked by all station operators. With the increasing availability of additional GNSS constellations, supporting these new/newer signals is becoming more important.

Anticipated Outcomes
Defining, maintain, and accessing the NSRS using the broadest number of GNSS signals.

Actions 1
Support owners and operators decision to upgrade equipment, provide feedback using data quality tools on new signals. Develop as necessary new tools to support quality controlling these new signals while emphasizing the importance of GPS as the core signal.

Geodetic Control Information on Passive Marks

Development and maintenance of passive control aligns with agency's mission. Major parts of the National Geodetic Survey's Ten Year Strategic Plan (2013-2023) focus on the need to maintain and provide access to passive control. Specifically, the following goals and objectives address the requirement.

Goal 1
Support the users of National Spatial Reference System.

Objective 1

Bluebooking and Datasheets

Maintain the capability to ingest, analyze, store, and disseminate internal and external survey data in the form of datasheets and associated products and services.

Anticipated Outcome

Maintain operational support to meet mission requirements.

Objective 2

Field Operations

Anticipated Outcome

Improve the coverage and accuracy of geodetic control.

Objective 3

Online Tools

Anticipated Outcome

Maintain and improve online services to ingest, analyze, store, and disseminate geodetic control and associated metadata.

Goal 2

Modernize and Improve the NSRS

Objectives 1

Define and Support New Horizontal and Vertical Datums

Anticipated Outcome

Improve the accuracy of geodetic control.

Objectives 2

Re-invent Bluebooking and Improve Surveying Techniques

Anticipated Outcome

Modernize survey procedures, analysis, quality control, data ingestion, and dissemination.

Objective 3

Fix the Toolkit

Anticipated Outcome

Modernize data analysis, dissemination tools, and promote open data standards.

Goal 3

Expand the NSRS Stakeholder Base

Objective

Engage New Stakeholders

Anticipated Outcome

Identify new stakeholders and improve outreach efforts.

Goal 4

Develop Workforce

Objective

Institutional Knowledge

Anticipated Outcome

Sustain institutional knowledge through succession planning.

Goal 5

Improve Organizational Functionality

Objective 1

Records Management

Anticipated Outcome

Maintain records following existing and evolving federal guidelines.

Objective 2

Regional Advisor Program

Anticipated Outcome

Promote outreach.

Key Activities and Milestones

1. Replace NAD83: 2022
2. Replace NAVD88: 2022
3. Re-invent Bluebooking: 2018
4. Fix the Toolkit: 2017
5. Better Surveying: 2017
6. Engage New Stakeholders: 2017
7. Dynamic Web Presence: 2018
8. Institutional Knowledge: 2017
9. IT Support: 2020
10. Records Management: 2017
11. Regional Advisor Program: 2017

Geoid Models

Goal 1
Support nation's current official vertical datum: the North American Vertical Datum 1988 (NAVD88).

Objective
The primary objective of a geoid model is to provide a transformation tool that converts the ellipsoidal height of NSRS into the orthometric height. For the so called "hybrid" geoid, this means transformation between NAD83 ellipsoidal heights to NAVD88 orthometric heights. A series of models have been computed using satellite gravity models, terrestrial gravity data and the GPS on Bench Marks data. Before the NAVD 88 is replaced by a new spatial datum in 2022, one update to this type geoid models is planned.

Anticipated Outcomes
A new hybrid geoid model is expected to be computed in 2017.

Action 1
Collect new GPS on Bench Marks data for geoid modeling, e.g. in Louisiana. Provide guidance to support data collection and quality control.

Action 2
Participate in the activities of replacing the North American Datum 1983 which may affect the geoid models.

Goal 2
Support the nation's new national geospatial reference system beyond 2022.

Objective
In 2022, the NAVD88 and NAD83 will be replaced by a new national geospatial reference system. The primary objective of gravimetric geoid mdels is to provide an equipotential surface determined

gravimetrically using satellite gravity models, GRAV-D airborne and terrestrial gravity data. While the GRAV-D project in progress, experimental geoid (xGEOID) models have been computed annually using available GRAV-D data since 2014. The xGEOID models will converge to the final geoid model for the geospatial reference system in 2022.

Anticipated Outcomes

xGEOID models for every year until 2022.

Action 1

Clean GRAV-D airborne gravity data using crossover adjustment, outlier detection. Combine the latest satellite gravity models, GRAV-D and terrestrial gravity data in an optimal way. Conduct research on improvement of combination, application of the topographic correction to geoid determination.

Action 2

Promote international cooperation. Meet with Canada and Mexico colleague on monthly basis for data exchange and research collaboration.

Action 3

Promote outreach.

Action 4

Ensure continuity with previous using conversion surface and other transformation tools as a part of NGS toolkit.