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Height Modernization in the U.S.: Implementing a Vertical Datum Referenced to a Gravimetric Geoid Model

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FIG WORKING WEEK 2012
May 6–10 2012
Rome, Italy

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National Geodetic Survey Mission

- Define, maintain, provide access to National Spatial Reference System (NSRS)
- Essentially the same Mission for over 200 years
- Historically datum definition includes realization of the datum, i.e. the passive control used to access it
- Historically maintaining the datum has meant re-establishing marks when they were destroyed




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National Geodetic Survey Mission

- Today NGS provides access through geodetic control: passive (survey disks) and active (CORS)
- Other federal mapping agencies use the NSRS for cadastral, topographic, floodplain, and other mapping applications – NGS does not do the mapping
- **NGS incorporates geodetic data from outside NGS into the NSRS**
 - from other federal agencies
 - from the surveying community at large



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National Geodetic Survey Mission

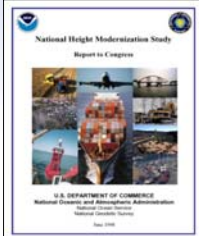
- What's changed? [*horizontal*]
 - Defined through active control – CORS
 - Maintained by computing and modeling velocities
- What's the same? [*vertical*]
 - Many users still access NSRS with passive control
 - Leveling still provides the most accurate heights – GNSS alone can't do the job
- What does this mean?
 - Dwindling resources make it difficult for NGS to maintain NSRS, particularly the vertical


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NGS' Height Modernization Program

- User driven – Congressional support
- Goal: Improve access to vertical control
- Method: Refine geoid height model to fit NAVD 88 so GNSS could be used
- Program Focus
 - Infrastructure: GPS on bench marks
 - Guidelines, models, tools: specifications for GNSS surveys, geoid and velocity models
 - Education, capacity building






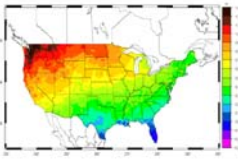
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Problems with this Approach

- Dependence on passive control
 - Susceptible to movement, destruction
 - Requires major resources to maintain
- Error apparent in network
 - Inherent error at continental scale
 - Using GNSS to survey larger areas reveals distortions not apparent before
 - Expectations are greater – desire is for fast *and accurate* heights using GNSS





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NGS Ten-year Plan and Height Modernization

- Science
 - Redefining the datums
 - Improving the geoid model
 - GRAV-D: Gravity for the Redefinition of the American Vertical Datum
- Program
 - Transition
 - Implementation




The GRAV-D Project:
 Gravity for the Redefinition
 of the American Vertical Datum
 A NOAA contribution to the
 Global Geoidic Charting System (GGCS)
 sponsored by the Global Earth Observation
 System of Systems (GEOSS)

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Height Modernization Strategic Plan

- Improve access to NAVD 88 today
 - Identify areas of immediate critical need
 - Build infrastructure that will help access today, **and** support access in the future
- Prepare for transition to new vertical datum
 - Models, tools, guidelines, specifications
 - Education, outreach, capacity building



NAVD83 stations
 GNSS
 Precise
 Precise (2008)

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Goal 1: NGS Understands User Capability to Get 2 cm Heights

- NAVD 88 today
 - Review data holdings: density of CORS, passive control, ties to tide gages, gravity data
 - Consider conditions: topography, dynamic processes, population, tree cover and extreme weather
 - Evaluate guidelines, models, tools
- Gravimetric geoid-based datum tomorrow
 - Define infrastructure needed to achieve 2 cm heights reference to new datum
 - Identify guidelines, models, tools that will need to be updated

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Goal 2: Strategically Address Gaps

Goal 3: Maintain Access to Vertical Datum

- NAVD 88 today
 - Recommend actions to address gaps/weaknesses in infrastructure – surveys, pilot projects, velocity models
 - Special attention to dynamic regions
 - Modify delivery of control: modify accuracies or expire outdated control
 - Support local communities' capacity to validate/maintain vertical control: guidelines, tools
- Gravimetric geoid-based datum tomorrow
 - Actions done today will support transition to new datum

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Goal 4: Education, Capacity Building



- Publications: technical journals, web site
- Training: workshops, webinars, conferences
- Capacity building: hands-on surveying and processing workshops
- Opportunities for collaboration: pilot and research survey projects

- Research grants: to test and develop guidelines, models, and tools
- Outreach: traditional and non-traditional user community



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Height Modernization will succeed if:

- NGS works with user community, federal and local agencies, universities
- Activities are multi-faceted, e.g. surveys
 - ... address gaps
 - ... test guidelines
 - ... provide opportunities to maintain core capabilities in NGS **and** train user community
- Activities are prioritized
 - Areas of critical need
 - Support access to NAVD 88 now **plus** transition to new datum

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Questions

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