

**Jay B. Parrish, Ph.D., P.G.**  
**Former State Geologist, Pennsylvania Geological Survey**  
**Chair, Mapping Committee, Association of American State Geologists**  
**Testimony on “H.R. 1604 (Lamborn) *Map It Once, Use It Many Times Act* and H.R. 916**  
**(Kind), *Federal Land Asset Inventory Reform Act of 2013*”**  
**NATURAL RESOURCES COMMITTEE**  
**UNITED STATES HOUSE OF REPRESENTATIVES**  
**December 5, 2013**

My name is Jay Parrish. I was the State Geologist and Director of the Pennsylvania Geological Survey. As Chair of the Mapping Committee of the Association of American State Geologists (AASG), I am testifying today on behalf of that organization, which represents the geological surveys in the fifty states and Puerto Rico.

Thank you for this opportunity to comment on the importance of H.R. 1604 *Map It Once, Use It Many Times Act* and H.R. 916 *Federal Land Asset Inventory Reform Act of 2013*. These bills are focused on making geospatial data more useful and readily accessible to governmental and civilian users, something the professional geological community can endorse. I would like to focus my testimony on the essential role that the US Geological Survey (USGS) plays in the operations of the federal government, and in particular a new initiative called 3DEP. I appreciate this opportunity to testify on behalf of the Association of American State Geologists.

We regard the USGS role as essential to the operations of the Federal government, while USGS provides scientific geological information that is needed to optimize the health, wealth, and security of the American people, as well as the health and sustainability of the nation’s natural environment.

Both Federal and state government geological surveys maintain comprehensive information on the expansive and diverse landmass administered by the governments in which we serve, collected from extensive mapping, monitoring, and research activities.

We believe that the President’s budget proposal outlines support for what we regard as successful and effective USGS programs that stimulate economic development, that save lives and property from natural disasters, and that protect the environment and public health.

When John Wesley Powell was director of the US Geological Survey over 125 years ago, he told Congress “A Government cannot do any scientific work of more value to the people at large than by causing the construction of proper topographic maps of the country.” He implemented a plan to map the entire country, producing the topographic maps that every one of you, your constituents, and American businesses have used at some time in their existence.

We endorse 3DEP as a means of continuing the “Powell Plan” to provide something of intrinsic value to the people: consistent, current and openly available geospatial data.

State Geologists direct state geological surveys and work to ensure that their states are supported by optimal, useful information. From time to time, a technology matures in a way that offers an opportunity to revolutionize everything that we do on the land – resulting in cost savings and improved benefits for a broad range of activities in our communities and their economies. Today, lidar and associated technologies offer that new opportunity.

The U.S. Geological Survey is developing the 3D Elevation Program (3DEP) initiative to systematically acquire high-quality lidar and ifsar data nationwide over the next 8 years: Light Detection and Ranging (lidar), data in the conterminous U.S. (CONUS), Hawaii, and the U.S Territories; and Interferometric Synthetic Aperture Radar (ifsar data in Alaska. The National Enhanced Elevation Assessment (NEEA) study identified more than 600 requirements for 3D elevation data to address the mission critical issues of 34 Federal agencies, all 50 states and for a sample of private sector companies, Tribes, and local governments. The initiative calls for funding to be increased to \$146 million annually over eight years, returning more than \$690 million annually in new benefits to the private sector directly, and to citizens through improved government program services.

For geologic resource assessment and hazard mitigation, it is estimated that there would be benefits that exceed \$51M per year if this program were implemented. That's just one of many business uses that would benefit from a national lidar program. In my state, Pennsylvania, we have seen the PAMAP lidar data provide a consistent and free base map for geospatial tools across county boundaries to support geologic hazards assessment and mapping; flood risk assessment, response and mitigation; forest resource management, land use management and many other applications.

Many organizations like the Association of American State Geologists agree that uniform national lidar data would facilitate mission-critical applications across government and spur innovations not possible with the patchwork of data we have in most places today.

Some have asked the question about funding and whether or not a program of this scope could be achieved. It is clear that to achieve the goal to acquire data over the entire country in eight years that investments will need to increase. It is estimated that the data acquisition rates will need to increase by three fold over today's rate in order to meet this timetable. New and improved program efficiencies and advancements in technology will help this along. The 3DEP initiative will achieve a 25 percent efficiency gain by moving toward larger projects where data acquisition costs are inherently lower.

The momentum that 3DEP is experiencing must be accelerated. This initiative is a key component to advancing our nation's geospatial capabilities. It is a well-coordinated plan based on well documented requirements and benefits, and it aims to meet a majority of real and important needs across the government. Any legislation on geospatial concerns should include the support and growth of the 3DEP initiative.

In summary, the Association of American State Geologists strongly endorses the President's FY13 budget proposal for the US Geological Survey, and associated funding for 3DEP. If it could be increased, the job could be done faster. But it must be funded. And Federal, state, and local governments, in their implementation of 3DEP acquisition, must be allowed the flexibility

to find the most cost-effective means of collecting geological and topographical data, using available and existing government resources as well as employing the freedom to contract with any qualified organization for maximum savings to the taxpayer.

Efficient coordination of geospatial data acquisition in the Federal government is sorely diminished by competition among those agencies for scarce resources. By fully funding one basic and essential geospatial program, you could make a tremendous difference in geospatial data assets of our country. The USGS has a long history of providing that basic, consistent, current, essential, and openly available data. 3DEP is a way forward into the future.

In particular, we endorse programs that are operated as partnerships between Federal agencies and state agencies, thus optimizing leveraged funds, as well as encouraging coordination, efficiency, and adoption of nation-wide standards.

In closing, I want to again indicate that we appreciate this opportunity to offer information that we hope will be helpful for the work of the subcommittee.

# National Enhanced Elevation Assessment at a Glance

## Introduction

Elevation data are essential for hazards mitigation, conservation, infrastructure development, national security, and many other applications. Under the leadership of the U.S. Geological Survey and the National Digital Elevation Program (NDEP), Federal agencies, State agencies, and others work together to acquire high-quality elevation data for the United States and its territories. New elevation data are acquired using modern technology to replace elevation data that are, on average, more than 30 years old. Through the efforts of the NDEP, a project-by-project data acquisition approach resulted in improved, publicly available data for 28 percent of the conterminous United States and 15 percent of Alaska over the past 15 years. Although the program operates efficiently, the rate of data collection and the typical project specifications are currently insufficient to address the needs of government, the private sector, and other organizations.

The National Enhanced Elevation Assessment (NEEA; Dewberry, 2011) was conducted to (1) document national-level requirements for improved elevation data, (2) estimate the benefits and costs of meeting those requirements, and (3) evaluate multiple national-level program-implementation scenarios. The assessment was sponsored by the NDEP's member agencies. The study participants came from 34 Federal agencies, agencies from all 50 States, selected local government and Tribal offices, and private and not-for-profit organizations. A total of 602 mission-critical activities were identified that need significantly more accurate data than are currently available. The results of the assessment indicate that enhanced elevation data have the potential to generate \$13 billion in new benefits annually.

## Requirements for Enhanced Elevation Data

The requirements for elevation data were documented as part of the assessment through surveys and structured interviews. Each requirement was described in terms

of the accuracy of the data, the data refresh cycle, and the geographic area of interest. The expected benefits that would result from meeting these requirements were also identified. To facilitate this analysis, the results of the survey and interviews were sorted by 27 predefined business uses. Table 1 summarizes expected benefits for the top 10 of 27 identified business uses, in dollar amounts. The dollar amounts represent cost savings either for the operating agencies or for the customers who use their services and are detailed for each organization in Dewberry (2011). For example, in Alabama, high-quality elevation data could potentially save the State's Department of Economic and Community Affairs \$5 million because of the reduced time (and thereby costs) needed to create datasets for analyzing flood risks. The improved data could potentially save the agency's customers \$3 million because the data would help reduce the costs and amount of time required to complete certain phases of flood-risk mitigation projects.

For about half of the reported applications, the surveyed organizations were unable to identify specific economic benefits even though most of them expected major benefits from improved elevation data. For example, the Environmental Protection Agency needs high-accuracy, high-resolution topographic data to characterize the landscape for both environmental protection and assessment of ecosystem services but did not quantify the benefits. Narratives describing the benefits of improved elevation data without associated monetary benefits are also included in Dewberry (2011).

## Analysis and National Elevation Program Scenarios

Benefit-cost analyses were developed and examined for more than 25 program scenarios (Dewberry, 2011), which included various quality levels for the elevation data (table 2) and data-replacement cycles. The estimated costs for each scenario include those for data collection and life-cycle management.

Enhanced elevation data support critical applications



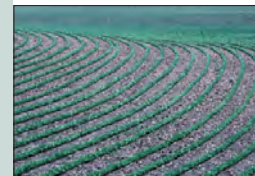
Flood risk management



Infrastructure management



Natural resources conservation



Agriculture and precision farming



Water supply



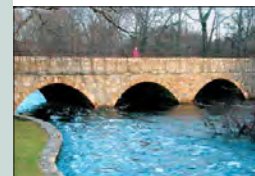
Wildfire management



Geologic resource assessment



Forest resources management



Stream resource management



Aviation safety

**Table 1.** Annual aggregated monetary benefits for the top 10 business uses identified in the National Enhanced Elevation Assessment.

[Benefits were reported as single values or as a range of values in the assessment report (Dewberry, 2011). Only one half of participants were able to assign benefits to their activities, and the conservative benefits include these numbers only. Further, when benefits were reported as a range, only the low end of the range was included in calculating conservative benefits. Potential benefits were based on the high end of benefit ranges and included some estimated and projected benefits as well as the benefits expected from some emerging applications]

Rank	Business use	Annual benefits	
		Conservative (in millions of dollars)	Potential (in millions of dollars)
1	Flood risk management	\$295	\$502
2	Infrastructure and construction management	206	942
3	Natural resources conservation	159	335
4	Agriculture and precision farming	122	2,011
5	Water supply and quality	85	156
6	Wildfire management, planning, and response	76	159
7	Geologic resource assessment and hazard mitigation	52	1,067
8	Forest resources management	44	62
9	River and stream resource management	38	87
10	Aviation navigation and safety	35	56

Each scenario would implement a national data-collection strategy to achieve cost efficiencies and meet the requirements of multiple organizations.

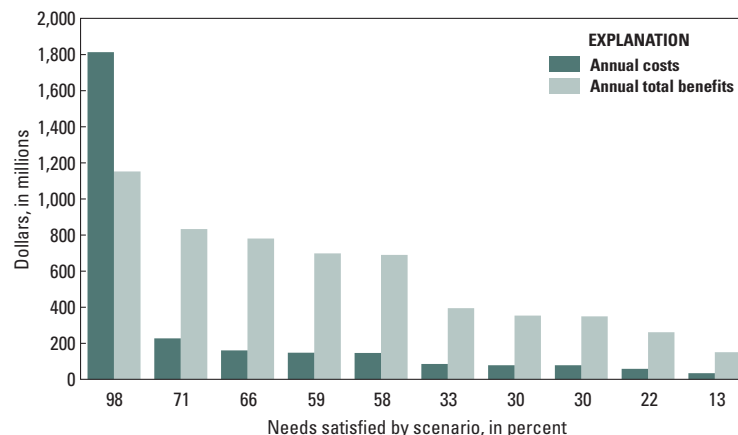
The final analysis yielded 10 leading scenarios, which are shown in figure 1. The least beneficial scenario is one that provides national data coverage at quality level 3 (see table 2 for more information on quality levels) on a 25-year replacement schedule but realizes only 13 percent of the benefits. In contrast, the national data coverage at quality level 1 on an annual replacement schedule realizes 98 percent of the conservative benefits. The 58-percent mid-range scenario offers a good benefit-to-cost ratio, uniform quality level 2 data, and an 8-year acquisition cycle. All of the scenarios included quality level 5 data coverage in Alaska, which would be collected by using interferometric synthetic aperture radar (ifsar) techniques; in Alaska cloud cover and remoteness preclude consideration of lidar data over much of the State. With the exception of the 98-percent scenario, all of the scenarios resulted in positive benefit-to-cost ratios ranging from 4:1 to 5:1 using the most conservative benefit estimates.

The NEEA also reviewed current and emerging commercial elevation-data technologies, assessed data life-cycle-management costs for the various scenarios, and produced an inventory of existing elevation data derived from lidar and ifsar datasets. The inventory revealed that about 28 percent of the conterminous United States is covered by quality level 3 lidar data and that about 15 percent of Alaska is covered by ifsar data.

## Summary

The current NDEP activity is a partnership between Federal, State, and other agencies. Although the effort is efficient (very little duplication of effort), the program currently meets less than 10 percent of the needs identified in the NEEA. The following are the major findings:

1. Significant benefits could be realized by systematically upgrading the Nation's elevation data. Hundreds of improved business applications would benefit all levels of government and multiple industries.
2. The developed program scenarios demonstrated that favorable benefit-to-cost ratios can be achieved by integrating multiple requirements in large projects.
3. A new information technology infrastructure is needed for a project of this scale.
4. Current elevation technologies, industry capacity, data standards, and related matters are sufficient; there are



**Figure 1.** The 10 leading program scenarios resulting from the National Enhanced Elevation Assessment showing annual costs and total benefits.

**Table 2.** Data quality levels used in the National Enhanced Elevation Assessment.

[≤, less than or equal to]

Quality level	Horizontal point spacing (meters)	Vertical accuracy (centimeters)
1	0.35	9.25
2	0.7	9.25
3	1–2	≤ 18.5
4	5	46–139
5	5	93–185

no capability constraints or technical barriers precluding a national program and no technical reasons to delay its implementation.

5. The majority of applications now require data better than quality level 3.

## Reference Cited

Dewberry, 2011, Final Report of the National Enhanced Elevation Assessment: Fairfax, Va., Dewberry, 84 p. plus appendixes (revised 2012), available at <http://www.dewberry.com/Consultants/Geospatial Mapping/FinalReport-National EnhancedElevationAssessment>.

## Partners

The NEEA was conducted under a contract between the U.S. Geological Survey and Dewberry (a consulting firm based in Fairfax, Va.). Additional support for the assessment came from other Federal agencies: the Federal Emergency Management Agency, the National Geospatial-Intelligence Agency, the National Oceanic and Atmospheric Administration, and the Natural Resources Conservation Service.

## For Further Information

More information on the NEEA may be found at <http://nationalmap.gov/3DEP/nea.html>, or by contacting the author at [gsnyder@usgs.gov](mailto:gsnyder@usgs.gov) or (703) 648-5169.

By Gregory I. Snyder



# The 3D Elevation Program—Summary of Program Direction

## Introduction

The 3D Elevation Program (3DEP) initiative responds to a growing need for high-quality topographic data and a wide range of other three-dimensional representations of the Nation’s natural and constructed features. The National Enhanced Elevation Assessment (NEEA), which was completed in 2011, clearly documented this need within government and industry sectors. The results of the NEEA indicated that enhanced elevation data have the potential to generate \$13 billion in new benefits annually. The benefits apply to flood risk management, agriculture, water supply, homeland security, renewable energy, aviation safety, and other areas. The 3DEP initiative was recommended by the National Digital Elevation Program and its 12 Federal member agencies and was endorsed by the National States Geographic Information Council (NSGIC) and the National Geospatial Advisory Committee (NGAC).

## Goals and Benefits

The primary goal of 3DEP is to systematically collect enhanced elevation data in the form of high-quality light detection and ranging (lidar) data over the conterminous United States, Hawaii, and the territories on an 8-year schedule. Interferometric synthetic aperture radar (ifsar) data will be collected over Alaska, where both the cloud cover and the remote location preclude the use of lidar over much of the State. It is expected that private-sector data-acquisition companies will mobilize to respond to these lidar and ifsar data needs and that the products and services will be accessible to all levels of government and the public. 3DEP will provide easy access to these authoritative data and derived products by using a cloud-based infrastructure. 3DEP products and services will be provided nationally at significantly higher resolution and accuracy than are available today.

The enhanced elevation data support flood-risk management, natural resources conservation, infrastructure management, agriculture and precision farming, aviation safety, renewable energy development, and many other identified business applications. The potential benefits to precision agriculture and intelligent vehicle navigation alone are estimated at over \$9 billion annually (Dewberry, 2011). It is expected that new, unimagined information services will be created, thus spawning job growth and transformation in the geospatial community. The following examples demonstrate the value of enhanced elevation data to both Federal and State programs. These examples are among the 602 applications documented in the NEEA report (Dewberry, 2011):

1. The Federal Emergency Management Agency (FEMA) expects that a national enhanced elevation program could reduce the amount of time needed to update its flood maps. These data could provide significant benefits to the communities and citizens that are customers of the National Flood Insurance Program by providing updated information to affected communities and homeowners more quickly. In addition, the national availability of enhanced elevation data (not just for areas where FEMA identifies a need) could lead to innovative tools that build on FEMA’s flood-risk data and make them more powerful, effective, and easier to use; for example, users may be able to easily visualize a variety of flood levels in three dimensions.
2. Using lidar data, U.S. Geological Survey (USGS) scientists discovered a surface rupture along the Tacoma fault in the State of Washington. This discovery led to a redesign of the structural elements of a \$735-million suspension bridge across the Tacoma Narrows. When lidar data enable the identification of active faults near

Enhanced elevation data support critical applications



Flood risk management



Infrastructure management



Natural resources conservation



Agriculture and precision farming



Water supply



Wildfire management



Geologic resource assessment



Forest resources management



Stream resource management



Aviation safety

planned nuclear-waste-treatment facilities or a major suspension bridge, proactive mitigation steps may be taken to avoid potential catastrophes in the future.

3. The U.S. Environmental Protection Agency's (EPA's) environmental impact assessments (EIAs) depend upon accurate elevation data for vulnerability mapping and for estimating the threat of sea-level rise to human populations, infrastructure, the fish and shellfish industries, and the coastal environment. Credible EIAs cannot be performed without accurate lidar data. The EPA estimates that billions of dollars would be saved by States, local communities, and citizens because they may have accurate elevation data on which to base their sea-level-rise mitigation activities.
4. The Centers for Disease Control indicate that lidar data provide significant benefits for occupational safety and health by enabling many tasks to be performed in an office environment that were previously performed in the field under dangerous or unhealthful conditions. For example, conducting land surveys during highway construction results in traffic deaths among surveyors each year. This hazard may be largely eliminated by the use of lidar-based surveys.
5. In the State of Alaska, poor-quality elevation data pose an ongoing threat to aviation safety. Improved elevation data for cockpit navigation and flight simulators may save a significant number of lives each year by reducing the number of accidents that result from the inability to safely fly over obstacles in the air space. The elevation data in

Alaska have large demonstrated errors and are not reliable for safe navigation. Poor weather conditions, extremes in terrain, and reliance on air travel underscore Alaska's requirement for improved elevation data for aviation safety.

6. Enhanced elevation data for the State of Illinois would dramatically improve precision farming. A more accurate depiction of variations in local relief helps determine a more accurate rate for applying agricultural chemicals, thereby yielding a significant cost savings and reducing agricultural pollution. Approximately two-thirds of the land area of Illinois is devoted to agricultural uses.

## Governance

3DEP will be a cooperatively funded national elevation program led by the USGS, which is the Federal Geographic Data Committee's designated lead Federal agency for the collection and management of terrestrial elevation data. A governance model is being developed to solidify 3DEP partner agency roles and data acquisition strategies, program expectations, and constraints. The program will be designed to meet the mission-critical data needs of the 3DEP partners and other communities of use. The Federal agencies poised to realize the highest benefits to their mission from enhanced elevation data include the Natural Resources Conservation Service, the U.S. Army Corps of Engineers, the Defense Installation Spatial Data Infrastructure, the USGS, the National Oceanic and Atmospheric Administration, the Federal Emergency Management Agency, the EPA, the U.S. Forest Service, the Federal Aviation Administration,

and the National Geospatial-Intelligence Agency. States and other partners will be able to participate in 3DEP and could fund higher quality data where needed. Efforts to reach out to current and future partners are underway.

The National Research Council (2007) concluded that the Nation's elevation data are inadequate to support FEMA's flood-plain mapping activities and that new national elevation data collection is required. The report proposed the use of lidar as the primary technology for elevation data acquisition and noted that these data would have many beneficial uses beyond FEMA's flood-plain mapping needs.

## Implementation

The program is expected to continue to function as an activity that is coordinated by the National Digital Elevation Program. Several key changes are expected as the current elevation program transitions to 3DEP. These changes include an expansion of the partnership base, larger and thus more cost-effective projects, a directed approach for national coverage, improved data quality, and expanded application services.

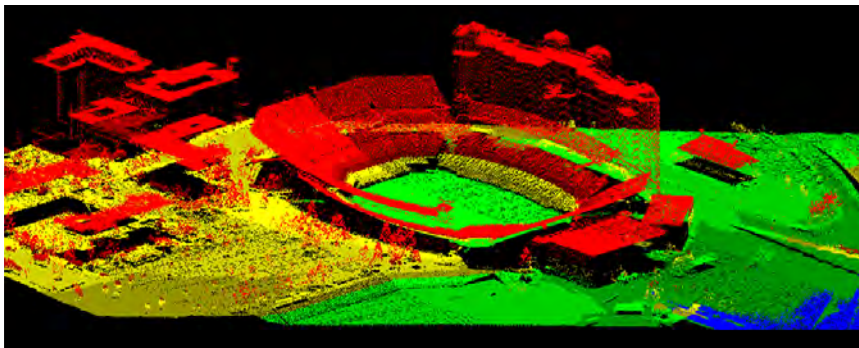
## References Cited

- Dewberry, 2011, Final Report of the National Enhanced Elevation Assessment (revised 2012): Fairfax, Va., Dewberry, 84 p. plus appendixes, available at <http://www.dewberry.com/Consultants/GeospatialMapping/FinalReport-NationalEnhancedElevationAssessment>.
- National Research Council, 2007, Elevation data for floodplain mapping: Washington, D.C., The National Academies Press, 168 p. (Also available at [http://books.nap.edu/openbook.php?record\\_id=11829&page=1](http://books.nap.edu/openbook.php?record_id=11829&page=1).)

## For Further Information

Further information on the 3DEP initiative can be found at <http://nationalmap.gov/3DEP/> or by contacting Mark DeMulder at [mdemulder@usgs.gov](mailto:mdemulder@usgs.gov) or (703) 648-5569.

By Gregory I. Snyder



Lidar image of University of Nebraska's Memorial Stadium. Lidar data support facility siting, infrastructure and construction management, and emergency response.