

**National Geospatial Advisory Committee
Elevation Subcommittee Summary Report
December 2012**

This paper was developed in response to the Guidance provided by the Federal Geographic Data Committee (FGDC) to the National Geospatial Advisory Committee (NGAC) requesting advice and recommendations on the National Enhanced Elevation Assessment and 3DEP Program.

Introduction:

The ability to understand a landscape's topography allowed ancient civilizations to build impressive aqueducts across vast distances and valleys in order to irrigate their land and bring fresh water to their cities. In modern society, the ability of land surveyors to collect accurate topographic data has allowed for construction and engineering projects. The ability of photogrammetrists to create topographic maps of vastly larger areas has allowed for energy exploration, natural resource conservation, and public works projects.

Within the past decade, advances in Light Detection and Ranging (LiDAR) technology have made it possible to cost-effectively collect digital land elevation data and advances in spatial data manipulation technology have made it possible to cost-effectively use digital land elevation data. Consequently, the use of digital elevation data has become increasingly common at all levels of government, which has also benefited the public and private sectors. *"With an ever-growing demand for digital elevation data by Federal, State and local governments, the [National Digital Elevation Program] (NDEP) was established to promote the exchange of digital elevation data among government, private, and non-profit sectors and the academic community and to establish standards and guidance that will benefit all users."*

As part of its mandate, NDEP commissioned the National Enhanced Elevation Assessment (NEEA) to:

- Document national requirements for improved elevation data
- Estimate the benefits and costs of meeting these requirements
- Evaluate national enhanced program implementation scenarios

One of the recommendations in the assessment report was the proposal to create the 3D Elevation Program (3DEP) (<http://pubs.usgs.gov/fs/2012/3089/>). The NGAC Elevation Subcommittee reviewed this proposal and answered the following three questions concerning the development and support of 3DEP in the public and private sectors:

Question 1: The 3DEP costs and program design are predicated on the assumption that economies of scale will be achieved through larger data acquisition projects, so a primary objective is to collect large area blocks rather than small project areas. Feedback we have received from potential Federal 3DEP partners is that they can only fund partnerships that meet their specific project requirements. Given that we have worked through NDEP and the liaison network to leverage requirements and funding to a high degree already, what can be done at current funding levels to move to large area collections? Factors include 1) capturing a greater percentage of the LiDAR acquisition investment across the community, 2) expanding coordination to increase project size, and 3) having better advance knowledge of partner plans and funding. How can this be achieved, what governance model would be most effective, and what other factors should be considered?

Question 2: The program proposal is for a partnership-funding model with Federal agencies and States increasing current investment levels. The USGS is currently pursuing additional funding within its base program and reaching out to others to do the same. What avenues or opportunities to achieve the program objectives are we missing?

Question 3: Several industries to include precision farming, intelligent vehicle navigation, and alternative energy development stand to gain from a national 3DEP program. How do we best engage these (and other) industry sectors?

The responses in this paper directly address the questions put forth to the subcommittee by the National Geospatial Program Office 3DEP Program. We recognize there are additional concerns and challenges facing this program as well as other national data collection initiatives. Further study may investigate lessons learned from other national initiatives such as Imagery for the Nation, environmental issues such as working with austere budgets, and challenges for establishing a culture of cooperation, coordination, and sharing of data among federal agencies and among all levels of government.

References & Resources:

Topographic Mapping: <http://egsc.usgs.gov/isb/pubs/booklets/topo/topo.html>

National Digital Elevation Program: http://www.ndep.gov/NDEP_one-pager.pdf

National Enhanced Elevation Assessment:

Summary: <http://pubs.usgs.gov/fs/2012/3088/>,

Summary & Recommendations: <http://www.fgdc.gov/ngac/meetings/april-2012/nea-presentation-ngac-apr-2012.pdf>

Full Report: <http://www.fgdc.gov/ngac/meetings/april-2012/nea-presentation-ngac-apr-2012.pdf>

3D Elevation Program (3DEP): <http://pubs.usgs.gov/fs/2012/3089/>

Question #1: The 3DEP costs and program design are predicated on the assumption that economies of scale will be achieved through larger data acquisition projects, so a primary objective is to collect large area blocks rather than small project areas. Feedback we have received from potential Federal 3DEP partners is that they can only fund partnerships that meet their specific project requirements. Given that we have worked through NDEP and the liaison network to leverage requirements and funding to a high degree already, what can be done at current funding levels to move to large area collections? Factors include 1) capturing a greater percentage of the LiDAR acquisition investment across the community, 2) expanding coordination to increase project size, and 3) having better advance knowledge of partner plans and funding. How can this be achieved, what governance model would be most effective, and what other factors should be considered?

Response:

The NGAC Elevation Subcommittee highly recommends that USGS take advantage of the recently enacted legislation in the *'Moving Ahead for Progress in the 21st Century Act'* or *'MAP-21'*. (Public Law 112-141) to achieve the goals outlined above. We believe the requirements stated in the legislation may be the vehicle and authorization to require coordination among federal agencies for obtaining elevation data.

Section 100216 National Flood Mapping Program of the legislation outlines requirements of the National Flood Mapping Program requiring “the most accurate topography and elevation data available.” The legislation also calls for the coordinated, inter-agency funding pool for flood mapping data including elevation data outlined in *Section 100220, Coordination*. It requires the Director of OMB in coordination with multiple federal agencies to *submit an interagency budget crosscut and coordination report*. It also states that the strategy or plan will *integrate with, leverage, and coordinate funding of the current flood mapping activities and current geospatial activities*.

We agree that in order to obtain the most accurate elevation data available a collaborative approach among federal agencies is needed. Further, to facilitate this initiative the NGAC encourages the USGS National Geospatial Program Office to:

- 1) take the leadership role in the coordination efforts;
- 2) reach out to FEMA to ensure flood mapping requirements are fully addressed by the 3DEP initiative;
- 3) review the existing Memoranda of Understanding (MOU) with FEMA and modify as needed to meet the requirements of this initiative; and
- 4) recruit NOAA, USACE, and other agencies to participate in the partnership and create MOUs with each partner.

The NGAC strongly encourages The U.S. Geological Survey to take the lead in coordinating efforts for the acquisition of elevation data as required to address the flood mapping program needs within the 3DEP initiative. The USGS is the designated lead agency (OMB Circular A-16) for terrestrial elevation data. The USGS manages the Center for LiDAR Information Coordination and Knowledge (CLICK) and the National Elevation Dataset (NED), which have been created from partnership contributions of high quality elevation data from FEMA, USGS, NGA and other Federal and state agencies. USGS has a mapping mission that encompasses elevation data collection and management activities for this important national data asset and should be looked to for continued leadership.

We believe that this joint effort could be the foundation for building a robust national elevation program. The expanded coordination would increase project size, contribute to establishing a

governance structure that would most effectively meet future requirements, as well as lead to the development of the joint funding strategy for data acquisition. Included in this funding strategy would be a plan to obtain additional monies to meet the current and future needs of the program.

Summary of Response:

- **Take advantage of the recently enacted legislation in the *'Moving Ahead for Progress in the 21st Century Act'* (Public Law 112-141) to achieve the goals of the program.**

Question 2: The program proposal is for a partnership-funding model with Federal agencies and States increasing current investment levels. The USGS is currently pursuing additional funding within its base program and reaching out to others to do the same. What avenues or opportunities to achieve the program objectives are we missing? In other words, how can we encourage states and other levels of government to participate?

Response:

State and other non-federal levels of government stand to gain valuable data at low cost by participating in the 3DEP data initiative. If money that currently funds local and regional projects were invested in a national program, a far greater area could be surveyed, redundancy in data collection would be avoided, and data would be more consistent and reliable. State and local governments may be slow to yield control of such projects to a national effort, however. The following six approaches would strengthen the case for a national program and encourage state and local partners to voluntarily subscribe to a national set of data products.

- **Inform and build trust with partners through clear and coordinated communication**

Develop a core set of consistent messages that engage all potential partners (federal, state, local, private sector) by describing the range of benefits of a National Enhanced Elevation dataset. This approach saves money by building a single set of resources and lends strength to the campaign's credibility by providing consistent information.

Summarize material from the National Enhanced Elevation Assessment (NEEA) Final Report Appendix E: Business Use Requirements and Benefits to convey the common interests that will be addressed by a single national effort. Leverage and reinforce positive examples of other models such as NAIP/ Digital Earth and the National Cooperative Geologic Mapping Program ((NCGMP), whereby national mapping objectives have been coordinated and accomplished via state and federal partners collaborating over a period of two decades. Listen and respond publicly to feedback from potential partners to establish trust and enhance the strength and longevity of partner relationships. Select informational materials may be tailored to the interests of state and local levels but they should be tied to the core materials and seen as an expansion upon the core message.

- **Ensure that local-level project needs will be met**

Clearly affirm that local-level project requirements will be met and that moving to a national program will not compromise data quality. The option to buy-up to Quality Level 1 data will be a critical program component for many state and local agencies. Some agencies may have found it difficult to engage with federal partners on elevation data acquisition projects in the past because the federal data standard was lower than the local project requirements. This experience should be acknowledged and assurances should be made that state and local governments will be able to meet their specification requirements even when they vary from the requirements of other program partners.

- **Ensure consistent national-level derivative data products as a value add**

Explore options for generating and provide means of acquiring derivative data products such as:

- Contours
- Elevation models (DEM, TIN)

- Tree canopy
- Streams

State and local partners may find it more enticing to subscribe to a program that delivers consistent, comprehensive, ready to consume data products they can use directly in their current operations rather than source LiDAR point cloud data that they must further process. The resulting products are a timesaving value-added service the federal government can offer.

The standard minimum specification for the national data is intended to ensure consistency and relative seamlessness of elevation data across the country. If the quality standard is met nationally but each state derives its own data products from the source, seams will reappear along jurisdictional boundaries and the ability to model regionally and nationally will be compromised.

- **Explore the interest in and feasibility of a repeat data collection cycle**

Most state and local agencies focus on one-time, project-specific elevation surveys despite the value of longer-term, comprehensive analysis and periodic data updates. Budgets at all levels of government are tight and justification is required for every line item. In this fiscal environment, projects that demonstrate enhanced value, yield long-term benefits, and anticipate future needs are more likely to be supported.

A regular, repeating LiDAR data collection cycle may entice partners to shift from a local, piecemeal approach to a national program by offering long-term savings, greater analytical capacity and depth, and more predictable costs and coverage.

While it is recognized that costs over an 8-year cycle may be difficult to predict, further investigation of the interest in and feasibility of a repeat collection model is warranted. Engage potential partners in discussions about this model and highlight applications of elevation data that become possible with multiple surveys over time such as tree canopy/vegetation monitoring, hydrological modeling, and flood plain change detection. Explore options for locking in future prices (potentially holding the base budget at a fixed amount and allowing technology to improve over time, resulting in improved data quality or expanded derived products over time).

- **Offer data hosting and user-friendly access to data products**

States and other levels of government struggle to manage the costs of high-volume data storage and organization. High quality elevation data is notoriously unwieldy and space intensive. The success of a data collection project can hinge upon fast and reliable data access.

A National Enhanced Elevation dataset with a standardized web-based portal and user-friendly interface for data downloads would relieve agencies of the need to invent, maintain, and budget for data storage systems individually. Economies of scale would be realized not only in data collection and processing, but also in the data distribution, for even greater savings and a more compelling program.

- **Reduce and stabilize administrative and contract costs**

The administrative costs associated with managing local level data collection projects create budget uncertainty and additional drains on resources for every governmental entity.

Quantify the cost savings that would result specifically from shifting the administrative burden of data acquisition projects to a national program. Make program participation as simple as possible to minimize administrative time spent by each jurisdiction. Pre-negotiate contract terms, including

buy-up costs for higher quality data, if competitive prices are available. If terms are not competitive, ensure that further negotiation is possible while being cognizant of the break-even point between the contracted rate savings and the cost of the negotiation itself.

Summary of Response:

- **Inform and build trust with partners through clear and coordinated communication**
- **Ensure that local-level project needs will be met**
- **Ensure consistent national-level derivative data products as a value add**
- **Explore the interest in and feasibility of a subscription model with repeat data collection**
- **Offer data hosting and user-friendly access to data products**
- **Reduce and stabilize administrative and contract costs**

Question 3: Several industries to include precision farming, intelligent vehicle navigation, and alternative energy development stand to gain from a national 3DEP program. How do we best engage these (and other) industry sectors?

How can 3DEP engage those industries that would benefit from a national 3DEP program? Enhanced elevation data would benefit not only those industries (e.g. floodplain mapping, forestry, and defense) that have a long history of utilizing LiDAR derived data from remote sensing, but would also benefit the following industries that have an increasing need for precise and accurate elevation data to construct three-dimensional representations of natural and constructed features:

- Agriculture and precision farming
- Alternative energy development
- Aviation safety
- Forest resources management
- Geologic resource assessment and hazard mitigation
- Infrastructure and construction management
- Intelligent vehicle navigation
- Natural resources conservation
- Stream resource management
- Water supply and quality
- Wildfire management, planning, and response

The National Geospatial Advisory Committee (NGAC) recommends the 3D Elevation Program (3DEP) engage and seek the support from these elevation data using industries by the following cost-effective methods:

- **Network with a key contact person in each of these industries**

In order to utilize resources in the most efficient manner, NGAC would assist 3DEP by identifying a key contact person in each of these industries who would be willing to provide 3DEP with information on:

- How to best reach the industry:
 - Networking (i.e. contact information for other key people)
 - Organizations
 - Trade journals/websites
 - Conferences and continuing education
 - Coalitions
- The industry's elevation needs and how they are currently being met

- **Network with LiDAR researchers: Public and Private**

NGAC would identify the LiDAR researchers at those colleges and universities that utilize LiDAR (<http://LiDAR.cr.usgs.gov/knowledge.php>) and those researchers in the private sector that build or utilize LiDAR. These researchers could provide 3DEP with:

- Solutions/potential solutions to the elevation needs of the targeted industries
- Published articles that could be used as references for articles that would be written for trade journals
- Networking (i.e. contact information for other LiDAR researchers)

- **Publish industry focused articles in their trade journal**

Ideally, 3DEP should develop industry-focused examples to showcase how enhanced elevation data could help solve each industry's elevation needs, write an industry-specific article about each industry's example, and then get each of these articles published in the corresponding industry trade journal/website.

However, due to limited resources, 3DEP could forgo developing industry-specific examples and instead base the industry-specific articles about existing LIDAR research that has the potential to help solve each industry's specific elevation needs. Conceivably, there could be many industry-specific examples that have already been developed, because the public and private sectors have been utilizing LiDAR derived elevation data since early 2000 and many universities have performed research projects utilizing LiDAR to support these public/private sector applications.

In order to maximize the effectiveness of these proposed industry-specific articles, 3DEP should determine which trade journals/websites have the largest readership.

- **Become active participants in their conferences**

Undoubtedly, each of these industries holds an annual conference that provides information about the latest technologies. Thus, 3DEP could reach/network with a lot of key personnel in these industries by providing conference speakers, submitting articles to be published in the conference report, and/or staffing a conference booth. However, the practicality of attending multiple conferences may not be possible due to time and funding.

Alternatively, 3DEP could focus on joint conferences that attract multiple elevation using industries, such as the World of Concrete Expo (<http://www.worldofconcrete.com/>), which is held in Las Vegas. This annual event is attended by many industries that utilize and benefit from the topographic data and three-dimensional representations of natural and constructed features.

- **Work with coalitions of related industries**

Many of the elevation data using industries have formed coalitions of related industries, such as the Coalition of Geospatial Organizations (COGO) (<http://www.cogo.pro>), which is composed of eleven member organizations that are themselves composed of multiple organizations (e.g. American Congress on Surveying & Mapping). Therefore, NGAC recommends working with coalitions as well as with the member organizations.

Summary of Response:

- **Network with a key contact person in each of these industries**
- **Network with LiDAR researchers**
- **Publish industry focused articles in their trade journal**
- **Become active participants in their conferences**
- **Work with coalitions of related industries**