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The 3D Elevation Program—Summary for Alaska

Introduction

Elevation data are essential to a broad range of applications, including forest resources management, wildlife and habitat management, national security, recreation, and many others. For the State of Alaska, elevation data are critical for aviation navigation and safety, natural resources conservation, oil and gas resources, flood risk management, geologic resource assessment and hazards mitigation, forest resources management, and other business uses. Today, high-quality light detection and ranging (lidar) data and interferometric synthetic aperture radar (ifsar) are the primary sources for deriving elevation models and datasets. Federal, State, and local agencies work in partnership to (1) replace data, on a national basis, that are older and of lower quality and (2) provide coverage where publicly accessible data do not exist.

Recent mapping information for the majority of land in Alaska is not available because clouds, smoke, and remoteness have hampered data collection. Lidar data have been collected only at selected coastal areas, cities, refuges, and parks. Within the last decade, ifsar technology has become the most effective tool for overcoming the challenges to acquiring elevation data for Alaska because this technology can penetrate clouds. State efforts for the collection of ifsar data are being coordinated through Alaska's Statewide Digital Mapping Initiative (SDMI), a cooperative program implemented across six State of Alaska departments and the University of Alaska. Federal efforts are coordinated through the Alaska Mapping Executive Committee (AMEC), chaired by the Department of the Interior with membership from 15 Federal agencies and representatives from the State of Alaska.

3DEP in Alaska by the Numbers

Expected annual benefits	$18.79 million
Estimated total cost	$54.59 million
Payback	2.9 years

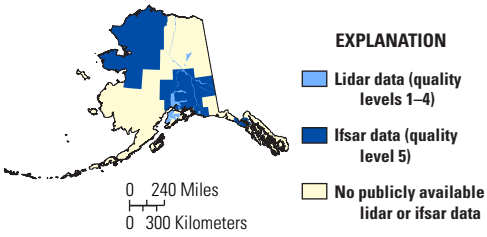

Figure 1. Map of Alaska showing the areal extent of planned and existing publicly available interferometric synthetic aperture radar (ifsar) and light detection and ranging (lidar) data and their quality in August 2013. Ifsar and lidar data meet 3DEP requirements. See table 2 for quality levels.

Coordination by SDMI and AMEC avoids duplication of effort and ensures a unified approach to consistent, statewide data acquisition; the enhancement of existing data; and support for emerging applications. The 3D Elevation Program (3DEP) initiative (Snyder, 2012a,b), managed by the U.S. Geological Survey (USGS), responds to the growing need for high-quality topographic data and a wide range of other three-dimensional representations of the Nation's natural and constructed features.

3D Elevation Program Benefits for Alaska

The top 10 Alaska business uses for 3D elevation data, which are based on the estimated annual benefits of the 3DEP initiative, are shown in table 1. The National Enhanced Elevation Assessment (NEEA; Dewberry, 2011) survey respondents in the State of Alaska estimated that the national 3DEP initiative would result in at least $18 million in new benefits annually to the State. The cost for such a program in Alaska is approximately $54 million, resulting in a payback period of 2.9 years and a benefit-to-cost ratio of 2.8 to 1 over an 8-year period. Because monetary estimates were not provided for all reported benefits, the total benefits of the 3DEP to Alaska are likely much higher.

3D Elevation Program

3DEP is a national program managed by the USGS to acquire high-resolution elevation data. The initiative is backed by a comprehensive assessment of requirements (Dewberry, 2011) and is in the early stages of implementation. 3DEP will improve data accuracy and provide more current data than is available in the National Elevation Dataset (NED). The goal of this high-priority cooperative program is to be operational by January 2015 and to have complete coverage of the United States by 2022, depending on funding and partnerships. The new program has the potential to generate $13 billion/year in new benefits through improved government services, reductions in crop and homeowner losses resulting from floods, more efficient routing of vehicles, and a host of other government, corporate, and citizen activities (Dewberry, 2011).

Benefits of a Funded National Program

- Economy of scale—Acquisition of data covering larger areas reduces costs by 25 percent.
- A systematic plan—Acquisition of data at a higher quality level reduces the cost of "buying up" to the highest levels needed by State and local governments.
- Higher quality data and national coverage—Ensure consistency for applications that span State and watershed boundaries and meet more needs, which results in increased benefits to citizens.
- Increase in Federal agency contributions—Reduces State and local partner contributions.
- Acquisition assistance—Provided through readily available contracts and published acquisition specifications.

The NEEA evaluated multiple data-collection scenerios and determined that the optimal data-quality level and data-replacement cycle, relative to cost, to meet the stated requirements was quality level 2 data and an 8-year replacement cycle. For Alaska, approximately 65 percent of the total conservative benefits are realized in aviation navigation and safety and natural resources conservation uses alone, as shown in table 1. The status of publicly available ifsar and lidar data in Alaska is shown in figure 1.

The following are examples of how 3DEP data can support business needs in Alaska: (1) Aviation navigation and safety is a major issue in Alaska because available in-cockpit maps are highly unreliable and pose a very serious danger to those who use them. Enhanced elevation datasets would help provide reliable terrain models and maps for use in aviation navigation by more accurately depicting Alaska's substantially mountainous topography. If the anticipated aircraft-related fatalities over hazardous terrain could be reduced by half during the next 10 years, the cost savings in terms of lives alone would exceed $100 million. (2) Enhanced elevation data could enable State, regional, and local governments to reduce planning for field work for conservation projects such as grade stabilization, ponds, grassed waterways, terracing, and wetland restoration, which could provide additional cost savings to the public.

References Cited

Dewberry, 2011, Final report of the National Enhanced Elevation Assessment (revised 2012): Fairfax, Va., Dewberry, 84 p. plus appendixes, http://www.dewberry.com/Consultants/GeospatialMapping/FinalReport-NationalEnhancedElevationAssessment.

Snyder, G.I., 2012a, National Enhanced Elevation Assessment at a glance: U.S. Geological Survey Fact Sheet 2012–3088, 2 p., http://pubs.usgs.gov/fs/2012/3088/.

Snyder, G.I., 2012b, The 3D Elevation Program—Summary of program direction: U.S. Geological Survey Fact Sheet 2012–3089, 2 p., http://pubs.usgs.gov/fs/2012/3089/.

Figure 2. Enhanced elevation data would provide reliable terrain models for use in aviation navigation by more accurately depicting Alaska's substantially mountainous topography. Photograph of Polar Bear Peak, Chugach State Park, Alaska, by Bill Anderson; used with permission.

Table 1. Conservative benefits for the top 10 business uses of the proposed 3DEP data identified in the National Enhanced Elevation Assessment for Alaska (Dewberry, 2011).

Rank	Business use	Annual benefits (millions)
1	Aviation navigation and safety	$10.04
2	Natural resources conservation	2.25
3	Oil and gas resources	1.59
4	Flood risk management	1.44
5	Geologic resource assessment and hazard mitigation	1.40
6	Forest resources management	0.83
7	Infrastructure and construction management	0.68
8	Coastal zone management	0.26
9	Sea level rise and subsidence	0.12
10	Wildfire management, planning, and response	0.10
	Other	0.08
	Total	18.79

3D Elevation Program—Continued

The USGS and its partners will acquire quality level 2 or better (table 2) three-dimensional lidar data over the conterminous United States, Hawaii, and the U.S. territories. Interferometric synthetic aperture radar (ifsar) data are being collected at quality level 5 (table 2) in Alaska. The data will be acquired over an 8-year period and will be made available to the public. A number of high-quality elevation-data products will be created to serve a wide range of business needs in government and the private sector.

Table 2. Data quality levels used in the National Enhanced Elevation Assessment (Dewberry, 2011).

[≤, less than or equal to]

Quality level	Nominal pulse 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

Next Steps for Implementing 3DEP

Accomplishing the 3DEP initiative's goal of national coverage in 8 years depends on the following factors:

- Increased partnerships among Federal, State, and local governments.
- Partnerships that acquire elevation data to the program's specifications across larger project areas.
- Increased communication about and awareness of the program's benefits and goals.
- Support for the program from government and other stakeholders.

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