

Appendix I - Not-for-Profit and Association MCAs

Academia

Representatives from 14 state universities in 12 states (Hawaii, Maine, Missouri, Montana, New Hampshire, North Carolina, Oklahoma, Oregon, Pennsylvania, Rhode Island, Vermont, and Virginia) provided information about nationwide requirements for elevation data. These responses are grouped here. Several additional responses from state universities and colleges with statewide or regional requirements are grouped with their corresponding states.

The universities depend on topographic and bathymetric elevation data to support education programs and basic research across numerous disciplines, many of which focus on coastal and environmental issues, natural resources management, emergency management and disaster response, and civil engineering. Elevation data support the modeling used in many of these programs. Elevation data are also used to support campus infrastructure and facilities management at some of the universities.

State universities have identified Business Uses and Mission Critical Activities that rely on elevation data and would benefit from enhanced elevation data. Summarized details of elevation data requirements and benefits received from the enhanced elevation data are provided in the following pages.

Summary Table

MCA Description				Requirements			Future Operational Benefits	Future Customer Service Benefits	Future Societal Benefits		
Primary Business Use	Agency/ Organization Name	MCA No.	Mission Critical Activity	Data Type	QL/Order	Update Frequency	Total Reported Future Annual Operational Benefits	Total Reported Future Annual Customer Service Benefits	Education or Outreach	Environmental	Public Safety
BU 03 – Coastal Zone Management	Old Dominion University	1225	Academic Research	Inland Topo	QL1 HD	2-3 years	Unable to quantify	Unable to quantify	Major	Moderate	Moderate
				Inland Bathy	QL2B	4-5 years	Unable to quantify	Unable to quantify	Moderate	None	None
				Nearshore Bathy	QL2B	4-5 years	Unable to quantify	Unable to quantify	Moderate	None	None
BU 03 – Coastal Zone Management	University of North Carolina	51001	Coastal Zone Management	Inland Topo	QL1	4-5 years	Unable to quantify	Unable to quantify	Major	Major	Major
				Inland Bathy	QL1B	4-5 years	Unable to quantify	Unable to quantify	Moderate	Major	Major
				Nearshore Bathy	QL1B	4-5 years	Unable to quantify	Unable to quantify	Major	Major	Major
				Offshore Bathy	Order 1a	6-10 years	Unable to quantify	Unable to quantify	Minor	Moderate	Moderate
BU 06 – Natural Resource Management	Montana State University	21662	Undergraduate and Graduate Spatial Sciences Education and Research	Inland Topo	QL2	Annually	\$372,654	\$3,268,863	Major	Major	None
				Inland Bathy	QL2B	4-5 years	Unable to quantify	Unable to quantify	Major	Major	I don't know
BU 06 – Natural Resource Management	University of Vermont	21797	Land Cover Mapping and Feature Extraction	Inland Topo	QL1	4-5 years	\$2,562	Unable to quantify	Major	Major	Moderate
				Inland Bathy	QL0B	4-5 years	Unable to quantify	Unable to quantify	Major	Major	Major
				Nearshore Bathy	QL2B	6-10 years	Unable to quantify	Unable to quantify	Major	Major	Major
BU 15 – Flood Risk Management	National Disaster Preparedness Training Center, University of Hawaii	1356	Natural Hazard Mitigation	Inland Topo	QL0	4-5 years	Unable to quantify	Unable to quantify	Major	Minor	Moderate
				Inland Bathy	QL0B	4-5 years	Unable to quantify	Unable to quantify	Moderate	Minor	Major
				Nearshore Bathy	QL0B	4-5 years	Unable to quantify	Unable to quantify	Moderate	None	Minor
BU 15 – Flood Risk Management	Pacific Disaster Center	21513	Disaster Based Situational Awareness and Risk Assessment	Inland Topo	QL2	Event driven	\$4,824	\$5,427	Major	None	Major
				Nearshore Bathy	QL3B	Event driven	Unable to quantify	Unable to quantify	I don't know	I don't know	I don't know
				Offshore Bathy	Order 2	Event driven	Unable to quantify	Unable to quantify	I don't know	I don't know	I don't know

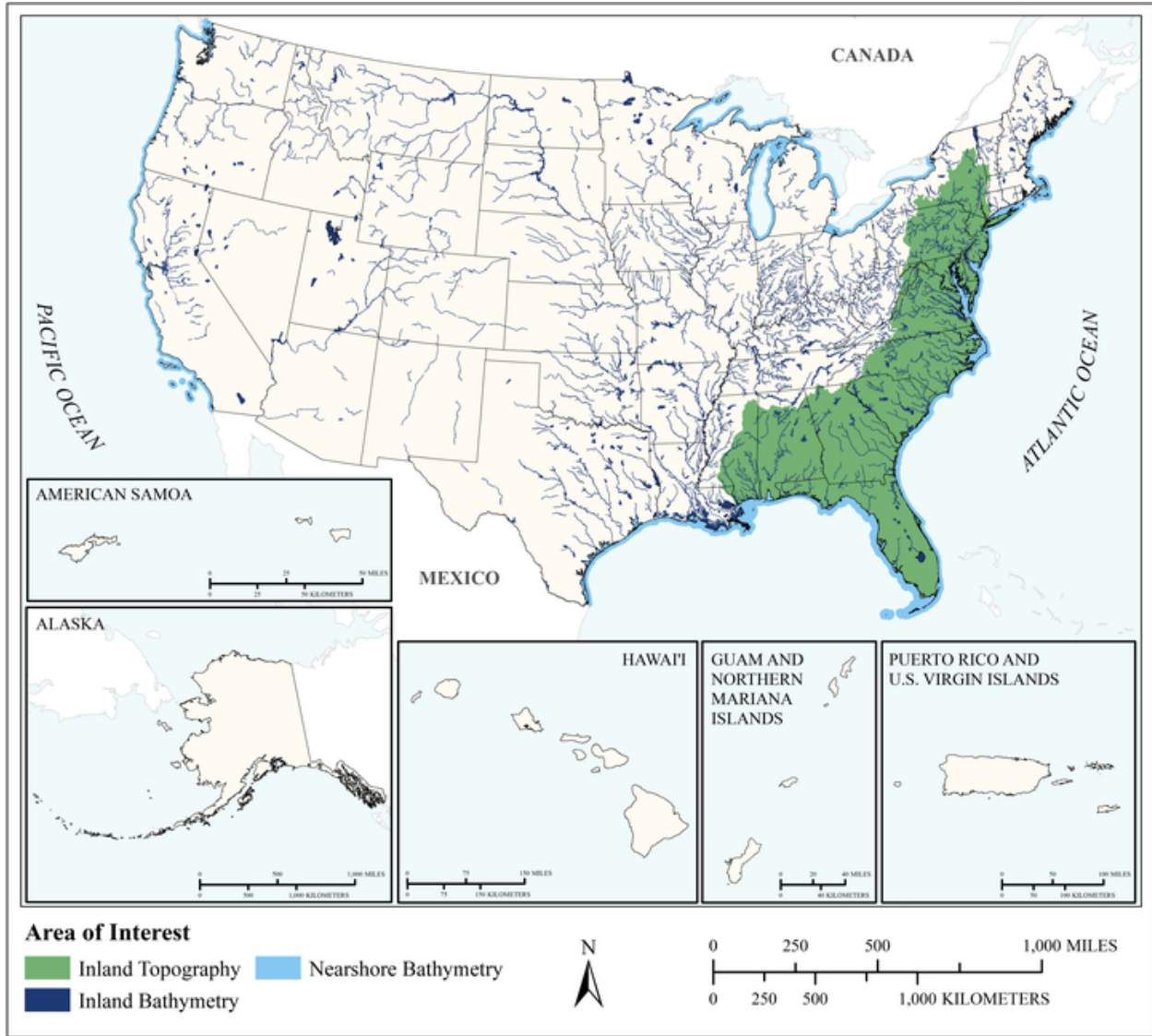
MCA Description				Requirements			Future Operational Benefits	Future Customer Service Benefits	Future Societal Benefits		
Primary Business Use	Agency/ Organization Name	MCA No.	Mission Critical Activity	Data Type	QL/Order	Update Frequency	Total Reported Future Annual Operational Benefits	Total Reported Future Annual Customer Service Benefits	Education or Outreach	Environmental	Public Safety
BU 20 – Marine and Riverine Navigation	University of New Hampshire Center for Coastal and Ocean Mapping/Joint Hydrographic Center (CCOM/JHC)	21515	Advance Ocean Mapping and Hydrography and Train Hydrographers	Inland Topo	QL0 HD	Depends on research. Annually for coastal change analysis in areas of rapid change. Event driven in areas with low rates of change. Coastal areas need more frequent updates, especially storm impacted areas; beach nourishment requires volumetric changes; marsh loss and migration require more frequency. Yearly flights for NH would be advantageous. Full waveform should be required for topo.	Unable to quantify	Unable to quantify	Major	Major	Major

MCA Description				Requirements			Future Operational Benefits	Future Customer Service Benefits	Future Societal Benefits		
Primary Business Use	Agency/ Organization Name	MCA No.	Mission Critical Activity	Data Type	QL/Order	Update Frequency	Total Reported Future Annual Operational Benefits	Total Reported Future Annual Customer Service Benefits	Education or Outreach	Environmental	Public Safety
				Nearshore Bathy	QL0B	Annually in locations where coastal change is being studied or where the seafloor changes rapidly. Otherwise, event driven. Triggering events would include major storms that alter hydrography, navigation, bathymetry, or shoreline position.	Unable to quantify	Unable to quantify	Major	I don't know	Major

MCA Description				Requirements			Future Operational Benefits	Future Customer Service Benefits	Future Societal Benefits		
Primary Business Use	Agency/ Organization Name	MCA No.	Mission Critical Activity	Data Type	QL/Order	Update Frequency	Total Reported Future Annual Operational Benefits	Total Reported Future Annual Customer Service Benefits	Education or Outreach	Environmental	Public Safety
				Offshore Bathy	The needed accuracy depends on the application . Deep ocean work may only require Order 1a, but shelf studies of seafloor change, habitats, electronic chart development may require high resolution of Special Order (2m).	The focus areas may vary depending on types of research being done. Some sites (deep ocean) may require only a single survey initially. However, in general for coastal resiliency, habitats, stability, the coverage of all nearshore areas should be done at a minimum of 2-3 years, and annually in areas of rapid erosion and or flooding.	Unable to quantify	Unable to quantify	Major	I don't know	I don't know
BU 26 – Education and Basic Research	Oregon State University	1103	Education and Research	Inland Topo	QL1	2-3 years	Unable to quantify	Unable to quantify	Major	I don't know	I don't know
				Inland Bathy	QL1B	2-3 years	Unable to quantify	Unable to quantify	Major	I don't know	I don't know
				Nearshore Bathy	QL1B	2-3 years	Unable to quantify	Unable to quantify	Major	I don't know	I don't know
				Offshore Bathy	Order 1b	2-3 years	Unable to quantify	Unable to quantify	Major	I don't know	I don't know

MCA Description				Requirements			Future Operational Benefits	Future Customer Service Benefits	Future Societal Benefits		
Primary Business Use	Agency/ Organization Name	MCA No.	Mission Critical Activity	Data Type	QL/Order	Update Frequency	Total Reported Future Annual Operational Benefits	Total Reported Future Annual Customer Service Benefits	Education or Outreach	Environmental	Public Safety
BU 26 – Education and Basic Research	Oklahoma State University	1145	Environmental Modeling and Research	Inland Topo	QL1	4-5 years	\$13,254	Unable to quantify	Moderate	Moderate	Minor
				Inland Bathy	Coarser bathymetric data satisfies my needs	4-5 years	\$3,973	\$1,206	Moderate	Minor	Minor
BU 26 – Education and Basic Research	Brown University	1265	High Resolution Elevation Data Supporting Research, Teaching, Planning, and Facilities Management	Inland Topo	QL0 HD	4-5 years	Unable to quantify	Unable to quantify	Major	Major	Major
				Inland Bathy	I don't know	Project by project basis	Unable to quantify	Unable to quantify	Major	None	None
				Nearshore Bathy	Cross sections and/or transects meet needs	Depends on specific project at any given time.	Unable to quantify	Unable to quantify	Major	I don't know	I don't know
				Offshore Bathy	I don't know	Event driven	Unable to quantify	Unable to quantify	Major	I don't know	I don't know
BU 26 – Education and Basic Research	Pennsylvania State University	1314	Undergraduate and Graduate Education and Academic Research	Inland Topo	QL0	Annually	Unable to quantify	Unable to quantify	Major	Minor	Moderate
				Inland Bathy	QL1B	4-5 years	Unable to quantify	Unable to quantify	Moderate	Minor	Minor
				Nearshore Bathy	Cross sections and/or transects meet needs	I don't know	Unable to quantify	Unable to quantify	Minor	Moderate	Moderate
BU 26 – Education and Basic Research	North Carolina State University	21516	Education, Research, and Services	Inland Topo	QL0 HD	Annually	\$588,918	\$14,472	Major	I don't know	I don't know
				Inland Bathy	QL1B	2-3 years	\$249,195	\$500,000	Major	I don't know	I don't know
				Nearshore Bathy	QL0B	Annually	\$276,582	\$320,000	Major	I don't know	I don't know
BU 26 – Education and Basic Research	University of Maine System	21716	Education and Applied Research	Inland Topo	QL0 HD	4-5 years	Unable to quantify	Unable to quantify	Major	Moderate	Moderate
				Inland Bathy	QL0B	4-5 years	Unable to quantify	Unable to quantify	Major	Moderate	Moderate
				Nearshore Bathy	QL0B	4-5 years	Unable to quantify	Unable to quantify	Major	Moderate	Moderate
				Offshore Bathy	Special Order	4-5 years	Unable to quantify	Unable to quantify	Major	Moderate	Moderate
BU 26 – Education and Basic Research	CARES - University of Missouri Extension	22414	Research, Public Service, and Education	Inland Topo	QL2	4-5 years	Unable to quantify	Unable to quantify	Moderate	Minor	None

MCA Title: Academic Research



MCA Area of Interest	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Data Type	Required	Required	Required	
Geographic Area Requirements	One or more Hydrologic Units (HUC4s)	Nationwide, inland areas	Nearshore areas along the coast off one or more states, territories, or counties (including Great Lakes states)	
Sub Area Requirements				

MCA Description	Response
Mission Critical Activity	We engage in research activities and educate students in the following areas: Analysis of coastal erosion and inundation, Sea level rise modeling and mapping, Hurricane storm surge modeling and assessment, Coastal hazard modeling and mapping, Coastal resiliency, Subsidence monitoring and mapping. Tide-coordinated lidar acquisitions and improved digital bathymetry (resolution and currency.) or of great value to Old Dominion University. Research and applications are seeing ever more use of topobathymetry for fine-scale hydrologic modeling (e.g., storm surges, sea level rise, and coastal erosion/sedimentation.).
MCA Title	Academic Research
MCA ID	1225
Organization Type	Academic or Not-for-Profit
Organization Name	Old Dominion University
Sub-Agency or Division	
Organization Mission	Old Dominion University, located in the City of Norfolk in the metropolitan Hampton Roads region of coastal Virginia, is a dynamic public research institution that serves its students and enriches the Commonwealth of Virginia, the nation, and the world through rigorous academic programs, strategic partnerships, and active civic engagement.
Program Name	There are several programs/units, including: Commonwealth Center for Recurrent Flooding Resiliency (CCRFR); Center for Geospatial Science, Education, and Analytics (GeoSEA); Department of Political Science & Geography; Department of Ocean, Earth, and Atmospheric Sciences
Total Annual Program Budget	
Primary Business Use	BU 03 - Coastal Zone Management
Secondary Business Use	BU 26 - Education K12 and Beyond, Basic Research
Tertiary Business Use	

What Needs to be Measured in 3D	Response
Bare earth ground	Required
Tops of buildings, structures, objects	Highly desirable
Tops of vegetation	Highly desirable
Tops of submerged structures, objects	Highly desirable
Tops of submerged vegetation	Highly desirable
Subcanopy of vegetation/understory	Nice to have
River/lake bottom	Required
Nearshore elevation (<10 m deep)	Required
Sea surface	Required
Ocean/sea bottom (>10 m deep)	Nice to have

General Geographic Area and Size	
Average geographic extent of day-to-day area	50 sq mi - 999 sq mi (e.g. small county or County Equivalent, District of Columbia, etc.)
Smallest 3D features needed	Small features (e.g. individual shrub, tree, car, mooring anchor, small dock, etc.)
Description of smallest 3D features	Small features

Inland Bathymetry Feature Size Requirements	Response
Navigable channels (as defined by USACE)	Highly desirable
Rivers and Streams	
Less than 10 ft	Nice to have

Inland Bathy Feature Size Requirements	Response
10 - 50 ft	Highly desirable
51 - 100 ft	Required
101 - 500 ft	Required
501 - 2,500 ft	Required
Greater than 2,500 ft	Required
Waterbodies (Reservoirs, lakes, ponds)	
Less than ½ acre	Nice to have
½ - 1 acre	Highly desirable
1.1 – 2 acres	Required
2.1 – 5 acres	Required
5.1 – 10 acres	Required
Greater than 10 acres	Required

Requirements	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Quality Level/IHO Order	QL1 HD	QL2B	QL2B	
Update Frequency	2-3 years	4-5 years	4-5 years	
Event type(s)				
Quality Level and/or update frequency variability across AOI				
Acceptable Horizontal Error	The best horizontal accuracy achievable for the vertical accuracy I need	The best horizontal accuracy achievable for the vertical accuracy I need	The best horizontal accuracy achievable for the vertical accuracy I need	
Acceptable Vertical Error	Up to 10 cm	Up to 30 cm	Up to 30 cm	
How far onshore needed			To cover the coastal uplands	
How far down the beach profile needed	To MLLW		To MLLW	
Tide correction requirement			MLLW	
Cross sections and/or transects meet needs				
Cross section/transect requirement				

Hydrologic Processing Required	Response
Hydro-flattening	Required
Hydro-enforcement	Highly desirable
Hydro-conditioning	Highly desirable
No Treatment	Not required

Seamlessness Requirements	Within Inland Topo Data	Within Inland Bathy Data	Within Nearshore Data	Within Offshore Data	Between Inland Topo and Inland Bathy	Between Topo, Topobathy, and/or Bathy
Importance of Seamlessness					Highly desirable	
Temporal Seamlessness						
Entire AOI in same acquisition season	Highly desirable	Nice to have	Nice to have		Nice to have	Nice to have
Entire AOI under same environmental conditions	Required	Highly desirable	Highly desirable		Highly desirable	Highly desirable
Spatial Seamlessness						
Point cloud for entire AOI needs to be seamless	Highly desirable	Highly desirable	Highly desirable		Highly desirable	Highly desirable
DEM for entire AOI needs to be seamless	Highly desirable	Highly desirable	Highly desirable		Highly desirable	Highly desirable
Amount of acceptable vertical manipulation to achieve spatial seamlessness	Whatever it takes to achieve seamlessness, including changes to the older, previously accepted dataset if it is proven to be less accurate than the newer	Up to the required Total Vertical Uncertainty (TVU) at the 95% confidence level	Up to the required Total Vertical Uncertainty (TVU) at the 95% confidence level		Up to the required Total Vertical Uncertainty (TVU) at the 95% confidence level	Up to the required Total Vertical Uncertainty (TVU) at the 95% confidence level

Importance of 3D Products	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
DSM	Highly desirable	Highly desirable	Highly desirable	
DTM	Required	Highly desirable	Highly desirable	
DEM	Required	Required	Required	
Raw point cloud data	Highly desirable	Highly desirable	Highly desirable	
Classified point cloud	Highly desirable	Highly desirable	Highly desirable	
Edited/cube XYZ		Nice to have	Nice to have	
Full waveform	Nice to have	Nice to have	Nice to have	
Bathymetric Attributed Grid (BAG)		Nice to have	Nice to have	

Importance of 3D Products	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Breaklines required for standard hydro-flattening	Highly desirable	Highly desirable		
Additional breaklines for hydro-enforcement of culverts	Highly desirable			
National Vertical Datum Transformation Tool (V-Datum)			Required	
Tide Predictions			Required	
Tidal Constituent And Residual Interpolation (TCARI)			Nice to have	
Intensity imagery/sidescan imagery	Nice to have	Nice to have	Nice to have	
Ground control/ground truthing	Highly desirable	Highly desirable	Highly desirable	

Importance of Integration with Other Datasets	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Hydrographic survey data			Required	
Nautical and/or navigation charts			Highly desirable	
Acoustic imagery of the seafloor			Highly desirable	
Aerial and/or satellite imagery	Required	Required	Required	
Underwater videography			Nice to have	
Bottom texture			Nice to have	
Bottom type			Nice to have	
Submerged features			Nice to have	
Subbottom characteristics			Nice to have	
Geologic and seismic data	Nice to have	Nice to have	Nice to have	
Water column properties - Physical			Nice to have	
Water column properties - Chemical			Nice to have	
Water column properties - Biological			Nice to have	
Currents			Nice to have	
Tide/wave heights			Required	
Sea ice conditions			Nice to have	
Habitat distribution and classification			Highly desirable	
Boundaries			Highly desirable	
Routes			Highly desirable	
Offshore cadastral			Nice to have	
Lease areas			Nice to have	
Fixed obstructions			Nice to have	
Floating observation/navigation systems			Nice to have	

Importance of Integration with Other Datasets	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Shorelines – current, historic, change rates	Required	Required	Required	
Land use/land cover	Highly desirable	Required	Required	
Wetlands	Required	Required	Required	
Estuaries			Required	
Inland surface water features	Required	Required	Required	
Bridges/culverts	Required	Required		
Landmark features	Nice to have	Nice to have	Highly desirable	
Cultural resources	Nice to have	Nice to have	Highly desirable	
Coastal and riverine structures	Required	Required	Required	
Overhead structures			Required	
Lowest Floor Elevation of Buildings	Highly desirable			

Benefits of Currently Used Elevation Data	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Current dataset used	QL2 LiDAR, 2013	Self collected (boat)	Self collected shoreline data and via boat	
Where current elevation data are accessed	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
National Map				
Digital Coast	Yes	Yes	Yes	
NCEI				
Open Topography				
NOAA nautical charts				
USACE navigation charts				
USGS Inland Waters server				
USGS data series				
Marine Minerals Program GIS				
State Repositories				
State repositories used				
Other	Yes	Yes	Yes	
Other description	Hampton Roads local LiDAR acquisition	Self-collected	Self-collected	
Data that meet my needs are not available				

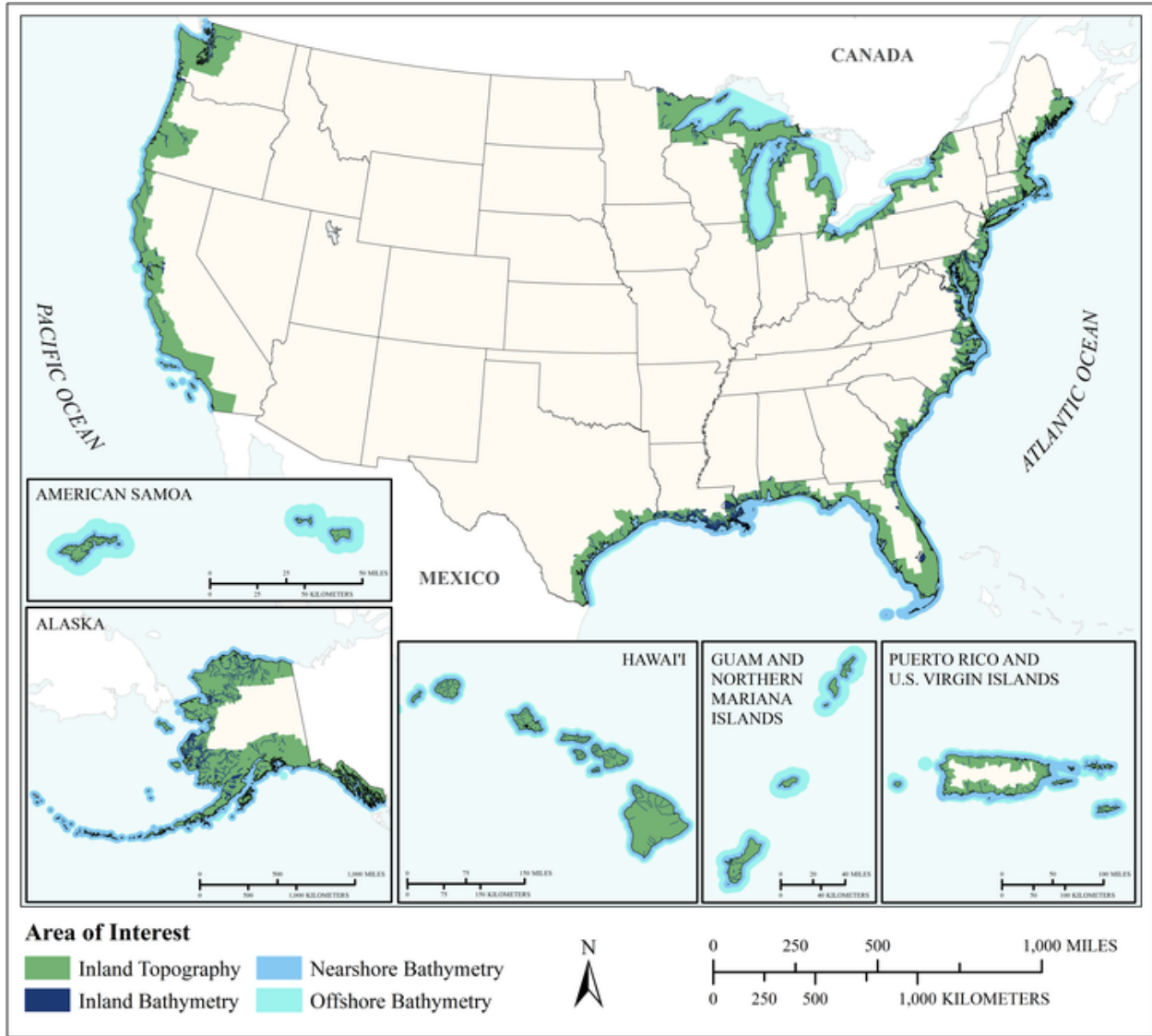
Benefits of Currently Used Elevation Data	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Current Operational Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Time savings	Moderate	Moderate	Moderate	
Cost savings/cost reduction	Moderate	Moderate	Moderate	
Cost avoidance	Minor	Minor	Minor	
Increased revenues	None	I don't know	None	
Mission-driven performance improvements	Major	Minor	Moderate	
Current Customer Service Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Value added to products or services	Moderate	Moderate	Moderate	
Improved response or timeliness	Minor	Minor	Minor	
Improved customer experience	Minor	Minor	Minor	
Current Societal Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Education or outreach	Moderate	Moderate	Moderate	
Environmental	Minor	None	None	
Public safety, including life and property	Minor	None	None	

Future Benefits if Elevation Data Requirements Are Met	Inland Topo			Inland Bathy			Nearshore Bathy			Offshore Bathy		
Future Operational Benefits	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount
Time savings	Moderate	Unable to provide		Moderate	Unable to provide		Major	Unable to provide				
Cost savings/cost reduction	Moderate	Unable to provide		Moderate	Unable to provide		Moderate	Unable to provide				
Cost avoidance	Major	Unable to provide		Major	Unable to provide		Major	Unable to provide				
Increased revenues	Minor	Unable to provide		Minor	Unable to provide		Minor	Unable to provide				
Mission-driven performance improvements	Major	Unable to provide		Moderate	Unable to provide		Major	Unable to provide				
Future Customer Service Benefits	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount
Value added to products or services	Major	Unable to provide		Major	Unable to provide		Major	Unable to provide				
Improved response or timeliness	Moderate	Unable to provide		Major	Unable to provide		Major	Unable to provide				
Improved customer experience	Moderate	Unable to provide		Moderate	Unable to provide		Moderate	Unable to provide				
Societal Benefits	Benefits			Benefits			Benefits			Benefits		
Education or outreach	Major			Moderate			Moderate					
Environmental	Moderate			None			None					
Public safety, including life and property	Moderate			None			None					

3D Derivatives Needed	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Triangulated Irregular Network (TIN)	Yes	Yes	Yes	
Contours	Yes	Yes	Yes	
Hillshades	Yes	Yes	Yes	
Slope maps	Yes	Yes	Yes	
Aspect maps	Yes			
Curvature maps				
Cross sections	Yes	Yes	Yes	
Height-Above-Ground maps	Yes			
Viewshed maps	Yes			
Hydrologic Flow Direction Grids	Yes			
Hydrologic Flow Accumulation Grids	Yes			
Hydrologic networks (e.g. streams, lakes)	Yes			
Hydrologic Units (Watershed Boundaries) (e.g. surface water drainage to a point)	Yes			
Building footprints				
Breaklines for road edge-of-pavement	Yes			
Rugosity/Surface Roughness				

Importance of 3D Data Requirements	Response
Geographic coverage	1
Vertical accuracy	3
Update frequency	2

MCA Title: Coastal Zone Management



MCA Area of Interest	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Data Type	Required	Required	Required	Required
Geographic Area Requirements	One or more states, territories, or counties	One or more states, territories, or counties	Nearshore areas along the coast off one or more states, territories, or counties (including Great Lakes states)	Waters offshore off one or more states (including Great Lakes states), territories, or counties
Sub Area Requirements	Coastal counties	Coastal counties		

MCA Description	Response
Mission Critical Activity	Coastal Zone Management
MCA Title	Coastal Zone Management
MCA ID	51001
Organization Type	Academic or Not-for-Profit
Organization Name	University of North Carolina
Sub-Agency or Division	
Organization Mission	
Program Name	
Total Annual Program Budget	
Primary Business Use	BU 03 - Coastal Zone Management
Secondary Business Use	
Tertiary Business Use	

What Needs to be Measured in 3D	Response
Bare earth ground	Required
Tops of buildings, structures, objects	Nice to have
Tops of vegetation	Highly desirable
Tops of submerged structures, objects	Highly desirable
Tops of submerged vegetation	Highly desirable
Subcanopy of vegetation/understory	Nice to have
River/lake bottom	Required
Nearshore elevation (<10 m deep)	Required
Sea surface	Highly desirable
Ocean/sea bottom (>10 m deep)	Required

General Geographic Area and Size	
Average geographic extent of day-to-day area	
Smallest 3D features needed	
Description of smallest 3D features	

Inland Bathymetry Feature Size Requirements	Response
Navigable channels (as defined by USACE)	Required
Rivers and Streams	
Less than 10 ft	Highly desirable
10 - 50 ft	Required
51 - 100 ft	Required
101 - 500 ft	Required
501 - 2,500 ft	Required
Greater than 2,500 ft	Required
Waterbodies (Reservoirs, lakes, ponds)	
Less than ½ acre	Nice to have
½ - 1 acre	Highly desirable
1.1 – 2 acres	Required
2.1 – 5 acres	Required
5.1 – 10 acres	Required
Greater than 10 acres	Required

Requirements	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Quality Level/IHO Order	QL1	QL1B	QL1B	Order 1a
Update Frequency	4-5 years	4-5 years	4-5 years	6-10 years
Event type(s)				
Quality Level and/or update frequency variability across AOI				
Acceptable Horizontal Error	Up to 1 meter	Up to 2 meters	Up to 2 meters	Up to 5 meters
Acceptable Vertical Error	Up to 20 cm	Up to 30 cm	Up to 30 cm	Less than 1 meter
How far onshore needed				
How far down the beach profile needed				
Tide correction requirement				
Cross sections and/or transects meet needs				
Cross section/transect requirement				

Hydrologic Processing Required	Response
Hydro-flattening	Required
Hydro-enforcement	Highly desirable
Hydro-conditioning	Highly desirable
No Treatment	Not required

Seamlessness Requirements	Within Inland Topo Data	Within Inland Bathy Data	Within Nearshore Data	Within Offshore Data	Between Inland Topo and Inland Bathy	Between Topo, Topobathy, and/or Bathy
Importance of Seamlessness					Required	
Temporal Seamlessness						
Entire AOI in same acquisition season	Highly desirable	Highly desirable	Highly desirable	Nice to have	Highly desirable	Highly desirable
Entire AOI under same environmental conditions	Highly desirable	Highly desirable	Highly desirable	Nice to have	Highly desirable	Highly desirable
Spatial Seamlessness						
Point cloud for entire AOI needs to be seamless	Required	Highly desirable	Highly desirable	Nice to have	Highly desirable	Nice to have
DEM for entire AOI needs to be seamless	Required	Required	Required	Highly desirable	Required	Required
Amount of acceptable vertical manipulation to achieve spatial seamlessness	Up to the required Total Vertical Uncertainty (TVU) at the 95% confidence level	Up to the required Total Vertical Uncertainty (TVU) at the 95% confidence level	Up to the required Total Vertical Uncertainty (TVU) at the 95% confidence level	Up to the required Total Vertical Uncertainty (TVU) at the 95% confidence level	Up to the required Total Vertical Uncertainty (TVU) at the 95% confidence level	Up to the required Total Vertical Uncertainty (TVU) at the 95% confidence level

Importance of 3D Products	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
DSM	Nice to have	Nice to have	Highly desirable	Highly desirable
DTM	Required	Highly desirable	Highly desirable	Highly desirable
DEM	Required	Required	Required	Required
Raw point cloud data	Nice to have	Nice to have	Nice to have	Highly desirable
Classified point cloud	Highly desirable	Highly desirable	Highly desirable	
Edited/cube XYZ		Nice to have	Nice to have	Nice to have
Full waveform	Not required	Nice to have	Nice to have	Nice to have
Bathymetric Attributed Grid (BAG)		Nice to have	Nice to have	Highly desirable
Breaklines required for standard hydro-flattening	Highly desirable	Highly desirable		
Additional breaklines for hydro-enforcement of culverts	Nice to have			

Importance of 3D Products	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
National Vertical Datum Transformation Tool (V-Datum)			Highly desirable	Nice to have
Tide Predictions			Highly desirable	Nice to have
Tidal Constituent And Residual Interpolation (TCARI)			Nice to have	Nice to have
Intensity imagery/sidescan imagery	Nice to have	Highly desirable	Highly desirable	Highly desirable
Ground control/ground truthing	Highly desirable	Required	Required	Highly desirable

Importance of Integration with Other Datasets	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Hydrographic survey data			Required	Required
Nautical and/or navigation charts			Highly desirable	Highly desirable
Acoustic imagery of the seafloor			Highly desirable	Highly desirable
Aerial and/or satellite imagery	Required	Highly desirable	Highly desirable	Highly desirable
Underwater videography			Nice to have	Nice to have
Bottom texture			Highly desirable	Highly desirable
Bottom type			Highly desirable	Highly desirable
Submerged features			Highly desirable	Highly desirable
Subbottom characteristics			Nice to have	Nice to have
Geologic and seismic data	Nice to have	Nice to have	Nice to have	Nice to have
Water column properties - Physical			Nice to have	Nice to have
Water column properties - Chemical			Nice to have	Nice to have
Water column properties - Biological			Nice to have	Nice to have
Currents			Highly desirable	Nice to have
Tide/wave heights			Highly desirable	Nice to have
Sea ice conditions			Not required	Nice to have
Habitat distribution and classification			Highly desirable	Highly desirable
Boundaries			Nice to have	Highly desirable
Routes			Nice to have	Nice to have
Offshore cadastral			Nice to have	Nice to have
Lease areas			Nice to have	Nice to have
Fixed obstructions			Nice to have	Nice to have
Floating observation/navigation systems			Nice to have	Nice to have
Shorelines – current, historic, change rates	Required	Required	Required	
Land use/land cover	Highly desirable	Highly desirable	Highly desirable	Nice to have
Wetlands	Required	Highly desirable	Required	Nice to have

Importance of Integration with Other Datasets	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Estuaries			Required	Nice to have
Inland surface water features	Required	Required	Highly desirable	
Bridges/culverts	Highly desirable	Highly desirable		
Landmark features	Nice to have	Nice to have	Nice to have	
Cultural resources	Nice to have	Nice to have	Nice to have	
Coastal and riverine structures	Required	Required	Required	
Overhead structures			Nice to have	
Lowest Floor Elevation of Buildings	Nice to have			

Benefits of Currently Used Elevation Data	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Current dataset used				
Where current elevation data are accessed	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
National Map				
Digital Coast			Yes	
NCEI				
Open Topography				
NOAA nautical charts				
USACE navigation charts				
USGS Inland Waters server				
USGS data series				
Marine Minerals Program GIS				
State Repositories				
State repositories used				
Data that meet my needs are not available				
Current Operational Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Time savings	Major	Major	Major	Moderate
Cost savings/cost reduction	Major	Moderate	Major	Moderate
Cost avoidance	Major	Moderate	Major	Minor
Increased revenues	None	None	None	None
Mission-driven performance improvements	Major	Moderate	Major	Moderate
Current Customer Service Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Value added to products or services	Major	Moderate	Major	Moderate

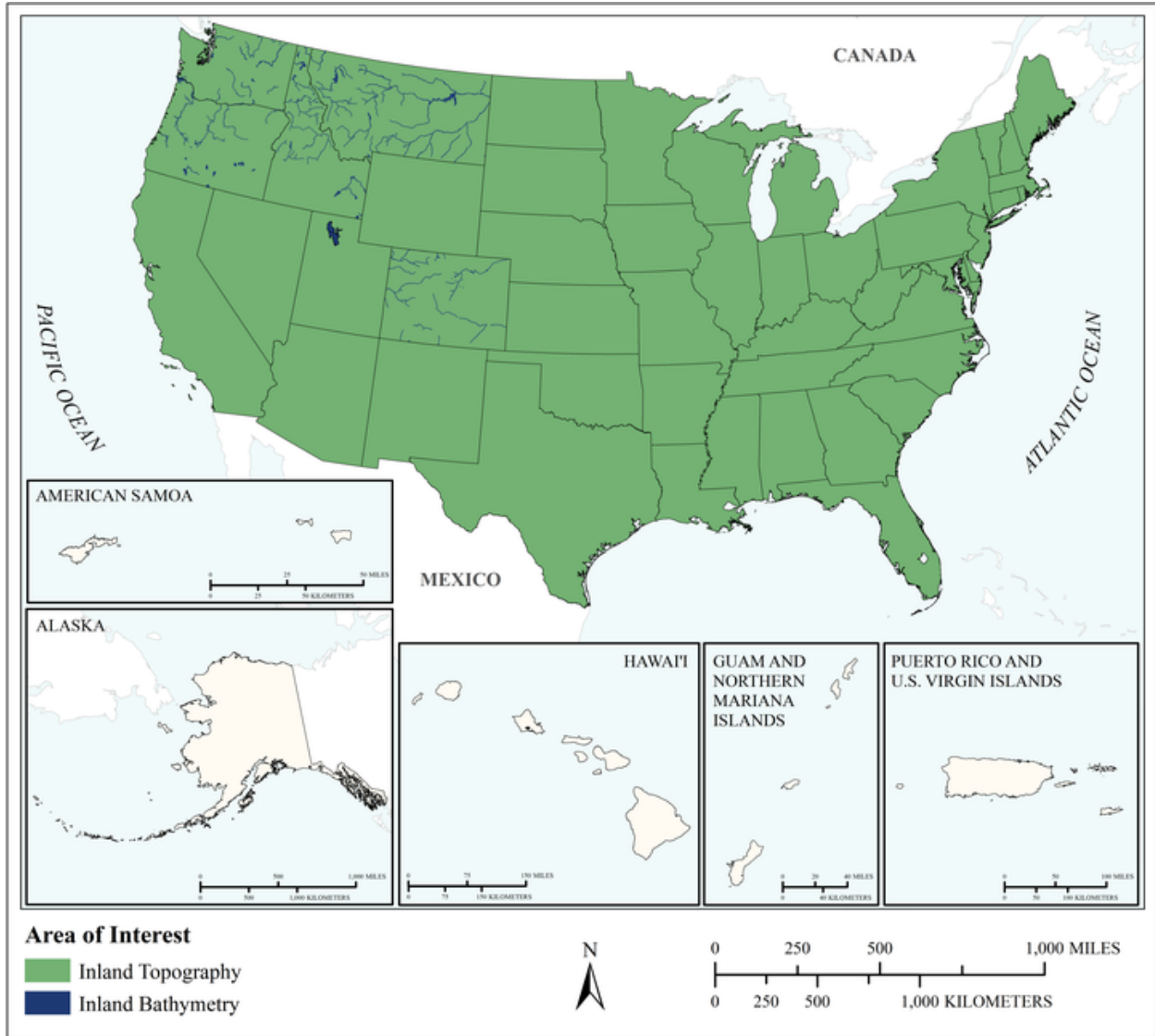
Benefits of Currently Used Elevation Data	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Improved response or timeliness	Major	Moderate	Moderate	Minor
Improved customer experience	Major	Moderate	Moderate	Minor
Current Societal Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Education or outreach	Major	Moderate	Moderate	Minor
Environmental	Major	Moderate	Major	Moderate
Public safety, including life and property	Major	Moderate	Moderate	Moderate

Future Benefits if Elevation Data Requirements Are Met	Inland Topo			Inland Bathy			Nearshore Bathy			Offshore Bathy		
	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount
Time savings	Major	Unable to provide		Major	Unable to provide		Moderate	Unable to provide		Moderate	Unable to provide	
Cost savings/cost reduction	Major	Unable to provide		Major	Unable to provide		Major	Unable to provide		Moderate	Unable to provide	
Cost avoidance	Major	Unable to provide		Moderate	Unable to provide		Major	Unable to provide		Major	Unable to provide	
Increased revenues	None			None			Minor	Unable to provide		Minor	Unable to provide	
Mission-driven performance improvements	Major	Unable to provide		Major	Unable to provide		Major	Unable to provide		Major	Unable to provide	
Future Customer Service Benefits	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount
Value added to products or services	Major	Unable to provide		Major	Unable to provide		Major	Unable to provide		Moderate	Unable to provide	
Improved response or timeliness	Major	Unable to provide		Major	Unable to provide		Major	Unable to provide		Moderate	Unable to provide	
Improved customer experience	Major	Unable to provide		Moderate	Unable to provide		Major	Unable to provide		Moderate	Unable to provide	
Societal Benefits	Benefits			Benefits			Benefits			Benefits		
Education or outreach	Major			Moderate			Major			Minor		
Environmental	Major			Major			Major			Moderate		
Public safety, including life and property	Major			Major			Major			Moderate		

3D Derivatives Needed	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Triangulated Irregular Network (TIN)				
Contours				
Hillshades				
Slope maps				
Aspect maps				
Curvature maps				
Cross sections				
Height-Above-Ground maps				
Viewshed maps				
Hydrologic Flow Direction Grids				
Hydrologic Flow Accumulation Grids				
Hydrologic networks (e.g. streams, lakes)				
Hydrologic Units (Watershed Boundaries) (e.g. surface water drainage to a point)				
Building footprints				
Breaklines for road edge-of-pavement				
Rugosity/Surface Roughness				

Importance of 3D Data Requirements	Response
Geographic coverage	
Vertical accuracy	
Update frequency	

MCA Title: Undergraduate and Graduate Spatial Sciences Education and Research



MCA Area of Interest	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Data Type	Required	Required		
Geographic Area Requirements	Nationwide, inland areas	Custom description		
Sub Area Requirements		Washington, Oregon, Idaho, Montana, Colorado, and the Great Salt Lake		

MCA Description	Response
Mission Critical Activity	The Elevation data is a mission critical data set to many of the laboratory assignments in the undergraduate and graduate spatial sciences classes where the following topics are addressed: rangeland ecology and management, snow science, ecology, biology, geology, environmental science. It is also a valuable tool for graduate research, specifically so for terrain analysis in snow science (natural and human induced avalanches), geologic hazards, rangeland ecology and biology, suitable habitat, migration pathways, precision farming, water quality and supply, and soils to name a few.
MCA Title	Undergraduate and Graduate Spatial Sciences Education and Research
MCA ID	21662
Organization Type	Academic or Not-for-Profit
Organization Name	Montana State University
Sub-Agency or Division	
Organization Mission	The mission of the Department of Land Resources and Environmental Sciences is to generate knowledge about local and global environments that can be disseminated to meet the needs of students, agricultural producers, land owners and managers, the general scientific community, and the citizens of Montana. We bring together disciplines related to soils, microorganisms, insects, plants, climate, and water to address issues affecting cropland, rangeland, forests, reclaimed land, extreme environments, and protected natural areas. Through our research, outreach, and teaching, we strive to integrate scientifically-sound information across spatial and temporal scales to enhance productivity of managed lands, facilitate knowledge-based adoption of sustainable practices, and produce broadly educated students prepared for careers in the environmental sciences.
Program Name	Land Resources and Environmental Sciences discipline for undergraduate and graduate degrees: Bachelor's of Science, Master of Science, Doctor of Philosophy
Total Annual Program Budget	
Primary Business Use	BU 06 - Natural Resources Conservation
Secondary Business Use	BU 01 - Water Supply and Quality
Tertiary Business Use	BU 07 - Wildlife and Habitat Management

What Needs to be Measured in 3D	Response
Bare earth ground	Required
Tops of buildings, structures, objects	Required
Tops of vegetation	Required
Tops of submerged structures, objects	Required
Tops of submerged vegetation	Required
Subcanopy of vegetation/understory	Required
River/lake bottom	Required
Nearshore elevation (<10 m deep)	Nice to have
Sea surface	Nice to have
Ocean/sea bottom (>10 m deep)	Nice to have

General Geographic Area and Size	
Average geographic extent of day-to-day area	1,000 sq mi - 24,999 sq mi (e.g. large county, small state, intrastate region [e.g. a multi-county region such as the San Francisco Bay Area, Tri-County Council, etc.])

General Geographic Area and Size	
Smallest 3D features needed	Small features (e.g. individual shrub, tree, car, mooring anchor, small dock, etc.)
Description of smallest 3D features	For our service learning courses we utilize the following: structures, canals and irrigation, trails and in hydrology studies small features and hazards such as rocks, debris and slumping of soil/snow is considered.

Inland Bathy Feature Size Requirements	Response
Navigable channels (as defined by USACE)	Required
Rivers and Streams	
Less than 10 ft	Required
10 - 50 ft	Required
51 - 100 ft	Required
101 - 500 ft	Required
501 - 2,500 ft	Required
Greater than 2,500 ft	Required
Waterbodies (Reservoirs, lakes, ponds)	
Less than ½ acre	Required
½ - 1 acre	Required
1.1 – 2 acres	Required
2.1 – 5 acres	Required
5.1 – 10 acres	Required
Greater than 10 acres	Required

Requirements	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Quality Level/IHO Order	QL2	QL2B		
Update Frequency	Annually	4-5 years		
Event type(s)				
Quality Level and/or update frequency variability across AOI	They are site specific for graduate research, but for undergraduate instruction we may use data sets in multiple environmental landscape across the 48 conterminous states			
Acceptable Horizontal Error	Up to 1 meter	Less than 50 cm		
Acceptable Vertical Error	Up to 20 cm	Up to 30 cm		
How far onshore needed				
How far down the beach profile needed	Not applicable			
Tide correction requirement				

Requirements	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Cross sections and/or transects meet needs				
Cross section/transect requirement				

Hydrologic Processing Required	Response
Hydro-flattening	Highly desirable
Hydro-enforcement	Highly desirable
Hydro-conditioning	Highly desirable
No Treatment	Not required

Seamlessness Requirements	Within Inland Topo Data	Within Inland Bathy Data	Within Nearshore Data	Within Offshore Data	Between Inland Topo and Inland Bathy	Between Topo, Topobathy, and/or Bathy
Importance of Seamlessness					Required	
Temporal Seamlessness						
Entire AOI in same acquisition season	Highly desirable	Required			Highly desirable	
Entire AOI under same environmental conditions	Highly desirable	Required			Highly desirable	
Spatial Seamlessness						
Point cloud for entire AOI needs to be seamless	Highly desirable	Highly desirable			Highly desirable	
DEM for entire AOI needs to be seamless	Highly desirable	Highly desirable			Highly desirable	
Amount of acceptable vertical manipulation to achieve spatial seamlessness	While the AOI is the Conterminous U.S. likely projects will be larger scale so seamless within states is best, but between states not necessary for MCA	I don't know			I don't know	

Importance of 3D Products	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
DSM	Highly desirable	Required		
DTM	Required	Required		
DEM	Required	Required		
Raw point cloud data	Highly desirable	Highly desirable		
Classified point cloud	Nice to have	Highly desirable		
Edited/cube XYZ		Highly desirable		
Full waveform	Nice to have	Highly desirable		
Bathymetric Attributed Grid (BAG)		Highly desirable		
Breaklines required for standard hydro-flattening	Highly desirable	Highly desirable		

Importance of 3D Products	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Additional breaklines for hydro-enforcement of culverts	Highly desirable			
National Vertical Datum Transformation Tool (V-Datum)				
Tide Predictions				
Tidal Constituent And Residual Interpolation (TCARI)				
Intensity imagery/sidescan imagery	Nice to have	Highly desirable		
Ground control/ground truthing	Required	Highly desirable		

Importance of Integration with Other Datasets	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Hydrographic survey data				
Nautical and/or navigation charts				
Acoustic imagery of the seafloor				
Aerial and/or satellite imagery	Required	Highly desirable		
Underwater videography				
Bottom texture				
Bottom type				
Submerged features				
Subbottom characteristics				
Geologic and seismic data	Highly desirable	Highly desirable		
Water column properties - Physical				
Water column properties - Chemical				
Water column properties - Biological				
Currents				
Tide/wave heights				
Sea ice conditions				
Habitat distribution and classification				
Boundaries				
Routes				
Offshore cadastral				
Lease areas				
Fixed obstructions				
Floating observation/navigation systems				
Shorelines – current, historic, change rates	Nice to have	Highly desirable		

Importance of Integration with Other Datasets	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Land use/land cover	Required	Required		
Wetlands	Required	Required		
Estuaries				
Inland surface water features	Required	Required		
Bridges/culverts	Highly desirable	Highly desirable		
Landmark features	Nice to have	Nice to have		
Cultural resources	Nice to have	Nice to have		
Coastal and riverine structures	Nice to have	Highly desirable		
Overhead structures				
Lowest Floor Elevation of Buildings	Nice to have			

Benefits of Currently Used Elevation Data	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Current dataset used	10 meter elevation data for the disciplines described in part 1. LiDAR driven projects are mostly large scale and collected by the research groups.	Have no data that is currently being used but would like to incorporate such exercises into the curriculum		
Where current elevation data are accessed	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
National Map	Yes			
Digital Coast				
NCEI				
Open Topography				
NOAA nautical charts				
USACE navigation charts				
USGS Inland Waters server				
USGS data series		Yes		
Marine Minerals Program GIS				
State Repositories	Yes			
State repositories used	Montana State Library Geographic Information Clearinghouse.			
Data that meet my needs are not available				

Benefits of Currently Used Elevation Data	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Current Operational Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Time savings	Major	I don't know		
Cost savings/cost reduction	Major	I don't know		
Cost avoidance	Major	I don't know		
Increased revenues	None	None		
Mission-driven performance improvements	Major	Moderate		
Current Customer Service Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Value added to products or services	None	None		
Improved response or timeliness	None	None		
Improved customer experience	None	None		
Current Societal Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Education or outreach	Major	Moderate		
Environmental	Major	Major		
Public safety, including life and property	Major	I don't know		

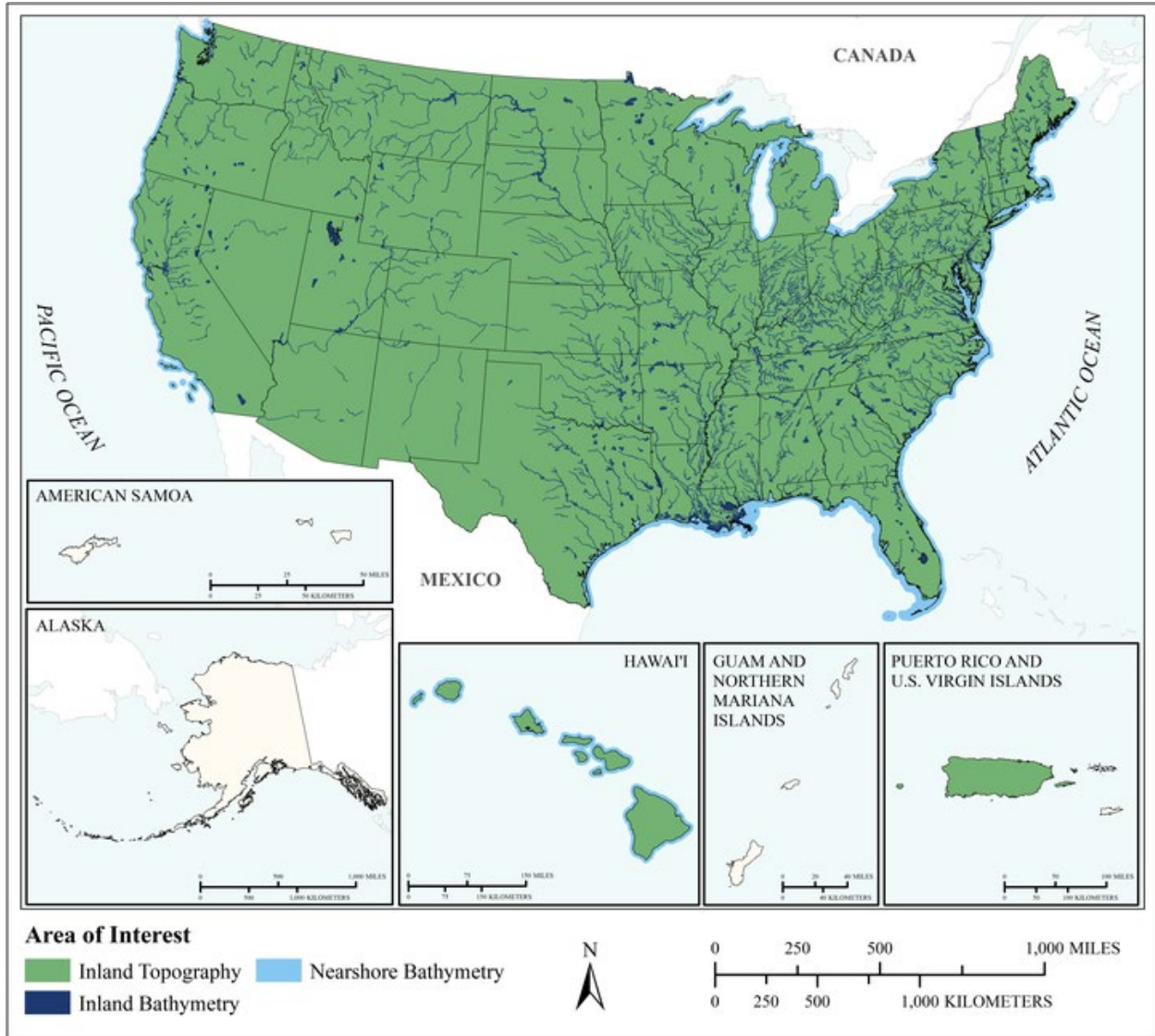
Future Benefits if Elevation Data Requirements Are Met	Inland Topo			Inland Bathy			Nearshore Bathy			Offshore Bathy		
	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount
Time savings	Major	Annual dollars saved/realized	\$369,036	Major	Unable to provide							
Time savings description	Per student project for a 1:500,000 area: 20 hours/month X 50 students = 1000 hrs/month. Will be project specific and hard to estimate. Students may be all replicating the same process as part of an exercise. Students will be able to accomplish more in the span of semester without needing to QA/QC errors. Hard to estimate but invaluable. Not applicable.			Such a survey, depending on the scale of the study area would be significant in time saved for a researcher to focus on analyzing the results.								
Cost savings/cost reduction	Major	Unable to provide		Major	Unable to provide							
Cost savings/cost reduction description	I do not have the knowledge base to estimate the cost savings for irrigation but know it will be significant for water and flow modeling. Will be dependent on scale of student study and hard to estimate, but will be substantial.			Provide many researchers interested bathymetric data who would not have been able to afford such research.								
Cost avoidance	Major	Unable to provide		Major	Unable to provide							
Cost avoidance description	Not a factor in program success monetarily and too hard to estimate with the variety of student projects. Will increase the ability for students to accomplish more out of datasets.											
Increased revenues	Moderate	Unable to provide		I don't know	Unable to provide							
Increased revenues description	Provide better terrain statistics for outdoor apps, and other map applications.											
Mission-driven performance improvements	Major	Annual percent improvement	25%	Major	Annual percent improvement	25%						
Mission-driven performance improvements description	Allows students to draw more accurate conclusions and real world solutions to posed questions. Incremental improvement as we improve student education curriculum with the advantage that superior 3DEP data sets provide. Ability to improve the breadth of student exercises allowing them to have better in-depth education.			Improve the breadth of exercises and data available to student education and research. Allowing the University to improve what the curriculum has to offer students. Ability to expose more students and critical thinkers to the data and the solutions it may provide.								
Other operational benefits	Major	Annual dollars saved/realized	\$3,618									
Other operational benefits description	Equivalent hours students and teachers are saved from dealing with inferior data sets.											
Future Customer Service Benefits	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount
Value added to products or services	Major	Annual dollars saved/realized	\$7,236	Major	Unable to provide							
Value added to products or services description	More effective GPS sampling in undergraduate classes and graduate research. Improved flood hazard maps have significant impacts in urban areas that are reflective of structure/home prices which is not available in Montana unless you are a real estate agent.			Improvement in student ability to conduct research.								
Improved response or timeliness	Major	Annual dollars saved/realized	\$5,427	I don't know	Unable to provide							

Future Benefits if Elevation Data Requirements Are Met	Inland Topo			Inland Bathy			Nearshore Bathy			Offshore Bathy		
Improved response or timeliness description	Hours needed to instruct students on how to obtain data. Improvement to Search and Rescue planning.											
Improved customer experience	Major	Annual dollars saved/realized	\$3,256,200	I don't know	Unable to provide							
Improved customer experience description	15 hours per month per student hours for undergraduate and graduate research and classes x 600 students = 9000 hrs/month.											
Societal Benefits	Benefits			Benefits			Benefits			Benefits		
Education or outreach	Major			Major								
Education or outreach description	Improvement of student ability to accomplish research and education			Exposing students to greater breadth of spatial data and issues								
Environmental	Major			Major								
Environmental description	Department able to more accurately pursue mission goals			Allowing students to approach environmental problems with superior data								
Public safety, including life and property	None			I don't know								

3D Derivatives Needed	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Triangulated Irregular Network (TIN)	Yes			
Contours	Yes			
Hillshades	Yes			
Slope maps	Yes			
Aspect maps	Yes			
Curvature maps	Yes			
Cross sections	Yes	Yes		
Height-Above-Ground maps	Yes			
Viewshed maps	Yes	Yes		
Hydrologic Flow Direction Grids	Yes	Yes		
Hydrologic Flow Accumulation Grids	Yes	Yes		
Hydrologic networks (e.g. streams, lakes)	Yes	Yes		
Hydrologic Units (Watershed Boundaries) (e.g. surface water drainage to a point)	Yes	Yes		
Building footprints	Yes			
Breaklines for road edge-of-pavement	Yes			
Rugosity/Surface Roughness	Yes			

Importance of 3D Data Requirements	Response
Geographic coverage	3
Vertical accuracy	1
Update frequency	2

MCA Title: Land Cover Mapping and Feature Extraction



MCA Area of Interest	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Data Type	Required	Required	Required	
Geographic Area Requirements	Nationwide, inland areas	Nationwide, inland areas	Nearshore areas along the coast off one or more states, territories, or counties (including Great Lakes states)	
Sub Area Requirements				

MCA Description	Response
Mission Critical Activity	Land cover mapping and feature extraction
MCA Title	Land Cover Mapping and Feature Extraction
MCA ID	21797
Organization Type	Academic or Not-for-Profit
Organization Name	University of Vermont
Sub-Agency or Division	
Organization Mission	Spatial analysis
Program Name	Land cover mapping
Total Annual Program Budget	
Primary Business Use	BU 06 - Natural Resources Conservation
Secondary Business Use	
Tertiary Business Use	

What Needs to be Measured in 3D	Response
Bare earth ground	Required
Tops of buildings, structures, objects	Required
Tops of vegetation	Required
Tops of submerged structures, objects	Highly desirable
Tops of submerged vegetation	Highly desirable
Subcanopy of vegetation/understory	Required
River/lake bottom	Required
Nearshore elevation (<10 m deep)	Required
Sea surface	Required
Ocean/sea bottom (>10 m deep)	Highly desirable

General Geographic Area and Size	
Average geographic extent of day-to-day area	Individual feature (e.g. single tree, single structure)
Smallest 3D features needed	Small features (e.g. individual shrub, tree, car, mooring anchor, small dock, etc.)
Description of smallest 3D features	Individual trees, small patches of aquatic invasive species, etc.

Inland Bathy Feature Size Requirements	Response
Navigable channels (as defined by USACE)	Nice to have
Rivers and Streams	
Less than 10 ft	Nice to have
10 - 50 ft	Highly desirable
51 - 100 ft	Required
101 - 500 ft	Required
501 - 2,500 ft	Required
Greater than 2,500 ft	Required
Waterbodies (Reservoirs, lakes, ponds)	
Less than ½ acre	Nice to have
½ - 1 acre	Nice to have
1.1 – 2 acres	Highly desirable
2.1 – 5 acres	Highly desirable
5.1 – 10 acres	Highly desirable
Greater than 10 acres	Highly desirable

Requirements	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Quality Level/IHO Order	QL1	QL0B	QL2B	
Update Frequency	4-5 years	4-5 years	6-10 years	
Event type(s)				
Quality Level and/or update frequency variability across AOI				
Acceptable Horizontal Error	Up to 40 cm	Up to 1 meter	Up to 1 meter	
Acceptable Vertical Error	Up to 20 cm	Up to 20 cm	Up to 40 cm	
How far onshore needed			1 kilometer inland	
How far down the beach profile needed	Below MLLW		Below MLLW	
Tide correction requirement			MSL	
Cross sections and/or transects meet needs				
Cross section/transect requirement				

Hydrologic Processing Required	Response
Hydro-flattening	Nice to have
Hydro-enforcement	Nice to have
Hydro-conditioning	Nice to have
No Treatment	Not required

Seamlessness Requirements	Within Inland Topo Data	Within Inland Bathy Data	Within Nearshore Data	Within Offshore Data	Between Inland Topo and Inland Bathy	Between Topo, Topobathy, and/or Bathy
Importance of Seamlessness					Required	
Temporal Seamlessness						
Entire AOI in same acquisition season	Nice to have	Highly desirable	Highly desirable		Highly desirable	Highly desirable
Entire AOI under same environmental conditions	Nice to have	Highly desirable	Highly desirable		Highly desirable	Highly desirable
Spatial Seamlessness						
Point cloud for entire AOI needs to be seamless	Required	Required	Required		Required	Required
DEM for entire AOI needs to be seamless	Required	Required	Required		Required	Required
Amount of acceptable vertical manipulation to achieve spatial seamlessness	Up to double the required TVU at the 95% confidence level	Up to triple the required TVU at the 95% confidence level	Up to triple the required TVU at the 95% confidence level		Up to triple the required TVU at the 95% confidence level	Up to triple the required TVU at the 95% confidence level

Importance of 3D Products	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
DSM	Highly desirable	Nice to have	Highly desirable	
DTM	Highly desirable	Nice to have	Highly desirable	
DEM	Required	Required	Required	
Raw point cloud data	Not required	Not required	Not required	
Classified point cloud	Required	Required	Required	
Edited/cube XYZ		Not required	Not required	
Full waveform	Not required	Not required	Not required	
Bathymetric Attributed Grid (BAG)		Nice to have	Nice to have	
Breaklines required for standard hydro-flattening	Nice to have	Highly desirable		
Additional breaklines for hydro-enforcement of culverts	Nice to have			

Importance of 3D Products	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
National Vertical Datum Transformation Tool (V-Datum)			Nice to have	
Tide Predictions			Nice to have	
Tidal Constituent And Residual Interpolation (TCARI)			Nice to have	
Intensity imagery/sidescan imagery	Highly desirable	Nice to have	Highly desirable	
Ground control/ground truthing	Nice to have	Nice to have	Nice to have	

Importance of Integration with Other Datasets	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Hydrographic survey data			Nice to have	
Nautical and/or navigation charts			Nice to have	
Acoustic imagery of the seafloor			Nice to have	
Aerial and/or satellite imagery	Required	Required	Required	
Underwater videography			Nice to have	
Bottom texture			Nice to have	
Bottom type			Highly desirable	
Submerged features			Nice to have	
Subbottom characteristics			Nice to have	
Geologic and seismic data	Not required	Not required	Nice to have	
Water column properties - Physical			Nice to have	
Water column properties - Chemical			Nice to have	
Water column properties - Biological			Nice to have	
Currents			Nice to have	
Tide/wave heights			Nice to have	
Sea ice conditions			Nice to have	
Habitat distribution and classification			Nice to have	
Boundaries			Nice to have	
Routes			Nice to have	
Offshore cadastral			Nice to have	
Lease areas			Nice to have	
Fixed obstructions			Nice to have	
Floating observation/navigation systems			Nice to have	
Shorelines – current, historic, change rates	Nice to have	Nice to have	Nice to have	
Land use/land cover	Nice to have	Nice to have	Nice to have	
Wetlands	Nice to have	Nice to have	Nice to have	

Importance of Integration with Other Datasets	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Estuaries			Nice to have	
Inland surface water features	Nice to have	Nice to have	Nice to have	
Bridges/culverts	Nice to have	Nice to have		
Landmark features	Nice to have	Nice to have	Nice to have	
Cultural resources	Nice to have	Nice to have	Nice to have	
Coastal and riverine structures	Nice to have	Nice to have	Nice to have	
Overhead structures			Nice to have	
Lowest Floor Elevation of Buildings	Nice to have			

Benefits of Currently Used Elevation Data	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Current dataset used	Topobathy LIDAR	QL2 topobathy lidar	QL2 topobathy lidar	
Where current elevation data are accessed	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
National Map	Yes			
Digital Coast	Yes	Yes	Yes	
NCEI				
Open Topography	Yes			
NOAA nautical charts				
USACE navigation charts				
USGS Inland Waters server				
USGS data series				
Marine Minerals Program GIS				
State Repositories				
State repositories used				
Data that meet my needs are not available				
Current Operational Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Time savings	Major	Minor	Major	
Cost savings/cost reduction	Major	Minor	Major	
Cost avoidance	Moderate	Moderate	Moderate	
Increased revenues	Major	Major	Major	
Mission-driven performance improvements	Major	Major	Major	
Current Customer Service Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Value added to products or services	Major	Major	Major	

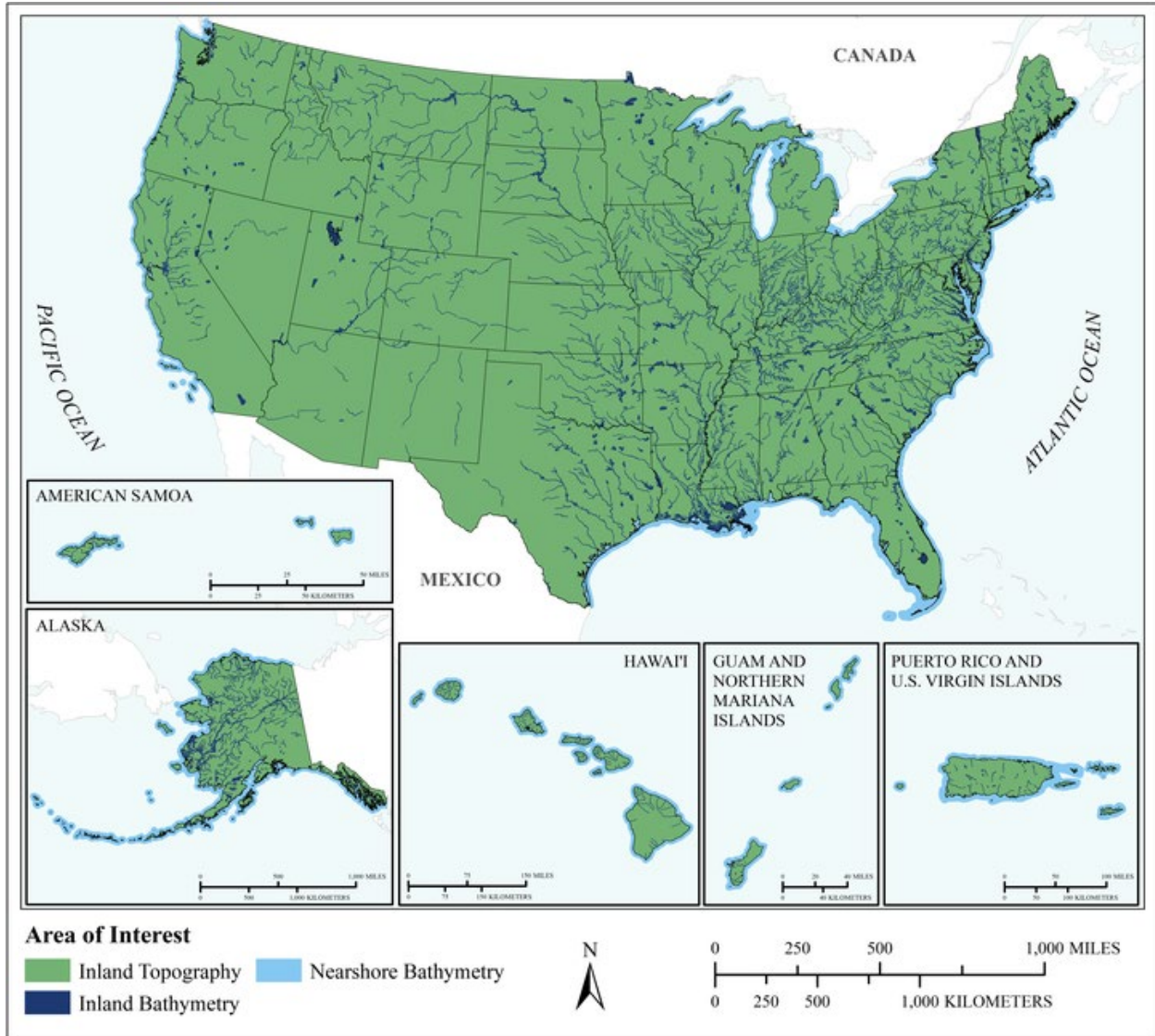
Benefits of Currently Used Elevation Data	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Improved response or timeliness	Moderate	Moderate	Moderate	
Improved customer experience	Major	Major	Major	
Current Societal Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Education or outreach	Major	Major	Major	
Environmental	Major	Major	Major	
Public safety, including life and property	Major	Major	Major	

Future Benefits if Elevation Data Requirements Are Met	Inland Topo			Inland Bathy			Nearshore Bathy			Offshore Bathy		
Future Operational Benefits	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount
Time savings	Major	Annual dollars saved/realized	\$2,563	Major	Unable to provide		Moderate	Unable to provide				
Time savings description	Lidar labor costs are 10x reduced, speed similarly improved.											
Cost savings/cost reduction	Major	Unable to provide		Major	Unable to provide		Moderate	Unable to provide				
Cost savings/cost reduction description	Drones supplement other available data.											
Cost avoidance	Moderate	Unable to provide		Major	Unable to provide		Moderate	Unable to provide				
Increased revenues	Major	Unable to provide		Major	Unable to provide		Major	Unable to provide				
Mission-driven performance improvements	Major	Unable to provide		Major	Unable to provide		Major	Unable to provide				
Future Customer Service Benefits	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount
Value added to products or services	Major	Unable to provide		Major	Unable to provide		Major	Unable to provide				
Improved response or timeliness	Major	Unable to provide		Major	Unable to provide		Minor	Unable to provide				
Improved customer experience	Major	Unable to provide		Major	Unable to provide		Major	Unable to provide				
Other customer service benefits	Major	Unable to provide										
Other customer service benefits description	Decision making.											
Societal Benefits	Benefits			Benefits			Benefits			Benefits		
Education or outreach	Major			Major			Major					
Environmental	Major			Major			Major					
Public safety, including life and property	Moderate			Major			Major					

3D Derivatives Needed	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Triangulated Irregular Network (TIN)				
Contours				
Hillshades	Yes	Yes	Yes	
Slope maps	Yes	Yes	Yes	
Aspect maps				
Curvature maps				
Cross sections				
Height-Above-Ground maps				
Viewshed maps				
Hydrologic Flow Direction Grids	Yes			
Hydrologic Flow Accumulation Grids	Yes			
Hydrologic networks (e.g. streams, lakes)	Yes			
Hydrologic Units (Watershed Boundaries) (e.g. surface water drainage to a point)	Yes			
Building footprints	Yes			
Breaklines for road edge-of-pavement	Yes			
Rugosity/Surface Roughness	Yes			

Importance of 3D Data Requirements	Response
Geographic coverage	3
Vertical accuracy	1
Update frequency	2

MCA Title: Natural Hazard Mitigation



MCA Area of Interest	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Data Type	Required	Required	Required	
Geographic Area Requirements	States and/or Territories	States and/or Territories	States and/or Territories	
Sub Area Requirements	Areas not shown on map: U.S. Minor Outlying Islands, Federated States of Micronesia, Marshall Islands, Palau	Areas not shown on map: U.S. Minor Outlying Islands, Federated States of Micronesia, Marshall Islands, Palau	Areas not shown on map: U.S. Minor Outlying Islands, Federated States of Micronesia, Marshall Islands, Palau	

MCA Description	Response
Mission Critical Activity	Natural Hazard Mitigation
MCA Title	Natural Hazard Mitigation
MCA ID	1356
Organization Type	Academic or Not-for-Profit
Organization Name	National Disaster Preparedness Training Center, University of Hawaii
Sub-Agency or Division	
Organization Mission	Education and Training on Natural Disaster Preparedness, Response, Recovery, and Resilience
Program Name	Education and Training Course Design and Development for First Responders and Emergency Management
Total Annual Program Budget	
Primary Business Use	BU 15 - Flood Risk Management
Secondary Business Use	BU 03 - Coastal Zone Management
Tertiary Business Use	BU 10 - Geologic Assessment and Hazard Mitigation

What Needs to be Measured in 3D	Response
Bare earth ground	Required
Tops of buildings, structures, objects	Highly desirable
Tops of vegetation	Nice to have
Tops of submerged structures, objects	Nice to have
Tops of submerged vegetation	Nice to have
Subcanopy of vegetation/understory	Nice to have
River/lake bottom	Required
Nearshore elevation (<10 m deep)	Required
Sea surface	Not required
Ocean/sea bottom (>10 m deep)	Not required

General Geographic Area and Size	
Average geographic extent of day-to-day area	25,000 sq mi - 74,999 sq mi (e.g. medium state or large multi-county region)
Smallest 3D features needed	Large features (e.g. groups of trees, house, building, road, underwater wreck, large commercial pier, etc.)
Description of smallest 3D features	House

Inland Bathymetry Feature Size Requirements	Response
Navigable channels (as defined by USACE)	Required
Rivers and Streams	
Less than 10 ft	Highly desirable
10 - 50 ft	Highly desirable
51 - 100 ft	Required
101 - 500 ft	Required
501 - 2,500 ft	Required
Greater than 2,500 ft	Required
Waterbodies (Reservoirs, lakes, ponds)	
Less than ½ acre	Highly desirable
½ - 1 acre	Highly desirable
1.1 – 2 acres	Highly desirable
2.1 – 5 acres	Required
5.1 – 10 acres	Required
Greater than 10 acres	Required

Requirements	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Quality Level/IHO Order	QL0	QL0B	QL0B	
Update Frequency	4-5 years	4-5 years	4-5 years	
Event type(s)				
Quality Level and/or update frequency variability across AOI				
Acceptable Horizontal Error	Less than 20 cm	Less than 50 cm	Less than 50 cm	
Acceptable Vertical Error	Less than 5 cm	Less than 10 cm	Less than 10 cm	
How far onshore needed			To Mean Higher High Water (MHHW)	
How far down the beach profile needed	To MHHW		To MHHW	
Tide correction requirement			MLLW	
Cross sections and/or transects meet needs				
Cross section/transect requirement				

Hydrologic Processing Required	Response
Hydro-flattening	Nice to have
Hydro-enforcement	Highly desirable
Hydro-conditioning	Required
No Treatment	Not required

Seamlessness Requirements	Within Inland Topo Data	Within Inland Bathy Data	Within Nearshore Data	Within Offshore Data	Between Inland Topo and Inland Bathy	Between Topo, Topobathy, and/or Bathy
Importance of Seamlessness					Highly desirable	
Temporal Seamlessness						
Entire AOI in same acquisition season	Required	Required	Required		Required	Required
Entire AOI under same environmental conditions	Required	Required	Required		Required	Required
Spatial Seamlessness						
Point cloud for entire AOI needs to be seamless	Required	Nice to have	Nice to have		Nice to have	Highly desirable
DEM for entire AOI needs to be seamless	Required	Required	Required		Required	Required
Amount of acceptable vertical manipulation to achieve spatial seamlessness	Whatever it takes to achieve seamlessness, including changes to the older, previously accepted dataset if it is proven to be less accurate than the newer	Whatever it takes to achieve seamlessness, including changes to the older, previously accepted dataset if it is proven to be less accurate than the newer	Whatever it takes to achieve seamlessness, including changes to the older, previously accepted dataset if it is proven to be less accurate than the newer		Whatever it takes to achieve seamlessness, including changes to the older, previously accepted dataset if it is proven to be less accurate than the newer	Whatever it takes to achieve seamlessness, including changes to the older, previously accepted dataset if it is proven to be less accurate than the newer

Importance of 3D Products	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
DSM	Nice to have	Highly desirable	Highly desirable	
DTM	Highly desirable	Highly desirable	Highly desirable	
DEM	Required	Required	Required	
Raw point cloud data	Nice to have	Nice to have	Nice to have	
Classified point cloud	Nice to have	Nice to have	Nice to have	
Edited/cube XYZ		Nice to have	Nice to have	
Full waveform	Nice to have	Nice to have	Nice to have	
Bathymetric Attributed Grid (BAG)		Nice to have	Nice to have	

Importance of 3D Products	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Breaklines required for standard hydro-flattening	Nice to have	Nice to have		
Additional breaklines for hydro-enforcement of culverts	Nice to have			
National Vertical Datum Transformation Tool (V-Datum)			Nice to have	
Tide Predictions			Nice to have	
Tidal Constituent And Residual Interpolation (TCARI)			Nice to have	
Intensity imagery/sidescan imagery	Nice to have	Highly desirable	Nice to have	
Ground control/ground truthing	Nice to have	Nice to have	Nice to have	

Importance of Integration with Other Datasets	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Hydrographic survey data			Nice to have	
Nautical and/or navigation charts			Not required	
Acoustic imagery of the seafloor			Nice to have	
Aerial and/or satellite imagery	Required	Required	Required	
Underwater videography			Nice to have	
Bottom texture			Highly desirable	
Bottom type			Highly desirable	
Submerged features			Nice to have	
Subbottom characteristics			Nice to have	
Geologic and seismic data	Highly desirable	Highly desirable	Highly desirable	
Water column properties - Physical			Not required	
Water column properties - Chemical			Not required	
Water column properties - Biological			Not required	
Currents			Required	
Tide/wave heights			Required	
Sea ice conditions			Not required	
Habitat distribution and classification			Not required	
Boundaries			Nice to have	
Routes			Not required	
Offshore cadastral			Not required	
Lease areas			Not required	
Fixed obstructions			Not required	
Floating observation/navigation systems			Not required	

Importance of Integration with Other Datasets	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Shorelines – current, historic, change rates	Highly desirable	Highly desirable	Nice to have	
Land use/land cover	Highly desirable	Highly desirable	Nice to have	
Wetlands	Nice to have	Nice to have	Nice to have	
Estuaries			Nice to have	
Inland surface water features	Nice to have	Nice to have	Nice to have	
Bridges/culverts	Highly desirable	Highly desirable		
Landmark features	Nice to have	Nice to have	Nice to have	
Cultural resources	Nice to have	Nice to have	Nice to have	
Coastal and riverine structures	Highly desirable	Required	Required	
Overhead structures			Required	
Lowest Floor Elevation of Buildings	Highly desirable			

Benefits of Currently Used Elevation Data	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Current dataset used	Best available data	Best available data	Best available data	
Where current elevation data are accessed	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
National Map	Yes			
Digital Coast	Yes	Yes	Yes	
NCEI				
Open Topography				
NOAA nautical charts				
USACE navigation charts				
USGS Inland Waters server				
USGS data series				
Marine Minerals Program GIS				
State Repositories	Yes			
State repositories used	State GIS Offices			
Data that meet my needs are not available				
Current Operational Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Time savings	Major	Minor	I don't know	
Cost savings/cost reduction	Major	Minor	Major	
Cost avoidance	Major	Minor	Major	
Increased revenues	None	Minor	Minor	

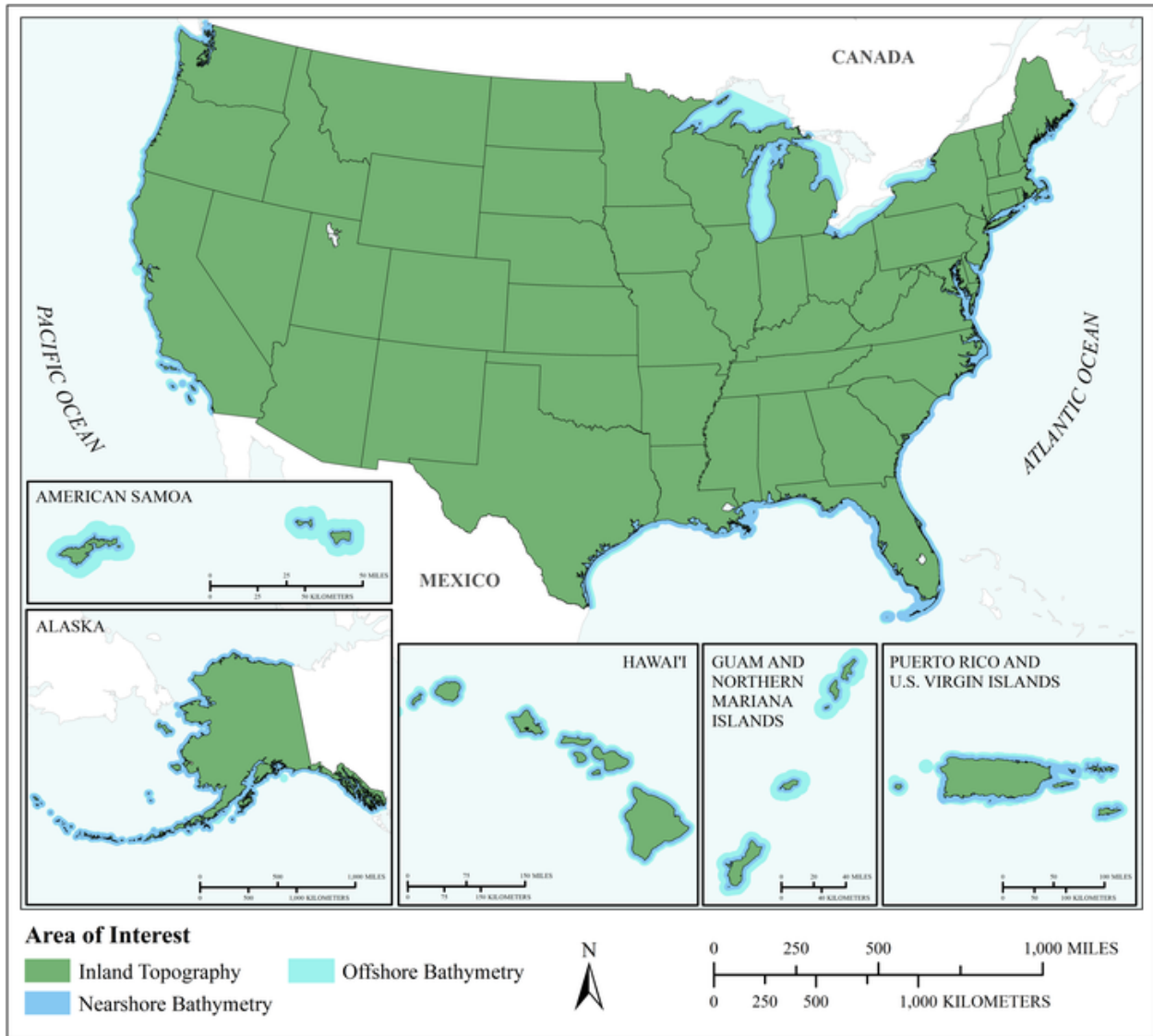
Benefits of Currently Used Elevation Data	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Mission-driven performance improvements	Moderate	Minor	Moderate	
Current Customer Service Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Value added to products or services	Minor	None	Minor	
Improved response or timeliness	Moderate	Minor	Moderate	
Improved customer experience	Minor	None	Minor	
Current Societal Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Education or outreach	Moderate	Minor	Minor	
Environmental	Moderate	None	None	
Public safety, including life and property	Moderate	Minor	Moderate	

Future Benefits if Elevation Data Requirements Are Met	Inland Topo			Inland Bathy			Nearshore Bathy			Offshore Bathy		
	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount
Time savings	Major	Unable to provide		Major	Unable to provide		Major	Unable to provide				
Cost savings/cost reduction	Major	Unable to provide		Major	Unable to provide		Major	Unable to provide				
Cost avoidance	Major	Unable to provide		Major	Unable to provide		Major	Unable to provide				
Increased revenues	None			Minor	Unable to provide		None					
Mission-driven performance improvements	Major	Unable to provide		Major	Unable to provide		Major	Unable to provide				
Future Customer Service Benefits	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount
Value added to products or services	None			Moderate	Unable to provide		Minor	Unable to provide				
Improved response or timeliness	Moderate	Unable to provide		Major	Unable to provide		Moderate	Unable to provide				
Improved customer experience	Major	Unable to provide		Moderate	Unable to provide		None					
Societal Benefits	Benefits			Benefits			Benefits			Benefits		
Education or outreach	Major			Moderate			Moderate					
Environmental	Minor			Minor			None					
Public safety, including life and property	Moderate			Major			Minor					

3D Derivatives Needed	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Triangulated Irregular Network (TIN)	Yes	Yes	Yes	
Contours	Yes			
Hillshades	Yes	Yes	Yes	
Slope maps	Yes			
Aspect maps				
Curvature maps				
Cross sections				
Height-Above-Ground maps				
Viewshed maps				
Hydrologic Flow Direction Grids	Yes			
Hydrologic Flow Accumulation Grids	Yes			
Hydrologic networks (e.g. streams, lakes)	Yes			
Hydrologic Units (Watershed Boundaries) (e.g. surface water drainage to a point)	Yes			
Building footprints	Yes			
Breaklines for road edge-of-pavement				
Rugosity/Surface Roughness	Yes			

Importance of 3D Data Requirements	Response
Geographic coverage	2
Vertical accuracy	3
Update frequency	1

MCA Title: Disaster Based Situational Awareness and Risk Assessment



MCA Area of Interest	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Data Type	Required		Required	Required
Geographic Area Requirements	States and/or Territories		States and/or Territories	States and/or Territories
Sub Area Requirements	Areas not shown on map: U.S. Minor Outlying Islands, Federated States of Micronesia, Marshall Islands, Palau		Areas not shown on map: U.S. Minor Outlying Islands, Federated States of Micronesia, Marshall Islands, Palau	Areas not shown on map: U.S. Minor Outlying Islands, Federated States of Micronesia, Marshall Islands, Palau

MCA Description	Response
Mission Critical Activity	Disaster based situational awareness, and risk assessment. (e.g. dam modeling, coastal flooding, tsunami inundation, etc.)
MCA Title	Disaster Based Situational Awareness and Risk Assessment
MCA ID	21513
Organization Type	Academic or Not-for-Profit
Organization Name	Pacific Disaster Center
Sub-Agency or Division	University of Hawaii
Organization Mission	Applied research center with a disaster management focus
Program Name	Applied research and analysis in support of disaster management
Total Annual Program Budget	
Primary Business Use	BU 15 - Flood Risk Management
Secondary Business Use	BU 10 - Geologic Assessment and Hazard Mitigation
Tertiary Business Use	BU 03 - Coastal Zone Management

What Needs to be Measured in 3D	Response
Bare earth ground	Required
Tops of buildings, structures, objects	Required
Tops of vegetation	Nice to have
Tops of submerged structures, objects	Nice to have
Tops of submerged vegetation	Not required
Subcanopy of vegetation/understory	Nice to have
River/lake bottom	Required
Nearshore elevation (<10 m deep)	Required
Sea surface	Required
Ocean/sea bottom (>10 m deep)	Nice to have

General Geographic Area and Size	
Average geographic extent of day-to-day area	Global
Smallest 3D features needed	Large features (e.g. groups of trees, house, building, road, underwater wreck, large commercial pier, etc.)
Description of smallest 3D features	Incorporating structures, including buildings, into impact potential products

Requirements	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Quality Level/IHO Order	QL2		QL3B	Order 2
Update Frequency	Event driven only – Data need to coincide with a specific event.		Event driven only – Data need to coincide with a specific event.	Event driven only – Data need to coincide with a specific event.
Event type(s)	Disaster related activity (e.g. surge, tsunami inundation, coastal flooding, etc.)		Disaster (e.g. dam break, hurricane or typhoon, tsunamis, etc.)	Disaster (e.g. dam break, hurricane or typhoon, tsunamis, etc.)
Quality Level and/or update frequency variability across AOI			Only where structures may be impacted	
Acceptable Horizontal Error	Up to 30 cm		Up to 1 meter	Up to 1 meter

Requirements	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Acceptable Vertical Error	Up to 10 cm		Up to 30 cm	Up to 2 meters
How far onshore needed			To cover the beach slope	
How far down the beach profile needed	Below MLLW		Below MLLW	
Tide correction requirement			I don't know	No requirement for tide correction
Cross sections and/or transects meet needs				
Cross section/transect requirement				

Hydrologic Processing Required	Response
Hydro-flattening	Required
Hydro-enforcement	Required
Hydro-conditioning	Required
No Treatment	Not required

Seamlessness Requirements	Within Inland Topo Data	Within Inland Bathy Data	Within Nearshore Data	Within Offshore Data	Between Inland Topo and Inland Bathy	Between Topo, Topobathy, and/or Bathy
Importance of Seamlessness						
Temporal Seamlessness						
Entire AOI in same acquisition season	Highly desirable		Nice to have	Nice to have		Nice to have
Entire AOI under same environmental conditions	Highly desirable		Highly desirable	Nice to have		Highly desirable
Spatial Seamlessness						
Point cloud for entire AOI needs to be seamless	Required		Highly desirable	Highly desirable		Required
DEM for entire AOI needs to be seamless	Required		Highly desirable	Highly desirable		Required
Amount of acceptable vertical manipulation to achieve spatial seamlessness	Up to the required Total Vertical Uncertainty (TVU) at the 95% confidence level		Up to the required Total Vertical Uncertainty (TVU) at the 95% confidence level	Up to the required Total Vertical Uncertainty (TVU) at the 95% confidence level		Up to the required Total Vertical Uncertainty (TVU) at the 95% confidence level

Importance of 3D Products	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
DSM	Required		Nice to have	Nice to have
DTM	Required		Nice to have	Nice to have
DEM	Required		Nice to have	Nice to have
Raw point cloud data	Not required		Not required	Not required
Classified point cloud	Not required		Not required	
Edited/cube XYZ			Not required	Not required
Full waveform	Not required		Not required	Not required
Bathymetric Attributed Grid (BAG)			Not required	Not required
Breaklines required for standard hydro-flattening	Not required			
Additional breaklines for hydro-enforcement of culverts	Not required			

Importance of 3D Products	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
National Vertical Datum Transformation Tool (V-Datum)			Not required	Not required
Tide Predictions			Not required	Not required
Tidal Constituent And Residual Interpolation (TCARI)			Not required	Not required
Intensity imagery/sidescan imagery	Not required		Not required	Not required
Ground control/ground truthing	Not required		Not required	Not required

Importance of Integration with Other Datasets	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Hydrographic survey data			Not required	Not required
Nautical and/or navigation charts			Not required	Not required
Acoustic imagery of the seafloor			Not required	Not required
Aerial and/or satellite imagery	Required		Nice to have	Not required
Underwater videography			Not required	Not required
Bottom texture			Not required	Not required
Bottom type			Not required	Not required
Submerged features			Not required	Not required
Subbottom characteristics			Not required	Not required
Geologic and seismic data	Required		Nice to have	Nice to have
Water column properties - Physical			Not required	Not required
Water column properties - Chemical			Not required	Not required
Water column properties - Biological			Not required	Not required
Currents			Not required	Not required
Tide/wave heights			Not required	Not required
Sea ice conditions			Not required	Not required
Habitat distribution and classification			Not required	Not required
Boundaries			Not required	Not required
Routes			Not required	Not required
Offshore cadastral			Not required	Not required
Lease areas			Not required	Not required
Fixed obstructions			Not required	Not required
Floating observation/navigation systems			Not required	Not required
Shorelines – current, historic, change rates	Highly desirable		Nice to have	
Land use/land cover	Highly desirable		Not required	Not required
Wetlands	Highly desirable		Not required	Not required

Importance of Integration with Other Datasets	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Estuaries			Not required	Not required
Inland surface water features	Required		Nice to have	
Bridges/culverts	Highly desirable			
Landmark features	Highly desirable		Not required	
Cultural resources	Highly desirable		Not required	
Coastal and riverine structures	Highly desirable		Nice to have	
Overhead structures			Not required	
Lowest Floor Elevation of Buildings	Required			

Benefits of Currently Used Elevation Data	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Current dataset used	Conducting flood loss modeling. Tsunami loss based on QL2. New project on Oahu based on 3 meter.		None at this time	None at this time
Where current elevation data are accessed	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
National Map	Yes			
Digital Coast	Yes			
NCEI				
Open Topography				
NOAA nautical charts				
USACE navigation charts				
USGS Inland Waters server				
USGS data series				
Marine Minerals Program GIS				
State Repositories				
State repositories used				
Other			Yes	Yes
Other description			None	None
Data that meet my needs are not available				
Current Operational Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Time savings	Moderate		None	None
Cost savings/cost reduction	Moderate		None	None

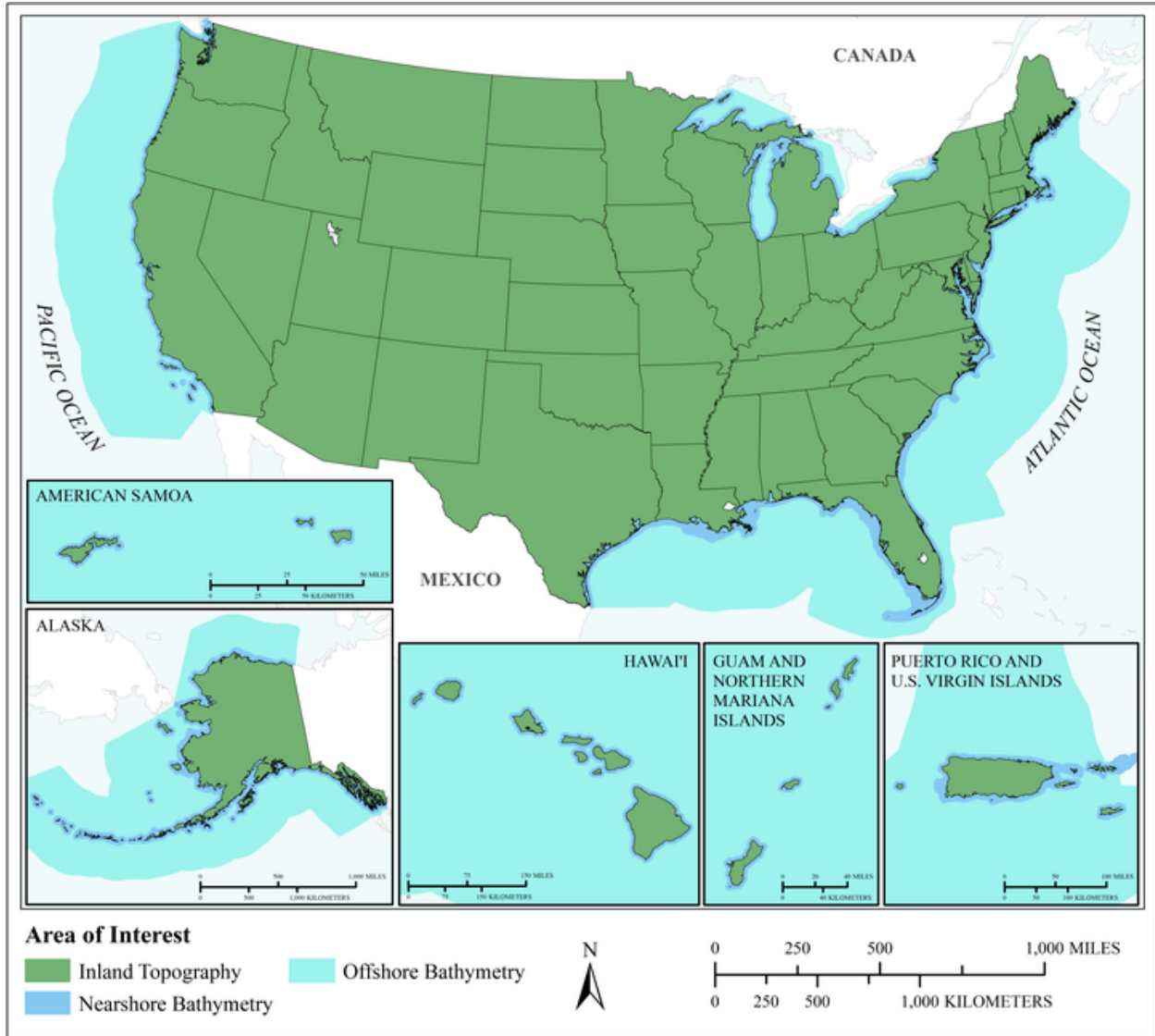
Benefits of Currently Used Elevation Data	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Cost avoidance	Major		None	None
Increased revenues	I don't know		None	None
Mission-driven performance improvements	Major		None	None
Current Customer Service Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Value added to products or services	Major		None	None
Improved response or timeliness	None		None	None
Improved customer experience	Major		None	None
Current Societal Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Education or outreach	Major		None	None
Environmental	Major		None	None
Public safety, including life and property	Major		None	None

Future Benefits if Elevation Data Requirements Are Met	Inland Topo			Inland Bathy			Nearshore Bathy			Offshore Bathy		
	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount
Time savings	Major	Annual dollars saved/realized	\$4,824				I don't know	Unable to provide		I don't know	Unable to provide	
Time savings description	On two or three hurricane event responses a year. Reduced need to rerun model scenarios. Higher processing time, but better product one week per year.											
Cost savings/cost reduction	None						I don't know	Unable to provide		I don't know	Unable to provide	
Cost avoidance	None						I don't know	Unable to provide		I don't know	Unable to provide	
Increased revenues	I don't know	Unable to provide					I don't know	Unable to provide		I don't know	Unable to provide	
Mission-driven performance improvements	Moderate	Annual percent improvement	6%				I don't know	Unable to provide		I don't know	Unable to provide	
Mission-driven performance improvements description	Better quality information and improved decision making. Ability to do additional products we wouldn't be able to do otherwise.											
Future Customer Service Benefits	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount
Value added to products or services	Moderate	Unable to provide					I don't know	Unable to provide		I don't know	Unable to provide	
Value added to products or services description	Improved real time capabilities. Better data and quality of results.											
Improved response or timeliness	Major	Annual dollars saved/realized	\$2,714				I don't know	Unable to provide		I don't know	Unable to provide	
Improved response or timeliness description	Readily available information provides faster response. More accurate situational awareness. Updated best available hazard information.											
Improved customer experience	Major	Annual dollars saved/realized	\$2,714				I don't know	Unable to provide		I don't know	Unable to provide	
Improved customer experience description	Time savings through expedited access. Improved accuracy of results and increased confidence. Additional capabilities for our system.											
Societal Benefits	Benefits			Benefits			Benefits			Benefits		
Education or outreach	Major						I don't know			I don't know		
Education or outreach description	Improved communication using more accurate products											
Environmental	None						I don't know			I don't know		
Public safety, including life and property	Major						I don't know			I don't know		
Public safety, including life and property description	Improved situational awareness and decision making based on more accurate products											

3D Derivatives Needed	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Triangulated Irregular Network (TIN)	Yes		Yes	Yes
Contours	Yes			
Hillshades	Yes			
Slope maps	Yes		Yes	Yes
Aspect maps	Yes		Yes	Yes
Curvature maps				
Cross sections				
Height-Above-Ground maps				
Viewshed maps				
Hydrologic Flow Direction Grids	Yes			
Hydrologic Flow Accumulation Grids	Yes			
Hydrologic networks (e.g. streams, lakes)	Yes		Yes	
Hydrologic Units (Watershed Boundaries) (e.g. surface water drainage to a point)	Yes			
Building footprints	Yes			
Breaklines for road edge-of-pavement				
Rugosity/Surface Roughness	Yes		Yes	Yes

Importance of 3D Data Requirements	Response
Geographic coverage	3
Vertical accuracy	2
Update frequency	1

MCA Title: Advance Ocean Mapping and Hydrography and Train Hydrographers



MCA Area of Interest	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Data Type	Required		Required	Required
Geographic Area Requirements	States and/or Territories		All study waters	All study waters
Sub Area Requirements	Areas not shown on map: U.S. Minor Outlying Islands, Federated States of Micronesia, Marshall Islands, Palau			

MCA Description	Response
Mission Critical Activity	<p>The major focus of CCOM/JHC is to develop tools to advance ocean mapping and hydrography. As such, much of the work at CCOM/JHC is directed at evaluating or developing technologies, algorithms, or best practices for acoustic bathymetry (multibeam and single beam) for hydrographic mapping and seafloor characterization (including acoustic backscatter). In addition, this effort is not limited to acoustics, but also includes airborne LIDAR. Therefore, the primary mission is to innovate and develop, rather than mapping surveys directly. However, the development of expanded high resolution mapping using both MBES and LIDAR for the nation enhances this effort significantly. There are also significant efforts directed at developing technologies for applications such as seafloor characterization, critical habitat evaluation, seafloor change analysis, electronic chart development, modeling, marine mineral resources, among others, that require high resolution multibeam echosounder (MBES) bathymetry and backscatter, both newly acquired for a specific study or existing (archived). Similarly, there are applications concerned with coastal and shallow water environments addressing coastal resiliency, shoreline change, restoration, etc., that need high resolution topographic and bathymetric LIDAR. These examples do not cover all of the applications, but are meant to show areas of focus. These applications also evolve over time. Furthermore, deep ocean applications are important (e.g., Law of the Sea).</p>
MCA Title	Advance Ocean Mapping and Hydrography and Train Hydrographers
MCA ID	21515
Organization Type	Academic or Not-for-Profit
Organization Name	University of New Hampshire Center for Coastal and Ocean Mapping/Joint Hydrographic Center (CCOM/JHC)
Sub-Agency or Division	
Organization Mission	<p>The Center for Coastal and Ocean Mapping/Joint Hydrographic Center (CCOM/JHC) is located at the University of New Hampshire (UNH). As stated on the CCOM/JHC website, "the JHC is a formal cooperative partnership between the University of New Hampshire and the National Oceanic and Atmospheric Administration (NOAA) whose aim is to create a national center for expertise in ocean mapping and hydrographic sciences. CCOM, a complementary university center, expands the scope of ocean mapping interaction and collaboration with the private sector, other government agencies, and other universities." The main mission or objectives of CCOM/JHC is "to develop tools to advance ocean mapping and hydrography, and to train the next generation of hydrographers and ocean mappers". This mission includes developing new technologies and tools for a number of other marine applications and needs such as seafloor characterization, habitat mapping, coastal resiliency, visualization, electronic charting, modeling, marine mineral resources, etc. These examples do not cover all of the applications, but are meant to show examples of focus. These applications also evolve over time. Furthermore, deeper ocean applications are important (e.g., Law of the Sea).</p>
Program Name	The major program supported by the Mission Critical Activates is the development of tools to advance ocean mapping and hydrography.
Total Annual Program Budget	
Primary Business Use	BU 20 - Marine and Riverine Navigation and Safety
Secondary Business Use	BU 03 - Coastal Zone Management
Tertiary Business Use	BU 30 - Maritime and Land Boundary Management

What Needs to be Measured in 3D	Response
Bare earth ground	Required
Tops of buildings, structures, objects	Required
Tops of vegetation	Required
Tops of submerged structures, objects	Required
Tops of submerged vegetation	Required
Subcanopy of vegetation/understory	Required
River/lake bottom	Not required
Nearshore elevation (<10 m deep)	Required
Sea surface	Required
Ocean/sea bottom (>10 m deep)	Required
Other	Required
Other description	River/lake bottom of large lake systems (e.g. Great Lakes)

General Geographic Area and Size	
Average geographic extent of day-to-day area	Due to the large number of research and development projects, the geographic extent can cover an area from an individual feature (meters) to 1,000s of sq miles (Law of the Sea).
Smallest 3D features needed	Small features (e.g. individual shrub, tree, car, mooring anchor, small dock, etc.)
Description of smallest 3D features	Seafloor obstructions, vegetation, bedforms, and more.

Requirements	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Quality Level/IHO Order	QL0 HD		QL0B	The needed accuracy depends on the application . Deep ocean work may only require Order 1a, but shelf studies of seafloor change, habitats, electronic chart development may require high resolution of Special Order (2m).

Requirements	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Update Frequency	Depends on research. Annually for coastal change analysis in areas of rapid change. Event driven in areas with low rates of change. Coastal areas need more frequent updates, especially storm impacted areas; beach nourishment requires volumetric changes; marsh loss and migration require more frequency. Yearly flights for NH would be advantageous. Full waveform should be required for topo.		Annually in locations where coastal change is being studied or where the seafloor changes rapidly. Otherwise, event driven. Triggering events would include major storms that alter hydrography, navigation, bathymetry, or shoreline position.	The focus areas may vary depending on types of research being done. Some sites (deep ocean) may require only a single survey initially. However, in general for coastal resiliency, habitats, stability, the coverage of all nearshore areas should be done at a minimum of 2-3 years, and annually in areas of rapid erosion and or flooding.
Event type(s)				
Quality Level and/or update frequency variability across AOI	Both the frequency and accuracy can vary due to the multiple objectives of the Center. For example, the highest resolution lidar surveys are needed for research purposes (e.g., predicting canopy height or biomass from lidar, determining the effect of plants on uncertainty). However, these surveys do not need to be rerun yearly. But, studies to measure shoreline change and modeling inundation need more frequent updates (e.g., yearly).		The focus areas may vary depending on types of research being done. Some sites may require only a single survey. However, in general for coastal resiliency, the coverage of all nearshore areas should be done at a minimum of 2-3 years, and annually in areas of rapid erosion and or flooding.	Although much of the United States coastal and offshore waters are of interest, specific study areas change with time. In addition, the requirements of the surveys vary.

Requirements	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Acceptable Horizontal Error	The best horizontal accuracy achievable for the vertical accuracy I need		The best horizontal accuracy achievable for the vertical accuracy I need	The best horizontal accuracy achievable for the vertical accuracy I need
Acceptable Vertical Error	Up to 10 cm		Up to 20 cm	The best vertical accuracy achievable. Depends on depth and application
How far onshore needed			>1 kilometer inland	
How far down the beach profile needed	Below MLLW		Below MLLW	
Tide correction requirement			Any tide correction is acceptable, as long as it is defined	Any tide correction is acceptable, as long as it is defined
Cross sections and/or transects meet needs				
Cross section/transect requirement				

Hydrologic Processing Required	Response
Hydro-flattening	Not required
Hydro-enforcement	Not required
Hydro-conditioning	Not required
No Treatment	Required

Seamlessness Requirements	Within Inland Topo Data	Within Inland Bathy Data	Within Nearshore Data	Within Offshore Data	Between Inland Topo and Inland Bathy	Between Topo, Topobathy, and/or Bathy
Importance of Seamlessness						
Temporal Seamlessness						
Entire AOI in same acquisition season	Required		Required	Required		Required
Entire AOI under same environmental conditions	Required		Required	Required		Required
Other	Required		Required	Required		Required
Other description	For coastal and beach flights, it is important that the surveys are flown over short periods and at low water (tidal) stage.		The topography/bathymetry should be completed concurrently and under the same environmental conditions for a particular study area.	The AOI can vary depending on research or mapping requirements. But if possible, the bathymetry should be collected during a minimal time period.		Topography/bathymetry should be completed concurrently and under the same environmental conditions for a study area. However, this does not mean the whole US coast and shelf. The study area will vary depending on the research problems.
Spatial Seamlessness						
Point cloud for entire AOI needs to be seamless	Required		Required	Required		Required
DEM for entire AOI needs to be seamless	Required		Required	Required		Required
Other	Required					Required

Seamlessness Requirements	Within Inland Topo Data	Within Inland Bathy Data	Within Nearshore Data	Within Offshore Data	Between Inland Topo and Inland Bathy	Between Topo, Topobathy, and/or Bathy
Other description	<p>Both the frequency and accuracy can vary due to the multiple objectives of the Centers. For example, the highest resolution lidar surveys are needed for research purposes (e.g., predicting canopy height or biomass from lidar, determining the effects of plants on uncertainty). However, these surveys do not need to rerun yearly. But, studies to measure shoreline change and modeling inundation need more frequent updates (e.g., yearly).</p>					<p>It is likely that for most studies conducted by the Centers the database will be gridded and combined in house. So the primary concern is narrowing the window when acquisition occurs and availability of the data.</p>

Seamlessness Requirements	Within Inland Topo Data	Within Inland Bathy Data	Within Nearshore Data	Within Offshore Data	Between Inland Topo and Inland Bathy	Between Topo, Topobathy, and/or Bathy
Amount of acceptable vertical manipulation to achieve spatial seamlessness	Up to the required Total Vertical Uncertainty (TVU) at the 95% confidence level		The higher the quality of the joining of datasets the better, so at least the required TVU at the 95% confidence level. However, for many or most of the Centers purposes, obtaining the processed databases or processed data point clouds that can be used for in house gridding and analysis is preferable.	It is likely the gridding and spatial integration would be done at the Center. If it is not done internally, then TVU at the 95% level.		This will vary. And it is likely the integrations will be done in house. But at a minimum, the required TVU at the 95% confidence level should be used.

Importance of 3D Products	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
DSM	Required		Required	Required
DTM	Required		Required	Required
DEM	Required		Required	Required
Raw point cloud data	Required		Required	Required
Classified point cloud	Required		Required	
Edited/cube XYZ			Required	Required
Full waveform	Required		Required	Required
Bathymetric Attributed Grid (BAG)			Required	Required
Breaklines required for standard hydro-flattening	Not required			
Additional breaklines for hydro-enforcement of culverts	Not required			
National Vertical Datum Transformation Tool (V-Datum)			Required	Required
Tide Predictions			Required	Not required

Importance of 3D Products	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Tidal Constituent And Residual Interpolation (TCARI)			Not required	Not required
Intensity imagery/sidescan imagery	Required		Required	Required
Ground control/ground truthing	Not required		Required	Required
Other			Required	
Other description			For most applications, the edited/cube XYZ data or BAGs would be preferable. If available the highest resolution DEM would be useful.	

Importance of Integration with Other Datasets	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Hydrographic survey data			Required	Required
Nautical and/or navigation charts			Required	Required
Acoustic imagery of the seafloor			Required	Required
Aerial and/or satellite imagery	Required		Required	Required
Underwater videography			Required	Required
Bottom texture			Required	Required
Bottom type			Required	Required
Submerged features			Required	Required
Subbottom characteristics			Required	Required
Geologic and seismic data	Required		Required	Required
Water column properties - Physical			Required	Required
Water column properties - Chemical			Not required	Not required
Water column properties - Biological			Not required	Not required
Currents			Required	Not required
Tide/wave heights			Required	Required
Sea ice conditions			Required	Not required
Habitat distribution and classification			Required	Required
Boundaries			Required	Required
Routes			Required	Required
Offshore cadastral			Required	Required
Lease areas			Required	Required
Fixed obstructions			Required	Required
Floating observation/navigation systems			Required	Required

Importance of Integration with Other Datasets	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Shorelines – current, historic, change rates	Required		Required	
Land use/land cover	Highly desirable			
Wetlands	Required		Required	Required
Estuaries			Required	Required
Inland surface water features	Not required		Not required	
Bridges/culverts	Required			
Landmark features	Required		Required	
Cultural resources	Required		Required	
Coastal and riverine structures	Required		Required	
Overhead structures			Required	
Lowest Floor Elevation of Buildings	Not required			

Benefits of Currently Used Elevation Data	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Current dataset used	CCOM/JHC specializes in advancing technologies for acquiring, processing, gridding, and visualizing bathymetry and nearshore topography data. Therefore, databases are often acquired internally or directly from the agencies conducting surveys. For additional research projects requiring bathymetry or topography data, Federal online inventories are often used IEI or NOAA Data Access Viewer. Typically, the highest resolution data available is sought.		CCOM/JHC specializes in advancing technologies for acquiring, processing, gridding, and visualizing bathymetry and nearshore topography data. Therefore, databases are often acquired internally or directly from the agencies conducting surveys. For additional research projects requiring bathymetry or topography data, Federal online inventories are often used IEI or NOAA Data Access Viewer. Typically, the highest resolution data available is sought.	CCOM/JHC specializes in advancing technologies for acquiring, processing, gridding, and visualizing bathymetry and topography data. Therefore, databases are often acquired internally or directly from the agencies conducting surveys. For additional research projects requiring bathymetry, federal online inventories are often used such as IEI or NOAA Data Access Viewer.
Where current elevation data are accessed	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
National Map	Yes			

Benefits of Currently Used Elevation Data	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Digital Coast	Yes		Yes	Yes
NCEI	Yes		Yes	Yes
Open Topography				
NOAA nautical charts			Yes	Yes
USACE navigation charts			Yes	Yes
USGS Inland Waters server				
USGS data series				
Marine Minerals Program GIS				
State Repositories				
State repositories used				
Other	Yes		Yes	
Other description	Also, Directly from various sources such as: USGS, USCOE, NCALM, JALBTCX.		Internal surveys (conducted by the Centers), NOAA, JALBTCX, NCALM, Directly from agency who does survey.	
Data that meet my needs are not available				
Current Operational Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Time savings	I don't know		I don't know	I don't know
Cost savings/cost reduction	None		Major	Major
Cost avoidance	I don't know		I don't know	I don't know
Increased revenues	None		None	None
Mission-driven performance improvements	Major		Major	Major
Current Customer Service Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Value added to products or services	Major		Major	Major
Improved response or timeliness	None		I don't know	I don't know
Improved customer experience	None		I don't know	I don't know
Current Societal Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Education or outreach	Moderate		I don't know	I don't know
Environmental	I don't know		I don't know	I don't know
Public safety, including life and property	I don't know		I don't know	I don't know

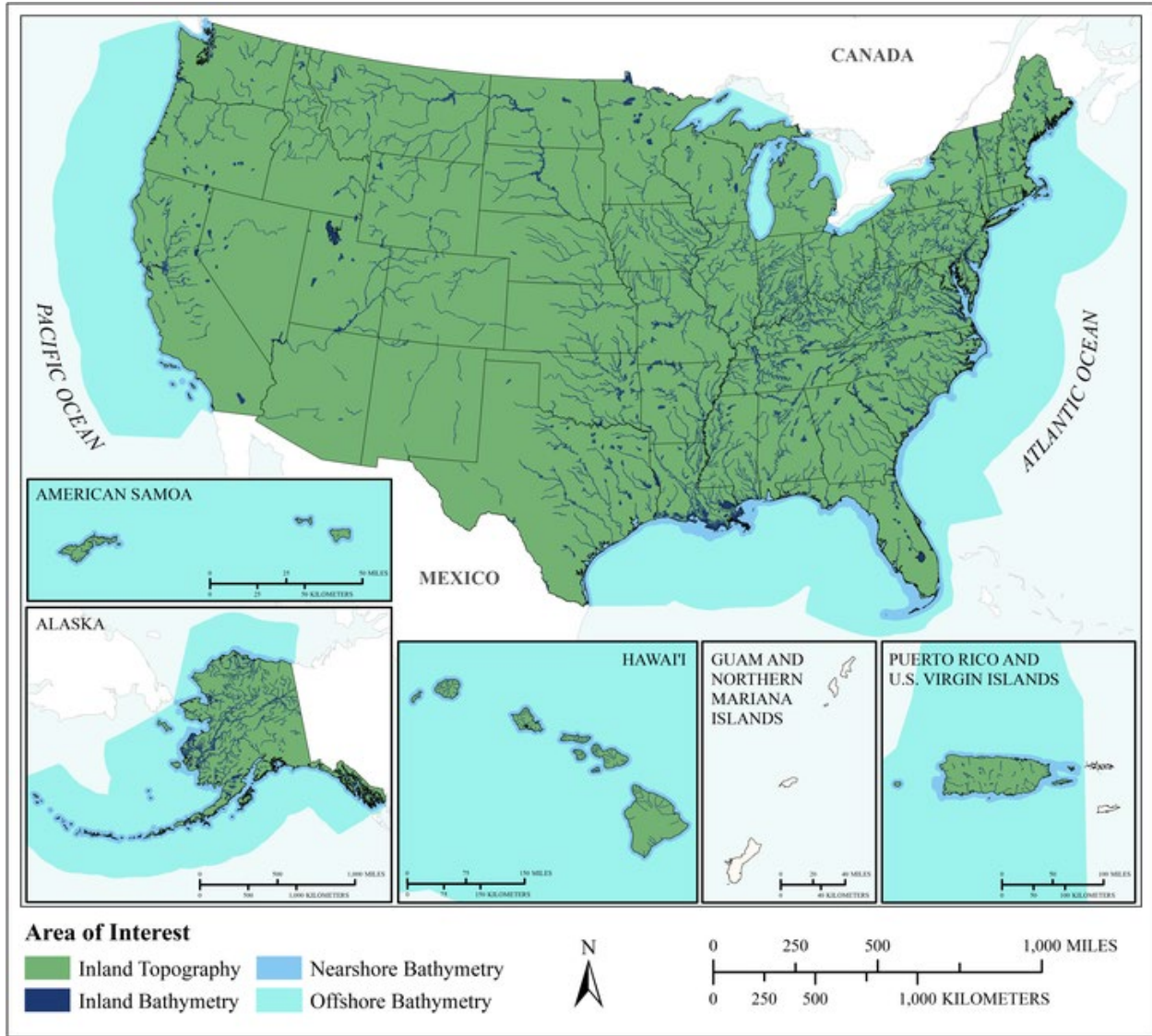
Future Benefits if Elevation Data Requirements Are Met	Inland Topo			Inland Bathy			Nearshore Bathy			Offshore Bathy		
	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount
Time savings	I don't know	Unable to provide					I don't know	Unable to provide		I don't know	Unable to provide	
Time savings description	Not applicable to research and development.						Not applicable to majority of programs.			Not applicable to majority of programs.		
Cost savings/cost reduction	Major	Unable to provide					Major	Unable to provide		Major	Unable to provide	
Cost savings/cost reduction description	Potential major cost savings in obtaining data sets for research. Not applicable to research and development.						Applicable to projects related to coastal resiliency, habitat studies, electronic chart development, marine minerals, etc.			Applicable to projects related to coastal resiliency, habitat studies, electronic charting, marine minerals, etc.		
Cost avoidance	Major	Unable to provide					Major	Unable to provide		I don't know	Unable to provide	
Cost avoidance description	Product is of major importance to marine accidents. Not applicable to research and development.						. Not applicable to majority of program.			Not applicable to majority of program.		
Increased revenues	I don't know	Unable to provide					I don't know	Unable to provide		I don't know	Unable to provide	
Increased revenues description	Development of new processing or uses for lidar in the coastal environment. Not applicable to research and development.						Not applicable to majority of program.			Not applicable to majority of program.		
Mission-driven performance improvements	Major	Unable to provide					Major	Unable to provide		Major	Unable to provide	
Mission-driven performance improvements description	Potential increase in available lidar data sets for research. Not applicable.						Applicable to projects related to coastal resiliency, seafloor characterization, habitat studies, marine minerals, electronic chart development, etc.			Applicable to projects related to seafloor characterization, habitat studies, electronic charting, marine minerals, etc.		
Other operational benefits	Major	Unable to provide					Major	Unable to provide		Major	Unable to provide	
Other operational benefits description	Potential increase in available lidar data sets for research.						Applicable to projects related to coastal resiliency, seafloor characterization, habitat studies, marine minerals, sediment transport modeling, electronic chart development, etc.			Applicable to projects related to seafloor characterization, habitat studies, marine minerals, sediment transport modeling, electronic chart development, etc.		
Future Customer Service Benefits	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount
Value added to products or services	Major	Unable to provide					Major	Unable to provide		Major	Unable to provide	
Value added to products or services description	New uses for lidar data. More data available for coastal resiliency issues.						Applicable to projects related to coastal resiliency, seafloor characterization, habitat studies, marine minerals, sediment transport modeling, electronic chart development, etc.			Applicable to projects related to seafloor characterization, habitat studies, marine minerals, sediment transport modeling, electronic chart development, etc.		
Improved response or timeliness	Major	Unable to provide					Major	Unable to provide		None		
Improved response or timeliness description	Potential important to data bases of coastal environments. Important to the development of electronic charting. Not applicable to research and development.						Applicable to projects related to coastal resiliency, seafloor characterization, habitat studies, marine minerals, sediment transport modeling, electronic chart development, etc.			Applicable to projects related to seafloor characterization, habitat studies, marine minerals, sediment transport modeling, electronic chart development, etc.		
Improved customer experience	Major	Unable to provide					Major	Unable to provide		Major	Unable to provide	
Improved customer experience description	Potential increase in available lidar data sets for research. Not applicable to research and development.						Applicable to projects related to coastal resiliency, seafloor characterization, habitat studies, marine minerals, sediment transport modeling, electronic chart development, etc.			Applicable to projects related to seafloor characterization, habitat studies, marine minerals, sediment transport modeling, electronic chart development, etc.		
Other customer service benefits	Major	Unable to provide					Major	Unable to provide		Major	Unable to provide	

Future Benefits if Elevation Data Requirements Are Met	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Other customer service benefits description	Potential increase in available lidar data sets for research.		Applicable to projects related to coastal resiliency, seafloor characterization, habitat studies, marine minerals, sediment transport modeling, electronic chart development, etc.	Applicable to projects related to seafloor characterization, habitat studies, marine minerals, sediment transport modeling, electronic chart development, etc.
Societal Benefits	Benefits	Benefits	Benefits	Benefits
Education or outreach	Major		Major	Major
Education or outreach description	Availability of lidar data for teaching purposes.			
Environmental	Major		I don't know	I don't know
Environmental description	Availability of new approaches for shoreline mapping, inundation, storm surge, restoration.			
Public safety, including life and property	Major		Major	I don't know
Public safety, including life and property description	Improved coastal navigation, flood prone area mapping, and surge prediction.		Better mapping products will enhance navigation, coastal resiliency, habitat studies and restoration, etc.	
Other	Potential increase in available lidar data sets for research.			Potential increase in available data sets for research.
Other benefits	Major			Major
Other description	Potential increase in available lidar data sets for research.			Applicable to projects related to seafloor characterization, habitat studies, marine minerals, sediment transport modeling, electronic chart development, etc.

3D Derivatives Needed	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Triangulated Irregular Network (TIN)			Yes	Yes
Contours			Yes	Yes
Hillshades			Yes	Yes
Slope maps				
Aspect maps			Yes	Yes
Curvature maps			Yes	Yes
Cross sections			Yes	Yes
Height-Above-Ground maps			Yes	Yes
Viewshed maps				
Hydrologic Flow Direction Grids				
Hydrologic Flow Accumulation Grids				
Hydrologic networks (e.g. streams, lakes)				
Hydrologic Units (Watershed Boundaries) (e.g. surface water drainage to a point)				
Building footprints				
Breaklines for road edge-of-pavement				
Rugosity/Surface Roughness			Yes	Yes
Other (please specify)			Yes	Yes
Other description	Since part of the mission of the Centers is to innovate, develop, and test ways to exploit topographic and bathymetric data for a variety of uses, all of these can be very important. Depends on the research and the application.			

Importance of 3D Data Requirements	Response
Geographic coverage	2
Vertical accuracy	3
Update frequency	1

MCA Title: Education and Research



MCA Area of Interest	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Data Type	Required	Required	Required	Required
Geographic Area Requirements	Nationwide, inland areas	Nationwide, inland areas	Custom description	Custom description
Sub Area Requirements			All nearshore off U.S. States, Puerto Rico, and American Samoa	All offshore off U.S. States, Puerto Rico, and American Samoa to the EEZ

MCA Description	Response
Mission Critical Activity	<p>Numerous research applications ranging from coastal erosion analysis, post-earthquake/hazard damage assessment, infrastructure management, landslide mapping and analysis. At OSU there are researchers using elevation data for research activities for most of the business uses listed below. A very large mixture of data are needed for research and classroom activities. Consistent quality across broader geographies rather than “Best available” is best for many projects. Projects include coastal erosion and landslides. The university collects mobile lidar for some projects, also airborne lidar, drones, and SFM.</p> <p>The respondent's core research and teaching interests are in geomatics; as a result, we are always looking at new ways to use and analyze data for different applications and the requirements aren't really well fleshed out. We are also collaborating with others on a wide range of applications and they all have different requirements. While the many derivative products are nice to have for a few projects - the core requirement is to have the point cloud and DEM and we can create the rest as needed. However, there are many others at the university that would simply prefer to have the various products created for them to use directly to minimize processing time.</p>
MCA Title	Education and Research
MCA ID	1103
Organization Type	Academic or Not-for-Profit
Organization Name	Oregon State University
Sub-Agency or Division	
Organization Mission	<p>As a land grant institution committed to teaching, research and outreach and engagement, Oregon State University promotes economic, social, cultural and environmental progress for the people of Oregon, the nation and the world. This mission is achieved by producing graduates competitive in the global economy, supporting a continuous search for new knowledge and solutions and maintaining a rigorous focus on academic excellence, particularly in the three Signature Areas: Advancing the Science of Sustainable Earth Ecosystems, Improving Human Health and Wellness, and Promoting Economic Growth and Social Progress. See: https://leadership.oregonstate.edu/trustees/oregon-state-university-mission-statement</p>
Program Name	Civil Engineering Department
Total Annual Program Budget	
Primary Business Use	BU 26 - Education K12 and Beyond, Basic Research
Secondary Business Use	BU 22 - Infrastructure and Construction Management
Tertiary Business Use	BU 10 - Geologic Assessment and Hazard Mitigation

What Needs to be Measured in 3D	Response
Bare earth ground	Required
Tops of buildings, structures, objects	Required
Tops of vegetation	Required
Tops of submerged structures, objects	Highly desirable
Tops of submerged vegetation	Highly desirable
Subcanopy of vegetation/understory	Highly desirable
River/lake bottom	Highly desirable
Nearshore elevation (<10 m deep)	Required
Sea surface	Required
Ocean/sea bottom (>10 m deep)	Highly desirable

General Geographic Area and Size	
Average geographic extent of day-to-day area	1 sq mi - 49 sq mi (e.g. small city/town, Census Tract, Voting District, Zip Code, etc)
Smallest 3D features needed	Survey-level features (e.g. sign, curb, road line, mailbox, rock, etc.
Description of smallest 3D features	Survey-level features

Inland Bathy Feature Size Requirements	Response
Navigable channels (as defined by USACE)	Nice to have
Rivers and Streams	
Less than 10 ft	Not required
10 - 50 ft	Not required
51 - 100 ft	Not required
101 - 500 ft	Nice to have
501 - 2,500 ft	Nice to have
Greater than 2,500 ft	Nice to have
Waterbodies (Reservoirs, lakes, ponds)	
Less than ½ acre	Not required
½ - 1 acre	Not required
1.1 – 2 acres	Not required
2.1 – 5 acres	Nice to have
5.1 – 10 acres	Nice to have
Greater than 10 acres	Nice to have

Requirements	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Quality Level/IHO Order	QL1	QL1B	QL1B	Order 1b
Update Frequency	2-3 years and certain events.	2-3 years	2-3 years and certain events.	2-3 years
Event type(s)	Landslides, earthquakes		Coastal erosion	
Quality Level and/or update frequency variability across AOI	more frequent in rapidly eroding locales		more frequent in rapidly eroding locales	more frequent in rapidly eroding locales
Acceptable Horizontal Error	Less than 20 cm	Less than 50 cm	Less than 50 cm	Up to 2 meters
Acceptable Vertical Error	Up to 10 cm	Up to 30 cm	Up to 30 cm	Less than 1 meter
How far onshore needed			10 m depth contour (relative to MLLW)	
How far down the beach profile needed	100 meters		100 meters	
Tide correction requirement			MLLW	MLLW
Cross sections and/or transects meet needs				
Cross section/transect requirement				

Hydrologic Processing Required	Response
Hydro-flattening	Nice to have
Hydro-enforcement	Nice to have

Hydrologic Processing Required	Response
Hydro-conditioning	Nice to have
No Treatment	Not required

Seamlessness Requirements	Within Inland Topo Data	Within Inland Bathy Data	Within Nearshore Data	Within Offshore Data	Between Inland Topo and Inland Bathy	Between Topo, Topobathy, and/or Bathy
Importance of Seamlessness					Nice to have	
Temporal Seamlessness						
Entire AOI in same acquisition season	Nice to have	Nice to have	Nice to have	Nice to have	Nice to have	Nice to have
Entire AOI under same environmental conditions	Nice to have	Nice to have	Nice to have	Nice to have	Nice to have	Nice to have
Spatial Seamlessness						
Point cloud for entire AOI needs to be seamless	Not required	Not required	Not required	Not required	Not required	Not required
DEM for entire AOI needs to be seamless	Nice to have	Nice to have	Nice to have	Nice to have	Nice to have	Nice to have
Amount of acceptable vertical manipulation to achieve spatial seamlessness	Less than 10cm	Less than 30cm	Less than 30cm	Less than 30cm	Less than 30cm	Less than 30cm

Importance of 3D Products	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
DSM	Required	Highly desirable	Highly desirable	Highly desirable
DTM	Required	Required	Required	Required
DEM	Required	Required	Required	Required
Raw point cloud data	Required	Required	Required	Required
Classified point cloud	Required	Required	Required	
Edited/cube XYZ		Not required	Not required	Not required
Full waveform	Nice to have	Highly desirable	Highly desirable	Highly desirable
Bathymetric Attributed Grid (BAG)		Not required	Not required	Not required
Breaklines required for standard hydro-flattening	Nice to have	Required		
Additional breaklines for hydro-enforcement of culverts	Nice to have			

Importance of 3D Products	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
National Vertical Datum Transformation Tool (V-Datum)			Highly desirable	Highly desirable
Tide Predictions			Highly desirable	Highly desirable
Tidal Constituent And Residual Interpolation (TCARI)			Highly desirable	Highly desirable
Intensity imagery/sidescan imagery	Required	Required	Required	Required
Ground control/ground truthing	Required	Required	Required	Required

Importance of Integration with Other Datasets	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Hydrographic survey data			Highly desirable	Highly desirable
Nautical and/or navigation charts			Highly desirable	Highly desirable
Acoustic imagery of the seafloor			Highly desirable	Highly desirable
Aerial and/or satellite imagery	Not required	Not required	Not required	Not required
Underwater videography			Not required	Not required
Bottom texture			Highly desirable	Highly desirable
Bottom type			Highly desirable	Highly desirable
Submerged features			Highly desirable	Highly desirable
Subbottom characteristics			Highly desirable	Highly desirable
Geologic and seismic data	Highly desirable	Highly desirable	Highly desirable	Highly desirable
Water column properties - Physical			Highly desirable	Highly desirable
Water column properties - Chemical			Highly desirable	Highly desirable
Water column properties - Biological			Highly desirable	Highly desirable
Currents			Not required	Not required
Tide/wave heights			Not required	Not required
Sea ice conditions			Not required	Not required
Habitat distribution and classification			Not required	Not required
Boundaries			Not required	Not required
Routes			Not required	Not required
Offshore cadastral			Not required	Not required
Lease areas			Not required	Not required
Fixed obstructions			Not required	Not required
Floating observation/navigation systems			Not required	Not required
Shorelines – current, historic, change rates	Not required	Not required	Highly desirable	
Land use/land cover	Not required	Not required	Not required	Not required
Wetlands	Not required	Not required	Required	Not required

Importance of Integration with Other Datasets	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Estuaries			Required	Not required
Inland surface water features	Not required	Not required	Not required	
Bridges/culverts	Required	Required		
Landmark features	Nice to have	Nice to have	Nice to have	
Cultural resources	Nice to have	Nice to have	Nice to have	
Coastal and riverine structures	Required	Required	Nice to have	
Overhead structures			Nice to have	
Lowest Floor Elevation of Buildings	Nice to have			

Benefits of Currently Used Elevation Data	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Current dataset used	Best available – QL1 from Oregon Lidar Consortium, USGS	Best available – QL1 from Oregon Lidar Consortium, USGS	JABLTCX	JABLTCX
Where current elevation data are accessed	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
National Map	Yes			
Digital Coast	Yes	Yes	Yes	Yes
NCEI	Yes	Yes	Yes	Yes
Open Topography	Yes			
NOAA nautical charts				
USACE navigation charts				
USGS Inland Waters server				
USGS data series				
Marine Minerals Program GIS				
State Repositories	Yes			
State repositories used	Oregon Lidar Consortium			
Data that meet my needs are not available		Yes		
Current Operational Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Time savings	Major	Major	Major	Major
Cost savings/cost reduction	Major	Major	Major	Major
Cost avoidance	Moderate	Moderate	Moderate	Moderate
Increased revenues	Moderate	Moderate	Minor	Minor
Mission-driven performance improvements	Major	Major	Major	Major

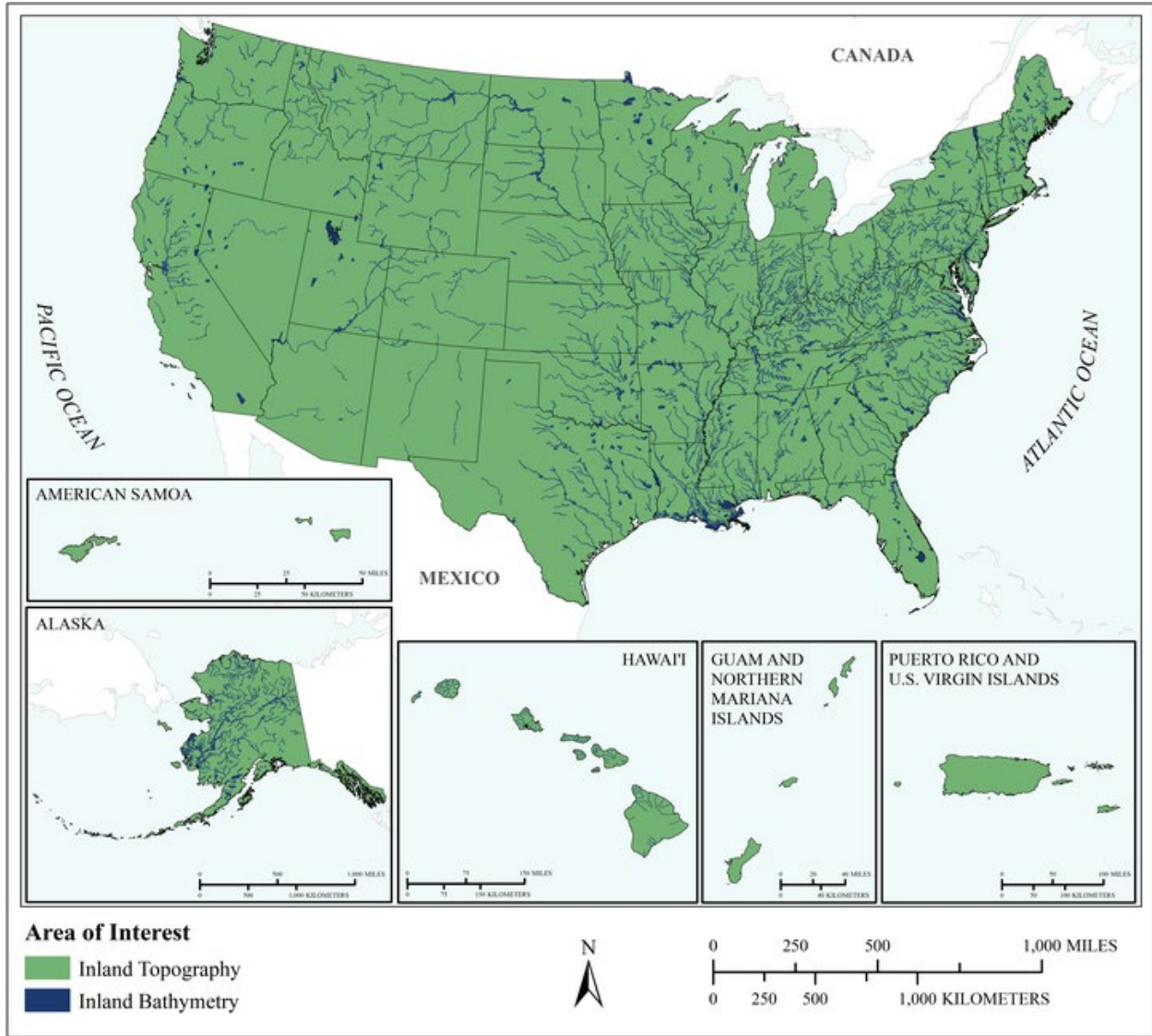
Benefits of Currently Used Elevation Data	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Current Customer Service Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Value added to products or services	Major	Major	Major	Major
Improved response or timeliness	Minor	Minor	Minor	Minor
Improved customer experience	Major	Major	Major	Major
Current Societal Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Education or outreach	Minor	Minor	Minor	Minor
Environmental	Major	Major	Major	Major
Public safety, including life and property	Major	Major	Major	Minor

Future Benefits if Elevation Data Requirements Are Met	Inland Topo			Inland Bathy			Nearshore Bathy			Offshore Bathy		
	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount
Time savings	Major	Unable to provide		I don't know	Unable to provide		I don't know	Unable to provide		I don't know	Unable to provide	
Cost savings/cost reduction	Major	Unable to provide		I don't know	Unable to provide		I don't know	Unable to provide		I don't know	Unable to provide	
Cost avoidance	I don't know	Unable to provide		I don't know	Unable to provide		I don't know	Unable to provide		I don't know	Unable to provide	
Increased revenues	Major	Unable to provide		I don't know	Unable to provide		I don't know	Unable to provide		I don't know	Unable to provide	
Increased revenues description	New grant opportunities.											
Mission-driven performance improvements	Major	Unable to provide		I don't know	Unable to provide		I don't know	Unable to provide		I don't know	Unable to provide	
Mission-driven performance improvements description	New research opportunities.											
Future Customer Service Benefits	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount
Value added to products or services	Major	Unable to provide		I don't know	Unable to provide		I don't know	Unable to provide		I don't know	Unable to provide	
Value added to products or services description	Improved data for courses and training students.											
Improved response or timeliness	I don't know	Unable to provide		I don't know	Unable to provide		I don't know	Unable to provide		I don't know	Unable to provide	
Improved customer experience	I don't know	Unable to provide		I don't know	Unable to provide		I don't know	Unable to provide		I don't know	Unable to provide	
Societal Benefits	Benefits			Benefits			Benefits			Benefits		
Education or outreach	Major			Major			Major			Major		
Education or outreach description	Data are frequently used in courses and student research projects			Data are frequently used in courses and student research projects			Data are frequently used in courses and student research projects			Data are frequently used in courses and student research projects		
Environmental	I don't know			I don't know			I don't know			I don't know		
Public safety, including life and property	I don't know			I don't know			I don't know			I don't know		

3D Derivatives Needed	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Triangulated Irregular Network (TIN)	Yes	Yes	Yes	Yes
Contours	Yes	Yes	Yes	Yes
Hillshades	Yes	Yes	Yes	Yes
Slope maps	Yes	Yes	Yes	Yes
Aspect maps	Yes	Yes	Yes	Yes
Curvature maps	Yes	Yes	Yes	Yes
Cross sections	Yes	Yes	Yes	Yes
Height-Above-Ground maps	Yes	Yes	Yes	Yes
Viewshed maps	Yes	Yes	Yes	Yes
Hydrologic Flow Direction Grids	Yes	Yes	Yes	Yes
Hydrologic Flow Accumulation Grids	Yes	Yes	Yes	Yes
Hydrologic networks (e.g. streams, lakes)	Yes	Yes	Yes	Yes
Hydrologic Units (Watershed Boundaries) (e.g. surface water drainage to a point)	Yes	Yes	Yes	Yes
Building footprints	Yes			
Breaklines for road edge-of-pavement	Yes			
Rugosity/Surface Roughness				

Importance of 3D Data Requirements	Response
Geographic coverage	
Vertical accuracy	
Update frequency	

MCA Title: Environmental Modeling and Research



MCA Area of Interest	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Data Type	Required	Required		
Geographic Area Requirements	States and/or Territories	Nationwide, inland areas		
Sub Area Requirements	Areas not shown on map: U.S. Minor Outlying Islands			

MCA Description	Response
Mission Critical Activity	Environmental Modeling and Research
MCA Title	Environmental Modeling and Research
MCA ID	1145
Organization Type	Academic or Not-for-Profit
Organization Name	Oklahoma State University
Sub-Agency or Division	
Organization Mission	Education and research
Program Name	Research related to GIS, Remote Sensing and Geography teaching classes
Total Annual Program Budget	
Primary Business Use	BU 26 - Education K12 and Beyond, Basic Research
Secondary Business Use	
Tertiary Business Use	

What Needs to be Measured in 3D	Response
Bare earth ground	Required
Tops of buildings, structures, objects	Highly desirable
Tops of vegetation	Highly desirable
Tops of submerged structures, objects	Nice to have
Tops of submerged vegetation	Nice to have
Subcanopy of vegetation/understory	Nice to have
River/lake bottom	Highly desirable
Nearshore elevation (<10 m deep)	Nice to have
Sea surface	Nice to have
Ocean/sea bottom (>10 m deep)	Nice to have

General Geographic Area and Size	
Average geographic extent of day-to-day area	200,000 sq mi - 2 million sq mi (e.g. large state, large multi-state region such as the Great Basin, standard Federal region, etc.)
Smallest 3D features needed	Small features (e.g. individual shrub, tree, car, mooring anchor, small dock, etc.)
Description of smallest 3D features	Individual tree, for canopy measuring ; shorelines of lakes and rivers

Inland Bathymetry Feature Size Requirements	Response
Navigable channels (as defined by USACE)	Nice to have
Rivers and Streams	
Less than 10 ft	Nice to have
10 - 50 ft	Nice to have
51 - 100 ft	Nice to have
101 - 500 ft	Nice to have
501 - 2,500 ft	Nice to have
Greater than 2,500 ft	Nice to have
Waterbodies (Reservoirs, lakes, ponds)	
Less than ½ acre	Nice to have
½ - 1 acre	Nice to have
1.1 – 2 acres	Nice to have
2.1 – 5 acres	Nice to have
5.1 – 10 acres	Nice to have
Greater than 10 acres	Nice to have

Requirements	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Quality Level/IHO Order	QL1	Coarser bathymetric data satisfies my needs		
Update Frequency	4-5 years	4-5 years		
Event type(s)				
Quality Level and/or update frequency variability across AOI				
Acceptable Horizontal Error	Up to 50 cm	Up to 5 meters		
Acceptable Vertical Error	Up to 20 cm	Up to 1 meter		
How far onshore needed				
How far down the beach profile needed	Not applicable			
Tide correction requirement				
Cross sections and/or transects meet needs				
Cross section/transect requirement				

Hydrologic Processing Required	Response
Hydro-flattening	Nice to have
Hydro-enforcement	Nice to have
Hydro-conditioning	Nice to have
No Treatment	Not required

Seamlessness Requirements	Within Inland Topo Data	Within Inland Bathy Data	Within Nearshore Data	Within Offshore Data	Between Inland Topo and Inland Bathy	Between Topo, Topobathy, and/or Bathy
Importance of Seamlessness					Nice to have	
Temporal Seamlessness						
Entire AOI in same acquisition season	Nice to have	Highly desirable			Nice to have	
Entire AOI under same environmental conditions	Highly desirable	Nice to have			Nice to have	
Other		Highly desirable				
Other description		Individual project AOI needs to be in same acquisition season				
Spatial Seamlessness						
Point cloud for entire AOI needs to be seamless	Highly desirable	Nice to have			Nice to have	
DEM for entire AOI needs to be seamless	Highly desirable	Nice to have			Nice to have	
Amount of acceptable vertical manipulation to achieve spatial seamlessness	Whatever it takes to achieve seamlessness, including changes to the older, previously accepted dataset if it is proven to be less accurate than the newer	Up to triple the required TVU at the 95% confidence level			Up to triple the required TVU at the 95% confidence level	

Importance of 3D Products	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
DSM	Highly desirable	Nice to have		
DTM	Highly desirable	Nice to have		
DEM	Required	Required		

Importance of 3D Products	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Raw point cloud data	Highly desirable	Highly desirable		
Classified point cloud	Nice to have	Nice to have		
Edited/cube XYZ		Nice to have		
Full waveform	Nice to have	Nice to have		
Bathymetric Attributed Grid (BAG)		Nice to have		
Breaklines required for standard hydro-flattening	Highly desirable	Nice to have		
Additional breaklines for hydro-enforcement of culverts	Nice to have			
National Vertical Datum Transformation Tool (V-Datum)				
Tide Predictions				
Tidal Constituent And Residual Interpolation (TCARI)				
Intensity imagery/sidescan imagery	Nice to have	Nice to have		
Ground control/ground truthing	Nice to have	Nice to have		

Importance of Integration with Other Datasets	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Hydrographic survey data				
Nautical and/or navigation charts				
Acoustic imagery of the seafloor				
Aerial and/or satellite imagery	Highly desirable	Highly desirable		
Underwater videography				
Bottom texture				
Bottom type				
Submerged features				
Subbottom characteristics				
Geologic and seismic data	Not required	Nice to have		
Water column properties - Physical				
Water column properties - Chemical				
Water column properties - Biological				
Currents				
Tide/wave heights				
Sea ice conditions				
Habitat distribution and classification				
Boundaries				

Importance of Integration with Other Datasets	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Routes				
Offshore cadastral				
Lease areas				
Fixed obstructions				
Floating observation/navigation systems				
Shorelines – current, historic, change rates	Not required	Nice to have		
Land use/land cover	Highly desirable	Highly desirable		
Wetlands	Nice to have	Nice to have		
Estuaries				
Inland surface water features	Highly desirable	Nice to have		
Bridges/culverts	Nice to have	Nice to have		
Landmark features	Nice to have	Nice to have		
Cultural resources	Nice to have	Nice to have		
Coastal and riverine structures	Nice to have	Nice to have		
Overhead structures				
Lowest Floor Elevation of Buildings	Nice to have			

Benefits of Currently Used Elevation Data	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Current dataset used	Topographic lidar	OWRB data; and small local collections		
Where current elevation data are accessed	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
National Map	Yes			
Digital Coast		Yes		
NCEI		Yes		
Open Topography	Yes			
NOAA nautical charts				
USACE navigation charts				
USGS Inland Waters server		Yes		
USGS data series				
Marine Minerals Program GIS				
State Repositories	Yes			
State repositories used	OK Digital Data Online			

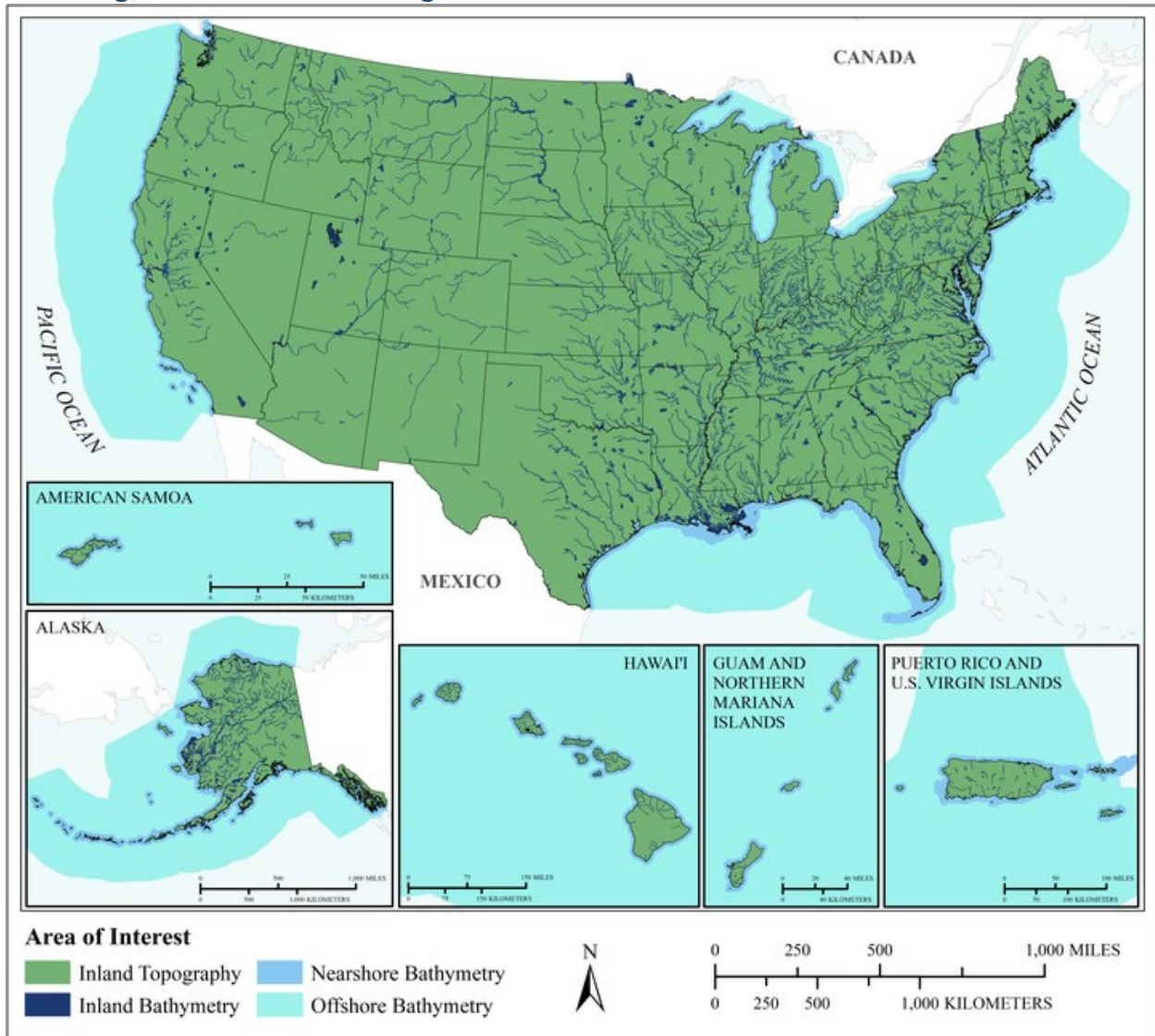
Benefits of Currently Used Elevation Data	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Data that meet my needs are not available				
Current Operational Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Time savings	Moderate	Minor		
Cost savings/cost reduction	Major	Minor		
Cost avoidance	Major	Minor		
Increased revenues	None	None		
Mission-driven performance improvements	Minor	Minor		
Current Customer Service Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Value added to products or services	Minor	Minor		
Improved response or timeliness	None	Minor		
Improved customer experience	None	Minor		
Current Societal Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Education or outreach	Major	Moderate		
Environmental	Minor	Minor		
Public safety, including life and property	Minor	Minor		

Future Benefits if Elevation Data Requirements Are Met	Inland Topo			Inland Bathy			Nearshore Bathy			Offshore Bathy		
	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount
Time savings	Major	Annual dollars saved/realized	\$10,854	Moderate	Annual dollars saved/realized	\$2,774						
Time savings description	Ready-to-use data for teaching in classroom and basic research use.											
Cost savings/cost reduction	Major	Annual dollars saved/realized	\$2,400	Moderate	Annual dollars saved/realized	\$1,200						
Cost avoidance	Moderate	Unable to provide		Minor	Unable to provide							
Increased revenues	None			Minor	Unable to provide							
Mission-driven performance improvements	Moderate	Unable to provide		Moderate	Unable to provide							
Future Customer Service Benefits	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount
Value added to products or services	None			Minor	Annual dollars saved/realized	\$1,206						
Improved response or timeliness	Minor	Unable to provide		Minor	Unable to provide							
Improved customer experience	Moderate	Unable to provide		Moderate	Unable to provide							
Societal Benefits	Benefits			Benefits			Benefits			Benefits		
Education or outreach	Moderate			Moderate								
Education or outreach description	Research projects and teaching classes, as well as outreach			Research projects and teaching classes, as well as outreach								
Environmental	Moderate			Minor								
Public safety, including life and property	Minor			Minor								

3D Derivatives Needed	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Triangulated Irregular Network (TIN)				
Contours	Yes			
Hillshades	Yes			
Slope maps	Yes			
Aspect maps	Yes			
Curvature maps				
Cross sections				
Height-Above-Ground maps				
Viewshed maps	Yes			
Hydrologic Flow Direction Grids				
Hydrologic Flow Accumulation Grids				
Hydrologic networks (e.g. streams, lakes)				
Hydrologic Units (Watershed Boundaries) (e.g. surface water drainage to a point)				
Building footprints				
Breaklines for road edge-of-pavement				
Rugosity/Surface Roughness				

Importance of 3D Data Requirements	Response
Geographic coverage	3
Vertical accuracy	2
Update frequency	1

MCA Title: High Resolution Elevation Data Supporting Research, Teaching, Planning, and Facilities Management



MCA Area of Interest	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Data Type	Required	Highly desirable	Highly desirable	Highly desirable
Geographic Area Requirements	States and/or Territories	States and/or Territories	All study waters	All study waters
Sub Area Requirements	Areas not shown on map: U.S. Minor Outlying Islands, Federated States of Micronesia, Marshall Islands, Palau	Areas not shown on map: U.S. Minor Outlying Islands, Federated States of Micronesia, Marshall Islands, Palau		

MCA Description	Response
Mission Critical Activity	Natural Science Research, Social Science Research, Urban Planning, Cartography, Development of Training Materials, Campus Planning, and Facilities Management. For research activities, the best available data is used; projects can be anywhere in the world.
MCA Title	High Resolution Elevation Data Supporting Research, Teaching, Planning, and Facilities Management
MCA ID	1265
Organization Type	Academic or Not-for-Profit
Organization Name	Brown University
Sub-Agency or Division	
Organization Mission	Higher Education (undergraduate, graduate, and a medical school)
Program Name	Higher Education
Total Annual Program Budget	
Primary Business Use	BU 26 - Education K12 and Beyond, Basic Research
Secondary Business Use	
Tertiary Business Use	

What Needs to be Measured in 3D	Response
Bare earth ground	Required
Tops of buildings, structures, objects	Required
Tops of vegetation	Required
Tops of submerged structures, objects	Nice to have
Tops of submerged vegetation	Nice to have
Subcanopy of vegetation/understory	Nice to have
River/lake bottom	Highly desirable
Nearshore elevation (<10 m deep)	Highly desirable
Sea surface	Nice to have
Ocean/sea bottom (>10 m deep)	Highly desirable

General Geographic Area and Size	
Average geographic extent of day-to-day area	Less than 1 sq mi (e.g. plot, acre, small study area)
Smallest 3D features needed	Small features (e.g. individual shrub, tree, car, mooring anchor, small dock, etc.)
Description of smallest 3D features	Stone walls, utility poles, utility lines, shipwrecks, sea mounts, offshore geological features

Inland Bathymetry Feature Size Requirements	Response
Navigable channels (as defined by USACE)	Highly desirable
Rivers and Streams	
Less than 10 ft	Nice to have
10 - 50 ft	Nice to have
51 - 100 ft	Nice to have
101 - 500 ft	Highly desirable
501 - 2,500 ft	Highly desirable
Greater than 2,500 ft	Highly desirable
Waterbodies (Reservoirs, lakes, ponds)	
Less than ½ acre	Nice to have
½ - 1 acre	Highly desirable
1.1 – 2 acres	Highly desirable
2.1 – 5 acres	Highly desirable

Inland Bathy Feature Size Requirements	Response
5.1 – 10 acres	Highly desirable
Greater than 10 acres	Highly desirable

Requirements	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Quality Level/IHO Order	QL0 HD	I don't know	Cross sections and/or transects meet needs	I don't know
Update Frequency	4-5 years	Project by project basis	Depends on specific project at any given time.	Event driven only – Data need to coincide with a specific event.
Event type(s)				Event driven only
Quality Level and/or update frequency variability across AOI				
Acceptable Horizontal Error	Up to 1 meter	I don't know	I don't know	I don't know
Acceptable Vertical Error	Up to 20 cm	I don't know	I don't know	I don't know
How far onshore needed			500 meters inland	
How far down the beach profile needed	To MLLW		Below MLLW	
Tide correction requirement			I don't know	I don't know
Cross sections and/or transects meet needs			Yes	
Cross section/transect requirement			Depends on specific project at any given time.	

Hydrologic Processing Required	Response
Hydro-flattening	Required
Hydro-enforcement	Highly desirable
Hydro-conditioning	Highly desirable
No Treatment	Not required

Seamlessness Requirements	Within Inland Topo Data	Within Inland Bathy Data	Within Nearshore Data	Within Offshore Data	Between Inland Topo and Inland Bathy	Between Topo, Topobathy, and/or Bathy
Importance of Seamlessness					Highly desirable	
Temporal Seamlessness						
Entire AOI in same acquisition season	Nice to have	Nice to have	Not required	Highly desirable	Nice to have	Highly desirable
Entire AOI under same environmental conditions	Nice to have	Nice to have	Not required	Highly desirable	Nice to have	Highly desirable
Spatial Seamlessness						
Point cloud for entire AOI needs to be seamless	Highly desirable	Nice to have	Not required	Highly desirable	Nice to have	Highly desirable
DEM for entire AOI needs to be seamless	Highly desirable	Nice to have	Not required	Highly desirable	Nice to have	Highly desirable
Amount of acceptable vertical manipulation to achieve spatial seamlessness	Whatever it takes to achieve seamlessness, including changes to the older, previously accepted dataset if it is proven to be less accurate than the newer	I don't know	I don't know	I don't know	I don't know	I don't know

Importance of 3D Products	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
DSM	Highly desirable	Highly desirable	Nice to have	Highly desirable
DTM	Required	Highly desirable	Nice to have	Highly desirable
DEM	Required	Highly desirable	Nice to have	Highly desirable
Raw point cloud data	Required	Nice to have	Nice to have	Highly desirable
Classified point cloud	Required	Highly desirable	Nice to have	
Edited/cube XYZ		Nice to have	Nice to have	Highly desirable
Full waveform	Not required	Not required	Nice to have	Highly desirable
Bathymetric Attributed Grid (BAG)		Nice to have	Nice to have	Highly desirable

Importance of 3D Products	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Breaklines required for standard hydro-flattening	Nice to have	Nice to have		
Additional breaklines for hydro-enforcement of culverts	Nice to have			
National Vertical Datum Transformation Tool (V-Datum)			Nice to have	Highly desirable
Tide Predictions			Nice to have	Highly desirable
Tidal Constituent And Residual Interpolation (TCARI)			Nice to have	Highly desirable
Intensity imagery/sidescan imagery	Nice to have	Not required	Nice to have	Highly desirable
Ground control/ground truthing	Highly desirable	Nice to have	Nice to have	Highly desirable

Importance of Integration with Other Datasets	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Hydrographic survey data			Nice to have	Highly desirable
Nautical and/or navigation charts			Nice to have	Highly desirable
Acoustic imagery of the seafloor			Nice to have	Highly desirable
Aerial and/or satellite imagery	Required	Highly desirable	Nice to have	Highly desirable
Underwater videography			Nice to have	Highly desirable
Bottom texture			Nice to have	Highly desirable
Bottom type			Nice to have	Highly desirable
Submerged features			Nice to have	Highly desirable
Subbottom characteristics			Nice to have	Highly desirable
Geologic and seismic data	Nice to have	Highly desirable	Nice to have	Highly desirable
Water column properties - Physical			Nice to have	Highly desirable
Water column properties - Chemical			Nice to have	Highly desirable
Water column properties - Biological			Nice to have	Highly desirable
Currents			Nice to have	Highly desirable
Tide/wave heights			Nice to have	Highly desirable
Sea ice conditions			Nice to have	Highly desirable
Habitat distribution and classification			Nice to have	Highly desirable
Boundaries			Nice to have	Highly desirable
Routes			Nice to have	Highly desirable
Offshore cadastral			Nice to have	Highly desirable
Lease areas			Nice to have	Highly desirable
Fixed obstructions			Nice to have	Highly desirable
Floating observation/navigation systems			Nice to have	Highly desirable

Importance of Integration with Other Datasets	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Shorelines – current, historic, change rates	Highly desirable	Highly desirable	Nice to have	
Land use/land cover	Required	Highly desirable	Nice to have	Highly desirable
Wetlands	Required	Highly desirable	Nice to have	Highly desirable
Estuaries			Nice to have	Highly desirable
Inland surface water features	Required	Highly desirable	Nice to have	
Bridges/culverts	Highly desirable	Nice to have		
Landmark features	Highly desirable	Nice to have	Nice to have	
Cultural resources	Highly desirable	Nice to have	Nice to have	
Coastal and riverine structures	Highly desirable	Nice to have	Nice to have	
Overhead structures			Nice to have	
Lowest Floor Elevation of Buildings	Required			

Benefits of Currently Used Elevation Data	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Current dataset used	This is on a project by project basis. Because the Mission Critical Activities in my organization vary widely in geographic extent and complexity, I use/recommend whatever the best available data are for that location or AOI. If the project is in Rhode Island, I will use/recommend the Rhode Island Geographic Information System (RIGIS) database. However, if a project is for a different state or region, I will search out what is available.	Do not currently use any. There has only been one project that needed it a few years ago and since there wasn't any available; had to do without. It would be very nice to have some available for future endeavors.	Do not have any.	Digital Coast primarily For Narragansett Bay, the metadata for the data set I have used is long lost. Only used for visualization.
Where current elevation data are accessed	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
National Map	Yes			

Benefits of Currently Used Elevation Data	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Digital Coast	Yes			Yes
NCEI	Yes			
Open Topography	Yes			
NOAA nautical charts				
USACE navigation charts				
USGS Inland Waters server				
USGS data series				
Marine Minerals Program GIS				Yes
State Repositories	Yes			
State repositories used	Primarily the Rhode Island Geographic Information System. However, research projects and or student thesis projects/term projects may be in a different state and as such, we would go to their state repository.			
Data that meet my needs are not available		Yes		
Current Operational Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Time savings	I don't know	Inland bathy data not available	I don't know	I don't know
Cost savings/cost reduction	I don't know	Inland bathy data not available	I don't know	I don't know
Cost avoidance	I don't know	Inland bathy data not available	I don't know	I don't know
Increased revenues	I don't know	Inland bathy data not available	I don't know	I don't know
Mission-driven performance improvements	I don't know	Inland bathy data not available	I don't know	I don't know
Current Customer Service Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Value added to products or services	Major	Inland bathy data not available	I don't know	I don't know
Improved response or timeliness	I don't know	Inland bathy data not available	I don't know	I don't know

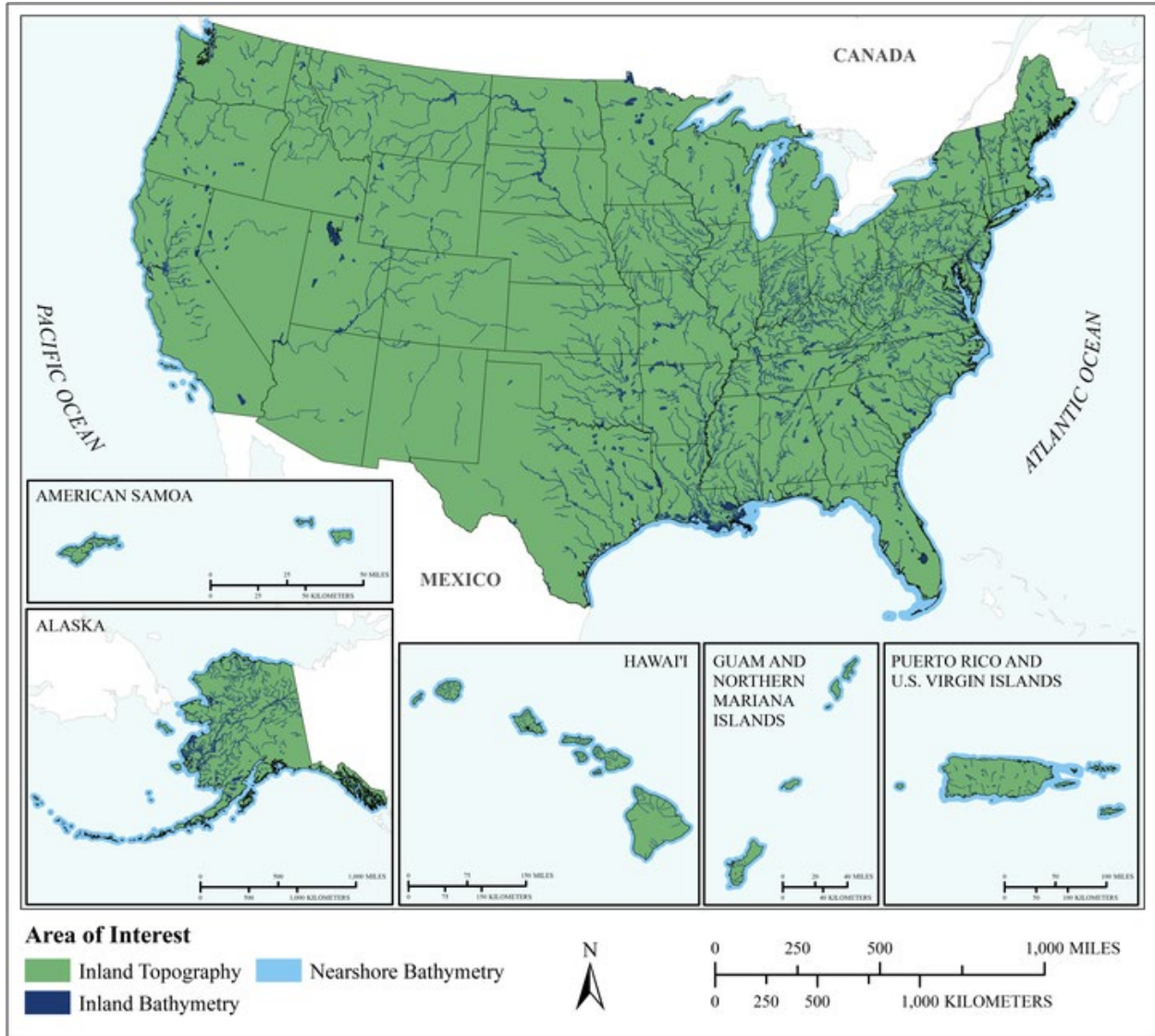
Benefits of Currently Used Elevation Data	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Improved customer experience	I don't know	Inland bathy data not available	I don't know	I don't know
Current Societal Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Education or outreach	Major	Inland bathy data not available	Major	Major
Environmental	Major	Inland bathy data not available	I don't know	I don't know
Public safety, including life and property	I don't know	Inland bathy data not available	I don't know	I don't know

Future Benefits if Elevation Data Requirements Are Met	Inland Topo			Inland Bathy			Nearshore Bathy			Offshore Bathy		
Future Operational Benefits	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount
Time savings	Major	Unable to provide		Major	Unable to provide		I don't know	Unable to provide		I don't know	Unable to provide	
Time savings description	To date, our campus facilities mgt. group has not taken advantage of 3D topographic elevation data even though they could. Impossible to know how much time they could save.											
Cost savings/cost reduction	I don't know	Unable to provide		None			I don't know	Unable to provide		I don't know	Unable to provide	
Cost avoidance	I don't know	Unable to provide		Major	Unable to provide		I don't know	Unable to provide		I don't know	Unable to provide	
Increased revenues	None			None			I don't know	Unable to provide		I don't know	Unable to provide	
Mission-driven performance improvements	Major	Unable to provide		Moderate	Unable to provide		I don't know	Unable to provide		I don't know	Unable to provide	
Future Customer Service Benefits	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount
Value added to products or services	I don't know	Unable to provide		Moderate	Unable to provide		I don't know	Unable to provide		I don't know	Unable to provide	
Improved response or timeliness	I don't know	Unable to provide		None			I don't know	Unable to provide		I don't know	Unable to provide	
Improved response or timeliness description	Could be, but not currently taking advantage of this capability.											
Improved customer experience	Major	Unable to provide		Moderate	Unable to provide		Major	Unable to provide		I don't know	Unable to provide	
Societal Benefits	Benefits			Benefits			Benefits			Benefits		
Education or outreach	Major			Major			Major			Major		
Environmental	Major			None			I don't know			I don't know		
Public safety, including life and property	Major			None			I don't know			I don't know		

3D Derivatives Needed	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Triangulated Irregular Network (TIN)				
Contours	Yes	Yes	Yes	Yes
Hillshades	Yes	Yes	Yes	Yes
Slope maps	Yes	Yes	Yes	Yes
Aspect maps	Yes	Yes	Yes	Yes
Curvature maps	Yes	Yes		
Cross sections	Yes	Yes	Yes	Yes
Height-Above-Ground maps	Yes	Yes	Yes	Yes
Viewshed maps	Yes	Yes	Yes	Yes
Hydrologic Flow Direction Grids	Yes	Yes		
Hydrologic Flow Accumulation Grids	Yes	Yes		
Hydrologic networks (e.g. streams, lakes)	Yes	Yes		
Hydrologic Units (Watershed Boundaries) (e.g. surface water drainage to a point)	Yes	Yes		
Building footprints	Yes			
Breaklines for road edge-of-pavement	Yes			
Rugosity/Surface Roughness	Yes			

Importance of 3D Data Requirements	Response
Geographic coverage	3
Vertical accuracy	2
Update frequency	1

MCA Title: Undergraduate and Graduate Education and Academic Research



MCA Area of Interest	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Data Type	Required	Required	Required	
Geographic Area Requirements	States and/or Territories	States and/or Territories	States and/or Territories	
Sub Area Requirements	Areas not shown on map: U.S. Minor Outlying Islands, Federated States of Micronesia, Marshall Islands, Palau	Areas not shown on map: U.S. Minor Outlying Islands, Federated States of Micronesia, Marshall Islands, Palau	Areas not shown on map: U.S. Minor Outlying Islands, Federated States of Micronesia, Marshall Islands, Palau	

MCA Description	Response
Mission Critical Activity	Education of undergraduate and graduate students in 3D engineering design and modeling.
MCA Title	Undergraduate and Graduate Education and Academic Research
MCA ID	1314
Organization Type	Academic or Not-for-Profit
Organization Name	Pennsylvania State University
Sub-Agency or Division	
Organization Mission	Our instructional mission includes undergraduate, graduate, professional, continuing, and extension education, offered through both resident instruction and distance learning. Our educational programs are enriched by the talent, knowledge, diversity, creativity, and teaching and research acumen of our faculty, students, and staff. Our discovery-oriented, collaborative, and interdisciplinary research and scholarship promote human and economic development, global understanding, and advancement in professional practice through the expansion of knowledge and its applications in the natural and applied sciences, social and behavioral sciences, engineering, technology, arts and humanities, and myriad professions. As Pennsylvania's land-grant university, we provide unparalleled access to education and public service to support the citizens of the Commonwealth and beyond. We engage in collaborative activities with private sector, educational, and governmental partners worldwide to generate, integrate, apply, and disseminate knowledge that is valuable to society.
Program Name	Department of Civil and Environmental Engineering
Total Annual Program Budget	
Primary Business Use	BU 26 - Education K12 and Beyond, Basic Research
Secondary Business Use	BU 22 - Infrastructure and Construction Management
Tertiary Business Use	BU 19 - Land Navigation and Safety

What Needs to be Measured in 3D	Response
Bare earth ground	Required
Tops of buildings, structures, objects	Highly desirable
Tops of vegetation	Nice to have
Tops of submerged structures, objects	Highly desirable
Tops of submerged vegetation	Nice to have
Subcanopy of vegetation/understory	Nice to have
River/lake bottom	Required
Nearshore elevation (<10 m deep)	Highly desirable
Sea surface	Nice to have
Ocean/sea bottom (>10 m deep)	Nice to have

General Geographic Area and Size	
Average geographic extent of day-to-day area	Less than 1 sq mi (e.g. plot, acre, small study area)
Smallest 3D features needed	Survey-level features (e.g. sign, curb, road line, mailbox, rock, etc.
Description of smallest 3D features	Any existing natural or man-made features not limited to utility valves and signage, top and bottom of curb, road center lines

Inland Bathymetry Feature Size Requirements	Response
Navigable channels (as defined by USACE)	Required

Inland Bathy Feature Size Requirements	Response
Rivers and Streams	
Less than 10 ft	Highly desirable
10 - 50 ft	Required
51 - 100 ft	Required
101 - 500 ft	Required
501 - 2,500 ft	Required
Greater than 2,500 ft	Required
Waterbodies (Reservoirs, lakes, ponds)	
Less than ½ acre	Highly desirable
½ - 1 acre	Required
1.1 – 2 acres	Required
2.1 – 5 acres	Required
5.1 – 10 acres	Required
Greater than 10 acres	Required

Requirements	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Quality Level/IHO Order	QL0	QL1B	Cross sections and/or transects meet needs	
Update Frequency	Annually	4-5 years	I don't know	
Event type(s)				
Quality Level and/or update frequency variability across AOI	Areas less prone to change can be updated every 2-3 years			
Acceptable Horizontal Error	The best horizontal accuracy achievable for the vertical accuracy I need	The best horizontal accuracy achievable for the vertical accuracy I need	The best horizontal accuracy achievable for the vertical accuracy I need	
Acceptable Vertical Error	Less than 5 cm	Less than 10 cm	Less than 10 cm	
How far onshore needed			To the fall line	
How far down the beach profile needed	To MLLW		Below MLLW	
Tide correction requirement			Any tide correction is acceptable, as long as it is defined	
Cross sections and/or transects meet needs			Yes	
Cross section/transect requirement			Not sure. Would be happy with anything that could be provided.	

Hydrologic Processing Required	Response
Hydro-flattening	Required
Hydro-enforcement	Highly desirable
Hydro-conditioning	Highly desirable
No Treatment	Nice to have

Seamlessness Requirements	Within Inland Topo Data	Within Inland Bathy Data	Within Nearshore Data	Within Offshore Data	Between Inland Topo and Inland Bathy	Between Topo, Topobathy, and/or Bathy
Importance of Seamlessness					Nice to have	
Temporal Seamlessness						
Entire AOI in same acquisition season	Nice to have	Highly desirable	Required		Highly desirable	Highly desirable
Entire AOI under same environmental conditions	Highly desirable	Required	Required		Required	Highly desirable
Spatial Seamlessness						
Point cloud for entire AOI needs to be seamless	Required	Required	Highly desirable		Required	Highly desirable
DEM for entire AOI needs to be seamless	Required	Required	Highly desirable		Required	Highly desirable
Amount of acceptable vertical manipulation to achieve spatial seamlessness	Up to the required Total Vertical Uncertainty (TVU) at the 95% confidence level	Up to the required Total Vertical Uncertainty (TVU) at the 95% confidence level	Up to the required Total Vertical Uncertainty (TVU) at the 95% confidence level		Up to the required Total Vertical Uncertainty (TVU) at the 95% confidence level	Up to the required Total Vertical Uncertainty (TVU) at the 95% confidence level

Importance of 3D Products	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
DSM	Nice to have	Not required	Not required	
DTM	Required	Required	Required	
DEM	Highly desirable	Required	Required	
Raw point cloud data	Highly desirable	Highly desirable	Highly desirable	
Classified point cloud	Highly desirable	Highly desirable	Highly desirable	
Edited/cube XYZ		Nice to have	Nice to have	
Full waveform	Highly desirable	Highly desirable	Highly desirable	
Bathymetric Attributed Grid (BAG)		Highly desirable	Highly desirable	
Breaklines required for standard hydro-flattening	Required	Required		
Additional breaklines for hydro-enforcement of culverts	Highly desirable			

Importance of 3D Products	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
National Vertical Datum Transformation Tool (V-Datum)			Required	
Tide Predictions			Highly desirable	
Tidal Constituent And Residual Interpolation (TCARI)			Nice to have	
Intensity imagery/sidescan imagery	Highly desirable	Highly desirable	Nice to have	
Ground control/ground truthing	Required	Required	Required	

Importance of Integration with Other Datasets	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Hydrographic survey data			Required	
Nautical and/or navigation charts			Nice to have	
Acoustic imagery of the seafloor			Highly desirable	
Aerial and/or satellite imagery	Required	Required	Required	
Underwater videography			Not required	
Bottom texture			Nice to have	
Bottom type			Nice to have	
Submerged features			Highly desirable	
Subbottom characteristics			Nice to have	
Geologic and seismic data	Nice to have	Nice to have	Nice to have	
Water column properties - Physical			Highly desirable	
Water column properties - Chemical			Highly desirable	
Water column properties - Biological			Highly desirable	
Currents			Nice to have	
Tide/wave heights			Nice to have	
Sea ice conditions			Nice to have	
Habitat distribution and classification			Not required	
Boundaries			Nice to have	
Routes			Nice to have	
Offshore cadastral			Nice to have	
Lease areas			Nice to have	
Fixed obstructions			Highly desirable	
Floating observation/navigation systems			Nice to have	
Shorelines – current, historic, change rates	Highly desirable	Highly desirable	Highly desirable	
Land use/land cover	Highly desirable	Highly desirable	Highly desirable	
Wetlands	Required	Required	Required	

Importance of Integration with Other Datasets	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Estuaries			Highly desirable	
Inland surface water features	Required	Required	Required	
Bridges/culverts	Highly desirable	Highly desirable		
Landmark features	Nice to have	Nice to have	Nice to have	
Cultural resources	Not required	Nice to have	Nice to have	
Coastal and riverine structures	Highly desirable	Required	Required	
Overhead structures			Required	
Lowest Floor Elevation of Buildings	Highly desirable			

Benefits of Currently Used Elevation Data	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Current dataset used	Various quality levels and dates are utilized. Survey data is used when the most accurate and recent data is required. Planning can often be performed with less accurate or recent data.	Various data sources used. Most of it is old and of poor quality. Field surveys must be performed in order to obtain accurate data.	Project specific and usually contractor provided. Quality varies and typically not recent.	
Where current elevation data are accessed	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
National Map	Yes			
Digital Coast				
NCEI				
Open Topography				
NOAA nautical charts				
USACE navigation charts				
USGS Inland Waters server				
USGS data series				
Marine Minerals Program GIS				
State Repositories	Yes			
State repositories used	Several. Primarily PASDA			
Other		Yes	Yes	
Other description		Contracted by Agency	Contractor Provided	
Data that meet my needs are not available				

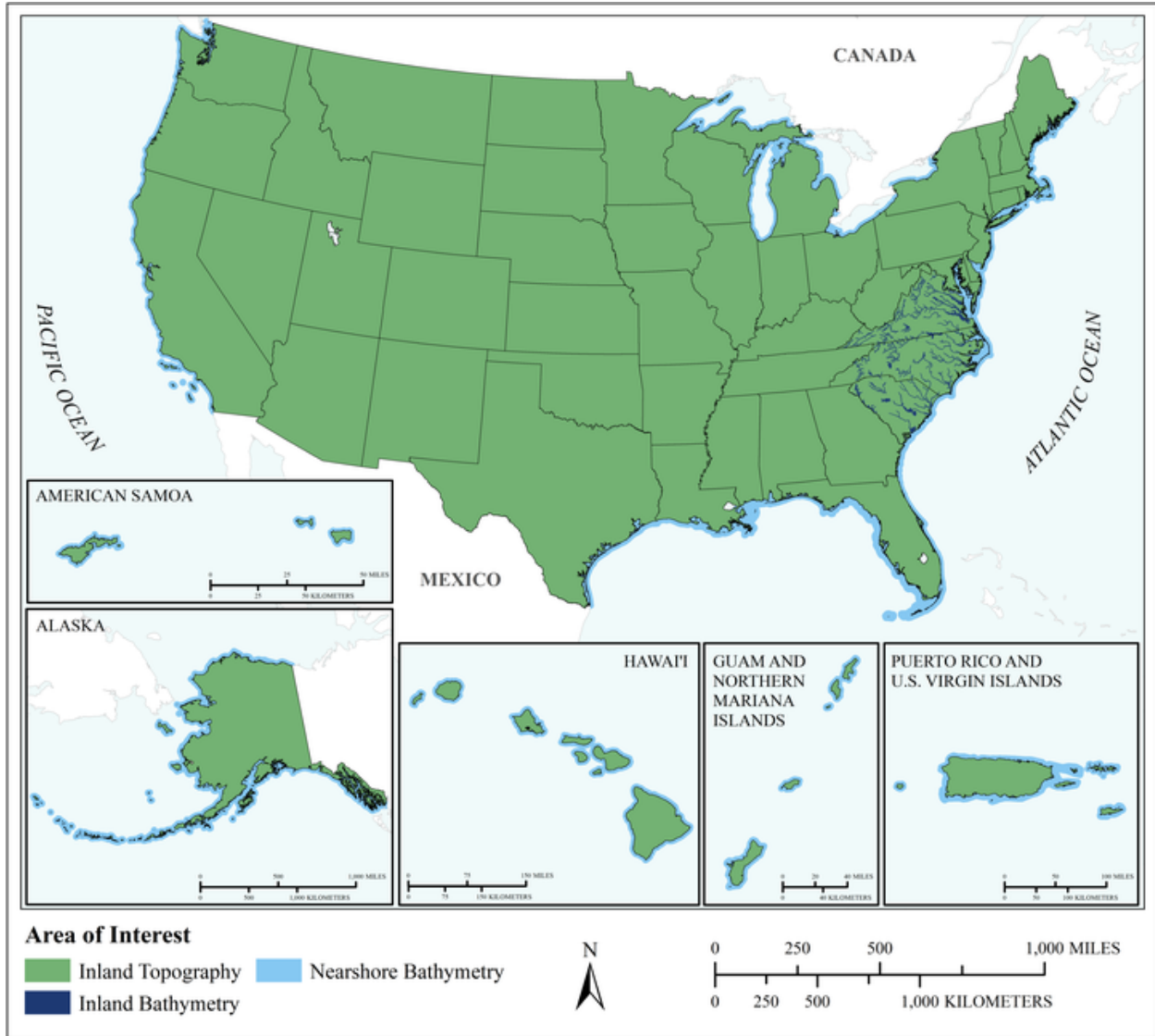
Benefits of Currently Used Elevation Data	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Current Operational Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Time savings	Major	Minor	None	
Cost savings/cost reduction	Major	None	Minor	
Cost avoidance	Moderate	None	Minor	
Increased revenues	Minor	Minor	None	
Mission-driven performance improvements	Moderate	Minor	Moderate	
Current Customer Service Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Value added to products or services	Major	Minor	Major	
Improved response or timeliness	Major	Minor	None	
Improved customer experience	Major	Minor	Moderate	
Current Societal Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Education or outreach	Major	Minor	Minor	
Environmental	Moderate	Minor	Minor	
Public safety, including life and property	Minor	Minor	Minor	

Future Benefits if Elevation Data Requirements Are Met	Inland Topo			Inland Bathy			Nearshore Bathy			Offshore Bathy		
	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount
Time savings	Major	Unable to provide		Moderate	Unable to provide		Major	Unable to provide				
Cost savings/cost reduction	Major	Unable to provide		Major	Unable to provide		Major	Unable to provide				
Cost avoidance	Moderate	Unable to provide		Major	Unable to provide		Major	Unable to provide				
Increased revenues	Minor	Unable to provide		Minor	Unable to provide		None					
Mission-driven performance improvements	Moderate	Unable to provide		Major	Unable to provide		Major	Unable to provide				
Future Customer Service Benefits	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount
Value added to products or services	Moderate	Unable to provide		Major	Unable to provide		Major	Unable to provide				
Improved response or timeliness	Moderate	Unable to provide		Major	Unable to provide		Major	Unable to provide				
Improved customer experience	Moderate	Unable to provide		Major	Unable to provide		Major	Unable to provide				
Societal Benefits	Benefits			Benefits			Benefits			Benefits		
Education or outreach	Major			Moderate			Minor					
Environmental	Minor			Minor			Moderate					
Public safety, including life and property	Moderate			Minor			Moderate					

3D Derivatives Needed	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Triangulated Irregular Network (TIN)	Yes			
Contours	Yes	Yes	Yes	
Hillshades	Yes			
Slope maps	Yes			
Aspect maps	Yes			
Curvature maps	Yes			
Cross sections	Yes	Yes	Yes	
Height-Above-Ground maps	Yes			
Viewshed maps	Yes			
Hydrologic Flow Direction Grids	Yes	Yes		
Hydrologic Flow Accumulation Grids	Yes	Yes		
Hydrologic networks (e.g. streams, lakes)	Yes	Yes		
Hydrologic Units (Watershed Boundaries) (e.g. surface water drainage to a point)	Yes			
Building footprints	Yes			
Breaklines for road edge-of-pavement	Yes			
Rugosity/Surface Roughness	Yes			

Importance of 3D Data Requirements	Response
Geographic coverage	1
Vertical accuracy	3
Update frequency	2

MCA Title: Education, Research, and Services



MCA Area of Interest	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Data Type	Required	Required	Required	
Geographic Area Requirements	States and/or Territories	One or more states, territories, or counties	States and/or Territories	
Sub Area Requirements	Areas not shown on map: U.S. Minor Outlying Islands		Areas not shown on map: U.S. Minor Outlying Islands	

MCA Description	Response
Mission Critical Activity	Educating the undergraduate and graduate level workforce for geospatial industry, government and academia, interdisciplinary basic and applied geospatial research and services. Geospatial services cover the following relevant Business Uses: Environmental, agriculture, natural resources, forestry, water quality, air quality, hazards, and coastal change.
MCA Title	Education, Research, and Services
MCA ID	21516
Organization Type	Academic or Not-for-Profit
Organization Name	North Carolina State University
Sub-Agency or Division	
Organization Mission	Higher education (undergraduate through PhD), basic and applied research: here is the official mission statement for NCSU: As a research-extensive land-grant university, North Carolina State University is dedicated to excellent teaching, the creation and application of knowledge, and engagement with public and private partners. By uniting our strength in science and technology with a commitment to excellence in a comprehensive range of disciplines, NC State promotes an integrated approach to problem solving that transforms lives and provides leadership for social, economic, and technological development across North Carolina and around the world.
Program Name	Geospatial Analytics
Total Annual Program Budget	
Primary Business Use	BU 26 - Education K12 and Beyond, Basic Research
Secondary Business Use	
Tertiary Business Use	

What Needs to be Measured in 3D	Response
Bare earth ground	Required
Tops of buildings, structures, objects	Required
Tops of vegetation	Required
Tops of submerged structures, objects	Highly desirable
Tops of submerged vegetation	Required
Subcanopy of vegetation/understory	Required
River/lake bottom	Required
Nearshore elevation (<10 m deep)	Required
Sea surface	Highly desirable
Ocean/sea bottom (>10 m deep)	Nice to have
Other	Nice to have
Other description	Full 3D structures (sides in addition to tops) e.g. bridges, subsurface (groundwater modeling, infiltration, hydrology)

General Geographic Area and Size	
Average geographic extent of day-to-day area	1 sq mi - 49 sq mi (e.g. small city/town, Census Tract, Voting District, Zip Code, etc)
Smallest 3D features needed	Small features (e.g. individual shrub, tree, car, mooring anchor, small dock, etc.)
Description of smallest 3D features	Smallest that can be achieved: microtopography, crop surfaces, sub-meter features.

Inland Bathymetry Feature Size Requirements	Response
Navigable channels (as defined by USACE)	Required

Inland Bathy Feature Size Requirements	Response
Rivers and Streams	
Less than 10 ft	Highly desirable
10 - 50 ft	Highly desirable
51 - 100 ft	Highly desirable
101 - 500 ft	Highly desirable
501 - 2,500 ft	Highly desirable
Greater than 2,500 ft	Highly desirable
Waterbodies (Reservoirs, lakes, ponds)	
Less than ½ acre	Highly desirable
½ - 1 acre	Highly desirable
1.1 – 2 acres	Highly desirable
2.1 – 5 acres	Required
5.1 – 10 acres	Required
Greater than 10 acres	Required

Requirements	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Quality Level/IHO Order	QL0 HD	QL1B	QL0B	
Update Frequency	Annually	2-3 years	Annually	
Event type(s)				
Quality Level and/or update frequency variability across AOI	Our QL and frequency is research driven, dependent on the research projects we are working on		Inlets	
Acceptable Horizontal Error	The best horizontal accuracy achievable for the vertical accuracy I need	Less than 50 cm	Up to 1 meter	
Acceptable Vertical Error	Up to 10 cm	Up to 20 cm	Up to 30 cm	
How far onshore needed			1 kilometer inland	
How far down the beach profile needed	Below MLLW		Below MLLW	
Tide correction requirement			MHW	
Cross sections and/or transects meet needs				
Cross section/transect requirement				

Hydrologic Processing Required	Response
Hydro-flattening	Not required
Hydro-enforcement	Not required
Hydro-conditioning	Not required
No Treatment	Required

Seamlessness Requirements	Within Inland Topo Data	Within Inland Bathy Data	Within Nearshore Data	Within Offshore Data	Between Inland Topo and Inland Bathy	Between Topo, Topobathy, and/or Bathy
Importance of Seamlessness					Highly desirable	
Temporal Seamlessness						
Entire AOI in same acquisition season	Highly desirable	Highly desirable	Highly desirable		Highly desirable	Highly desirable
Entire AOI under same environmental conditions	Required	Highly desirable	Highly desirable		Highly desirable	Highly desirable
Spatial Seamlessness						
Point cloud for entire AOI needs to be seamless	Required	Required	Required		Required	Required
DEM for entire AOI needs to be seamless	Required	Required	Required		Required	Required
Amount of acceptable vertical manipulation to achieve spatial seamlessness	Up to the required Total Vertical Uncertainty (TVU) at the 95% confidence level	Up to the required Total Vertical Uncertainty (TVU) at the 95% confidence level	Up to the required Total Vertical Uncertainty (TVU) at the 95% confidence level		Up to the required Total Vertical Uncertainty (TVU) at the 95% confidence level	Up to the required Total Vertical Uncertainty (TVU) at the 95% confidence level

Importance of 3D Products	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
DSM	Required	Required	Required	
DTM	Required	Highly desirable	Highly desirable	
DEM	Required	Required	Required	
Raw point cloud data	Required	Highly desirable	Highly desirable	
Classified point cloud	Required	Highly desirable	Highly desirable	
Edited/cube XYZ		Highly desirable	Highly desirable	
Full waveform	Highly desirable	Nice to have	Nice to have	
Bathymetric Attributed Grid (BAG)		Required	Required	
Breaklines required for standard hydro-flattening	Nice to have	Nice to have		
Additional breaklines for hydro-enforcement of culverts	Nice to have			

Importance of 3D Products	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
National Vertical Datum Transformation Tool (V-Datum)			Required	
Tide Predictions			Highly desirable	
Tidal Constituent And Residual Interpolation (TCARI)			Highly desirable	
Intensity imagery/sidescan imagery	Nice to have	Nice to have	Nice to have	
Ground control/ground truthing	Required	Highly desirable	Required	

Importance of Integration with Other Datasets	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Hydrographic survey data			Nice to have	
Nautical and/or navigation charts			Highly desirable	
Acoustic imagery of the seafloor			Nice to have	
Aerial and/or satellite imagery	Required	Highly desirable	Highly desirable	
Underwater videography			Nice to have	
Bottom texture			Nice to have	
Bottom type			Nice to have	
Submerged features			Highly desirable	
Subbottom characteristics			Nice to have	
Geologic and seismic data	Nice to have	Nice to have	Nice to have	
Water column properties - Physical			Nice to have	
Water column properties - Chemical			Nice to have	
Water column properties - Biological			Nice to have	
Currents			Highly desirable	
Tide/wave heights			Highly desirable	
Sea ice conditions			Nice to have	
Habitat distribution and classification			Nice to have	
Boundaries			Highly desirable	
Routes			Highly desirable	
Offshore cadastral			Highly desirable	
Lease areas			Highly desirable	
Fixed obstructions			Nice to have	
Floating observation/navigation systems			Highly desirable	
Shorelines – current, historic, change rates	Nice to have	Highly desirable	Highly desirable	
Land use/land cover	Highly desirable	Highly desirable	Highly desirable	
Wetlands	Required	Required	Highly desirable	

Importance of Integration with Other Datasets	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Estuaries			Highly desirable	
Inland surface water features	Highly desirable	Highly desirable	Highly desirable	
Bridges/culverts	Required	Highly desirable		
Landmark features	Highly desirable	Highly desirable	Highly desirable	
Cultural resources	Highly desirable	Highly desirable	Highly desirable	
Coastal and riverine structures	Highly desirable	Highly desirable	Highly desirable	
Overhead structures			Highly desirable	
Lowest Floor Elevation of Buildings	Highly desirable			

Benefits of Currently Used Elevation Data	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Current dataset used	We use classified point clouds, DSMs, DTMs and DEMs in general, at a wide range of quality level from the 1996 coastal lidar to the most recent QL2 and various research lidar data.	We are using the best data that we can find for our study areas from on-line repositories or research data collected by our collaborators, but for streams and rivers we often don't have data that we need (e.g. for research on endangered mussels)	We use the data from NCDOT and Digital coast, but they are quite limited in both spatial coverage and time	
Where current elevation data are accessed	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
National Map	Yes			
Digital Coast	Yes		Yes	
NCEI				
Open Topography	Yes			
NOAA nautical charts			Yes	
USACE navigation charts		Yes		
USGS Inland Waters server				
USGS data series				
Marine Minerals Program GIS				
State Repositories	Yes			
State repositories used	NORTH CAROLINA'S SPATIAL DATA DOWNLOAD			

Benefits of Currently Used Elevation Data	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Other			Yes	
Other description			We use research data through repositories by our collaborators	
Data that meet my needs are not available		Yes		
Current Operational Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Time savings	Major	Inland bathy data not available	Moderate	
Cost savings/cost reduction	Moderate	Inland bathy data not available	Major	
Cost avoidance	Major	Inland bathy data not available	Major	
Increased revenues	None	Inland bathy data not available	None	
Mission-driven performance improvements	Major	Inland bathy data not available	Moderate	
Current Customer Service Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Value added to products or services	Major	Inland bathy data not available	Moderate	
Improved response or timeliness	Minor	Inland bathy data not available	None	
Improved customer experience	Major	Inland bathy data not available	Moderate	
Current Societal Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Education or outreach	Major	Inland bathy data not available	Major	
Environmental	Major	Inland bathy data not available	Moderate	
Public safety, including life and property	Minor	Inland bathy data not available	None	

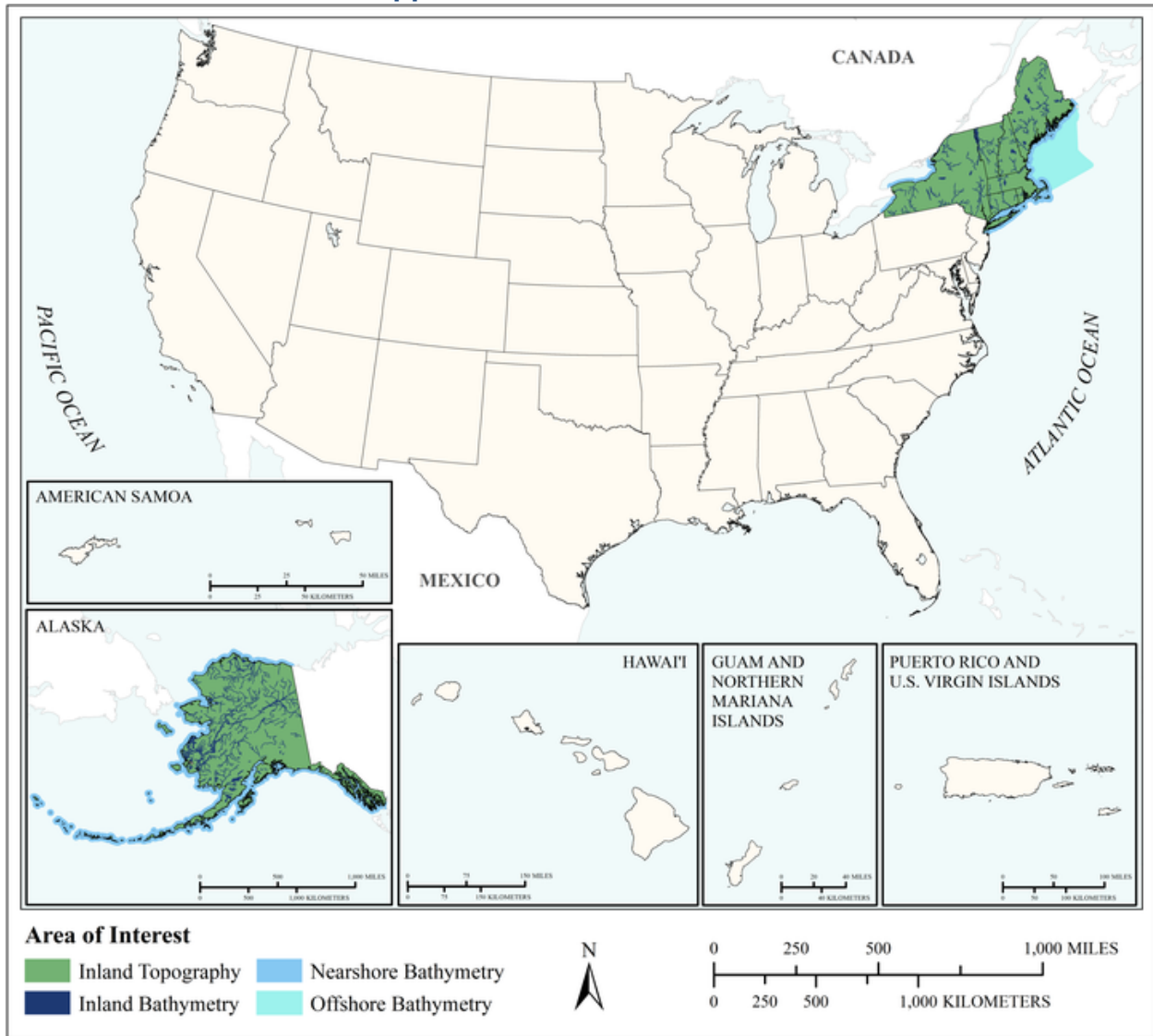
Future Benefits if Elevation Data Requirements Are Met	Inland Topo			Inland Bathy			Nearshore Bathy			Offshore Bathy		
	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount
Time savings	Major	Annual dollars saved/realized	\$49,446	Major	Annual dollars saved/realized	\$39,195	Major	Annual dollars saved/realized	\$16,582			
Time savings description	Students in our classes will be able to use the data more efficiently, focusing on new applications and science rather than basic processing. Similarly this is highly variable in our case. Highly variable but we currently spend a lot of time on this which will be freed for more productive and innovative research. This is highly variable in research - depends on research projects, but we save a lot of time and money by not having to collect data ourselves.											
Cost savings/cost reduction	Major	Annual dollars saved/realized	\$400,000	Major	Annual dollars saved/realized	\$50,000	Major	Annual dollars saved/realized	\$100,000			
Cost savings/cost reduction description	This is highly variable depending on research projects, it may be much higher or lower based on the personnel and equipment requirements. Free access to state of the art data for educating hundreds of students is hard to quantify in terms of money, so this is just a very rough estimate.			This is highly variable depending on research projects.								
Cost avoidance	Major	Annual dollars saved/realized	\$25,000	Major	Annual dollars saved/realized	\$60,000	Major	Annual dollars saved/realized	\$60,000			
Cost avoidance description	Free access to state of the art data for educating hundreds of students is hard to quantify in terms of money, so this is just a very rough estimate.											
Increased revenues	Major	Annual dollars saved/realized	\$100,000	Major	Annual dollars saved/realized	\$100,000	Major	Annual dollars saved/realized	\$100,000			
Increased revenues description	Tuition, workshop fees and grants that we are able to raise by having access to state of the art data.											
Mission-driven performance improvements	Major	Annual percent improvement	58%	Major	Annual percent improvement	40%	Major	Annual percent improvement	30%			
Mission-driven performance improvements description	Access to 3D state of the art data is essential for graduate research and education.											
Other operational benefits	Major	Annual dollars saved/realized	\$14,472									
Other operational benefits description												
Future Customer Service Benefits	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount
Value added to products or services	Major	Annual dollars saved/realized	\$14,472	Major	Annual dollars saved/realized	\$150,000	Major	Annual dollars saved/realized	\$100,000			
Value added to products or services description	We can perform new, cutting edge research and offer advanced courses.											
Improved response or timeliness	Major	Unable to provide		Major	Annual dollars saved/realized	\$50,000	Major	Annual dollars saved/realized	\$100,000			
Improved response or timeliness description	Improved education and research.						Improved education and research.					
Improved customer experience	Major	Unable to provide		Major	Annual dollars saved/realized	\$300,000	Major	Annual dollars saved/realized	\$120,000			

Future Benefits if Elevation Data Requirements Are Met	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Societal Benefits	Benefits	Benefits	Benefits	Benefits
Education or outreach	Major	Major	Major	
Environmental	I don't know	I don't know	I don't know	
Public safety, including life and property	I don't know	I don't know	I don't know	

3D Derivatives Needed	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Triangulated Irregular Network (TIN)				
Contours	Yes	Yes	Yes	
Hillshades	Yes	Yes	Yes	
Slope maps	Yes	Yes	Yes	
Aspect maps	Yes	Yes	Yes	
Curvature maps				
Cross sections	Yes	Yes	Yes	
Height-Above-Ground maps	Yes	Yes	Yes	
Viewshed maps	Yes			
Hydrologic Flow Direction Grids	Yes			
Hydrologic Flow Accumulation Grids	Yes			
Hydrologic networks (e.g. streams, lakes)	Yes			
Hydrologic Units (Watershed Boundaries) (e.g. surface water drainage to a point)	Yes			
Building footprints	Yes			
Breaklines for road edge-of-pavement	Yes			
Rugosity/Surface Roughness				
Other (please specify)	Yes			
Other description	Canopy height			

Importance of 3D Data Requirements	Response
Geographic coverage	3
Vertical accuracy	2
Update frequency	1

MCA Title: Education and Applied Research



MCA Area of Interest	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Data Type	Required	Required	Required	Required
Geographic Area Requirements	One or more states, territories, or counties	One or more states, territories, or counties	Nearshore areas along the coast off one or more states, territories, or counties (including Great Lakes states)	Custom description
Sub Area Requirements				Gulf of Maine

MCA Description	Response
Mission Critical Activity	Education and basic and applied research using geospatial applications in any number of BUs. This response reflects information provided by a sampling of researchers within the University of Maine System and does not reflect an official comprehensive response from the system as a whole.
MCA Title	Education and Applied Research
MCA ID	21716
Organization Type	Academic or Not-for-Profit
Organization Name	University of Maine System
Sub-Agency or Division	
Organization Mission	Undergraduate and graduate education, research, and service
Program Name	University of Maine System
Total Annual Program Budget	
Primary Business Use	BU 26 - Education K12 and Beyond, Basic Research
Secondary Business Use	
Tertiary Business Use	

What Needs to be Measured in 3D	Response
Bare earth ground	Required
Tops of buildings, structures, objects	Required
Tops of vegetation	Required
Tops of submerged structures, objects	Required
Tops of submerged vegetation	Highly desirable
Subcanopy of vegetation/understory	Required
River/lake bottom	Highly desirable
Nearshore elevation (<10 m deep)	Required
Sea surface	Highly desirable
Ocean/sea bottom (>10 m deep)	Highly desirable

General Geographic Area and Size	
Average geographic extent of day-to-day area	25,000 sq mi - 74,999 sq mi (e.g. medium state or large multi-county region)
Smallest 3D features needed	Survey-level features (e.g. sign, curb, road line, mailbox, rock, etc.
Description of smallest 3D features	Intrusion dikes often a couple centimeters wide, posts in high marsh environments often 10-15 centimeters, grave monuments often 10 centimeters, stone wall remnants often 20-30 centimeters diameter, small stream and river obstructions and debris

Inland Bathy Feature Size Requirements	Response
Navigable channels (as defined by USACE)	Required
Rivers and Streams	
Less than 10 ft	Required
10 - 50 ft	Required
51 - 100 ft	Required
101 - 500 ft	Required
501 - 2,500 ft	Required
Greater than 2,500 ft	Required
Other	Required

Inland Bathymetry Feature Size Requirements	Response
Other description	Tidal creeks < 10 ft
Waterbodies (Reservoirs, lakes, ponds)	
Less than 1/2 acre	Required
1/2 - 1 acre	Required
1.1 - 2 acres	Required
2.1 - 5 acres	Required
5.1 - 10 acres	Required
Greater than 10 acres	Required
Other	Required
Other description	Tidal pools < 1/2 acre

Requirements	Inland Topo	Inland Bathymetry	Nearshore Bathymetry	Offshore Bathymetry
Quality Level/IHO Order	QL0 HD	QL0B	QL0B	Special Order
Update Frequency	4-5 years	4-5 years	4-5 years	4-5 years
Event type(s)				
Quality Level and/or update frequency variability across AOI	Depends on business use, feature(s) of interest, and project extent			Special Order out to approx. 60m depth, Order 1a but THU <= 5m out to approx. 100m depth, Order 1b but THU <= 5m out to approx. 200m depth, Order 2 but THU <= 30m out to approx. 2500 m depth
Acceptable Horizontal Error	Up to 30 cm	Less than 50 cm	Less than 50 cm	The best horizontal accuracy achievable for the vertical accuracy I need
Acceptable Vertical Error	Less than 5 cm	Less than 10 cm	Less than 10 cm	Less than 1 meter
How far onshore needed			For nearshore habitat work, we need contiguous topo-bathymetry data extending inland to the drainage divides for moderate and small coastal streams. MOST would be picked up with 1 km+ inland data. Similarly, a focus on SLR suggests a need for data to ~ 10m elevation, regardless of distance from the existing coast.	

Requirements	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
How far down the beach profile needed	Below MLLW		Below MLLW	
Tide correction requirement			Multiple tide corrections required: Mean Lower Low Water (MLLW) and Mean High Water (MHW) along with need to match topo elevation for combination topo-bathy product, on either those datums or NAVD88 or newer	Multiple tide corrections required: Mean Lower Low Water (MLLW) generally, although Mean High Water (MHW) also when match topo elevation for combination topo-bathy product, on either those datums or NAVD88 or newer
Cross sections and/or transects meet needs				
Cross section/transect requirement				

Hydrologic Processing Required	Response
Hydro-flattening	Highly desirable
Hydro-enforcement	Highly desirable
Hydro-conditioning	Highly desirable
No Treatment	Not required

Seamlessness Requirements	Within Inland Topo Data	Within Inland Bathy Data	Within Nearshore Data	Within Offshore Data	Between Inland Topo and Inland Bathy	Between Topo, Topobathy, and/or Bathy
Importance of Seamlessness					Required	
Temporal Seamlessness						
Entire AOI in same acquisition season	Highly desirable	Highly desirable	Highly desirable	Nice to have	Highly desirable	Highly desirable
Entire AOI under same environmental conditions	Highly desirable	Required	Required	Highly desirable	Required	Required
Spatial Seamlessness						
Point cloud for entire AOI needs to be seamless	Required	Required	Required	Required	Required	Required
DEM for entire AOI needs to be seamless	Required	Required	Required	Required	Required	Required
Amount of acceptable vertical manipulation to achieve spatial seamlessness	Up to the required Total Vertical Uncertainty (TVU) at the 95% confidence level	Up to the required Total Vertical Uncertainty (TVU) at the 95% confidence level	Up to the required Total Vertical Uncertainty (TVU) at the 95% confidence level	Up to the required Total Vertical Uncertainty (TVU) at the 95% confidence level	Up to the required Total Vertical Uncertainty (TVU) at the 95% confidence level	Up to the required Total Vertical Uncertainty (TVU) at the 95% confidence level

Importance of 3D Products	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
DSM	Required	Required	Highly desirable	Highly desirable
DTM	Highly desirable	Highly desirable	Highly desirable	Highly desirable
DEM	Required	Required	Required	Required
Raw point cloud data	Required	Required	Required	Required
Classified point cloud	Required	Required	Required	
Edited/cube XYZ		Highly desirable	Highly desirable	Highly desirable
Full waveform	Required	Required	Required	Required
Bathymetric Attributed Grid (BAG)		Required	Required	Required
Breaklines required for standard hydro-flattening	Highly desirable	Highly desirable		
Additional breaklines for hydro-enforcement of culverts	Highly desirable			

Importance of 3D Products	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
National Vertical Datum Transformation Tool (V-Datum)			Required	Required
Tide Predictions			Highly desirable	Highly desirable
Tidal Constituent And Residual Interpolation (TCARI)			Highly desirable	Highly desirable
Intensity imagery/sidescan imagery	Highly desirable	Highly desirable	Highly desirable	Required
Ground control/ground truthing	Required	Required	Required	Highly desirable

Importance of Integration with Other Datasets	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Hydrographic survey data			Highly desirable	Highly desirable
Nautical and/or navigation charts			Highly desirable	Highly desirable
Acoustic imagery of the seafloor			Nice to have	Highly desirable
Aerial and/or satellite imagery	Highly desirable	Highly desirable	Required	Highly desirable
Underwater videography			Nice to have	Nice to have
Bottom texture			Highly desirable	Required
Bottom type			Highly desirable	Required
Submerged features			Nice to have	Nice to have
Subbottom characteristics			Highly desirable	Required
Geologic and seismic data	Highly desirable	Highly desirable	Nice to have	Required
Water column properties - Physical			Highly desirable	Highly desirable
Water column properties - Chemical			Highly desirable	Highly desirable
Water column properties - Biological			Nice to have	Nice to have
Currents			Highly desirable	Highly desirable
Tide/wave heights			Highly desirable	Highly desirable
Sea ice conditions			Highly desirable	Highly desirable
Habitat distribution and classification			Required	Required
Boundaries			Required	Required
Routes			Highly desirable	Highly desirable
Offshore cadastral			Highly desirable	Highly desirable
Lease areas			Highly desirable	Required
Fixed obstructions			Highly desirable	Highly desirable
Floating observation/navigation systems			Highly desirable	Highly desirable
Shorelines – current, historic, change rates	Required	Required	Required	
Land use/land cover	Required	Required	Required	Not required
Wetlands	Required	Required	Nice to have	Not required

Importance of Integration with Other Datasets	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Estuaries			Highly desirable	Nice to have
Inland surface water features	Highly desirable	Highly desirable	Highly desirable	
Bridges/culverts	Required	Required		
Landmark features	Nice to have	Highly desirable		
Cultural resources	Required	Highly desirable	Highly desirable	
Coastal and riverine structures	Required	Required	Highly desirable	
Overhead structures				
Lowest Floor Elevation of Buildings	Highly desirable			

Benefits of Currently Used Elevation Data	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Current dataset used	Lidar elevation data from NOAA Digital Coast USGS National Map elevation products NOAA Coastal Relief Models Coastal Digital Elevation Models	NOAA Charts-Paper, Raster, and ENC Maine DEP pond maps with depth contours and soundings USACE diagrams	NOAA-derived from Charts-Paper, Raster, and ENC NCEI Estuarine Bathymetric Digital Elevation Models NOS Hydrographic Survey Data NOAA Coastal Relief Models Coastal Digital Elevation Models	NCEI GEBCO International Bathymetric Chart (IBC) Regional Mapping Projects IHO Data Center for Digital Bathymetry US Extended Continental Shelf Mapping Project U.S. UNCLOS Bathymetry Project at UNH CCOM/JHC NOAA-derived from Charts-Paper, Raster, and ENC NCEI Estuarine Bathymetric Digital Elevation Models NOS Hydrographic Survey Data NOAA Coastal Relief Models Coastal Digital Elevation Models
Where current elevation data are accessed	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
National Map	Yes			
Digital Coast	Yes	Yes	Yes	Yes
NCEI	Yes		Yes	Yes
Open Topography	Yes			
NOAA nautical charts		Yes	Yes	Yes

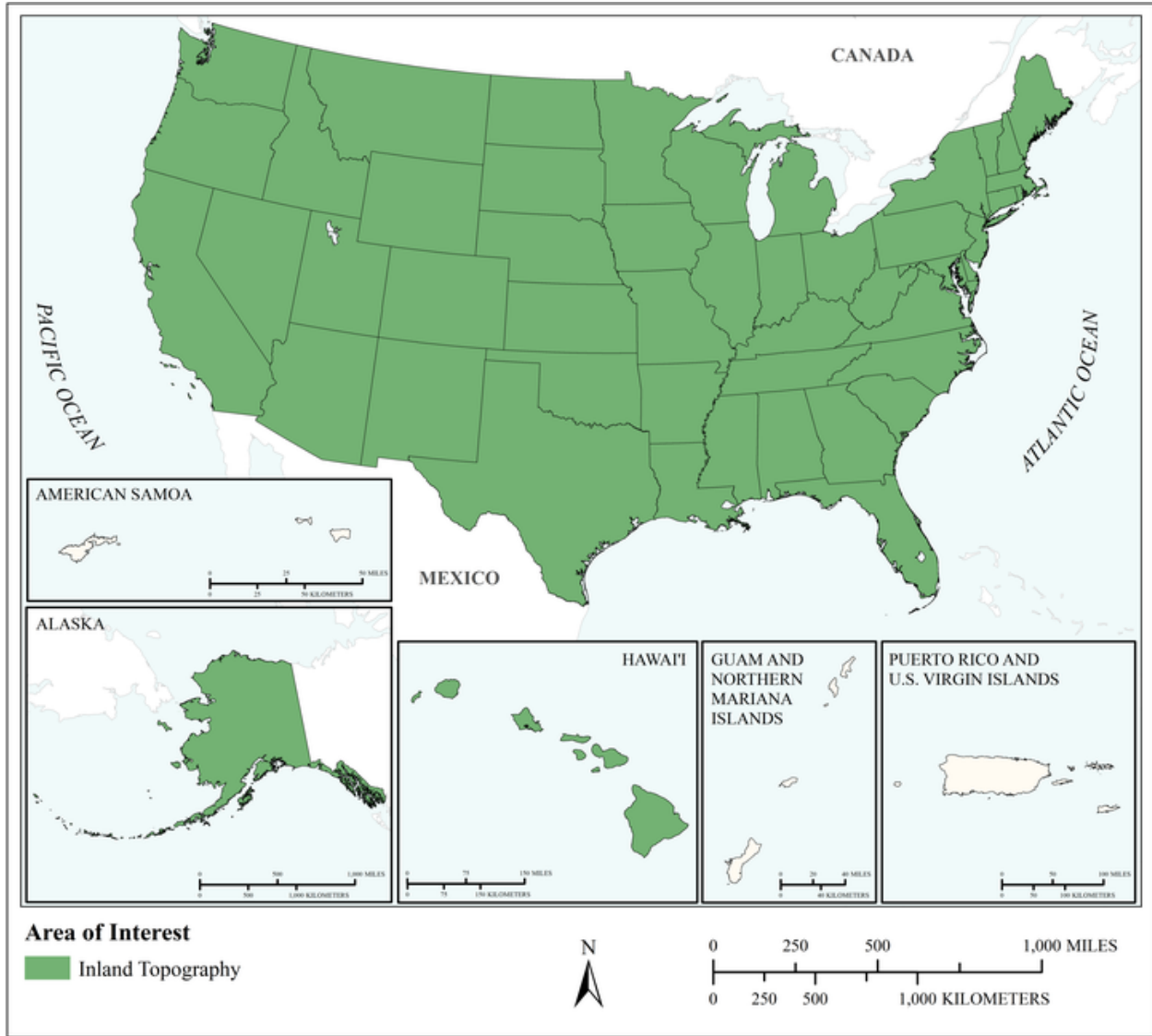
Benefits of Currently Used Elevation Data	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
USACE navigation charts				
USGS Inland Waters server				
USGS data series				
Marine Minerals Program GIS			Yes	Yes
State Repositories	Yes	Yes	Yes	
State repositories used	Maine Office of GIS/ Maine Library of Geographic Information State of Alaska MassGIS	Maine Office of GIS/Maine Library of Geographic Information MassGIS	Maine Office of GIS/Maine Library of Geographic Information MassGIS State of Alaska	
Data that meet my needs are not available				
Current Operational Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Time savings	Moderate	Moderate	Moderate	Moderate
Cost savings/cost reduction	Major	Minor	Moderate	Moderate
Cost avoidance	Major	Minor	Moderate	Moderate
Increased revenues	Minor	None	None	None
Mission-driven performance improvements	Moderate	Minor	Moderate	Moderate
Current Customer Service Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Value added to products or services	Moderate	Minor	Major	Major
Improved response or timeliness	Moderate	Minor	None	None
Improved customer experience	Moderate	Minor	None	None
Current Societal Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Education or outreach	Major	Major	Major	Major
Environmental	Major	Moderate	Moderate	Moderate
Public safety, including life and property	Major	Moderate	Moderate	Moderate

Future Benefits if Elevation Data Requirements Are Met	Inland Topo			Inland Bathy			Nearshore Bathy			Offshore Bathy		
	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount
Time savings	Major	Unable to provide		Major	Unable to provide		Major	Unable to provide		Major	Unable to provide	
Cost savings/cost reduction	Minor	Unable to provide		Minor	Unable to provide		Moderate	Unable to provide		Moderate	Unable to provide	
Cost avoidance	Moderate	Unable to provide		Major	Unable to provide		Moderate	Unable to provide		Moderate	Unable to provide	
Increased revenues	Moderate	Unable to provide		Moderate	Unable to provide		Moderate	Unable to provide		Moderate	Unable to provide	
Mission-driven performance improvements	Major	Unable to provide		Major	Unable to provide		Major	Unable to provide		Major	Unable to provide	
Future Customer Service Benefits	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount
Value added to products or services	Moderate	Unable to provide		Moderate	Unable to provide		Moderate	Unable to provide		Moderate	Unable to provide	
Improved response or timeliness	Moderate	Unable to provide		Moderate	Unable to provide		Moderate	Unable to provide		Moderate	Unable to provide	
Improved customer experience	Major	Unable to provide		Major	Unable to provide		Major	Unable to provide		Major	Unable to provide	
Societal Benefits	Benefits			Benefits			Benefits			Benefits		
Education or outreach	Major			Major			Major			Major		
Environmental	Moderate			Moderate			Moderate			Moderate		
Public safety, including life and property	Moderate			Moderate			Moderate			Moderate		

3D Derivatives Needed	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Triangulated Irregular Network (TIN)	Yes	Yes		
Contours				
Hillshades	Yes	Yes	Yes	Yes
Slope maps	Yes	Yes	Yes	Yes
Aspect maps	Yes	Yes		
Curvature maps				
Cross sections				
Height-Above-Ground maps	Yes			
Viewshed maps	Yes			
Hydrologic Flow Direction Grids	Yes	Yes		
Hydrologic Flow Accumulation Grids	Yes	Yes		
Hydrologic networks (e.g. streams, lakes)	Yes	Yes		
Hydrologic Units (Watershed Boundaries) (e.g. surface water drainage to a point)	Yes	Yes		
Building footprints				
Breaklines for road edge-of-pavement				
Rugosity/Surface Roughness	Yes	Yes	Yes	Yes

Importance of 3D Data Requirements	Response
Geographic coverage	3
Vertical accuracy	2
Update frequency	1

MCA Title: Research, Public Service, and Education



MCA Area of Interest	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Data Type	Required			
Geographic Area Requirements	Nationwide, inland areas			
Sub Area Requirements				

MCA Description	Response
Mission Critical Activity	Research, public service, and education. This response reflects input related to the University of Missouri Extension applications of the data and may not completely represent the entirety of the University of Missouri.
MCA Title	Research, Public Service, and Education
MCA ID	22414
Organization Type	Academic or Not-for-Profit
Organization Name	CARES - University of Missouri Extension
Sub-Agency or Division	
Organization Mission	CARES is a research and service center at the University of Missouri. We cooperate with State/Federal agencies, non-profits, researchers, and foundations on project-based research, data collection, web-based tool development, and data visualization.
Program Name	CARES - University of Missouri Extension
Total Annual Program Budget	
Primary Business Use	BU 26 - Education K12 and Beyond, Basic Research
Secondary Business Use	
Tertiary Business Use	

What Needs to be Measured in 3D	Response
Bare earth ground	Required
Tops of buildings, structures, objects	Highly desirable
Tops of vegetation	Highly desirable
Tops of submerged structures, objects	Not required
Tops of submerged vegetation	Not required
Subcanopy of vegetation/understory	Not required
River/lake bottom	Nice to have
Nearshore elevation (<10 m deep)	Not required
Sea surface	Not required
Ocean/sea bottom (>10 m deep)	Not required

General Geographic Area and Size	
Average geographic extent of day-to-day area	75,000 sq mi - 199,999 sq mi (e.g. large state or medium multi-state region)
Smallest 3D features needed	Small features (e.g. individual shrub, tree, car, mooring anchor, small dock, etc.)
Description of smallest 3D features	Individual trees, sinkholes, field terraces

Requirements	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Quality Level/IHO Order	QL2			
Update Frequency	4-5 years			
Event type(s)				
Quality Level and/or update frequency variability across AOI				
Acceptable Horizontal Error	Up to 1 meter			
Acceptable Vertical Error	Up to 20 cm			

Requirements	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
How far onshore needed				
How far down the beach profile needed	To MLLW			
Tide correction requirement				
Cross sections and/or transects meet needs				
Cross section/transect requirement				

Hydrologic Processing Required	Response
Hydro-flattening	Highly desirable
Hydro-enforcement	Highly desirable
Hydro-conditioning	Not required
No Treatment	Not required

Seamlessness Requirements	Within Inland Topo Data	Within Inland Bathy Data	Within Nearshore Data	Within Offshore Data	Between Inland Topo and Inland Bathy	Between Topo, Topobathy, and/or Bathy
Importance of Seamlessness						
Temporal Seamlessness						
Entire AOI in same acquisition season	Nice to have					
Entire AOI under same environmental conditions	Highly desirable					
Spatial Seamlessness						
Point cloud for entire AOI needs to be seamless	Required					
DEM for entire AOI needs to be seamless	Required					
Amount of acceptable vertical manipulation to achieve spatial seamlessness	I don't know					

Importance of 3D Products	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
DSM	Highly desirable			
DTM	Highly desirable			
DEM	Required			
Raw point cloud data	Nice to have			
Classified point cloud	Nice to have			
Edited/cube XYZ				
Full waveform	Not required			
Bathymetric Attributed Grid (BAG)				
Breaklines required for standard hydro-flattening	Not required			
Additional breaklines for hydro-enforcement of culverts	Not required			

Importance of 3D Products	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
National Vertical Datum Transformation Tool (V-Datum)				
Tide Predictions				
Tidal Constituent And Residual Interpolation (TCARI)				
Intensity imagery/sidescan imagery	Not required			
Ground control/ground truthing	Nice to have			

Importance of Integration with Other Datasets	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Hydrographic survey data				
Nautical and/or navigation charts				
Acoustic imagery of the seafloor				
Aerial and/or satellite imagery	Highly desirable			
Underwater videography				
Bottom texture				
Bottom type				
Submerged features				
Subbottom characteristics				
Geologic and seismic data	Nice to have			
Water column properties - Physical				
Water column properties - Chemical				
Water column properties - Biological				
Currents				
Tide/wave heights				
Sea ice conditions				
Habitat distribution and classification				
Boundaries				
Routes				
Offshore cadastral				
Lease areas				
Fixed obstructions				
Floating observation/navigation systems				
Shorelines – current, historic, change rates	Nice to have			
Land use/land cover	Nice to have			
Wetlands	Nice to have			

Importance of Integration with Other Datasets	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Estuaries				
Inland surface water features	Highly desirable			
Bridges/culverts	Nice to have			
Landmark features	Nice to have			
Cultural resources	Nice to have			
Coastal and riverine structures	Highly desirable			
Overhead structures				
Lowest Floor Elevation of Buildings	Not required			

Benefits of Currently Used Elevation Data	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Current dataset used	Best available			
Where current elevation data are accessed	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
National Map	Yes			
Digital Coast				
NCEI				
Open Topography				
NOAA nautical charts				
USACE navigation charts				
USGS Inland Waters server				
USGS data series				
Marine Minerals Program GIS				
State Repositories	Yes			
State repositories used	Missouri Spatial Data information Service (MSDIS)			
Data that meet my needs are not available				
Current Operational Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Time savings	None			
Cost savings/cost reduction	None			
Cost avoidance	None			
Increased revenues	None			
Mission-driven performance improvements	Minor			

Benefits of Currently Used Elevation Data	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Current Customer Service Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Value added to products or services	Moderate			
Improved response or timeliness	Minor			
Improved customer experience	Moderate			
Current Societal Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Education or outreach	Major			
Environmental	Moderate			
Public safety, including life and property	Minor			

Future Benefits if Elevation Data Requirements Are Met	Inland Topo			Inland Bathy			Nearshore Bathy			Offshore Bathy		
	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount
Time savings	Minor	Unable to provide										
Cost savings/cost reduction	Minor	Unable to provide										
Cost avoidance	Minor	Unable to provide										
Increased revenues	Minor	Unable to provide										
Mission-driven performance improvements	Minor	Unable to provide										
Future Customer Service Benefits	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount
Value added to products or services	Minor	Unable to provide										
Improved response or timeliness	Minor	Unable to provide										
Improved customer experience	Minor	Unable to provide										
Societal Benefits	Benefits			Benefits			Benefits			Benefits		
Education or outreach	Moderate											
Education or outreach description	This data will be integrated with online tools educating the public on agricultural and natural resources issues											
Environmental	Minor											
Public safety, including life and property	None											

3D Derivatives Needed	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Triangulated Irregular Network (TIN)				
Contours	Yes			
Hillshades	Yes			
Slope maps	Yes			
Aspect maps	Yes			
Curvature maps				
Cross sections	Yes			
Height-Above-Ground maps				
Viewshed maps				
Hydrologic Flow Direction Grids	Yes			
Hydrologic Flow Accumulation Grids	Yes			
Hydrologic networks (e.g. streams, lakes)				
Hydrologic Units (Watershed Boundaries) (e.g. surface water drainage to a point)	Yes			
Building footprints				
Breaklines for road edge-of-pavement				
Rugosity/Surface Roughness				

Importance of 3D Data Requirements	Response
Geographic coverage	3
Vertical accuracy	2
Update frequency	1

American Association of Port Authorities (AAPA)

AAPA represents more than 130 public port authorities in the U.S., Canada, the Caribbean, and Latin America. For more than a century, AAPA membership has empowered port authorities and their maritime industry partners to serve global customers and create economic and social value for their communities. AAPA's events, resources, and partnerships connect, inform, and unify seaport leaders and maritime professionals who deliver prosperity around the western hemisphere. For its U.S. members, AAPA provides compelling advocacy and effective public outreach to influence seaports' most urgent public policy issues. Today, AAPA continues to promote the common interests of the port community, and provides critical industry leadership on security, trade, transportation, infrastructure, environmental, and other issues related to port development and operations.

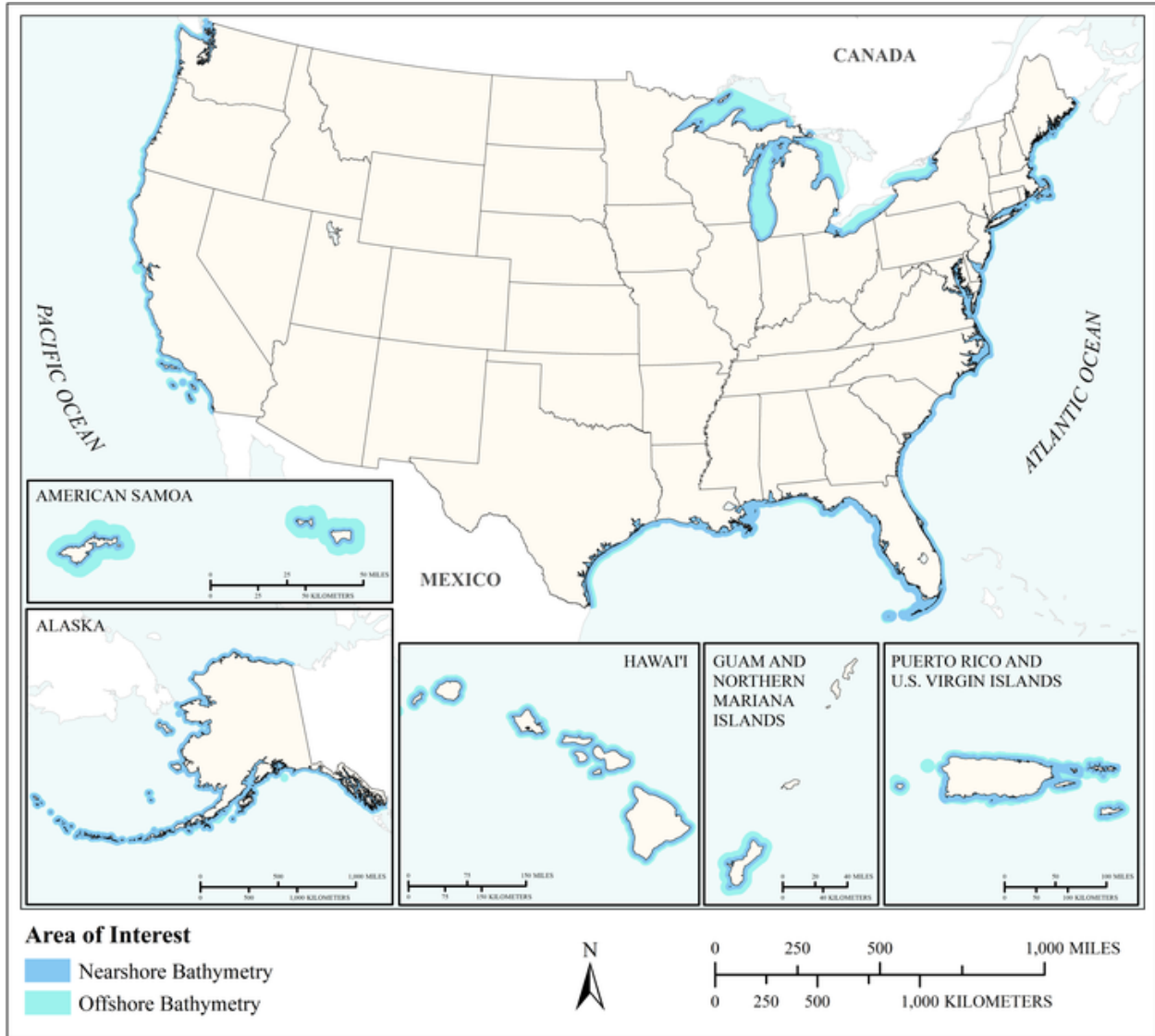
The mission of the AAPA is to educate stakeholders, provide services, and advocate policies that strengthen the ability of member seaports to serve their global customers and create economic and social value for their communities.

AAPA has identified a Business Use and Mission Critical Activity that relies on topographic and bathymetric elevation data and would benefit from enhanced elevation data. Summarized details of elevation data requirements and benefits received from the enhanced elevation data are provided in the following pages.

Summary Table

MCA Description				Requirements			Future Operational Benefits	Future Customer Service Benefits	Future Societal Benefits		
Primary Business Use	Agency/ Organization Name	MCA No.	Mission Critical Activity	Data Type	QL/Order	Update Frequency	Total Reported Future Annual Operational Benefits	Total Reported Future Annual Customer Service Benefits	Education or Outreach	Environmental	Public Safety
BU 20 – Marine and Riverine Navigation	American Association of Port Authorities	21867	Commercial Navigation	Nearshore Bathy	QL0B	Annually	Unable to quantify	Unable to quantify	Minor	Major	Major
				Offshore Bathy	(a) Special Order (b) Order 1a (c) Order 2	4-5 years	Unable to quantify	Unable to quantify	Minor	Major	Major

MCA Title: Commercial Navigation



MCA Area of Interest	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Data Type			Required	Required
Geographic Area Requirements			Nearshore areas along the coast off one or more states, territories, or counties (including Great Lakes states)	Area split by varying quality level or update frequency
Sub Area Requirements				Waters around States, Puerto Rico, U.S. Virgin Islands, American Samoa, and Guam

MCA Description	Response
Mission Critical Activity	Commercial navigation, predominantly deep draft navigation
MCA Title	Commercial Navigation
MCA ID	21867
Organization Type	Association or Professional Organization
Organization Name	American Association of Port Authorities
Sub-Agency or Division	
Organization Mission	The mission of American Association of Port Authorities (AAPA) is to educate stakeholders, provide services, and advocate policies that strengthen the ability of member seaports to serve their global customers and create economic and social value for their communities. AAPA serves to promote collaboration and cooperation on port related issues - freight movement, navigation, environmental issues, etc.
Program Name	Commercial deep draft navigation
Total Annual Program Budget	
Primary Business Use	BU 20 - Marine and Riverine Navigation and Safety
Secondary Business Use	BU 19 - Land Navigation and Safety
Tertiary Business Use	

What Needs to be Measured in 3D	Response
Bare earth ground	Nice to have
Tops of buildings, structures, objects	Nice to have
Tops of vegetation	Nice to have
Tops of submerged structures, objects	Highly desirable
Tops of submerged vegetation	Nice to have
Subcanopy of vegetation/understory	Nice to have
River/lake bottom	Highly desirable
Nearshore elevation (<10 m deep)	Required
Sea surface	Nice to have
Ocean/sea bottom (>10 m deep)	Required

General Geographic Area and Size	
Average geographic extent of day-to-day area	Less than 1 sq mi (e.g. plot, acre, small study area)
Smallest 3D features needed	Large features (e.g. groups of trees, house, building, road, underwater wreck, large commercial pier, etc.)
Description of smallest 3D features	We need to know where the bottom is in general and where: Looking down: 1. Where the bottom is and what it is made of in general 2. Where specific obstructions are such as rocks, wrecks, etc, and Looking up: 1. Where the bottom of bridges are so ships' masts, smokestacks, antennas, etc. do not touch. Also building structures, access roads, railroad network, and small docks onshore.

Requirements	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Quality Level/IHO Order			QL0B	(a) Special Order (b) Order 1a (c) Order 2
Update Frequency			Annually	4-5 years
Event type(s)				

Requirements	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Quality Level and/or update frequency variability across AOI			Channels and anchorages need great detail. General waterways greater than 100' deep require less accuracy.	Special order for harbors and channels. Order 2 for depths greater than 100m
Acceptable Horizontal Error			Up to 1 meter	Up to 20 meters
Acceptable Vertical Error			Up to 30 cm	Up to 2 meters
How far onshore needed			1 kilometer inland	
How far down the beach profile needed			Below MLLW	
Tide correction requirement			MLLW	MLLW
Cross sections and/or transects meet needs			Partial	
Cross section/transect requirement			Vertical: 20 Horizontal: 1 meter	

Seamlessness Requirements	Within Inland Topo Data	Within Inland Bathy Data	Within Nearshore Data	Within Offshore Data	Between Inland Topo and Inland Bathy	Between Topo, Topobathy, and/or Bathy
Importance of Seamlessness						
Temporal Seamlessness						
Entire AOI in same acquisition season			Highly desirable	Highly desirable		Highly desirable
Entire AOI under same environmental conditions			Highly desirable	Highly desirable		Nice to have
Spatial Seamlessness						
Point cloud for entire AOI needs to be seamless			Highly desirable	Highly desirable		Highly desirable
DEM for entire AOI needs to be seamless			Highly desirable	Highly desirable		Highly desirable
Amount of acceptable vertical manipulation to achieve spatial seamlessness			Up to the required Total Vertical Uncertainty (TVU) at the 95% confidence level	Up to the required Total Vertical Uncertainty (TVU) at the 95% confidence level		Up to the required Total Vertical Uncertainty (TVU) at the 95% confidence level

Importance of 3D Products	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
DSM			Highly desirable	Highly desirable
DTM			Highly desirable	Highly desirable
DEM			Highly desirable	Highly desirable
Raw point cloud data			Required	Required
Classified point cloud			Nice to have	
Edited/cube XYZ			Nice to have	Nice to have
Full waveform			Nice to have	Nice to have
Bathymetric Attributed Grid (BAG)			Nice to have	Nice to have
Breaklines required for standard hydro-flattening				
Additional breaklines for hydro-enforcement of culverts				

Importance of 3D Products	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
National Vertical Datum Transformation Tool (V-Datum)			Nice to have	Nice to have
Tide Predictions			Highly desirable	Highly desirable
Tidal Constituent And Residual Interpolation (TCARI)			Highly desirable	Highly desirable
Intensity imagery/sidescan imagery			Highly desirable	Highly desirable
Ground control/ground truthing			Highly desirable	Highly desirable

Importance of Integration with Other Datasets	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Hydrographic survey data			Required	Required
Nautical and/or navigation charts			Required	Required
Acoustic imagery of the seafloor			Nice to have	Nice to have
Aerial and/or satellite imagery			Highly desirable	Highly desirable
Underwater videography			Nice to have	Nice to have
Bottom texture			Highly desirable	Highly desirable
Bottom type			Highly desirable	Highly desirable
Submerged features			Highly desirable	Highly desirable
Subbottom characteristics			Highly desirable	Highly desirable
Geologic and seismic data			Highly desirable	Highly desirable
Water column properties - Physical			Nice to have	Nice to have
Water column properties - Chemical			Nice to have	Nice to have
Water column properties - Biological			Nice to have	Nice to have
Currents			Highly desirable	Highly desirable
Tide/wave heights			Required	Required
Sea ice conditions			Highly desirable	Highly desirable
Habitat distribution and classification			Nice to have	Nice to have
Boundaries			Nice to have	Nice to have
Routes			Highly desirable	Highly desirable
Offshore cadastral			Not required	Not required
Lease areas			Not required	Not required
Fixed obstructions			Required	Required
Floating observation/navigation systems			Highly desirable	Highly desirable
Shorelines – current, historic, change rates			Highly desirable	
Land use/land cover			Highly desirable	Highly desirable
Wetlands			Highly desirable	Highly desirable

Importance of Integration with Other Datasets	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Estuaries			Highly desirable	Highly desirable
Inland surface water features			Highly desirable	
Bridges/culverts				
Landmark features			Highly desirable	
Cultural resources			Not required	
Coastal and riverine structures			Required	
Overhead structures			Required	
Lowest Floor Elevation of Buildings				

Benefits of Currently Used Elevation Data	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Current dataset used			Nautical charts	Nautical charts
Where current elevation data are accessed	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
National Map				
Digital Coast			Yes	Yes
NCEI			Yes	Yes
Open Topography				
NOAA nautical charts			Yes	Yes
USACE navigation charts			Yes	Yes
USGS Inland Waters server				
USGS data series				
Marine Minerals Program GIS				
State Repositories				
State repositories used				
Data that meet my needs are not available				
Current Operational Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Time savings			Major	Major
Cost savings/cost reduction			Major	Major
Cost avoidance			Major	Major
Increased revenues			Major	Major
Mission-driven performance improvements			Major	Major
Current Customer Service Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Value added to products or services			Major	Major

Benefits of Currently Used Elevation Data	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Improved response or timeliness			Major	Major
Improved customer experience			Major	Major
Current Societal Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Education or outreach			Moderate	Moderate
Environmental			Major	Major
Public safety, including life and property			Major	Major

Future Benefits if Elevation Data Requirements Are Met	Inland Topo			Inland Bathy			Nearshore Bathy			Offshore Bathy		
	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount
Time savings							Major	Unable to provide		Major	Unable to provide	
Time savings description							Reduced risk of ship grounding.			Reduced risk of ship grounding.		
Cost savings/cost reduction							Moderate	Unable to provide		I don't know	Unable to provide	
Cost avoidance							Major	Unable to provide		Major	Unable to provide	
Increased revenues							Major	Unable to provide		Major	Unable to provide	
Increased revenues description							Increased revenue due to more efficient ship movement due to using science and technology to enable better go/no go decision-making.			Increased revenue due to more efficient ship movement due to using science and technology to enable better go/no go decision-making.		
Mission-driven performance improvements							Major	Unable to provide		Major	Unable to provide	
Mission-driven performance improvements description							More cargo and passengers moved without delay, but delays made when appropriate, based on science and technology.			More cargo and passengers moved without delay, but delays made when appropriate, based on science and technology.		
Other operational benefits							Major	Unable to provide				
Other operational benefits description							Safer and more reliable and efficient ship movements. Reduced emissions due to less waiting.					
Future Customer Service Benefits	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount
Value added to products or services							Major	Unable to provide		Major	Unable to provide	
Value added to products or services description							Reduced risk of oil spills from groundings, and striking bridges and other overhead obstructions.			Reduced risk of oil spills from groundings, and striking bridges and other overhead obstructions.		
Improved response or timeliness							Major	Unable to provide		Major	Unable to provide	
Improved customer experience							Major	Unable to provide		Major	Unable to provide	
Societal Benefits	Benefits			Benefits			Benefits			Benefits		
Education or outreach							Minor			Minor		
Environmental							Major			Major		
Public safety, including life and property							Major			Major		

3D Derivatives Needed	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Triangulated Irregular Network (TIN)			Yes	
Contours			Yes	Yes
Hillshades			Yes	
Slope maps			Yes	
Aspect maps				
Curvature maps				
Cross sections				
Height-Above-Ground maps			Yes	Yes
Viewshed maps				
Hydrologic Flow Direction Grids				
Hydrologic Flow Accumulation Grids				
Hydrologic networks (e.g. streams, lakes)				
Hydrologic Units (Watershed Boundaries) (e.g. surface water drainage to a point)				
Building footprints				
Breaklines for road edge-of-pavement				
Rugosity/Surface Roughness			Yes	Yes

Importance of 3D Data Requirements	Response
Geographic coverage	
Vertical accuracy	
Update frequency	

American Shore and Beach Preservation Association (ASBPA)

ASBPA is dedicated to preserving, protecting and enhancing our coasts by merging science and public policy. It advocates for healthy, sustainable and resilient coastal systems to sustain four inter-connected core values provided by shores and beaches: community protection, a strong economy, ecologic health, and recreation.

ASBPA is dedicated to translating science and technical information from researchers and academics to coastal managers. It focuses on four major initiatives:

1. integrating U.S. nearshore research;
2. providing national scale beach preservation data;
3. addressing storm processes/impacts and dune management challenges; and
4. improving and quantifying coastal resilience.

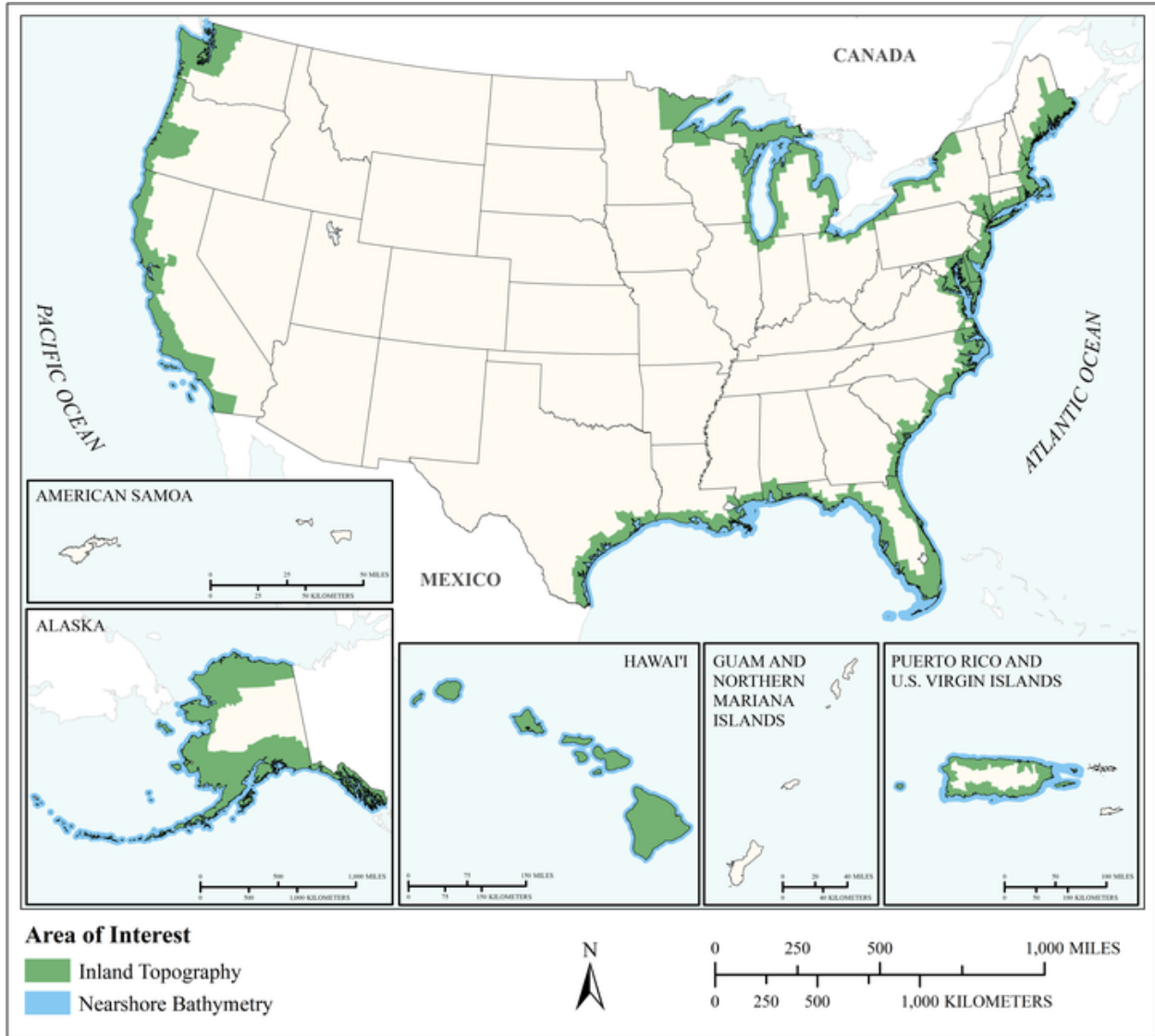
ASBPA is interested in working with NOAA to quantify the benefits of robust elevation/bathymetry data. There may be opportunities to leverage existing federal benefit calculation methodologies, for example with beach nourishment projects, and extrapolating for the topo/bathy component.

ASBPA has identified a Business Use and Mission Critical Activity that relies on topographic and bathymetric elevation data and would benefit from enhanced elevation data. Summarized details of elevation data requirements and benefits received from the enhanced elevation data are provided in the following pages.

Summary Table

MCA Description				Requirements			Future Operational Benefits	Future Customer Service Benefits	Future Societal Benefits		
Primary Business Use	Agency/ Organization Name	MCA No.	Mission Critical Activity	Data Type	QL/Order	Update Frequency	Total Reported Future Annual Operational Benefits	Total Reported Future Annual Customer Service Benefits	Education or Outreach	Environmental	Public Safety
BU 03 – Coastal Zone Management	American Shore and Beach Preservation Association	22319	Protection and Preservation of Our Nation's Coasts	Inland Topo	QL2	4-5 years	Unable to quantify	Unable to quantify	Major	I don't know	I don't know
				Nearshore Bathymetry	QL1B	Annually	Unable to quantify	Unable to quantify	Major	I don't know	I don't know

MCA Title: Protection and Preservation of Our Nation's Coasts



MCA Area of Interest	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Data Type	Required		Required	
Geographic Area Requirements	One or more states, territories, or counties		Nearshore areas along the coast off one or more states, territories, or counties (including Great Lakes states)	
Sub Area Requirements	All coastal counties of CONUS, Alaska, Hawai'i, and Puerto Rico			

MCA Description	Response
Mission Critical Activity	Advocacy for federal coastal research and infrastructure investment
MCA Title	Protection and Preservation of Our Nation's Coasts
MCA ID	22319
Organization Type	Association or Professional Organization
Organization Name	American Shore and Beach Preservation Association
Sub-Agency or Division	
Organization Mission	Preserving, protecting and enhancing our coasts by merging science and public policy
Program Name	Science & Technology
Total Annual Program Budget	
Primary Business Use	BU 03 - Coastal Zone Management
Secondary Business Use	
Tertiary Business Use	

What Needs to be Measured in 3D	Response
Bare earth ground	Required
Tops of buildings, structures, objects	Not required
Tops of vegetation	Nice to have
Tops of submerged structures, objects	Highly desirable
Tops of submerged vegetation	Highly desirable
Subcanopy of vegetation/understory	Not required
River/lake bottom	Required
Nearshore elevation (<10 m deep)	Required
Sea surface	Not required
Ocean/sea bottom (>10 m deep)	Not required

General Geographic Area and Size	
Average geographic extent of day-to-day area	Larger than 2 million sq mi (e.g. National)
Smallest 3D features needed	Large features (e.g. groups of trees, house, building, road, underwater wreck, large commercial pier, etc.)
Description of smallest 3D features	Vegetated sand dunes

Requirements	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Quality Level/IHO Order	QL2		QL1B	
Update Frequency	4-5 years		Annually	
Event type(s)				
Quality Level and/or update frequency variability across AOI				
Acceptable Horizontal Error	Up to 1 meter		Up to 2 meters	
Acceptable Vertical Error	Up to 20 cm		Up to 30 cm	
How far onshore needed			To cover the coastal uplands	
How far down the beach profile needed			Below MLLW	
Tide correction requirement			NAVD88	

Requirements	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Cross sections and/or transects meet needs			Partial	
Cross section/transect requirement			1,000 feet spacing on average, but higher spatial resolution is desired	

Hydrologic Processing Required	Response
Hydro-flattening	Nice to have
Hydro-enforcement	Nice to have
Hydro-conditioning	Nice to have
No Treatment	Not required

Seamlessness Requirements	Within Inland Topo Data	Within Inland Bathy Data	Within Nearshore Data	Within Offshore Data	Between Inland Topo and Inland Bathy	Between Topo, Topobathy, and/or Bathy
Importance of Seamlessness						
Temporal Seamlessness						
Entire AOI in same acquisition season	Not required		Not required			Not required
Entire AOI under same environmental conditions	Highly desirable		Highly desirable			Highly desirable
Spatial Seamlessness						
Point cloud for entire AOI needs to be seamless	Not required		Not required			Not required
DEM for entire AOI needs to be seamless	Not required		Not required			Not required
Amount of acceptable vertical manipulation to achieve spatial seamlessness	I don't know		I don't know			I don't know

Importance of 3D Products	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
DSM	Nice to have		Nice to have	
DTM	Nice to have		Nice to have	
DEM	Required		Required	
Raw point cloud data	Not required		Not required	
Classified point cloud	Nice to have		Nice to have	
Edited/cube XYZ			Not required	
Full waveform	Not required		Not required	
Bathymetric Attributed Grid (BAG)			Not required	
Breaklines required for standard hydro-flattening	Nice to have			
Additional breaklines for hydro-enforcement of culverts	Nice to have			

Importance of 3D Products	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
National Vertical Datum Transformation Tool (V-Datum)			Nice to have	
Tide Predictions			Not required	
Tidal Constituent And Residual Interpolation (TCARI)			Not required	
Intensity imagery/sidescan imagery	Nice to have		Nice to have	
Ground control/ground truthing	Nice to have		Nice to have	

Importance of Integration with Other Datasets	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Hydrographic survey data			Highly desirable	
Nautical and/or navigation charts			Not required	
Acoustic imagery of the seafloor			Not required	
Aerial and/or satellite imagery	Required		Required	
Underwater videography			Not required	
Bottom texture			Not required	
Bottom type			Not required	
Submerged features			Highly desirable	
Subbottom characteristics			Highly desirable	
Geologic and seismic data	Highly desirable		Highly desirable	
Water column properties - Physical			Not required	
Water column properties - Chemical			Not required	
Water column properties - Biological			Not required	
Currents			Nice to have	
Tide/wave heights			Highly desirable	
Sea ice conditions			Nice to have	
Habitat distribution and classification			Nice to have	
Boundaries			Highly desirable	
Routes			Not required	
Offshore cadastral			Not required	
Lease areas			Nice to have	
Fixed obstructions			Nice to have	
Floating observation/navigation systems			Nice to have	
Shorelines – current, historic, change rates	Highly desirable		Highly desirable	
Land use/land cover	Nice to have		Nice to have	
Wetlands	Nice to have		Nice to have	

Importance of Integration with Other Datasets	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Estuaries			Nice to have	
Inland surface water features	Nice to have		Not required	
Bridges/culverts	Not required			
Landmark features	Not required		Not required	
Cultural resources	Nice to have		Nice to have	
Coastal and riverine structures	Required		Required	
Overhead structures			Nice to have	
Lowest Floor Elevation of Buildings	Nice to have			

Benefits of Currently Used Elevation Data	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Current dataset used	Best available		Beach nourishment monitoring data (transects), state annual monitoring data (transects), lidar data	
Where current elevation data are accessed	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
National Map	Yes			
Digital Coast	Yes		Yes	
NCEI			Yes	
Open Topography				
NOAA nautical charts				
USACE navigation charts				
USGS Inland Waters server				
USGS data series				
Marine Minerals Program GIS				
State Repositories	Yes		Yes	
State repositories used	As available		As available	
Data that meet my needs are not available				
Current Operational Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Time savings	Moderate		Moderate	
Cost savings/cost reduction	Minor		Minor	
Cost avoidance	Moderate		Moderate	
Increased revenues	None		None	

Benefits of Currently Used Elevation Data	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Mission-driven performance improvements	Minor		Minor	
Current Customer Service Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Value added to products or services	Minor		Minor	
Improved response or timeliness	None		None	
Improved customer experience	Moderate		Moderate	
Current Societal Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Education or outreach	Major		Major	
Environmental	None		None	
Public safety, including life and property	None		None	

Future Benefits if Elevation Data Requirements Are Met	Inland Topo			Inland Bathy			Nearshore Bathy			Offshore Bathy		
	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount
Time savings	I don't know	Unable to provide					I don't know	Unable to provide				
Cost savings/cost reduction	I don't know	Unable to provide					I don't know	Unable to provide				
Cost avoidance	I don't know	Unable to provide					I don't know	Unable to provide				
Increased revenues	I don't know	Unable to provide					I don't know	Unable to provide				
Mission-driven performance improvements	I don't know	Unable to provide					I don't know	Unable to provide				
Future Customer Service Benefits	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount
Value added to products or services	Major	Unable to provide					Major	Unable to provide				
Improved response or timeliness	Major	Unable to provide					Major	Unable to provide				
Improved customer experience	Major	Unable to provide					Major	Unable to provide				
Societal Benefits	Benefits			Benefits			Benefits			Benefits		
Education or outreach	Major						Major					
Environmental	I don't know						I don't know					
Public safety, including life and property	I don't know						I don't know					

3D Derivatives Needed	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Triangulated Irregular Network (TIN)				
Contours				
Hillshades				
Slope maps				
Aspect maps				
Curvature maps				
Cross sections				
Height-Above-Ground maps				
Viewshed maps				
Hydrologic Flow Direction Grids				
Hydrologic Flow Accumulation Grids				
Hydrologic networks (e.g. streams, lakes)				
Hydrologic Units (Watershed Boundaries) (e.g. surface water drainage to a point)				
Building footprints				
Breaklines for road edge-of-pavement				
Rugosity/Surface Roughness				

Importance of 3D Data Requirements	Response
Geographic coverage	2
Vertical accuracy	1
Update frequency	3

Appalachian Mountain Club

Founded in 1876, the Appalachian Mountain Club promotes the protection, enjoyment, and understanding of the mountains, forests, waters, and trails of America's Northeast and Mid-Atlantic regions. We believe these resources have intrinsic worth and also provide recreational opportunities, spiritual renewal, and ecological and economic health for the region. Because successful conservation depends on active engagement with the outdoors, we encourage people to experience, learn about, and appreciate the natural world.

Elevation data are primarily used for:

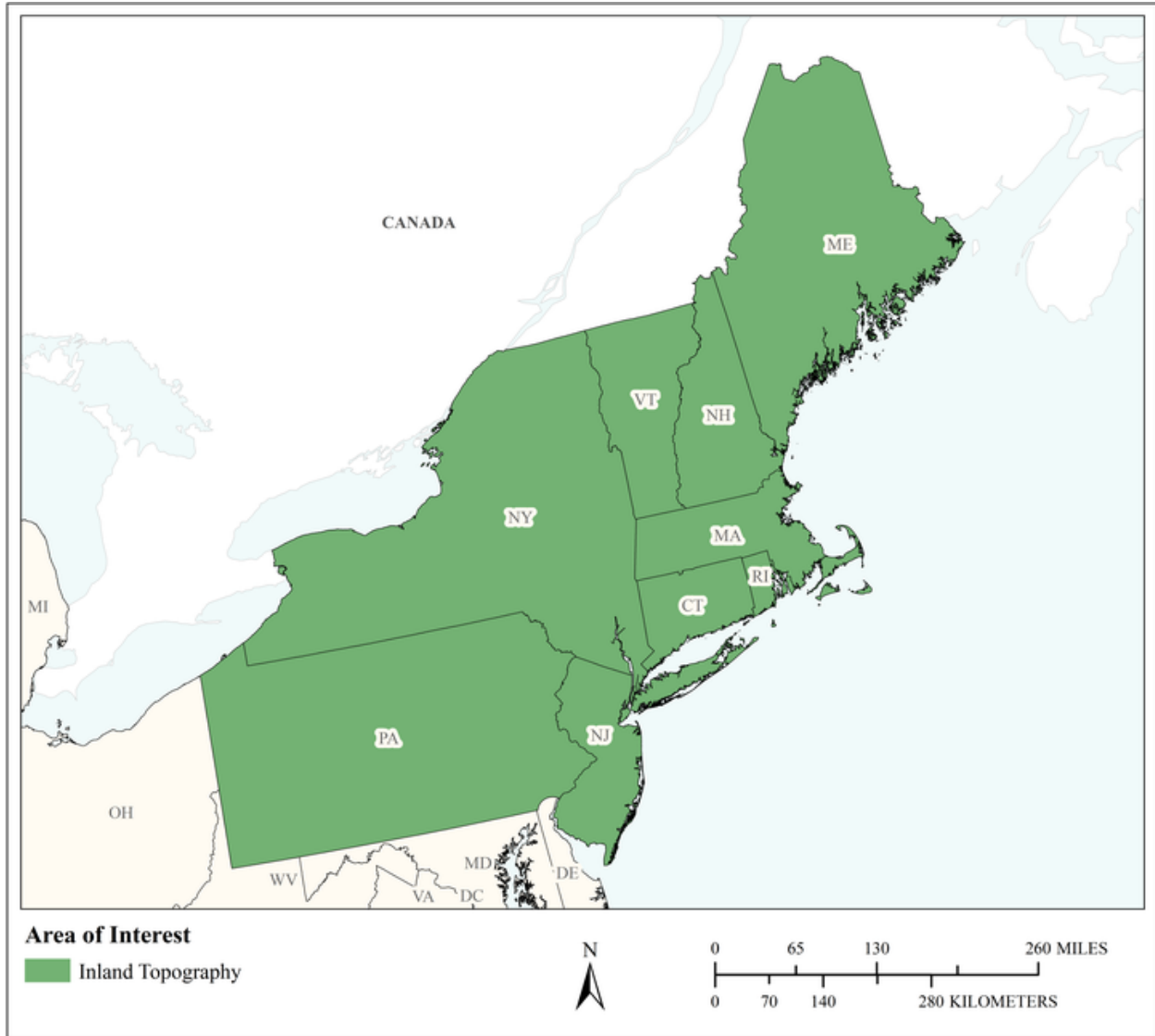
1. Forest health assessment, determination of standing inventory of forest resources, analysis of carbon stocks for trade, and harvest systems planning.
2. Alpine mapping, modeling of biological and ecological systems including carbon stocks, and assessing ecological/conservation components for land protection including viewshed analysis.
3. Recreation planning and development, facilities, maps and guides, and trail planning.
4. Analysis of wind energy potential and turbine placement including viewshed analysis.

The Appalachian Mountain Club has identified a Business Use and Mission Critical Activity that relies on elevation data and would benefit from enhanced elevation data. Summarized details of elevation data requirements and benefits received from the enhanced elevation data are provided in the following pages.

Summary Table

MCA Description				Requirements			Future Operational Benefits	Future Customer Service Benefits	Future Societal Benefits		
Primary Business Use	Agency/ Organization Name	MCA No.	Mission Critical Activity	Data Type	QL/Order	Update Frequency	Total Reported Future Annual Operational Benefits	Total Reported Future Annual Customer Service Benefits	Education or Outreach	Environmental	Public Safety
BU 04 – Forest Resource Management	Appalachian Mountain Club	22350	Protection, Enjoyment, and Understanding the Mountains, Forests, Waters, and Trails of America's Northeast and Mid-Atlantic Regions	Inland Topo	(a) QL0 (b) QL2	4-5 years	Unable to quantify	Unable to quantify	Moderate	Major	None

MCA Title: Protection, Enjoyment, and Understanding the Mountains, Forests, Waters, and Trails of America's Northeast and Mid-Atlantic Regions



MCA Area of Interest	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Data Type	Required			
Geographic Area Requirements	Area split by varying quality level or update frequency			
Sub Area Requirements	Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont			

MCA Description	Response
Mission Critical Activity	1. Forest health assessment. Determination of standing inventory of forest resources. Analysis of carbon stocks for trade. Harvest systems planning. 2. Alpine mapping, Modeling of biological and ecological systems including carbon stocks, Assessing ecological/conservation components for land protection including viewshed analysis. 3. Recreation planning and development; facilities; maps and guides; trail planning. 4. Analysis of wind energy potential and turbine placement including viewshed analysis.
MCA Title	Protection, Enjoyment, and Understanding the Mountains, Forests, Waters, and Trails of America's Northeast and Mid-Atlantic Regions
MCA ID	22350
Organization Type	Academic or Not-for-Profit
Organization Name	Appalachian Mountain Club
Sub-Agency or Division	
Organization Mission	Founded in 1876, the Appalachian Mountain Club promotes the protection, enjoyment, and understanding of the mountains, forests, waters, and trails of America's Northeast and Mid-Atlantic regions. We believe these resources have intrinsic worth and also provide recreational opportunities, spiritual renewal, and ecological and economic health for the region. Because successful conservation depends on active engagement with the outdoors, we encourage people to experience, learn about, and appreciate the natural world.
Program Name	Conservation Department
Total Annual Program Budget	
Primary Business Use	BU 04 - Forest Resources Management
Secondary Business Use	BU 06 - Natural Resources Conservation
Tertiary Business Use	BU 27 - Recreation

What Needs to be Measured in 3D	Response
Bare earth ground	Required
Tops of buildings, structures, objects	Required
Tops of vegetation	Required
Tops of submerged structures, objects	Not required
Tops of submerged vegetation	Not required
Subcanopy of vegetation/understory	Required
River/lake bottom	Not required
Nearshore elevation (<10 m deep)	Not required
Sea surface	Not required
Ocean/sea bottom (>10 m deep)	Not required

General Geographic Area and Size	
Average geographic extent of day-to-day area	Less than 1 sq mi (e.g. plot, acre, small study area)
Smallest 3D features needed	Survey-level features (e.g. sign, curb, road line, mailbox, rock, etc.
Description of smallest 3D features	Alpine plants and grasses

Requirements	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Quality Level/IHO Order	(a) QL0 (b) QL2			
Update Frequency	4-5 years			
Event type(s)				

Requirements	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Quality Level and/or update frequency variability across AOI	QL0 data needed for Alpine areas in ME and NH and QL2 for the remainder of our study area, each updated every 4 to 5 years.			
Acceptable Horizontal Error	The best horizontal accuracy achievable for the vertical accuracy I need			
Acceptable Vertical Error	Up to 20 cm			
How far onshore needed				
How far down the beach profile needed	Not applicable			
Tide correction requirement				
Cross sections and/or transects meet needs				
Cross section/transect requirement				

Hydrologic Processing Required	Response
Hydro-flattening	Not required
Hydro-enforcement	Not required
Hydro-conditioning	Not required
No Treatment	Not required

Seamlessness Requirements	Within Inland Topo Data	Within Inland Bathy Data	Within Nearshore Data	Within Offshore Data	Between Inland Topo and Inland Bathy	Between Topo, Topobathy, and/or Bathy
Importance of Seamlessness						
Temporal Seamlessness						
Entire AOI in same acquisition season	Required					
Entire AOI under same environmental conditions	Required					
Other	Required					
Other description	Individual states needed in same acquisition season					
Spatial Seamlessness						
Point cloud for entire AOI needs to be seamless	Required					
DEM for entire AOI needs to be seamless	Required					
Amount of acceptable vertical manipulation to achieve spatial seamlessness	Up to the required Total Vertical Uncertainty (TVU) at the 95% confidence level					

Importance of 3D Products	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
DSM	Required			
DTM	Required			
DEM	Required			
Raw point cloud data	Not required			
Classified point cloud	Highly desirable			
Edited/cube XYZ				
Full waveform	Not required			
Bathymetric Attributed Grid (BAG)				

Importance of 3D Products	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Breaklines required for standard hydro-flattening	Not required			
Additional breaklines for hydro-enforcement of culverts	Not required			
National Vertical Datum Transformation Tool (V-Datum)				
Tide Predictions				
Tidal Constituent And Residual Interpolation (TCARI)				
Intensity imagery/sidescan imagery	Not required			
Ground control/ground truthing	Not required			

Importance of Integration with Other Datasets	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Hydrographic survey data				
Nautical and/or navigation charts				
Acoustic imagery of the seafloor				
Aerial and/or satellite imagery	Required			
Underwater videography				
Bottom texture				
Bottom type				
Submerged features				
Subbottom characteristics				
Geologic and seismic data	Not required			
Water column properties - Physical				
Water column properties - Chemical				
Water column properties - Biological				
Currents				
Tide/wave heights				
Sea ice conditions				
Habitat distribution and classification				
Boundaries				
Routes				
Offshore cadastral				
Lease areas				
Fixed obstructions				
Floating observation/navigation systems				

Importance of Integration with Other Datasets	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Shorelines – current, historic, change rates	Not required			
Land use/land cover	Required			
Wetlands	Required			
Estuaries				
Inland surface water features	Required			
Bridges/culverts	Required			
Landmark features	Required			
Cultural resources	Highly desirable			
Coastal and riverine structures	Not required			
Overhead structures				
Lowest Floor Elevation of Buildings	Not required			

Benefits of Currently Used Elevation Data	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Current dataset used	- 1, 10 and 30 meter DEM - 2008 & 2016 Classified point cloud data used to develop DSM			
Where current elevation data are accessed	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
National Map	Yes			
Digital Coast				
NCEI	Yes			
Open Topography				
NOAA nautical charts				
USACE navigation charts				
USGS Inland Waters server				
USGS data series				
Marine Minerals Program GIS				
State Repositories	Yes			
State repositories used	Maine, Massachusetts, New Hampshire, Vermont, Pennsylvania and New Jersey			

Benefits of Currently Used Elevation Data	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Other	Yes			
Other description	NRCS Geospatial Data Gateway			
Data that meet my needs are not available				
Current Operational Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Time savings	Moderate			
Cost savings/cost reduction	None			
Cost avoidance	None			
Increased revenues	Moderate			
Mission-driven performance improvements	Major			
Current Customer Service Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Value added to products or services	Moderate			
Improved response or timeliness	None			
Improved customer experience	Moderate			
Current Societal Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Education or outreach	Moderate			
Environmental	Major			
Public safety, including life and property	None			

Future Benefits if Elevation Data Requirements Are Met	Inland Topo			Inland Bathy			Nearshore Bathy			Offshore Bathy		
	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount
Time savings	Major	Unable to provide										
Time savings description	Availability of DSM would be major time saver.											
Cost savings/cost reduction	None											
Cost avoidance	Moderate	Unable to provide										
Increased revenues	Minor	Unable to provide										
Mission-driven performance improvements	Moderate	Unable to provide										
Future Customer Service Benefits	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount
Value added to products or services	Moderate	Unable to provide										
Improved response or timeliness	Moderate	Unable to provide										
Improved customer experience	Major	Unable to provide										
Societal Benefits	Benefits			Benefits			Benefits			Benefits		
Education or outreach	Moderate											
Education or outreach description	Improved maps and education materials											
Environmental	Major											
Environmental description	Higher quality analysis especially in mapping alpine vegetation and viewshed analysis											
Public safety, including life and property	None											

3D Derivatives Needed	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Triangulated Irregular Network (TIN)	Yes			
Contours	Yes			
Hillshades	Yes			
Slope maps	Yes			
Aspect maps	Yes			
Curvature maps				
Cross sections	Yes			
Height-Above-Ground maps	Yes			
Viewshed maps	Yes			
Hydrologic Flow Direction Grids	Yes			
Hydrologic Flow Accumulation Grids	Yes			
Hydrologic networks (e.g. streams, lakes)	Yes			
Hydrologic Units (Watershed Boundaries) (e.g. surface water drainage to a point)	Yes			
Building footprints	Yes			
Breaklines for road edge-of-pavement				
Rugosity/Surface Roughness				

Importance of 3D Data Requirements	Response
Geographic coverage	2
Vertical accuracy	3
Update frequency	1

Chesapeake Conservancy

Chesapeake Conservancy is a non-profit organization comprised of conservation entrepreneurs who believe that the Chesapeake is a national treasure that should be accessible for everyone and a place where wildlife can thrive. It uses technology to enhance the pace and quality of conservation and helps build parks, trails, and public access sites.

As principal partner for the National Park Service on the Chesapeake Bay Gateways Network and the Captain John Smith Chesapeake National Historic Trail, Chesapeake Conservancy has helped create 153 new public access sites and permanently protected some of the Bay's special places like Werowocomoco, Blackwater National Wildlife Refuge, Harriet Tubman Underground Railroad National Historical Park, and Fort Monroe National Monument.

The Chesapeake Conservancy works in close partnership with the National Park Service, the U.S. Environmental Protection Agency's Chesapeake Bay Program, the U.S. Fish and Wildlife Service, as well as other federal, state, and local agencies, private foundations, and corporations to advance conservation.

The mission of the Chesapeake Conservancy is to conserve and restore the natural and cultural resources of the Chesapeake Bay watershed for the enjoyment, education, and inspiration of this and future generations.

The Conservancy serves as a catalyst for change, advancing strong public and private partnerships, developing and using new technology, and empowering environmental stewardship.

Strategies:

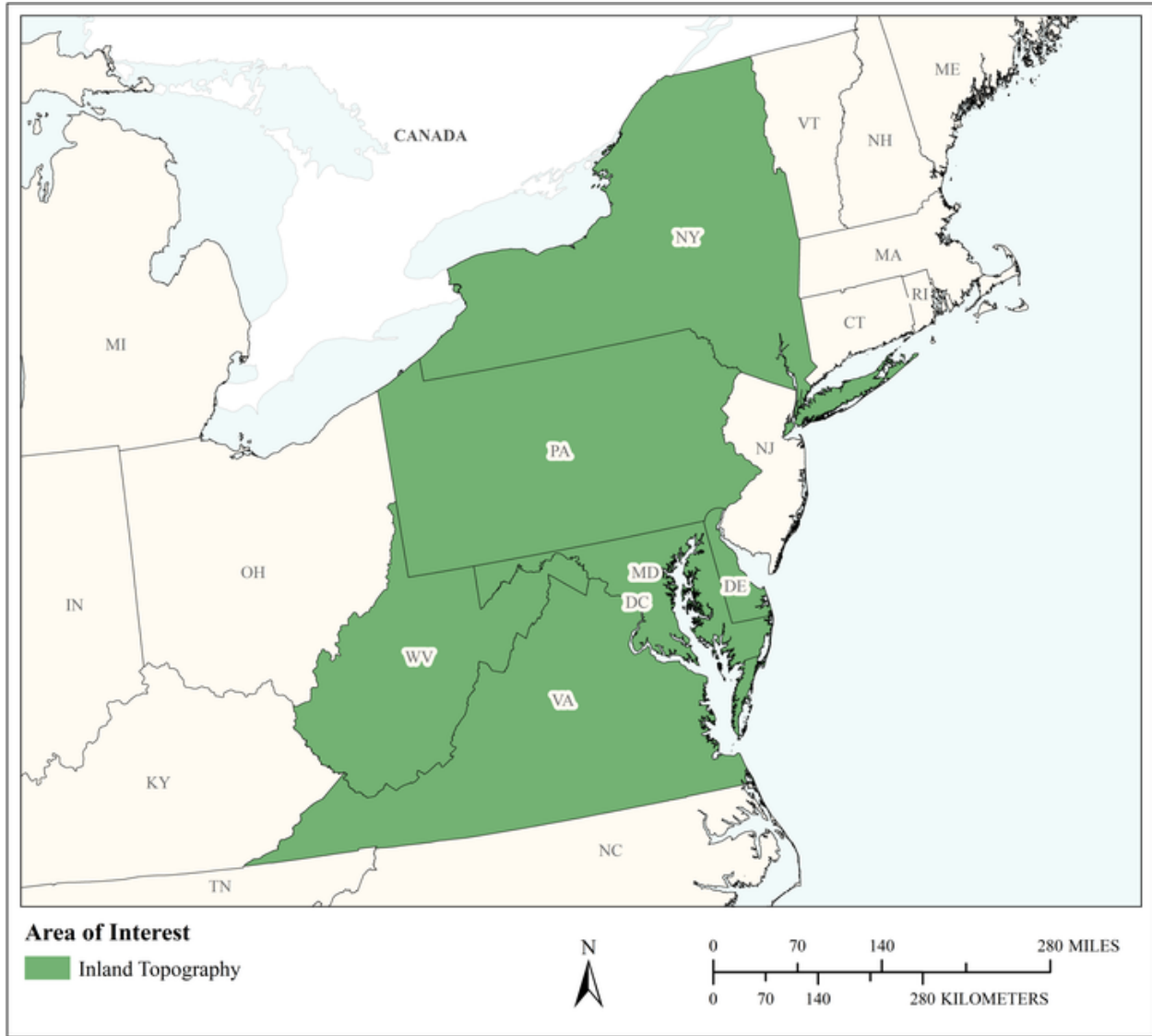
- Implement Captain John Smith Chesapeake National Historic Trail (Chesapeake Trail) and Chesapeake Bay Gateways & Watertrails Network in partnership with the National Park Service;
- Quantify the conservation movement and empower environmental stewards;
- Defend and expand conservation, recreation, and restoration programs;
- Enhance collaboration and leverage partnerships; and
- Develop replicable approaches.

The Chesapeake Conservancy has identified a Business Use and Mission Critical Activity that relies on elevation data and would benefit from enhanced elevation data. Summarized details of elevation data requirements and benefits received from the enhanced elevation data are provided in the following pages.

Summary Table

MCA Description				Requirements			Future Operational Benefits	Future Customer Service Benefits	Future Societal Benefits		
Primary Business Use	Agency/ Organization Name	MCA No.	Mission Critical Activity	Data Type	QL/Order	Update Frequency	Total Reported Future Annual Operational Benefits	Total Reported Future Annual Customer Service Benefits	Education or Outreach	Environmental	Public Safety
BU 06 – Natural Resource Management	Chesapeake Conservancy	32563	Conservation of the Chesapeake Bay Watershed	Inland Topo	QL2	2-3 years	Unable to quantify	Unable to quantify	Moderate	Major	None

MCA Title: Conservation of the Chesapeake Bay Watershed



MCA Area of Interest	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Data Type	Required			
Geographic Area Requirements	One or more states, territories, or counties			
Sub Area Requirements				

MCA Description	Response
Mission Critical Activity	Precision Conservation: land cover mapping, stream mapping, riparian assessment, BMP siting
MCA Title	Conservation of the Chesapeake Bay Watershed
MCA ID	32563
Organization Type	Academic or Not-for-Profit
Organization Name	Chesapeake Conservancy
Sub-Agency or Division	
Organization Mission	To conserve and restore the natural and cultural resources of the Chesapeake Bay watershed for the enjoyment, education, and inspiration of this and future generations. We serve as a catalyst for change, advancing strong public and private partnerships, developing and using new technology, and empowering environmental stewardship.
Program Name	
Total Annual Program Budget	
Primary Business Use	BU 06 - Natural Resources Conservation
Secondary Business Use	
Tertiary Business Use	

What Needs to be Measured in 3D	Response
Bare earth ground	Required
Tops of buildings, structures, objects	Required
Tops of vegetation	Required
Tops of submerged structures, objects	Not required
Tops of submerged vegetation	Nice to have
Subcanopy of vegetation/understory	Highly desirable
River/lake bottom	Not required
Nearshore elevation (<10 m deep)	Not required
Sea surface	Not required
Ocean/sea bottom (>10 m deep)	Not required

General Geographic Area and Size	
Average geographic extent of day-to-day area	25,000 sq mi - 74,999 sq mi (e.g. medium state or large multi-county region)
Smallest 3D features needed	Small features (e.g. individual shrub, tree, car, mooring anchor, small dock, etc.)
Description of smallest 3D features	For land cover classification: shrubs, small structures, small trees/vegetation, docks For stream mapping: small headwater channels (~1m wide), stream banks, headcuts

Requirements	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Quality Level/IHO Order	QL2			
Update Frequency	2-3 years			
Event type(s)				
Quality Level and/or update frequency variability across AOI				
Acceptable Horizontal Error	Up to 1 meter			

Requirements	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Acceptable Vertical Error	Up to 20 cm			
How far onshore needed				
How far down the beach profile needed	Not applicable			
Tide correction requirement				
Cross sections and/or transects meet needs				
Cross section/transect requirement				

Hydrologic Processing Required	Response
Hydro-flattening	Required
Hydro-enforcement	Required
Hydro-conditioning	Required
No Treatment	Not required

Seamlessness Requirements	Within Inland Topo Data	Within Inland Bathy Data	Within Nearshore Data	Within Offshore Data	Between Inland Topo and Inland Bathy	Between Topo, Topobathy, and/or Bathy
Importance of Seamlessness						
Temporal Seamlessness						
Entire AOI in same acquisition season	Nice to have					
Entire AOI under same environmental conditions	Nice to have					
Spatial Seamlessness						
Point cloud for entire AOI needs to be seamless	Required					
DEM for entire AOI needs to be seamless	Required					
Amount of acceptable vertical manipulation to achieve spatial seamlessness	Whatever it takes to achieve seamlessness, including changes to the older, previously accepted dataset if it is proven to be less accurate than the newer					

Importance of 3D Products	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
DSM	Required			
DTM	Required			
DEM	Required			
Raw point cloud data	Nice to have			
Classified point cloud	Highly desirable			
Edited/cube XYZ				
Full waveform	Not required			
Bathymetric Attributed Grid (BAG)				

Importance of 3D Products	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Breaklines required for standard hydro-flattening	Highly desirable			
Additional breaklines for hydro-enforcement of culverts	Highly desirable			
National Vertical Datum Transformation Tool (V-Datum)				
Tide Predictions				
Tidal Constituent And Residual Interpolation (TCARI)				
Intensity imagery/sidescan imagery	Highly desirable			
Ground control/ground truthing	Nice to have			

Importance of Integration with Other Datasets	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Hydrographic survey data				
Nautical and/or navigation charts				
Acoustic imagery of the seafloor				
Aerial and/or satellite imagery	Required			
Underwater videography				
Bottom texture				
Bottom type				
Submerged features				
Subbottom characteristics				
Geologic and seismic data	Nice to have			
Water column properties - Physical				
Water column properties - Chemical				
Water column properties - Biological				
Currents				
Tide/wave heights				
Sea ice conditions				
Habitat distribution and classification				
Boundaries				
Routes				
Offshore cadastral				
Lease areas				
Fixed obstructions				
Floating observation/navigation systems				

Importance of Integration with Other Datasets	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Shorelines – current, historic, change rates	Nice to have			
Land use/land cover	Required			
Wetlands	Required			
Estuaries				
Inland surface water features	Required			
Bridges/culverts	Required			
Landmark features	Nice to have			
Cultural resources	Nice to have			
Coastal and riverine structures	Nice to have			
Overhead structures				
Lowest Floor Elevation of Buildings	Not required			

Benefits of Currently Used Elevation Data	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Current dataset used	<p>Currently using best-available elevation data. Ranges from QL1 - QL3 lidar. If a good quality DEM is publicly available for areas of interest, we typically will use it. However, the DEMs that are publicly available for some areas are not suitable for our needs (i.e. may be a TIN surface, or have poor quality interpolation) in which case we will attempt to acquire classified LAS for the area and create elevation products (DEM, DSM) we need using interpolation that better suits our purpose.</p>			

Benefits of Currently Used Elevation Data	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Where current elevation data are accessed	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
National Map	Yes			
Digital Coast	Yes			
NCEI				
Open Topography				
NOAA nautical charts				
USACE navigation charts				
USGS Inland Waters server				
USGS data series				
Marine Minerals Program GIS				
State Repositories	Yes			
State repositories used	PASDA, MD IMAP, NY GIS Clearinghouse, Opendata DC, others as applicable			
Data that meet my needs are not available				
Current Operational Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Time savings	Moderate			
Cost savings/cost reduction	Moderate			
Cost avoidance	Moderate			
Increased revenues	Moderate			
Mission-driven performance improvements	Moderate			
Current Customer Service Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Value added to products or services	Moderate			
Improved response or timeliness	Moderate			
Improved customer experience	Moderate			
Current Societal Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Education or outreach	Moderate			
Environmental	Moderate			
Public safety, including life and property	Moderate			

Future Benefits if Elevation Data Requirements Are Met	Inland Topo			Inland Bathy			Nearshore Bathy			Offshore Bathy		
	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount
Time savings	Major	Unable to provide										
Cost savings/cost reduction	Moderate	Unable to provide										
Cost avoidance	Major	Unable to provide										
Increased revenues	Moderate	Unable to provide										
Mission-driven performance improvements	Major	Unable to provide										
Future Customer Service Benefits	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount
Value added to products or services	Major	Unable to provide										
Improved response or timeliness	Major	Unable to provide										
Improved customer experience	Major	Unable to provide										
Societal Benefits	Benefits			Benefits			Benefits			Benefits		
Education or outreach	Moderate											
Environmental	Major											
Public safety, including life and property	None											

3D Derivatives Needed	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Triangulated Irregular Network (TIN)				
Contours				
Hillshades	Yes			
Slope maps	Yes			
Aspect maps	Yes			
Curvature maps	Yes			
Cross sections	Yes			
Height-Above-Ground maps	Yes			
Viewshed maps	Yes			
Hydrologic Flow Direction Grids	Yes			
Hydrologic Flow Accumulation Grids	Yes			
Hydrologic networks (e.g. streams, lakes)	Yes			
Hydrologic Units (Watershed Boundaries) (e.g. surface water drainage to a point)	Yes			
Building footprints	Yes			
Breaklines for road edge-of-pavement	Yes			
Rugosity/Surface Roughness	Yes			

Importance of 3D Data Requirements	Response
Geographic coverage	3
Vertical accuracy	2
Update frequency	1

Lake Carriers' Association (LCA)

LCA was founded in 1880. As such, it is one of the oldest active trade associations in the country. LCA represents U.S.-flag vessel operators on the Great Lakes. To facilitate a broad-based understanding of U.S.-flag shipping on the Great Lakes and its role in the nation's economy, LCA compiles statistical information on the volume of cargo movement, both in U.S.-flag lakes and from major Great Lakes ports in the United States and Canada.

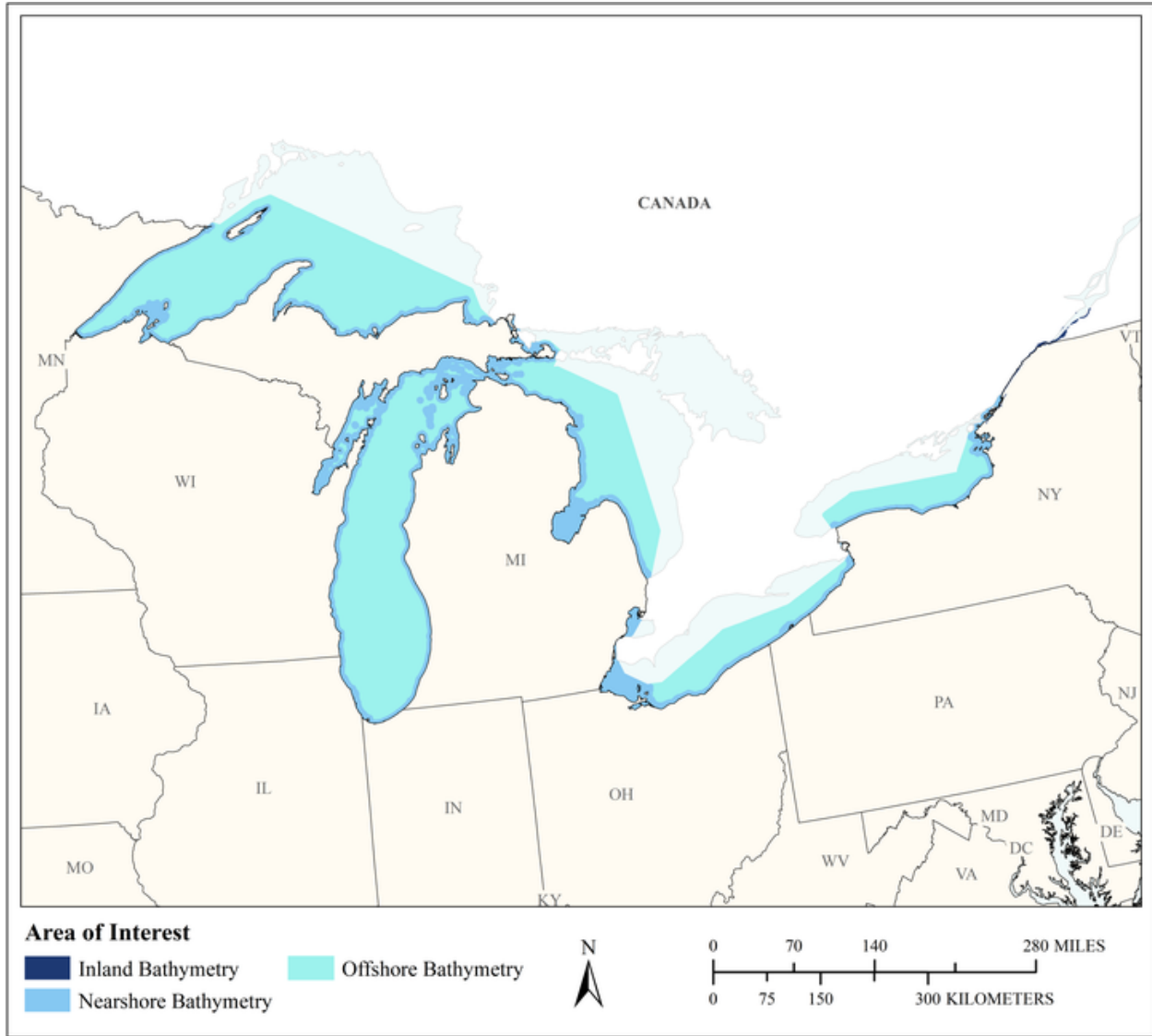
LCA promotes the common interests of its members, with special emphasis on legislative and regulatory matters. In all that it does, LCA strives to maximize the efficiencies of waterborne commerce on the Great Lakes in a manner that respects the environment and the natural treasure these freshwater seas represent.

LCA has identified a Business Use and Mission Critical Activity that relies on bathymetric elevation data and would benefit from enhanced elevation data. Summarized details of elevation data requirements and benefits received from the enhanced elevation data are provided in the following pages.

Summary Table

MCA Description				Requirements			Future Operational Benefits	Future Customer Service Benefits	Future Societal Benefits		
Primary Business Use	Agency/ Organization Name	MCA No.	Mission Critical Activity	Data Type	QL/Order	Update Frequency	Total Reported Future Annual Operational Benefits	Total Reported Future Annual Customer Service Benefits	Education or Outreach	Environmental	Public Safety
BU 20 – Marine and Riverine Navigation	Lake Carriers' Association	32570	Great Lakes Shipping	Inland Bathy	QL0B	Annually	Unable to quantify	Unable to quantify	Moderate	Moderate	Major
				Nearshore Bathy	QL0B	Annually	Unable to quantify	Unable to quantify	Moderate	Moderate	Major
				Offshore Bathy	Order 1a	As driven by fluctuating water levels and dredging of channels	Unable to quantify	Unable to quantify	Moderate	Moderate	Major

MCA Title: Great Lakes Shipping



MCA Area of Interest	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Data Type		Required	Required	Required
Geographic Area Requirements		Custom description	Custom description	Custom description
Sub Area Requirements		St. Lawrence River	Great Lakes	Great Lakes

MCA Description	Response
Mission Critical Activity	Movement by vessels over water of dry bulk materials throughout the Great Lakes and connecting channels.
MCA Title	Great Lakes Shipping
MCA ID	32570
Organization Type	Association or Professional Organization
Organization Name	Lake Carriers' Association
Sub-Agency or Division	
Organization Mission	Lake Carriers' Association (LCA) represents U.S.-flag vessel operators on the Great Lakes. LCA promotes the common interests of its members and their customers, LCA places special importance on legislative and regulatory matters. To facilitate a broad-based understanding of U.S.-flag shipping on the Great Lakes and its role in the nation's economy, LCA compiles statistical information on the volume of cargo movement, both in U.S.-flag lakes and from major Great Lakes ports in the United States and Canada.
Program Name	Nautical charting. Bathymetric measurements of near-shore submerged coastal topography. Identification of hazards to navigation. Sediment management at coastal navigation projects. Precision marine navigation. Movement of goods throughout the Great Lakes and connecting channels.
Total Annual Program Budget	
Primary Business Use	BU 20 - Marine and Riverine Navigation and Safety
Secondary Business Use	
Tertiary Business Use	

What Needs to be Measured in 3D	Response
Bare earth ground	Not required
Tops of buildings, structures, objects	Not required
Tops of vegetation	Not required
Tops of submerged structures, objects	Required
Tops of submerged vegetation	Not required
Subcanopy of vegetation/understory	Not required
River/lake bottom	Required
Nearshore elevation (<10 m deep)	Required
Sea surface	Required
Ocean/sea bottom (>10 m deep)	Required

General Geographic Area and Size	
Average geographic extent of day-to-day area	75,000 sq mi - 199,999 sq mi (e.g. large state or medium multi-state region)
Smallest 3D features needed	Small features (e.g. individual shrub, tree, car, mooring anchor, small dock, etc.)
Description of smallest 3D features	Privately owned river-based dock, breakwater, submerged hazard.

Inland Bathy Feature Size Requirements	Response
Navigable channels (as defined by USACE)	Required
Rivers and Streams	
Less than 10 ft	Not required
10 - 50 ft	Not required
51 - 100 ft	Not required

Inland Bathymetry Feature Size Requirements	Response
101 - 500 ft	Not required
501 - 2,500 ft	Not required
Greater than 2,500 ft	Not required
Waterbodies (Reservoirs, lakes, ponds)	
Less than ½ acre	Not required
½ - 1 acre	Not required
1.1 – 2 acres	Not required
2.1 – 5 acres	Not required
5.1 – 10 acres	Not required
Greater than 10 acres	Not required

Requirements	Inland Topo	Inland Bathymetry	Nearshore Bathymetry	Offshore Bathymetry
Quality Level/IHO Order		QL0B	QL0B	Order 1a
Update Frequency		Annually	Annually	As driven by fluctuating water levels and dredging of channels
Event type(s)				
Quality Level and/or update frequency variability across AOI				Priorities are connecting channels of the Great Lakes, ports, docks, and their approaches.
Acceptable Horizontal Error		The best horizontal accuracy achievable for the vertical accuracy I need	The best horizontal accuracy achievable for the vertical accuracy I need	The best horizontal accuracy achievable for the vertical accuracy I need
Acceptable Vertical Error		Up to 40 cm	Up to 30 cm	Less than 1 meter
How far onshore needed			None	
How far down the beach profile needed			Below MLLW	
Tide correction requirement			Low water datum on the Great Lakes.	Low water datum on the Great Lakes.
Cross sections and/or transects meet needs				
Cross section/transect requirement				

Seamlessness Requirements	Within Inland Topo Data	Within Inland Bathy Data	Within Nearshore Data	Within Offshore Data	Between Inland Topo and Inland Bathy	Between Topo, Topobathy, and/or Bathy
Importance of Seamlessness						
Temporal Seamlessness						
Entire AOI in same acquisition season		Nice to have	Nice to have	Nice to have		Nice to have
Entire AOI under same environmental conditions		Nice to have	Nice to have	Nice to have		Nice to have
Spatial Seamlessness						
Point cloud for entire AOI needs to be seamless		Highly desirable	Highly desirable	Highly desirable		Highly desirable
DEM for entire AOI needs to be seamless		Required	Required	Required		Required
Amount of acceptable vertical manipulation to achieve spatial seamlessness		I don't know	I don't know	I don't know		I don't know

Importance of 3D Products	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
DSM		Nice to have	Nice to have	Nice to have
DTM		Nice to have	Nice to have	Nice to have
DEM		Required	Required	Required
Raw point cloud data		Not required	Not required	Not required
Classified point cloud		Nice to have	Nice to have	
Edited/cube XYZ		Not required	Not required	Not required
Full waveform		Not required	Not required	Not required
Bathymetric Attributed Grid (BAG)		Highly desirable	Highly desirable	Highly desirable
Breaklines required for standard hydro-flattening		Not required		
Additional breaklines for hydro-enforcement of culverts				

Importance of 3D Products	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
National Vertical Datum Transformation Tool (V-Datum)			Nice to have	Nice to have
Tide Predictions			Not required	Not required
Tidal Constituent And Residual Interpolation (TCARI)			Not required	Not required
Intensity imagery/sidescan imagery		Nice to have	Nice to have	Nice to have
Ground control/ground truthing		Highly desirable	Highly desirable	Highly desirable

Importance of Integration with Other Datasets	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Hydrographic survey data			Required	Required
Nautical and/or navigation charts			Required	Required
Acoustic imagery of the seafloor			Nice to have	Nice to have
Aerial and/or satellite imagery		Highly desirable	Highly desirable	Highly desirable
Underwater videography			Not required	Not required
Bottom texture			Nice to have	Nice to have
Bottom type			Highly desirable	Highly desirable
Submerged features			Required	Required
Subbottom characteristics			Not required	Not required
Geologic and seismic data		Nice to have	Nice to have	Nice to have
Water column properties - Physical			Not required	Not required
Water column properties - Chemical			Not required	Not required
Water column properties - Biological			Not required	Not required
Currents			Required	Required
Tide/wave heights			Required	Required
Sea ice conditions			Required	Required
Habitat distribution and classification			Not required	Not required
Boundaries			Required	Required
Routes			Required	Required
Offshore cadastral			Nice to have	Nice to have
Lease areas			Highly desirable	Highly desirable
Fixed obstructions			Required	Required
Floating observation/navigation systems			Required	Required
Shorelines – current, historic, change rates		Highly desirable	Highly desirable	
Land use/land cover		Not required	Not required	Not required
Wetlands		Not required	Not required	Not required

Importance of Integration with Other Datasets	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Estuaries			Not required	Not required
Inland surface water features		Not required	Not required	
Bridges/culverts		Nice to have		
Landmark features		Highly desirable	Highly desirable	
Cultural resources		Not required	Nice to have	
Coastal and riverine structures		Highly desirable	Highly desirable	
Overhead structures			Required	
Lowest Floor Elevation of Buildings				

Benefits of Currently Used Elevation Data	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Current dataset used		Use NOAA charts for the Great Lakes, Army Corps data for connecting channels, and depth finders for real time monitoring.	Use NOAA charts for the Great Lakes, Army Corps data for connecting channels, and depth finders for real time monitoring.	Use NOAA charts for the Great Lakes, Army Corps data for connecting channels, and depth finders for real time monitoring.
Where current elevation data are accessed	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
National Map				
Digital Coast				
NCEI				
Open Topography				
NOAA nautical charts		Yes	Yes	Yes
USACE navigation charts		Yes	Yes	Yes
USGS Inland Waters server				
USGS data series				
Marine Minerals Program GIS				
State Repositories				
State repositories used				
Data that meet my needs are not available				
Current Operational Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Time savings		I don't know	I don't know	I don't know
Cost savings/cost reduction		I don't know	I don't know	I don't know
Cost avoidance		I don't know	I don't know	I don't know
Increased revenues		I don't know	I don't know	I don't know

Benefits of Currently Used Elevation Data	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Mission-driven performance improvements		I don't know	I don't know	I don't know
Current Customer Service Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Value added to products or services		I don't know	I don't know	I don't know
Improved response or timeliness		I don't know	I don't know	I don't know
Improved customer experience		I don't know	I don't know	I don't know
Current Societal Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Education or outreach		Moderate	Moderate	Moderate
Environmental		Moderate	Moderate	Moderate
Public safety, including life and property		Major	Major	Major

Future Benefits if Elevation Data Requirements Are Met	Inland Topo			Inland Bathy			Nearshore Bathy			Offshore Bathy		
	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount
Time savings				I don't know	Unable to provide		I don't know	Unable to provide		I don't know	Unable to provide	
Cost savings/cost reduction				I don't know	Unable to provide		I don't know	Unable to provide		I don't know	Unable to provide	
Cost avoidance				I don't know	Unable to provide		I don't know	Unable to provide		I don't know	Unable to provide	
Increased revenues				I don't know	Unable to provide		I don't know	Unable to provide		I don't know	Unable to provide	
Mission-driven performance improvements				I don't know	Unable to provide		I don't know	Unable to provide		I don't know	Unable to provide	
Future Customer Service Benefits	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount
Value added to products or services				I don't know	Unable to provide		I don't know	Unable to provide		I don't know	Unable to provide	
Improved response or timeliness				I don't know	Unable to provide		I don't know	Unable to provide		I don't know	Unable to provide	
Improved customer experience				I don't know	Unable to provide		I don't know	Unable to provide		I don't know	Unable to provide	
Societal Benefits	Benefits			Benefits			Benefits			Benefits		
Education or outreach				Moderate			Moderate			Moderate		
Education or outreach description										Data helps to explain system and benefits of shipping on the Great Lakes.		
Environmental				Moderate			Moderate			Moderate		
Environmental description										Data is a component of environmental picture for shipping on the Great Lakes.		
Public safety, including life and property				Major			Major			Major		
Public safety, including life and property description										Paramount for safety of mariners and vessels.		
Other				Navigational efficiencies			Navigational efficiencies			Navigational efficiencies		
Other benefits				Major			Major			Major		
Other description				Identifying safety of route, efficiency of course selection			Identifying safety of route, efficiency of course selection			Identifying safety of route, efficiency of course selection		

3D Derivatives Needed	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Triangulated Irregular Network (TIN)				
Contours		Yes	Yes	Yes
Hillshades				
Slope maps				
Aspect maps				
Curvature maps				
Cross sections				
Height-Above-Ground maps				
Viewshed maps				
Hydrologic Flow Direction Grids		Yes	Yes	Yes
Hydrologic Flow Accumulation Grids				
Hydrologic networks (e.g. streams, lakes)		Yes	Yes	Yes
Hydrologic Units (Watershed Boundaries) (e.g. surface water drainage to a point)				
Building footprints				
Breaklines for road edge-of-pavement				
Rugosity/Surface Roughness				

Importance of 3D Data Requirements	Response
Geographic coverage	3
Vertical accuracy	1
Update frequency	2

National Tribal Geographic Information Support Center (NTGISC)

NTGISC is a non-profit organization with the objective to provide assistance to Native American tribal governments and Native American organizations regarding geographic information technology. NTGISC brings together an organized environment for novice and advanced tribal GIS users. It strives to enable others to share their success in GIS as this may help another community or program. NTGISC addresses the challenges of utilizing GIS as a tool within the tribal governments, and it assists those responsible for making critical decisions about the stewardship of their lands, resources, and health and well-being of their people. The specific goal of this organization is to bring awareness to all aspects of implementing and maintaining a successful GIS program by establishing “The Best Practices and Standards for Geographic Information Systems within Indian Country.”

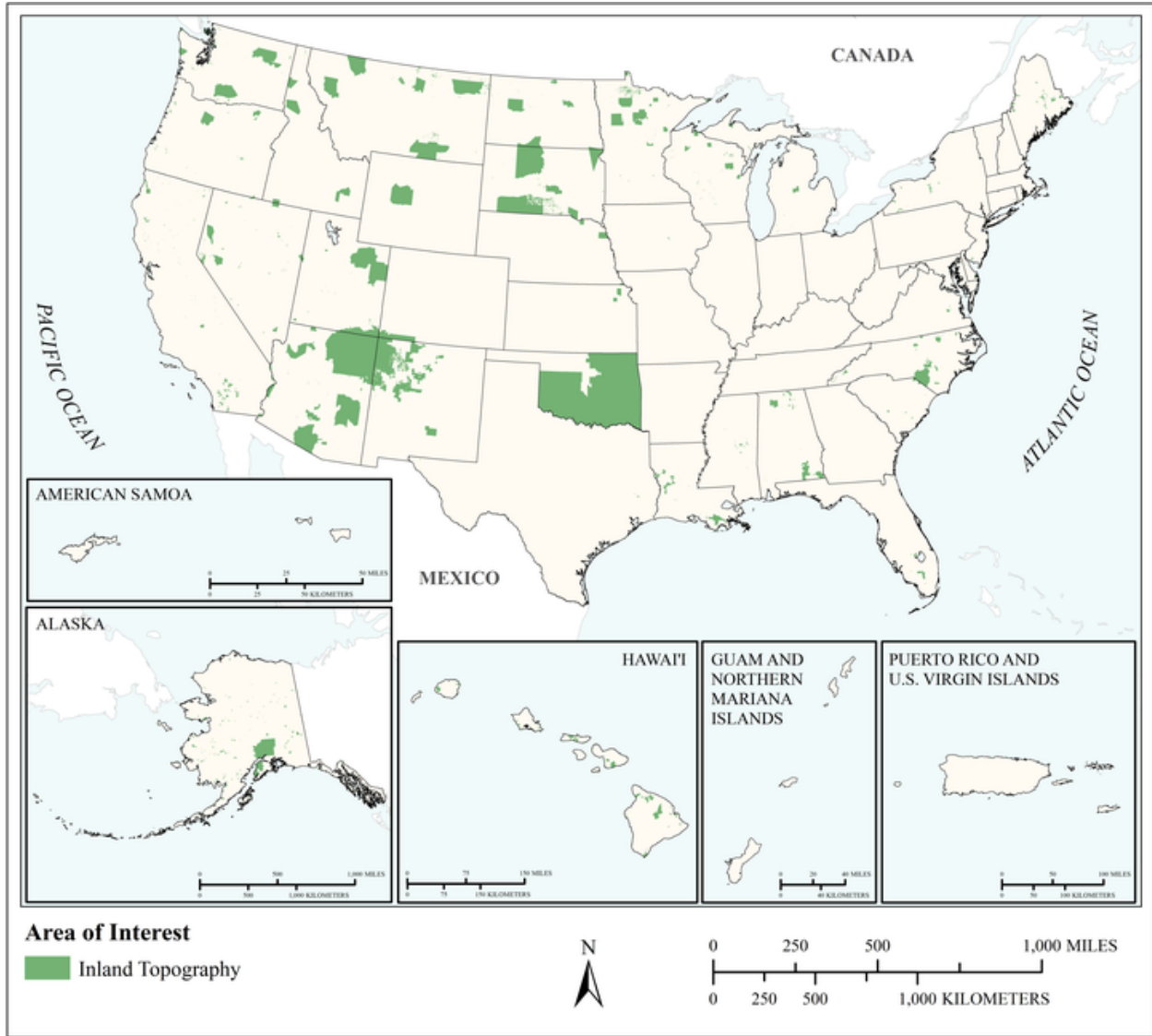
NTGISC has many members representing coastal tribes analyzing environmental impacts and identifying archaeological and cultural sites in the nearshore that would benefit from enhanced topographic and bathymetric data.

NTGISC has identified a Business Use and Mission Critical Activity that relies on elevation data and would benefit from enhanced elevation data. Summarized details of elevation data requirements and benefits received from the enhanced elevation data are provided in the following pages.

Summary Table

MCA Description				Requirements			Future Operational Benefits	Future Customer Service Benefits	Future Societal Benefits		
Primary Business Use	Agency/ Organization Name	MCA No.	Mission Critical Activity	Data Type	QL/Order	Update Frequency	Total Reported Future Annual Operational Benefits	Total Reported Future Annual Customer Service Benefits	Education or Outreach	Environmental	Public Safety
BU 15 – Flood Risk Management	National Tribal Geographic Information Support Center	22416	GIS Support for Tribal Organizations	Inland Topo	(a) QL0 HD (b) QL2	(a) 2-3 years (b) 6-10 years	Unable to quantify	Unable to quantify	Moderate	Moderate	Moderate

MCA Title: GIS Support for Tribal Organizations



MCA Area of Interest	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Data Type	Required			
Geographic Area Requirements	Area split by varying quality level or update frequency			
Sub Area Requirements	Tribal lands			

MCA Description	Response
Mission Critical Activity	Effective management and planning for Tribal Governments
MCA Title	GIS Support for Tribal Organizations
MCA ID	22416
Organization Type	Association or Professional Organization
Organization Name	National Tribal Geographic Information Support Center
Sub-Agency or Division	
Organization Mission	The National Tribal Geographic Information Support Center (NTGISC), also known as Tribal GIS®, is a non-profit organization with an objective to provide assistance to Native American tribal governments and Native American organizations regarding geographic information technology. Tribal GIS® brings together an organized environment for novice and advanced tribal GIS users. It strives to enable others to share their success in GIS as this may help another community or program. This organization addresses the challenges of utilizing GIS as a tool within the tribal governments; which assists in making critical decisions for those responsible for the stewardship of their lands, resources, health and well-being of their people. The specific goal of this organization is to bring awareness to all aspects of implementing and maintaining a successful GIS program by establishing “The Best Practices and Standards for Geographic Information Systems within Indian Country.”
Program Name	GIS departments within Tribal Governments
Total Annual Program Budget	
Primary Business Use	BU 15 - Flood Risk Management
Secondary Business Use	BU 14 - Cultural Resources Preservation and Management
Tertiary Business Use	BU 22 - Infrastructure and Construction Management

What Needs to be Measured in 3D	Response
Bare earth ground	Required
Tops of buildings, structures, objects	Highly desirable
Tops of vegetation	Nice to have
Tops of submerged structures, objects	Nice to have
Tops of submerged vegetation	Not required
Subcanopy of vegetation/understory	Nice to have
River/lake bottom	Nice to have
Nearshore elevation (<10 m deep)	Highly desirable
Sea surface	Not required
Ocean/sea bottom (>10 m deep)	Not required

General Geographic Area and Size	
Average geographic extent of day-to-day area	1,000 sq mi - 24,999 sq mi (e.g. large county, small state, intrastate region [e.g. a multi-county region such as the San Francisco Bay Area, Tri-County Council, etc.])
Smallest 3D features needed	Survey-level features (e.g. sign, curb, road line, mailbox, rock, etc.
Description of smallest 3D features	Curbing, drainage, and cultural resources

Requirements	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Quality Level/IHO Order	(a) QL0 HD (b) QL2			
Update Frequency	(a) 2-3 years (b) 6-10 years			

Requirements	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Event type(s)				
Quality Level and/or update frequency variability across AOI	QL0 for populated areas updated every 2-3 years. QL2 updated every 6-10 years for unpopulated areas			
Acceptable Horizontal Error	Up to 30 cm			
Acceptable Vertical Error	Up to 10 cm			
How far onshore needed				
How far down the beach profile needed	To MLLW			
Tide correction requirement				
Cross sections and/or transects meet needs				
Cross section/transect requirement				

Hydrologic Processing Required	Response
Hydro-flattening	Highly desirable
Hydro-enforcement	Not required
Hydro-conditioning	Not required
No Treatment	Not required

Seamlessness Requirements	Within Inland Topo Data	Within Inland Bathy Data	Within Nearshore Data	Within Offshore Data	Between Inland Topo and Inland Bathy	Between Topo, Topobathy, and/or Bathy
Importance of Seamlessness						
Temporal Seamlessness						
Entire AOI in same acquisition season	Nice to have					
Entire AOI under same environmental conditions	Required					
Spatial Seamlessness						
Point cloud for entire AOI needs to be seamless	Highly desirable					
DEM for entire AOI needs to be seamless	Highly desirable					
Amount of acceptable vertical manipulation to achieve spatial seamlessness	Up to the required Total Vertical Uncertainty (TVU) at the 95% confidence level					

Importance of 3D Products	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
DSM	Highly desirable			
DTM	Highly desirable			
DEM	Required			
Raw point cloud data	Highly desirable			
Classified point cloud	Highly desirable			
Edited/cube XYZ				
Full waveform	Not required			
Bathymetric Attributed Grid (BAG)				
Breaklines required for standard hydro-flattening	Nice to have			
Additional breaklines for hydro-enforcement of culverts	Nice to have			

Importance of 3D Products	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
National Vertical Datum Transformation Tool (V-Datum)				
Tide Predictions				
Tidal Constituent And Residual Interpolation (TCARI)				
Intensity imagery/sidescan imagery	Nice to have			
Ground control/ground truthing	Nice to have			

Importance of Integration with Other Datasets	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Hydrographic survey data				
Nautical and/or navigation charts				
Acoustic imagery of the seafloor				
Aerial and/or satellite imagery	Highly desirable			
Underwater videography				
Bottom texture				
Bottom type				
Submerged features				
Subbottom characteristics				
Geologic and seismic data	Nice to have			
Water column properties - Physical				
Water column properties - Chemical				
Water column properties - Biological				
Currents				
Tide/wave heights				
Sea ice conditions				
Habitat distribution and classification				
Boundaries				
Routes				
Offshore cadastral				
Lease areas				
Fixed obstructions				
Floating observation/navigation systems				
Shorelines – current, historic, change rates	Highly desirable			
Land use/land cover	Highly desirable			
Wetlands	Highly desirable			

Importance of Integration with Other Datasets	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Estuaries				
Inland surface water features	Highly desirable			
Bridges/culverts	Highly desirable			
Landmark features	Highly desirable			
Cultural resources	Highly desirable			
Coastal and riverine structures	Nice to have			
Overhead structures				
Lowest Floor Elevation of Buildings	Nice to have			

Benefits of Currently Used Elevation Data	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Current dataset used	Varies across Tribal Governments			
Where current elevation data are accessed	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
National Map				
Digital Coast				
NCEI				
Open Topography				
NOAA nautical charts				
USACE navigation charts				
USGS Inland Waters server				
USGS data series				
Marine Minerals Program GIS				
State Repositories				
State repositories used				
Other	Yes			
Other description	NRCS Data gateway			
Data that meet my needs are not available				
Current Operational Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Time savings	Minor			
Cost savings/cost reduction	Minor			
Cost avoidance	Moderate			
Increased revenues	I don't know			

Benefits of Currently Used Elevation Data	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Mission-driven performance improvements	Minor			
Current Customer Service Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Value added to products or services	Moderate			
Improved response or timeliness	Minor			
Improved customer experience	Minor			
Current Societal Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Education or outreach	Moderate			
Environmental	Moderate			
Public safety, including life and property	Moderate			

Future Benefits if Elevation Data Requirements Are Met	Inland Topo			Inland Bathy			Nearshore Bathy			Offshore Bathy		
	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount
Time savings	Major	Unable to provide										
Time savings description	Hard to calculate across all Tribal Governments but would be substantial. Hard to calculate across all Tribal Governments.											
Cost savings/cost reduction	Major	Unable to provide										
Cost savings/cost reduction description	Hard to calculate across all Tribal Governments but would be substantial. Hard to calculate across all Tribal Governments.											
Cost avoidance	Major	Unable to provide										
Cost avoidance description	Hard to calculate across all Tribal Governments but would be substantial.											
Increased revenues	Moderate	Unable to provide										
Increased revenues description	Hard to calculate across all Tribal Governments but would be substantial.											
Mission-driven performance improvements	Major	Unable to provide										
Mission-driven performance improvements description	Hard to calculate across all Tribal Governments.											
Future Customer Service Benefits	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount
Value added to products or services	Major	Unable to provide										
Value added to products or services description	Hard to calculate across all Tribal Governments but would be substantial. Hard to calculate across all Tribal Governments.											
Improved response or timeliness	Major	Unable to provide										
Improved response or timeliness description	Hard to calculate across all Tribal Governments but would be substantial. Hard to calculate across all Tribal Governments.											
Improved customer experience	Major	Unable to provide										
Improved customer experience description	Hard to calculate across all Tribal Governments but would be substantial. Hard to calculate across all Tribal Governments.											
Societal Benefits	Benefits			Benefits			Benefits			Benefits		
Education or outreach	Moderate											
Education or outreach description	Hard to calculate across all Tribal Governments											
Environmental	Moderate											
Environmental description	Hard to calculate across all Tribal Governments											
Public safety, including life and property	Moderate											
Public safety, including life and property description	Hard to calculate across all Tribal Governments											

3D Derivatives Needed	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Triangulated Irregular Network (TIN)	Yes			
Contours	Yes			
Hillshades	Yes			
Slope maps				
Aspect maps				
Curvature maps				
Cross sections	Yes			
Height-Above-Ground maps				
Viewshed maps				
Hydrologic Flow Direction Grids	Yes			
Hydrologic Flow Accumulation Grids				
Hydrologic networks (e.g. streams, lakes)	Yes			
Hydrologic Units (Watershed Boundaries) (e.g. surface water drainage to a point)	Yes			
Building footprints	Yes			
Breaklines for road edge-of-pavement	Yes			
Rugosity/Surface Roughness				

Importance of 3D Data Requirements	Response
Geographic coverage	1
Vertical accuracy	2
Update frequency	3

New England Fishery Management Council (NEFMC)

NEFMC, one of eight regional councils established by the Magnuson-Stevens Fishery Conservation and Management Act (MSA) in 1976, is charged with conserving and managing fishery resources from three to 200 miles off the coasts of Maine, New Hampshire, Massachusetts, Rhode Island, and Connecticut. The management authority of the NEFMC extends to the Gulf of Maine, Georges Bank, and southern New England, and overlaps with the Mid-Atlantic Council for some species in that region. Major ports include Portland, ME, Gloucester and New Bedford, MA, and Point Judith, RI.

The NEFMC:

- Develops and amends fishery management plans for approval/implementation by the National Marine Fisheries Service (NMFS) on behalf of the Secretary of Commerce;
- Sets annual catch limits and accountability measures based on the best available science;
- Develops research priorities with scientists and stakeholder/industry partners;
- Adheres to MSA's mandate and 10 National Standards, prevents overfishing, and balances resource conservation with achieving optimum yield for domestic fisheries.

The NEFMC is comprised of both Non-Voting Members which include representatives from the Coast Guard, State Department, U.S. Fish and Wildlife Service, and Interstate Commissions, and two types of Voting Members:

- Appointed Members are private citizens who are knowledgeable about the region's fisheries, such as commercial and recreational fishermen, industry leaders, environmentalists, academics, and tribal representatives. These individuals are nominated by each state's Governor and appointed by the Secretary of Commerce for three-year terms.
- Designated State/Federal Members include marine fishery management officials from each state and the NMFS regional administrator.

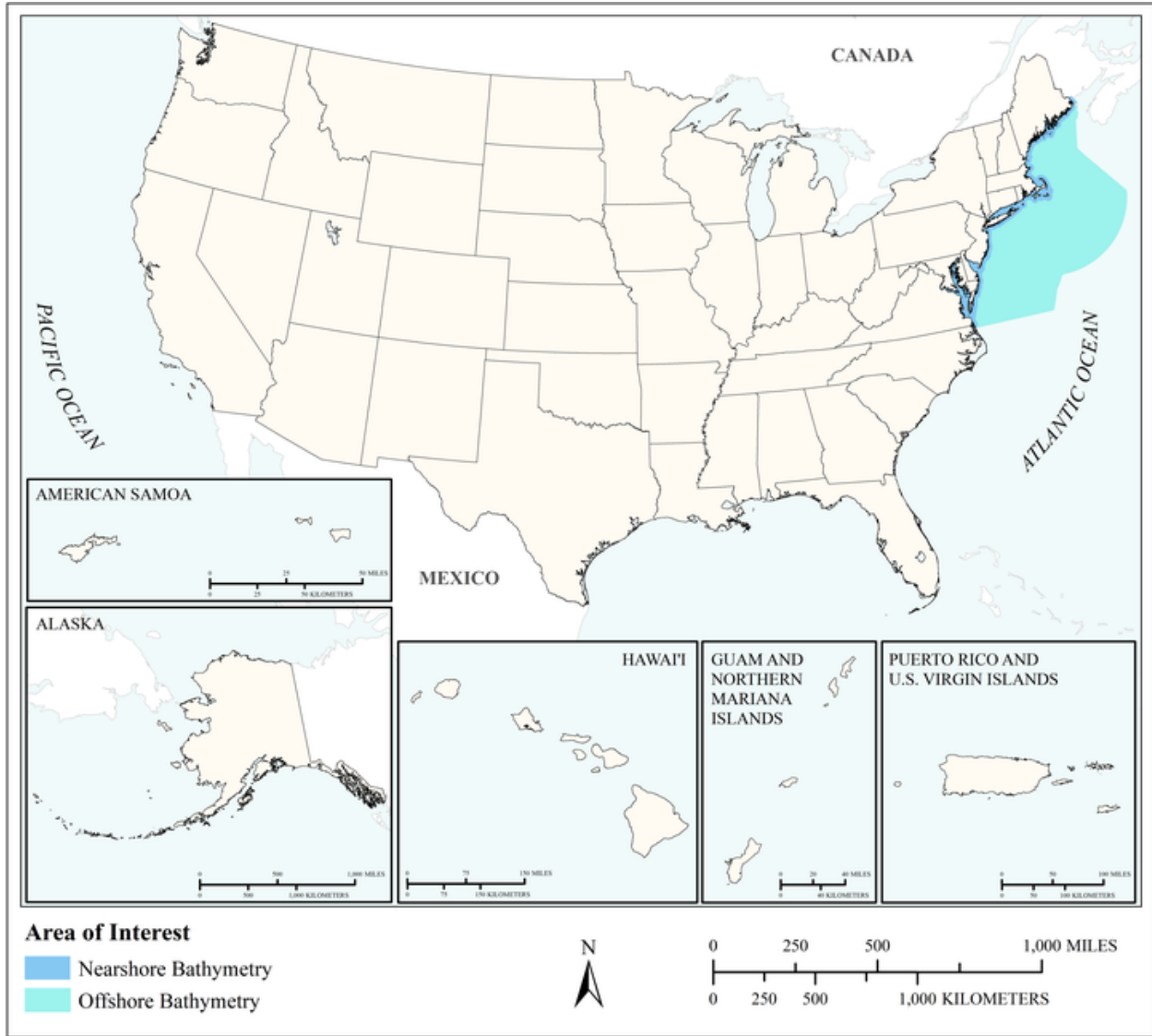
Enhanced bathymetric data would allow NEFMC to design better spatial fishery management measures, and these closures and gear restrictions in combination with many other measures should lead to better conservation of fishery stocks. Also, a clearer understanding of seafloor features might lead to more confidence in the management process. Other Councils likely use bathymetric data in similar ways and would derive similar types of benefits.

NEFMC has identified a Business Use and Mission Critical Activity that relies on bathymetric elevation data and would benefit from enhanced elevation data. Summarized details of elevation data requirements and benefits received from the enhanced elevation data are provided in the following pages.

Summary Table

MCA Description				Requirements			Future Operational Benefits	Future Customer Service Benefits	Future Societal Benefits		
Primary Business Use	Agency/ Organization Name	MCA No.	Mission Critical Activity	Data Type	QL/Order	Update Frequency	Total Reported Future Annual Operational Benefits	Total Reported Future Annual Customer Service Benefits	Education or Outreach	Environmental	Public Safety
BU 09 – Fisheries Management and Aquaculture	New England Fishery Management Council	51002	Fishery Management	Nearshore Bathy	QL1B	4-5 years	Unable to quantify	Unable to quantify	Moderate	Major	Minor
				Offshore Bathy	Special Order	6-10 years	Unable to quantify	Unable to quantify	Moderate	Major	Minor

MCA Title: Fishery Management



MCA Area of Interest	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Data Type			Required	Required
Geographic Area Requirements			Custom description	Custom description
Sub Area Requirements			Atlantic Maine to Virginia	Atlantic Maine to Virginia to the EEZ

MCA Description	Response
Mission Critical Activity	Management of fisheries. Sustainable aquaculture. Bathymetric data can be used to design improved spatial fishery management measures, and these closures and gear restrictions in combination with many other measures lead to better conservation of fishery stocks. Also, a clearer understanding of seafloor features leads to more confidence in the management process.
MCA Title	Fishery Management
MCA ID	51002
Organization Type	Academic or Not-for-Profit
Organization Name	New England Fishery Management Council
Sub-Agency or Division	
Organization Mission	
Program Name	
Total Annual Program Budget	
Primary Business Use	BU 09 - Fisheries Management and Aquaculture
Secondary Business Use	
Tertiary Business Use	

What Needs to be Measured in 3D	Response
Bare earth ground	Highly desirable
Tops of buildings, structures, objects	Not required
Tops of vegetation	Nice to have
Tops of submerged structures, objects	Highly desirable
Tops of submerged vegetation	Highly desirable
Subcanopy of vegetation/understory	Nice to have
River/lake bottom	Required
Nearshore elevation (<10 m deep)	Required
Sea surface	Nice to have
Ocean/sea bottom (>10 m deep)	Required

General Geographic Area and Size	
Average geographic extent of day-to-day area	
Smallest 3D features needed	
Description of smallest 3D features	Seafloor features used by fish for specific activities, e.g. spawning habitat

Requirements	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Quality Level/IHO Order			QL1B	Special Order
Update Frequency			4-5 years	6-10 years
Event type(s)				

Requirements	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Quality Level and/or update frequency variability across AOI				Fisheries are predominantly in Maine, New Hampshire, Massachusetts, Rhode Island, and Connecticut above 500 meters depth. Some fisheries management for sea scallops and red crab off New York, New Jersey, Delaware, Maryland, and Virginia.
Acceptable Horizontal Error			Up to 2 meters	Up to 2 meters
Acceptable Vertical Error			Up to 30 cm	Less than 1 meter
How far onshore needed				
How far down the beach profile needed				
Tide correction requirement				
Cross sections and/or transects meet needs				
Cross section/transect requirement				

Seamlessness Requirements	Within Inland Topo Data	Within Inland Bathy Data	Within Nearshore Data	Within Offshore Data	Between Inland Topo and Inland Bathy	Between Topo, Topobathy, and/or Bathy
Importance of Seamlessness						
Temporal Seamlessness						
Entire AOI in same acquisition season			Nice to have	Nice to have		Nice to have
Entire AOI under same environmental conditions			Required	Highly desirable		Nice to have
Spatial Seamlessness						
Point cloud for entire AOI needs to be seamless			Highly desirable	Highly desirable		Highly desirable
DEM for entire AOI needs to be seamless			Highly desirable	Highly desirable		Required
Amount of acceptable vertical manipulation to achieve spatial seamlessness			Up to the required Total Vertical Uncertainty (TVU) at the 95% confidence level	Up to the required Total Vertical Uncertainty (TVU) at the 95% confidence level		Up to the required Total Vertical Uncertainty (TVU) at the 95% confidence level

Importance of 3D Products	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
DSM			Highly desirable	Required
DTM			Highly desirable	Nice to have
DEM			Required	Required
Raw point cloud data			Highly desirable	Nice to have
Classified point cloud			Highly desirable	
Edited/cube XYZ			Nice to have	Nice to have
Full waveform			Nice to have	Nice to have
Bathymetric Attributed Grid (BAG)			Highly desirable	Nice to have
Breaklines required for standard hydro-flattening				
Additional breaklines for hydro-enforcement of culverts				

Importance of 3D Products	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
National Vertical Datum Transformation Tool (V-Datum)			Highly desirable	Nice to have
Tide Predictions			Not required	Nice to have
Tidal Constituent And Residual Interpolation (TCARI)			Nice to have	Nice to have
Intensity imagery/sidescan imagery			Highly desirable	Required
Ground control/ground truthing			Required	Required

Importance of Integration with Other Datasets	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Hydrographic survey data			Required	Required
Nautical and/or navigation charts			Nice to have	Highly desirable
Acoustic imagery of the seafloor			Highly desirable	Required
Aerial and/or satellite imagery			Required	Highly desirable
Underwater videography			Nice to have	Required
Bottom texture			Nice to have	Required
Bottom type			Highly desirable	Required
Submerged features			Highly desirable	Required
Subbottom characteristics			Nice to have	Highly desirable
Geologic and seismic data			Nice to have	Nice to have
Water column properties - Physical			Nice to have	Highly desirable
Water column properties - Chemical			Nice to have	Highly desirable
Water column properties - Biological			Nice to have	Highly desirable
Currents			Nice to have	Highly desirable
Tide/wave heights			Nice to have	Nice to have
Sea ice conditions			Nice to have	Nice to have
Habitat distribution and classification			Highly desirable	Highly desirable
Boundaries			Nice to have	Highly desirable
Routes			Nice to have	Nice to have
Offshore cadastral			Nice to have	Nice to have
Lease areas			Nice to have	Nice to have
Fixed obstructions			Nice to have	Required
Floating observation/navigation systems			Nice to have	Highly desirable
Shorelines – current, historic, change rates			Highly desirable	
Land use/land cover			Nice to have	Highly desirable
Wetlands			Highly desirable	Highly desirable

Importance of Integration with Other Datasets	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Estuaries			Required	Highly desirable
Inland surface water features			Nice to have	
Bridges/culverts				
Landmark features			Nice to have	
Cultural resources			Nice to have	
Coastal and riverine structures			Required	
Overhead structures			Nice to have	
Lowest Floor Elevation of Buildings				

Benefits of Currently Used Elevation Data	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Current dataset used				
Where current elevation data are accessed	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
National Map				
Digital Coast				
NCEI				
Open Topography				
NOAA nautical charts			Yes	
USACE navigation charts				
USGS Inland Waters server				
USGS data series				
Marine Minerals Program GIS				
State Repositories				
State repositories used				
Data that meet my needs are not available				
Current Operational Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Time savings			Major	Moderate
Cost savings/cost reduction			Major	Moderate
Cost avoidance			Moderate	Minor
Increased revenues			Minor	None
Mission-driven performance improvements			Major	Minor
Current Customer Service Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Value added to products or services			Major	Moderate

Benefits of Currently Used Elevation Data	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Improved response or timeliness			Major	Minor
Improved customer experience			Moderate	Minor
Current Societal Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Education or outreach			Moderate	Moderate
Environmental			Major	Moderate
Public safety, including life and property			Moderate	None

Future Benefits if Elevation Data Requirements Are Met	Inland Topo			Inland Bathy			Nearshore Bathy			Offshore Bathy		
	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount
Time savings							Major	Unable to provide		Major	Unable to provide	
Cost savings/cost reduction							Moderate	Unable to provide		Minor	Unable to provide	
Cost avoidance							Major	Unable to provide		Minor	Unable to provide	
Increased revenues							Moderate	Unable to provide		Minor	Unable to provide	
Mission-driven performance improvements							Major	Unable to provide		Major	Unable to provide	
Future Customer Service Benefits	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount
Value added to products or services							Moderate	Unable to provide		Moderate	Unable to provide	
Improved response or timeliness							Major	Unable to provide		Moderate	Unable to provide	
Improved customer experience							Major	Unable to provide		Major	Unable to provide	
Societal Benefits	Benefits			Benefits			Benefits			Benefits		
Education or outreach							Moderate			Moderate		
Environmental							Major			Major		
Public safety, including life and property							Minor			Minor		

3D Derivatives Needed	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Triangulated Irregular Network (TIN)				
Contours				
Hillshades				
Slope maps				
Aspect maps				
Curvature maps				
Cross sections				
Height-Above-Ground maps				
Viewshed maps				
Hydrologic Flow Direction Grids				
Hydrologic Flow Accumulation Grids				
Hydrologic networks (e.g. streams, lakes)				
Hydrologic Units (Watershed Boundaries) (e.g. surface water drainage to a point)				
Building footprints				
Breaklines for road edge-of-pavement				
Rugosity/Surface Roughness				

Importance of 3D Data Requirements	Response
Geographic coverage	
Vertical accuracy	
Update frequency	

The Nature Conservancy (TNC)

TNC is a global environmental nonprofit working to create a world where people and nature can thrive. Its mission is to conserve the land and waters on which all life depends. Its vision is a world where the diversity of life thrives, and people act to conserve nature for its own sake and its ability to fulfill our needs and enrich our lives. TNC prioritizes key areas to achieve its mission:

- Climate change: impact mitigation through forest restoration, clean energy investment, and habitat restoration.
- Land and water protection: clean water, land, and healthy oceans achieved through large-scale land conservation and ocean habitat restoration.
- Food and water sustainability: manage fish stocks, increase soil productivity and water quality, create water funds, and forest protection.
- Healthy cities: resilient, sustainable cities that promote green designs, integrate urban forests, and use the natural environment as the first line of defense against the effects of climate change.

Elevation data are used by TNC for forest and fisheries management, hydrographic mapping, conservation engineering, flooding analysis, restoration of critical habitats, identification of oyster reefs, and general natural resource and environmental conservation purposes.

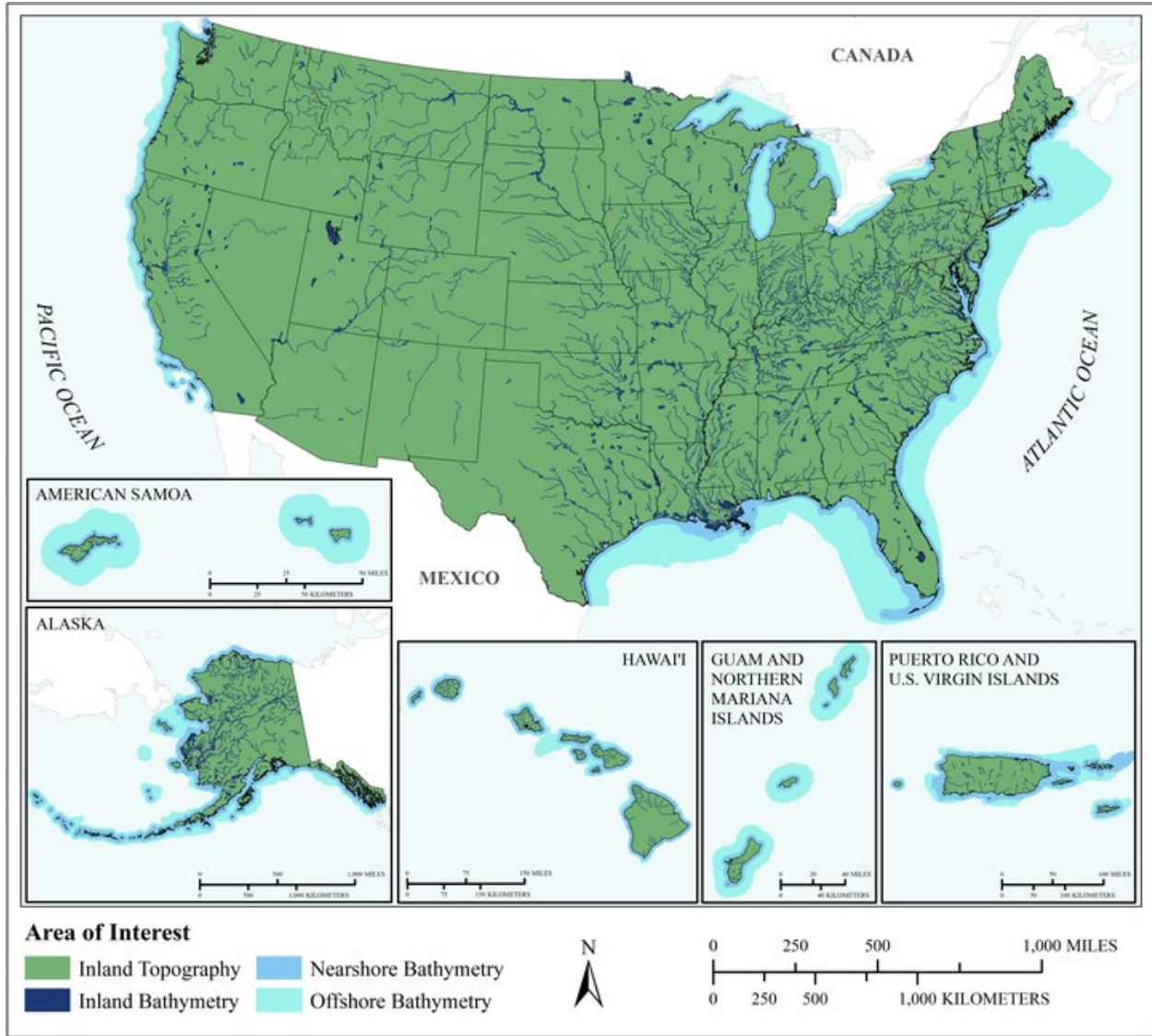
TNC managers expressed a need for Quality Level 1 HD (QL1 HD) inland topography updated every 4-5 years, QL0B inland and nearshore bathymetry updated every 2-3 years, and Order 1b offshore bathymetry updated every 6-10 years to cover the nation. If these needs were fulfilled, TNC would receive major to moderate benefits from inland topography, minor benefits from inland bathymetry, major to moderate benefits from nearshore bathymetry particularly related to oyster reef restoration, and minor benefits from offshore bathymetry.

TNC has identified a Business Use and Mission Critical Activity that relies on elevation data and would benefit from enhanced elevation data. Summarized details of elevation data requirements and benefits received from the enhanced elevation data are provided in the following pages.

Summary Table

MCA Description				Requirements			Future Operational Benefits	Future Customer Service Benefits	Future Societal Benefits		
Primary Business Use	Agency/ Organization Name	MCA No.	Mission Critical Activity	Data Type	QL/Order	Update Frequency	Total Reported Future Annual Operational Benefits	Total Reported Future Annual Customer Service Benefits	Education or Outreach	Environmental	Public Safety
BU 03 – Coastal Zone Management	The Nature Conservancy	51204	Natural Resources Conservation	Inland Topo	QL1 HD	4-5 years	\$72,360	\$135,675	Major	Major	Major
				Inland Bathy	QL0B	2-3 years	Unable to quantify	Unable to quantify	None	None	None
				Nearshore Bathy	QL0B	2-3 years	\$81,405	Unable to quantify	Moderate	Major	I don't know
				Offshore Bathy	Order 1b	6-10 years	Unable to quantify	Unable to quantify	Minor	Minor	I don't know

MCA Title: Natural Resources Conservation



MCA Area of Interest	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Data Type	Required	Required	Required	Required
Geographic Area Requirements	States and/or Territories	States and/or Territories	All study waters	Custom description
Sub Area Requirements	Areas not shown on map: U.S. Minor Outlying Islands, Federated States of Micronesia, Marshall Islands, Palau	Areas not shown on map: U.S. Minor Outlying Islands, Federated States of Micronesia, Marshall Islands, Palau		All study waters to 30m depth is highest priority, to 300m depth is 2nd priority

MCA Description	Response
Mission Critical Activity	Conservation of natural resources. Environmental stewardship. Restoration of critical habitats. Forest management. Fisheries management. Hydrographic mapping (stream channel analysis and mapping). Conservation engineering. Flooding/inundation analyses. Bathymetry is needed for identification of oyster reefs, sometimes less than 12". Additional Business Uses include BU 04 – Forest Resources Management, BU 02 - Riverine Ecosystem Management, BU 15 – Flood Risk Management, and BU 09 – Fisheries Management and Aquaculture.
MCA Title	Natural Resources Conservation
MCA ID	51204
Organization Type	Academic or Not-for-Profit
Organization Name	The Nature Conservancy
Sub-Agency or Division	
Organization Mission	To conserve the lands and waters on which all life depends.
Program Name	The Nature Conservancy
Total Annual Program Budget	
Primary Business Use	BU 03 - Coastal Zone Management
Secondary Business Use	BU 06 - Natural Resources Conservation
Tertiary Business Use	BU 07 - Wildlife and Habitat Management

What Needs to be Measured in 3D	Response
Bare earth ground	Required
Tops of buildings, structures, objects	Required
Tops of vegetation	Required
Tops of submerged structures, objects	Highly desirable
Tops of submerged vegetation	Highly desirable
Subcanopy of vegetation/understory	Highly desirable
River/lake bottom	Highly desirable
Nearshore elevation (<10 m deep)	Required
Sea surface	Required
Ocean/sea bottom (>10 m deep)	Required

General Geographic Area and Size	
Average geographic extent of day-to-day area	Less than 1 sq mi (e.g. plot, acre, small study area)
Smallest 3D features needed	Aggregated features (e.g. generalized landscapes, large areal patches of seagrass, coral reef, etc.)
Description of smallest 3D features	Patches of trees, patches of marsh, culverts, roads, buildings. Any feature resolved by 0.5 meter resolution DEM. 1 m ² oyster reef sitting on bottom of bay.

Inland Bathy Feature Size Requirements	Response
Navigable channels (as defined by USACE)	Not required
Rivers and Streams	
Less than 10 ft	Nice to have
10 - 50 ft	Nice to have
51 - 100 ft	Nice to have
101 - 500 ft	Nice to have
501 - 2,500 ft	Nice to have
Greater than 2,500 ft	Nice to have

Inland Bathy Feature Size Requirements	Response
Waterbodies (Reservoirs, lakes, ponds)	
Less than ½ acre	Nice to have
½ - 1 acre	Nice to have
1.1 – 2 acres	Nice to have
2.1 – 5 acres	Nice to have
5.1 – 10 acres	Nice to have
Greater than 10 acres	Nice to have

Requirements	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Quality Level/IHO Order	QL1 HD	Cross sections and/or transects meet needs	QL0B	Order 1b
Update Frequency	4-5 years	2-3 years	2-3 years	6-10 years
Event type(s)				
Quality Level and/or update frequency variability across AOI				
Acceptable Horizontal Error	Up to 1 meter	Up to 1 meter	The best horizontal accuracy achievable for the vertical accuracy I need	Up to 5 meters
Acceptable Vertical Error	Up to 10 cm	Up to 20 cm	Up to 20 cm	Less than 1 meter
How far onshore needed			To cover the beach slope	
How far down the beach profile needed	Below MLLW		Below MLLW	
Tide correction requirement			MHW	MLLW
Cross sections and/or transects meet needs		Yes		
Cross section/transect requirement				

Hydrologic Processing Required	Response
Hydro-flattening	Required
Hydro-enforcement	Highly desirable
Hydro-conditioning	Highly desirable
No Treatment	Not required

Seamlessness Requirements	Within Inland Topo Data	Within Inland Bathy Data	Within Nearshore Data	Within Offshore Data	Between Inland Topo and Inland Bathy	Between Topo, Topobathy, and/or Bathy
Importance of Seamlessness					Nice to have	
Temporal Seamlessness						
Entire AOI in same acquisition season	Nice to have	Nice to have	Nice to have	Not required	Nice to have	Nice to have
Entire AOI under same environmental conditions	Highly desirable	Nice to have	Highly desirable	Not required	Nice to have	Required
Spatial Seamlessness						
Point cloud for entire AOI needs to be seamless	Required	Nice to have	Nice to have	Not required	Nice to have	Not required
DEM for entire AOI needs to be seamless	Required	Nice to have	Highly desirable	Nice to have	Nice to have	Required
Amount of acceptable vertical manipulation to achieve spatial seamlessness	Whatever it takes to achieve seamlessness, including changes to the older, previously accepted dataset if it is proven to be less accurate than the newer	Whatever it takes to achieve seamlessness, including changes to the older, previously accepted dataset if it is proven to be less accurate than the newer	Whatever it takes to achieve seamlessness, including changes to the older, previously accepted dataset if it is proven to be less accurate than the newer	Whatever it takes to achieve seamlessness, including changes to the older, previously accepted dataset if it is proven to be less accurate than the newer	Whatever it takes to achieve seamlessness, including changes to the older, previously accepted dataset if it is proven to be less accurate than the newer	Whatever it takes to achieve seamlessness, including changes to the older, previously accepted dataset if it is proven to be less accurate than the newer

Importance of 3D Products	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
DSM	Required	Nice to have	Required	Not required
DTM	Highly desirable	Nice to have	Required	Not required
DEM	Required	Highly desirable	Required	Required
Raw point cloud data	Nice to have	Nice to have	Nice to have	Not required
Classified point cloud	Required	Not required	Nice to have	
Edited/cube XYZ		Not required	Nice to have	Not required
Full waveform	Nice to have	Not required	Not required	Not required
Bathymetric Attributed Grid (BAG)		Not required	Not required	Not required

Importance of 3D Products	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Breaklines required for standard hydro-flattening	Required	Nice to have		
Additional breaklines for hydro-enforcement of culverts	Required			
National Vertical Datum Transformation Tool (V-Datum)			Highly desirable	Highly desirable
Tide Predictions			Nice to have	Not required
Tidal Constituent And Residual Interpolation (TCARI)			Not required	Not required
Intensity imagery/sidescan imagery	Required	Not required	Required	Nice to have
Ground control/ground truthing	Required	Nice to have	Highly desirable	Not required

Importance of Integration with Other Datasets	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Hydrographic survey data			Highly desirable	Not required
Nautical and/or navigation charts			Nice to have	Not required
Acoustic imagery of the seafloor			Required	Not required
Aerial and/or satellite imagery	Nice to have	Nice to have	Highly desirable	Not required
Underwater videography			Highly desirable	Not required
Bottom texture			Required	Not required
Bottom type			Required	Highly desirable
Submerged features			Required	Highly desirable
Subbottom characteristics			Required	Not required
Geologic and seismic data	Not required	Not required	Not required	Not required
Water column properties - Physical			Nice to have	Nice to have
Water column properties - Chemical			Nice to have	Nice to have
Water column properties - Biological			Nice to have	Nice to have
Currents			Nice to have	Nice to have
Tide/wave heights			Nice to have	Not required
Sea ice conditions			Not required	Not required
Habitat distribution and classification			Highly desirable	Highly desirable
Boundaries			Not required	Nice to have
Routes			Not required	Not required
Offshore cadastral			Not required	Not required
Lease areas			Highly desirable	Nice to have
Fixed obstructions			Nice to have	Nice to have
Floating observation/navigation systems			Not required	Nice to have

Importance of Integration with Other Datasets	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Shorelines – current, historic, change rates	Highly desirable	Nice to have	Highly desirable	
Land use/land cover	Highly desirable	Nice to have	Nice to have	Not required
Wetlands	Highly desirable	Nice to have	Highly desirable	Not required
Estuaries			Highly desirable	Not required
Inland surface water features	Required	Nice to have	Nice to have	
Bridges/culverts	Required	Not required		
Landmark features	Highly desirable	Not required	Not required	
Cultural resources	Nice to have	Not required	Not required	
Coastal and riverine structures	Highly desirable	Nice to have	Highly desirable	
Overhead structures			Not required	
Lowest Floor Elevation of Buildings	Highly desirable			

Benefits of Currently Used Elevation Data	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Current dataset used	DEM and DSM derived from LiDAR where available and at varying quality levels and dates. NED where LiDAR is not available.	Best available data from USGS, NOAA, USACE	We have some high resolution data developed by local researchers using traditional survey methods and shallow draft boat based soundings. Otherwise we use what's publicly available from NOS, which is often very dated.	Mostly publicly available data from NOAA NCEI
Where current elevation data are accessed	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
National Map	Yes			
Digital Coast				
NCEI	Yes	Yes	Yes	Yes
Open Topography				
NOAA nautical charts				
USACE navigation charts		Yes		
USGS Inland Waters server		Yes		
USGS data series				
Marine Minerals Program GIS				

Benefits of Currently Used Elevation Data	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
State Repositories	Yes			
State repositories used	Any available state repositories			
Other			Yes	
Other description			Directly from university researchers who developed it	
Data that meet my needs are not available				
Current Operational Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Time savings	Major	Minor	Minor	None
Cost savings/cost reduction	Moderate	Minor	Minor	None
Cost avoidance	Moderate	None	Minor	None
Increased revenues	Moderate	None	None	None
Mission-driven performance improvements	Major	None	Moderate	None
Current Customer Service Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Value added to products or services	Major	None	None	None
Improved response or timeliness	Moderate	Minor	None	None
Improved customer experience	Major	None	None	None
Current Societal Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Education or outreach	Major	None	Minor	Moderate
Environmental	Major	Minor	Moderate	Moderate
Public safety, including life and property	Minor	None	None	None

Future Benefits if Elevation Data Requirements Are Met	Inland Topo			Inland Bathy			Nearshore Bathy			Offshore Bathy		
Future Operational Benefits	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount
Time savings	Major	Annual dollars saved/realized	\$72,360	None			Moderate	Annual dollars saved/realized	\$81,405	Minor	Unable to provide	
Time savings description	Simple source and download of consistent data.						Authoritative, accessible data would result in time savings in the siting, design and permitting of oyster reefs. This applies to all benefits.					
Cost savings/cost reduction	Moderate	Unable to provide		Minor	Unable to provide		Minor	Unable to provide		None		
Cost avoidance	Major	Unable to provide		Minor	Unable to provide		Minor	Unable to provide		Minor	Unable to provide	
Increased revenues	Major	Unable to provide		None			None			None		
Mission-driven performance improvements	Major	Annual percent improvement	2%	Minor	Unable to provide		Major	Unable to provide		Minor	Unable to provide	
Mission-driven performance improvements description							Ultimately, the probability of success of the oyster reef restoration would be increased by better data. Better and more efficient planning and implementation of oyster reef restoration.					
Future Customer Service Benefits	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount
Value added to products or services	Major	Annual dollars saved/realized	\$36,180	Minor	Unable to provide		Moderate	Unable to provide		None		
Value added to products or services description	Improved impact accuracy assessments.											
Improved response or timeliness	Major	Annual dollars saved/realized	\$63,315	Minor	Unable to provide		Minor	Unable to provide		None		
Improved customer experience	Moderate	Annual dollars saved/realized	\$36,180	None			Moderate	Unable to provide		None		
Societal Benefits	Benefits			Benefits			Benefits			Benefits		
Education or outreach	Major			None			Moderate			Minor		
Education or outreach description							Oyster reefs can be used as educational examples. Increased benefits to the community and volunteer opportunities.					
Environmental	Major			None			Major			Minor		
Environmental description							Healthy oyster reefs provide numerous benefits					
Public safety, including life and property	Major			None			I don't know			I don't know		
Public safety, including life and property description							Oyster reefs have the potential to buffer the shoreline					

3D Derivatives Needed	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Triangulated Irregular Network (TIN)				
Contours	Yes			
Hillshades	Yes	Yes	Yes	Yes
Slope maps	Yes			
Aspect maps	Yes			
Curvature maps				
Cross sections				
Height-Above-Ground maps				
Viewshed maps	Yes		Yes	
Hydrologic Flow Direction Grids	Yes			
Hydrologic Flow Accumulation Grids	Yes			
Hydrologic networks (e.g. streams, lakes)	Yes			
Hydrologic Units (Watershed Boundaries) (e.g. surface water drainage to a point)	Yes			
Building footprints				
Breaklines for road edge-of-pavement				
Rugosity/Surface Roughness			Yes	

Importance of 3D Data Requirements	Response
Geographic coverage	3
Vertical accuracy	2
Update frequency	1

Trout Unlimited

Founded in Michigan in 1959, Trout Unlimited is a national nonprofit organization dedicated to conserving, protecting, and restoring North America's coldwater fisheries and their watersheds. Trout Unlimited works from coast to coast, spanning nearly a million miles of cold water all across North America, to protect, reconnect, restore, and sustain trout and salmon habitat on behalf of today's anglers and coming generations of sportsmen and women who value the connection between healthy, intact habitat and angling opportunity.

Trout Unlimited has a basic approach to its conservation strategy. First, use the best available science to protect headwater spawning habitat for trout and salmon. This can be achieved by reconnecting tributaries with their rivers to ensure resilience and restoring waters where development has impacted trout and salmon and the opportunity to fish for them.

Second, Trout Unlimited sustains its work on the ground by:

- using the best science to drive conservation priorities;
- promoting and maintaining a strong legal and regulatory framework to protect fish and fishing opportunity;
- connecting with passionate anglers who want to give back to the resource they value so much;
- increasing its ability to engage its members in conservation by training, educating, and building a strong community of angler advocates;
- connecting with generous donors and helping them give to the fish they cherish and the places they love; and
- helping members connect and communicate with one another.

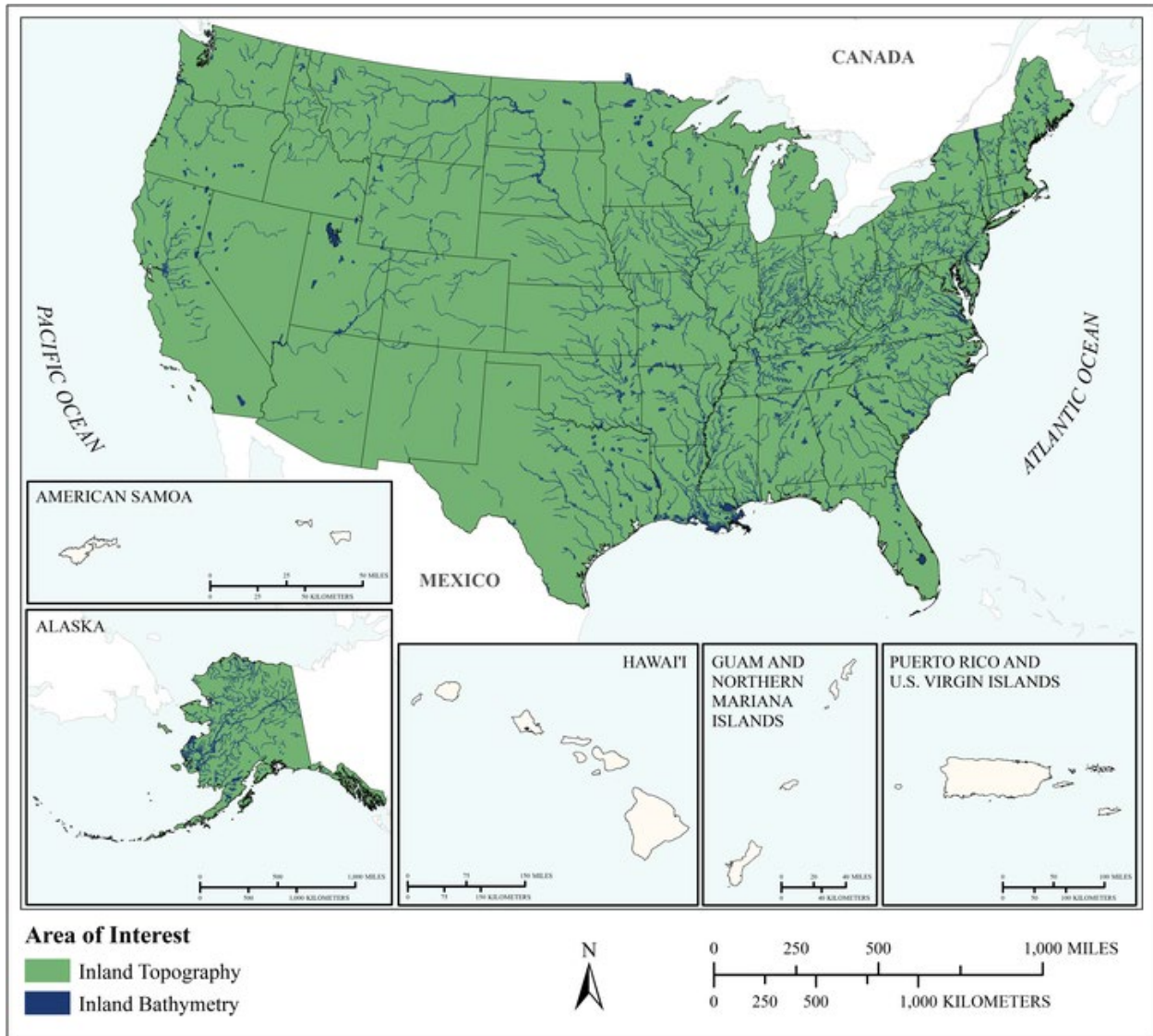
Elevation data are used by Trout Unlimited for freshwater fisheries conservation. Trout Unlimited managers expressed a need for Quality Level 1 (QL1) inland topography updated every 6-10 years, and QL1B inland bathymetry updated every 6-10 years to cover the nation. If these needs were fulfilled, Trout Unlimited would receive major to moderate benefits from inland topography and inland bathymetry.

Trout Unlimited has identified a Business Use and Mission Critical Activity that relies on elevation data and would benefit from enhanced elevation data. Summarized details of elevation data requirements and benefits received from the enhanced elevation data are provided in the following pages.

Summary Table

MCA Description				Requirements			Future Operational Benefits	Future Customer Service Benefits	Future Societal Benefits		
Primary Business Use	Agency/ Organization Name	MCA No.	Mission Critical Activity	Data Type	QL/Order	Update Frequency	Total Reported Future Annual Operational Benefits	Total Reported Future Annual Customer Service Benefits	Education or Outreach	Environmental	Public Safety
BU 02 – Riverine Ecosystem Management	Trout Unlimited	22527	Freshwater Fisheries Conservation	Inland Topo	QL1	6-10 years	\$46,798	\$56,079	Moderate	Moderate	I don't know
				Inland Bathy	QL1B	6-10 years	\$63,225	\$86,832	Major	Major	None

MCA Title: Freshwater Fisheries Conservation



MCA Area of Interest	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Data Type	Required	Required		
Geographic Area Requirements	Nationwide, inland areas	Nationwide, inland areas		
Sub Area Requirements				

MCA Description	Response
Mission Critical Activity	Freshwater fisheries conservation
MCA Title	Freshwater Fisheries Conservation
MCA ID	22527
Organization Type	Academic or Not-for-Profit
Organization Name	Trout Unlimited
Sub-Agency or Division	
Organization Mission	To conserve, protect and restore North America's coldwater fisheries and their watersheds.
Program Name	Science
Total Annual Program Budget	
Primary Business Use	BU 02 - Riverine Ecosystem Management
Secondary Business Use	BU 07 - Wildlife and Habitat Management
Tertiary Business Use	

What Needs to be Measured in 3D	Response
Bare earth ground	Required
Tops of buildings, structures, objects	Required
Tops of vegetation	Required
Tops of submerged structures, objects	Required
Tops of submerged vegetation	Required
Subcanopy of vegetation/understory	Nice to have
River/lake bottom	Required
Nearshore elevation (<10 m deep)	Not required
Sea surface	Not required
Ocean/sea bottom (>10 m deep)	Not required

General Geographic Area and Size	
Average geographic extent of day-to-day area	50 sq mi - 999 sq mi (e.g. small county or County Equivalent, District of Columbia, etc.)
Smallest 3D features needed	Small features (e.g. individual shrub, tree, car, mooring anchor, small dock, etc.)
Description of smallest 3D features	Large rocks or vegetation

Inland Bathy Feature Size Requirements	Response
Navigable channels (as defined by USACE)	Highly desirable
Rivers and Streams	
Less than 10 ft	Required
10 - 50 ft	Highly desirable
51 - 100 ft	Nice to have
101 - 500 ft	Not required
501 - 2,500 ft	Not required
Greater than 2,500 ft	Not required
Waterbodies (Reservoirs, lakes, ponds)	
Less than ½ acre	Highly desirable
½ - 1 acre	Highly desirable
1.1 – 2 acres	Highly desirable
2.1 – 5 acres	Highly desirable
5.1 – 10 acres	Highly desirable
Greater than 10 acres	Highly desirable

Requirements	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Quality Level/IHO Order	QL1	QL1B		
Update Frequency	6-10 years	6-10 years		
Event type(s)				
Quality Level and/or update frequency variability across AOI				
Acceptable Horizontal Error	Up to 50 cm	Less than 50 cm		
Acceptable Vertical Error	Up to 20 cm	Up to 30 cm		
How far onshore needed				
How far down the beach profile needed	Not applicable			
Tide correction requirement				
Cross sections and/or transects meet needs				
Cross section/transect requirement				

Hydrologic Processing Required	Response
Hydro-flattening	Required
Hydro-enforcement	Required
Hydro-conditioning	Required
No Treatment	Not required

Seamlessness Requirements	Within Inland Topo Data	Within Inland Bathy Data	Within Nearshore Data	Within Offshore Data	Between Inland Topo and Inland Bathy	Between Topo, Topobathy, and/or Bathy
Importance of Seamlessness					Highly desirable	
Temporal Seamlessness						
Entire AOI in same acquisition season	Highly desirable	Nice to have			Highly desirable	
Entire AOI under same environmental conditions	Highly desirable	Highly desirable			Highly desirable	
Spatial Seamlessness						
Point cloud for entire AOI needs to be seamless	Required	Nice to have			Nice to have	
DEM for entire AOI needs to be seamless	Required	Nice to have			Nice to have	
Amount of acceptable vertical manipulation to achieve spatial seamlessness	I don't know	I don't know			I don't know	

Importance of 3D Products	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
DSM	Highly desirable	Required		
DTM	Required	Required		
DEM	Highly desirable	Required		
Raw point cloud data	Nice to have	Not required		
Classified point cloud	Nice to have	Not required		
Edited/cube XYZ		Not required		
Full waveform	Not required	Not required		
Bathymetric Attributed Grid (BAG)		Not required		
Breaklines required for standard hydro-flattening	Highly desirable	Not required		
Additional breaklines for hydro-enforcement of culverts	Highly desirable			

Importance of 3D Products	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
National Vertical Datum Transformation Tool (V-Datum)				
Tide Predictions				
Tidal Constituent And Residual Interpolation (TCARI)				
Intensity imagery/sidescan imagery	Nice to have	Not required		
Ground control/ground truthing	Highly desirable	Not required		

Importance of Integration with Other Datasets	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Hydrographic survey data				
Nautical and/or navigation charts				
Acoustic imagery of the seafloor				
Aerial and/or satellite imagery	Required	Not required		
Underwater videography				
Bottom texture				
Bottom type				
Submerged features				
Subbottom characteristics				
Geologic and seismic data	Not required	Not required		
Water column properties - Physical				
Water column properties - Chemical				
Water column properties - Biological				
Currents				
Tide/wave heights				
Sea ice conditions				
Habitat distribution and classification				
Boundaries				
Routes				
Offshore cadastral				
Lease areas				
Fixed obstructions				
Floating observation/navigation systems				
Shorelines – current, historic, change rates	Not required	Not required		
Land use/land cover	Required	Not required		
Wetlands	Not required	Not required		

Importance of Integration with Other Datasets	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Estuaries				
Inland surface water features	Highly desirable	Not required		
Bridges/culverts	Highly desirable	Not required		
Landmark features	Not required	Not required		
Cultural resources	Not required	Not required		
Coastal and riverine structures	Not required	Not required		
Overhead structures				
Lowest Floor Elevation of Buildings	Not required			

Benefits of Currently Used Elevation Data	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Current dataset used	10m DEM (NED) and Lidar datasets where available	None		
Where current elevation data are accessed	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
National Map	Yes			
Digital Coast				
NCEI				
Open Topography	Yes			
NOAA nautical charts				
USACE navigation charts				
USGS Inland Waters server				
USGS data series				
Marine Minerals Program GIS				
State Repositories	Yes			
State repositories used	Oregon DOGAMI and others			
Data that meet my needs are not available		Yes		
Current Operational Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Time savings	Major	Inland bathy data not available		
Cost savings/cost reduction	Major	Inland bathy data not available		

Benefits of Currently Used Elevation Data	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Cost avoidance	Minor	Inland bathy data not available		
Increased revenues	None	Inland bathy data not available		
Mission-driven performance improvements	Minor	Inland bathy data not available		
Current Customer Service Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Value added to products or services	Major	Inland bathy data not available		
Improved response or timeliness	Minor	Inland bathy data not available		
Improved customer experience	Moderate	Inland bathy data not available		
Current Societal Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Education or outreach	Moderate	Inland bathy data not available		
Environmental	Moderate	Inland bathy data not available		
Public safety, including life and property	None	Inland bathy data not available		

Future Benefits if Elevation Data Requirements Are Met	Inland Topo			Inland Bathy			Nearshore Bathy			Offshore Bathy		
	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount
Time savings	Major	Annual dollars saved/realized	\$39,798	Major	Annual dollars saved/realized	\$45,225						
Cost savings/cost reduction	Minor	Annual dollars saved/realized	\$7,000	Major	Annual dollars saved/realized	\$12,000						
Cost avoidance	None			Minor	Annual dollars saved/realized	\$6,000						
Increased revenues	None			None								
Mission-driven performance improvements	Moderate	Annual percent improvement	5%	Moderate	Annual percent improvement	10%						
Future Customer Service Benefits	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount
Value added to products or services	Moderate	Annual dollars saved/realized	\$14,472	Major	Annual dollars saved/realized	\$28,944						
Improved response or timeliness	Moderate	Annual dollars saved/realized	\$21,708	Major	Annual dollars saved/realized	\$28,944						
Improved customer experience	Major	Annual dollars saved/realized	\$19,899	Major	Annual dollars saved/realized	\$28,944						
Societal Benefits	Benefits			Benefits			Benefits			Benefits		
Education or outreach	Moderate			Major								
Environmental	Moderate			Major								
Public safety, including life and property	I don't know			None								

3D Derivatives Needed	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Triangulated Irregular Network (TIN)				
Contours	Yes	Yes		
Hillshades	Yes	Yes		
Slope maps	Yes	Yes		
Aspect maps				
Curvature maps				
Cross sections	Yes	Yes		
Height-Above-Ground maps	Yes			
Viewshed maps				
Hydrologic Flow Direction Grids	Yes			
Hydrologic Flow Accumulation Grids	Yes			
Hydrologic networks (e.g. streams, lakes)	Yes			
Hydrologic Units (Watershed Boundaries) (e.g. surface water drainage to a point)	Yes			
Building footprints				
Breaklines for road edge-of-pavement				
Rugosity/Surface Roughness		Yes		

Importance of 3D Data Requirements	Response
Geographic coverage	3
Vertical accuracy	2
Update frequency	1

United States Power Squadrons (USPS)

USPS is America's largest nonprofit boating organization, with nearly 30,000 members in more than 350 squadrons. USPS is dedicated to promoting boating safety through education, civic service, and fun.

USPS provides service to the boating community through training courses (Seamanship, Piloting, Sailing, etc.) and service activities such as Vessel Safety Checks and Cooperative Charting.

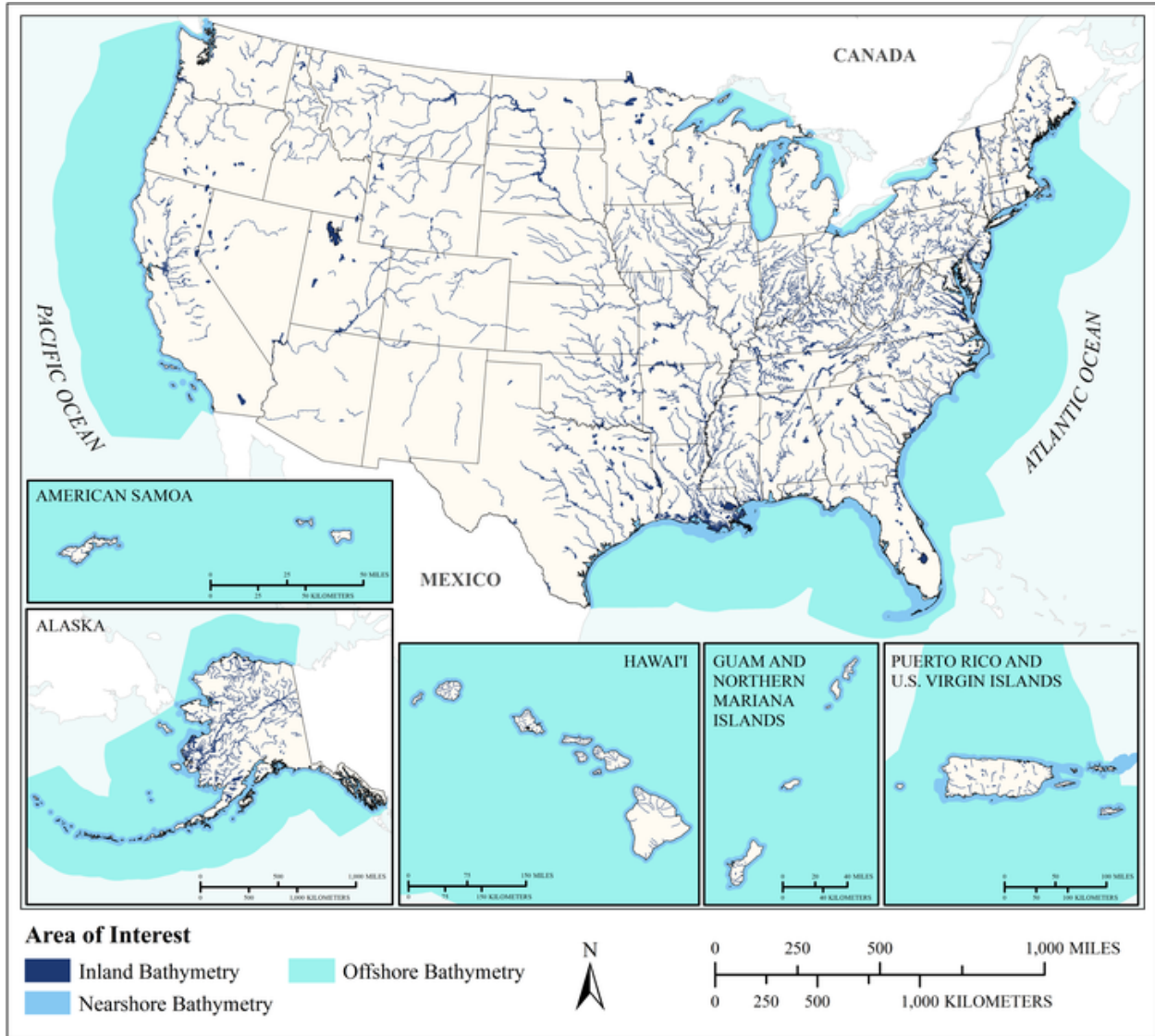
Elevation data are used for marine navigation including geodetic recovery, navigating shallow waters, and teaching navigation to new mariners.

USPS has identified Business Uses and Mission Critical Activities that rely on topographic and bathymetric elevation data and would benefit from enhanced elevation data. Summarized details of elevation data requirements and benefits received from the enhanced elevation data are provided in the following pages.

Summary Table

MCA Description				Requirements			Future Operational Benefits	Future Customer Service Benefits	Future Societal Benefits		
Primary Business Use	Agency/ Organization Name	MCA No.	Mission Critical Activity	Data Type	QL/Order	Update Frequency	Total Reported Future Annual Operational Benefits	Total Reported Future Annual Customer Service Benefits	Education or Outreach	Environmental	Public Safety
BU 20 – Marine and Riverine Navigation	United States Power Squadrons	22456	Marine Navigation	Inland Bathy	QL2B	6-10 years	Unable to quantify	Unable to quantify	None	None	Moderate
				Nearshore Bathy	QL2B	6-10 years	Unable to quantify	Unable to quantify	None	None	Moderate
				Offshore Bathy	Order 2	>10 years	Unable to quantify	Unable to quantify	None	None	Minor
BU 20 – Marine and Riverine Navigation	United States Power Squadrons	22530	Geodetic Recovery	Inland Topo	Cross sections and/or transects meet needs	6-10 years	Unable to quantify	Unable to quantify	Minor	I don't know	Minor

MCA Title: Marine Navigation



MCA Area of Interest	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Data Type		Required	Required	Required
Geographic Area Requirements		States and/or Territories	All study waters	All study waters
Sub Area Requirements		Areas not shown on map: U.S. Minor Outlying Islands, Federated States of Micronesia, Marshall Islands, Palau		

MCA Description	Response
Mission Critical Activity	Marine Navigation (BU20). Navigating in shallow waters (Galveston Bay, etc.) Teaching navigation to new mariners.
MCA Title	Marine Navigation
MCA ID	22456
Organization Type	Academic or Not-for-Profit
Organization Name	United States Power Squadrons
Sub-Agency or Division	
Organization Mission	Service to the boating community through training courses (Seamanship, Piloting, Sailing, etc.) and service activities such as Vessel Safety Checks and Cooperative Charting.
Program Name	BU 20, marine navigation. We teach marine navigation, and we navigate our vessels in shallow water and confined spaces.
Total Annual Program Budget	
Primary Business Use	BU 20 - Marine and Riverine Navigation and Safety
Secondary Business Use	
Tertiary Business Use	

What Needs to be Measured in 3D	Response
Bare earth ground	Not required
Tops of buildings, structures, objects	Nice to have
Tops of vegetation	Not required
Tops of submerged structures, objects	Required
Tops of submerged vegetation	Not required
Subcanopy of vegetation/understory	Not required
River/lake bottom	Required
Nearshore elevation (<10 m deep)	Required
Sea surface	Required
Ocean/sea bottom (>10 m deep)	Highly desirable

General Geographic Area and Size	
Average geographic extent of day-to-day area	1,000 sq mi - 24,999 sq mi (e.g. large county, small state, intrastate region [e.g. a multi-county region such as the San Francisco Bay Area, Tri-County Council, etc.])
Smallest 3D features needed	Large features (e.g. groups of trees, house, building, road, underwater wreck, large commercial pier, etc.)
Description of smallest 3D features	Wrecks, dolphins, buoys/markers.

Inland Bathy Feature Size Requirements	Response
Navigable channels (as defined by USACE)	Required
Rivers and Streams	
Less than 10 ft	Not required
10 - 50 ft	Not required
51 - 100 ft	Required
101 - 500 ft	Not required
501 - 2,500 ft	Not required
Greater than 2,500 ft	Not required
Waterbodies (Reservoirs, lakes, ponds)	
Less than ½ acre	Not required
½ - 1 acre	Not required
1.1 – 2 acres	Not required

Inland Bathymetry Feature Size Requirements	Response
2.1 – 5 acres	Not required
5.1 – 10 acres	Not required
Greater than 10 acres	Required

Requirements	Inland Topo	Inland Bathymetry	Nearshore Bathymetry	Offshore Bathymetry
Quality Level/IHO Order		QL2B	QL2B	Order 2
Update Frequency		6-10 years	6-10 years	>10 years
Event type(s)				
Quality Level and/or update frequency variability across AOI				
Acceptable Horizontal Error		Up to 10 meters	Up to 10 meters	Up to 10 meters
Acceptable Vertical Error		Up to 30 cm	Up to 30 cm	Up to 10 meters
How far onshore needed			1 kilometer inland	
How far down the beach profile needed			Below MLLW	
Tide correction requirement			MLLW	No requirement for tide correction
Cross sections and/or transects meet needs				
Cross section/transect requirement				

Seamlessness Requirements	Within Inland Topo Data	Within Inland Bathy Data	Within Nearshore Data	Within Offshore Data	Between Inland Topo and Inland Bathy	Between Topo, Topobathy, and/or Bathy
Importance of Seamlessness						
Temporal Seamlessness						
Entire AOI in same acquisition season		Not required	Not required	Not required		Not required
Entire AOI under same environmental conditions		Highly desirable	Nice to have	Not required		Not required
Spatial Seamlessness						
Point cloud for entire AOI needs to be seamless		Nice to have	Nice to have	Not required		Not required
DEM for entire AOI needs to be seamless		Nice to have	Nice to have	Not required		Not required
Amount of acceptable vertical manipulation to achieve spatial seamlessness		I don't know	I don't know	I don't know		I don't know

Importance of 3D Products	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
DSM		Nice to have	Nice to have	Not required
DTM		Not required	Not required	Not required
DEM		Not required	Not required	Not required
Raw point cloud data		Not required	Not required	Not required
Classified point cloud		Not required	Not required	
Edited/cube XYZ		Not required	Not required	Not required
Full waveform		Not required	Not required	Not required
Bathymetric Attributed Grid (BAG)		Not required	Not required	Not required
Breaklines required for standard hydro-flattening		Not required		
Additional breaklines for hydro-enforcement of culverts				

Importance of 3D Products	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
National Vertical Datum Transformation Tool (V-Datum)			Not required	Not required
Tide Predictions			Nice to have	Not required
Tidal Constituent And Residual Interpolation (TCARI)			Not required	Not required
Intensity imagery/sidescan imagery		Not required	Not required	Not required
Ground control/ground truthing		Not required	Not required	Not required
Other		Required	Required	Required
Other description		Bathymetric contours	Bathymetric contours	Bathymetric contours

Importance of Integration with Other Datasets	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Hydrographic survey data			Highly desirable	Highly desirable
Nautical and/or navigation charts			Highly desirable	Highly desirable
Acoustic imagery of the seafloor			Not required	Not required
Aerial and/or satellite imagery		Nice to have	Highly desirable	Not required
Underwater videography			Not required	Not required
Bottom texture			Nice to have	Not required
Bottom type				Nice to have
Submerged features			Highly desirable	Highly desirable
Subbottom characteristics			Not required	Not required
Geologic and seismic data		Not required	Not required	Not required
Water column properties - Physical			Not required	Not required
Water column properties - Chemical			Not required	Not required
Water column properties - Biological			Not required	Not required
Currents			Nice to have	Nice to have
Tide/wave heights			Nice to have	Nice to have
Sea ice conditions			Not required	Not required
Habitat distribution and classification			Not required	Not required
Boundaries			Highly desirable	Highly desirable
Routes			Highly desirable	Highly desirable
Offshore cadastral			Not required	Not required
Lease areas			Nice to have	Highly desirable
Fixed obstructions			Required	Highly desirable
Floating observation/navigation systems			Required	Highly desirable
Shorelines – current, historic, change rates		Highly desirable	Highly desirable	

Importance of Integration with Other Datasets	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Land use/land cover		Not required	Not required	Not required
Wetlands		Not required	Not required	Not required
Estuaries			Not required	Not required
Inland surface water features		Highly desirable	Not required	
Bridges/culverts		Highly desirable		
Landmark features		Highly desirable	Highly desirable	
Cultural resources		Nice to have	Not required	
Coastal and riverine structures		Highly desirable	Highly desirable	
Overhead structures			Required	
Lowest Floor Elevation of Buildings				

Benefits of Currently Used Elevation Data	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Current dataset used		Most data collected by depth sounders. Some data nearly 100 years old.	NOAA charts. Individuals may buy one chart a year for an area, then use Notice to Mariners to keep it updated.	NOAA Charts. Some of the items above may not be needed on some scales of charts.
Where current elevation data are accessed	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
National Map				
Digital Coast				
NCEI				
Open Topography				
NOAA nautical charts		Yes	Yes	Yes
USACE navigation charts				
USGS Inland Waters server				
USGS data series				
Marine Minerals Program GIS				
State Repositories				
State repositories used				
Data that meet my needs are not available				
Current Operational Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Time savings		I don't know	I don't know	I don't know
Cost savings/cost reduction		I don't know	I don't know	I don't know

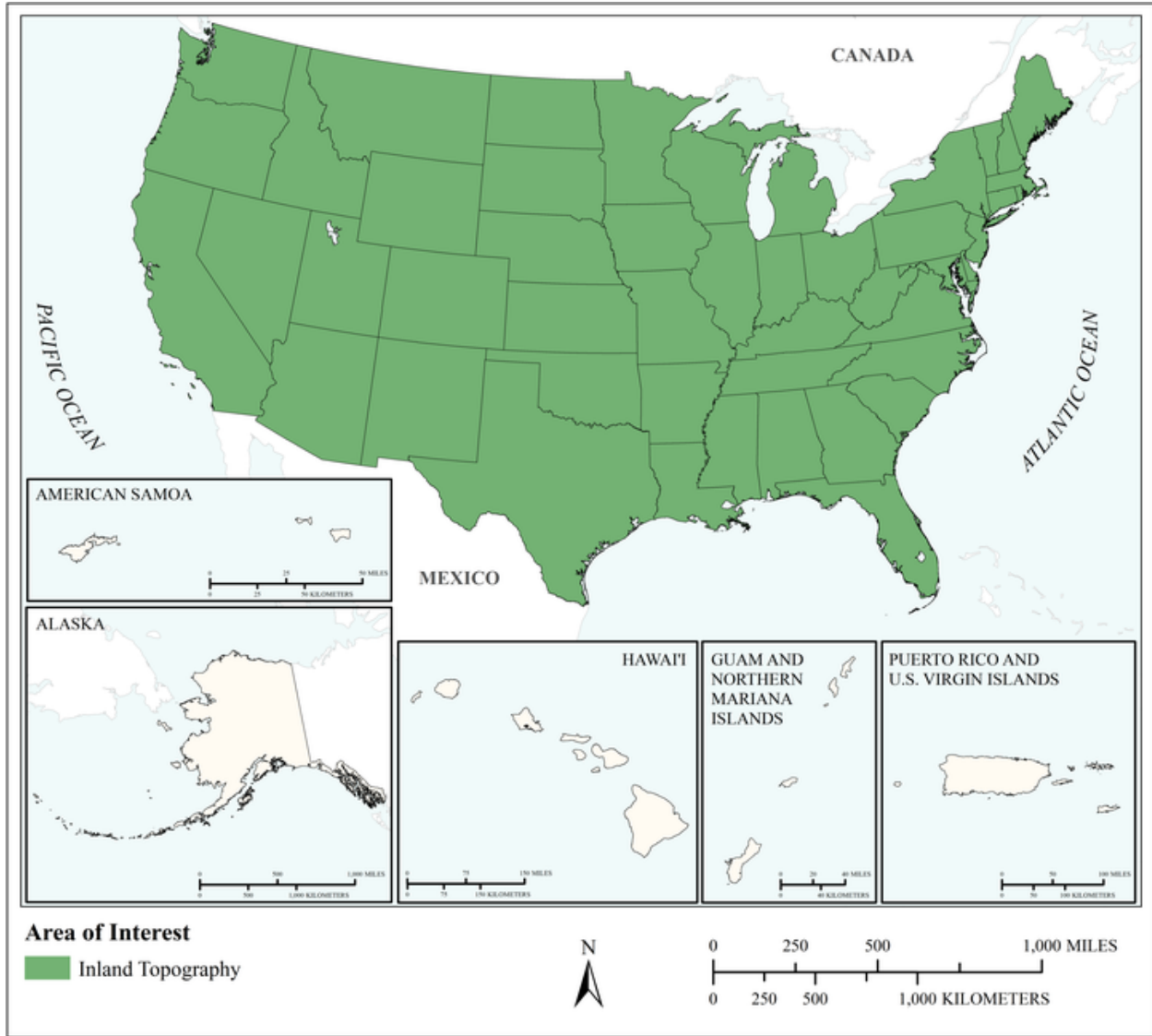
Benefits of Currently Used Elevation Data	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Cost avoidance		I don't know	I don't know	I don't know
Increased revenues		I don't know	I don't know	I don't know
Mission-driven performance improvements		I don't know	I don't know	I don't know
Current Customer Service Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Value added to products or services		I don't know	I don't know	I don't know
Improved response or timeliness		I don't know	I don't know	I don't know
Improved customer experience		I don't know	I don't know	I don't know
Current Societal Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Education or outreach		I don't know	I don't know	I don't know
Environmental		I don't know	I don't know	I don't know
Public safety, including life and property		I don't know	I don't know	I don't know

Future Benefits if Elevation Data Requirements Are Met	Inland Topo			Inland Bathy			Nearshore Bathy			Offshore Bathy		
	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount
Time savings				Minor	Unable to provide		Minor	Unable to provide		None		
Cost savings/cost reduction				None			None			None		
Cost avoidance				Minor	Unable to provide		Minor	Unable to provide		Minor	Unable to provide	
Increased revenues				None			None			None		
Mission-driven performance improvements				Minor	Unable to provide		Moderate	Unable to provide		Minor	Unable to provide	
Other operational benefits				Minor	Unable to provide							
Other operational benefits description												
Future Customer Service Benefits	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount
Value added to products or services				Moderate	Unable to provide		Moderate	Unable to provide		Minor	Unable to provide	
Improved response or timeliness				Moderate	Unable to provide		Minor	Unable to provide		Minor	Unable to provide	
Improved customer experience				None			None			None		
Societal Benefits	Benefits			Benefits			Benefits			Benefits		
Education or outreach				None			None			None		
Environmental				None			None			None		
Public safety, including life and property				Moderate			Moderate			Minor		

3D Derivatives Needed	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Triangulated Irregular Network (TIN)				
Contours				
Hillshades				
Slope maps				
Aspect maps				
Curvature maps				
Cross sections				
Height-Above-Ground maps				
Viewshed maps				
Hydrologic Flow Direction Grids				
Hydrologic Flow Accumulation Grids				
Hydrologic networks (e.g. streams, lakes)				
Hydrologic Units (Watershed Boundaries) (e.g. surface water drainage to a point)				
Building footprints				
Breaklines for road edge-of-pavement				
Rugosity/Surface Roughness				

Importance of 3D Data Requirements	Response
Geographic coverage	3
Vertical accuracy	2
Update frequency	1

MCA Title: Geodetic Recovery



MCA Area of Interest	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Data Type	Required			
Geographic Area Requirements	Nationwide, inland areas			
Sub Area Requirements				

MCA Description	Response
Mission Critical Activity	Geodetic Recovery
MCA Title	Geodetic Recovery
MCA ID	22530
Organization Type	Association or Professional Organization
Organization Name	United States Power Squadrons
Sub-Agency or Division	
Organization Mission	Education, civic and social
Program Name	Geodetic recovery/verification
Total Annual Program Budget	
Primary Business Use	BU 20 - Marine and Riverine Navigation and Safety
Secondary Business Use	
Tertiary Business Use	

What Needs to be Measured in 3D	Response
Bare earth ground	Nice to have
Tops of buildings, structures, objects	Not required
Tops of vegetation	Not required
Tops of submerged structures, objects	Not required
Tops of submerged vegetation	Not required
Subcanopy of vegetation/understory	Not required
River/lake bottom	Not required
Nearshore elevation (<10 m deep)	Not required
Sea surface	Not required
Ocean/sea bottom (>10 m deep)	Not required

General Geographic Area and Size	
Average geographic extent of day-to-day area	1 sq mi - 49 sq mi (e.g. small city/town, Census Tract, Voting District, Zip Code, etc)
Smallest 3D features needed	Large features (e.g. groups of trees, house, building, road, underwater wreck, large commercial pier, etc.)
Description of smallest 3D features	Roads

Requirements	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Quality Level/IHO Order	Cross sections and/or transects meet needs			
Update Frequency	6-10 years			
Event type(s)				
Quality Level and/or update frequency variability across AOI				
Acceptable Horizontal Error	Up to 5 meters			
Acceptable Vertical Error	I don't know			
How far onshore needed				
How far down the beach profile needed	Not applicable			

Requirements	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Tide correction requirement				
Cross sections and/or transects meet needs	Yes			
Cross section/transect requirement	Unknown			

Hydrologic Processing Required	Response
Hydro-flattening	Not required
Hydro-enforcement	Not required
Hydro-conditioning	Not required
No Treatment	Not required

Seamlessness Requirements	Within Inland Topo Data	Within Inland Bathy Data	Within Nearshore Data	Within Offshore Data	Between Inland Topo and Inland Bathy	Between Topo, Topobathy, and/or Bathy
Importance of Seamlessness						
Temporal Seamlessness						
Entire AOI in same acquisition season	Not required					
Entire AOI under same environmental conditions	Not required					
Spatial Seamlessness						
Point cloud for entire AOI needs to be seamless	Not required					
DEM for entire AOI needs to be seamless	Not required					
Amount of acceptable vertical manipulation to achieve spatial seamlessness	I don't know					

Importance of 3D Products	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
DSM	Not required			
DTM	Nice to have			
DEM	Not required			
Raw point cloud data	Not required			
Classified point cloud	Not required			
Edited/cube XYZ				
Full waveform	Not required			
Bathymetric Attributed Grid (BAG)				
Breaklines required for standard hydro-flattening	Not required			
Additional breaklines for hydro-enforcement of culverts	Not required			

Importance of 3D Products	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
National Vertical Datum Transformation Tool (V-Datum)				
Tide Predictions				
Tidal Constituent And Residual Interpolation (TCARI)				
Intensity imagery/sidescan imagery	Not required			
Ground control/ground truthing	Not required			

Importance of Integration with Other Datasets	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Hydrographic survey data				
Nautical and/or navigation charts				
Acoustic imagery of the seafloor				
Aerial and/or satellite imagery	Highly desirable			
Underwater videography				
Bottom texture				
Bottom type				
Submerged features				
Subbottom characteristics				
Geologic and seismic data	Not required			
Water column properties - Physical				
Water column properties - Chemical				
Water column properties - Biological				
Currents				
Tide/wave heights				
Sea ice conditions				
Habitat distribution and classification				
Boundaries				
Routes				
Offshore cadastral				
Lease areas				
Fixed obstructions				
Floating observation/navigation systems				
Shorelines – current, historic, change rates	Nice to have			
Land use/land cover	Not required			
Wetlands	Not required			

Importance of Integration with Other Datasets	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Estuaries				
Inland surface water features	Nice to have			
Bridges/culverts	Nice to have			
Landmark features	Not required			
Cultural resources	Not required			
Coastal and riverine structures	Nice to have			
Overhead structures				
Lowest Floor Elevation of Buildings	Nice to have			

Benefits of Currently Used Elevation Data	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Current dataset used	Best available			
Where current elevation data are accessed	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
National Map	Yes			
Digital Coast				
NCEI				
Open Topography				
NOAA nautical charts				
USACE navigation charts				
USGS Inland Waters server				
USGS data series				
Marine Minerals Program GIS				
State Repositories				
State repositories used				
Data that meet my needs are not available				
Current Operational Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Time savings	I don't know			
Cost savings/cost reduction	I don't know			
Cost avoidance	I don't know			
Increased revenues	I don't know			
Mission-driven performance improvements	I don't know			
Current Customer Service Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Value added to products or services	I don't know			

Benefits of Currently Used Elevation Data	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Improved response or timeliness	I don't know			
Improved customer experience	I don't know			
Current Societal Benefits	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Education or outreach	Moderate			
Environmental	I don't know			
Public safety, including life and property	I don't know			

Future Benefits if Elevation Data Requirements Are Met	Inland Topo			Inland Bathy			Nearshore Bathy			Offshore Bathy		
	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount
Time savings	Minor	Unable to provide										
Cost savings/cost reduction	None											
Cost avoidance	None											
Increased revenues	None											
Mission-driven performance improvements	Minor	Unable to provide										
Future Customer Service Benefits	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount	Benefits	Units	Amount
Value added to products or services	Moderate	Unable to provide										
Improved response or timeliness	Minor	Unable to provide										
Improved customer experience	Minor	Unable to provide										
Societal Benefits	Benefits			Benefits			Benefits			Benefits		
Education or outreach	Minor											
Environmental	I don't know											
Public safety, including life and property	Minor											

3D Derivatives Needed	Inland Topo	Inland Bathy	Nearshore Bathy	Offshore Bathy
Triangulated Irregular Network (TIN)				
Contours	Yes			
Hillshades				
Slope maps				
Aspect maps				
Curvature maps				
Cross sections				
Height-Above-Ground maps				
Viewshed maps				
Hydrologic Flow Direction Grids				
Hydrologic Flow Accumulation Grids				
Hydrologic networks (e.g. streams, lakes)				
Hydrologic Units (Watershed Boundaries) (e.g. surface water drainage to a point)				
Building footprints				
Breaklines for road edge-of-pavement				
Rugosity/Surface Roughness				

Importance of 3D Data Requirements	Response
Geographic coverage	3
Vertical accuracy	2
Update frequency	1