RIEGL Government and Industry Market Development:

Mapping the Globe

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Light detection and ranging (LiDAR) has evolved as an essential remote sensing technology needed to support high-value applications, such as flood risk management, water supply and quality, infrastructure and construction management, natural resources conservation, geologic resource assessment, and hazard mitigation. LiDAR is one of the primary technologies used to support mapping of elevation and other Earth surface characteristics.
National Mapping Remote Sensing Tools

- Satellite,
- Photogrammetry
- LiDAR
- Geodesy
- Check point surveys and ground control
- Photo interpretation
- Field reconnaissance
- Orthophotography
- Hyperspectral and multispectral imagery analysis

Country Statistics (UN)
ECOSOC established the Committee of Experts as the apex intergovernmental mechanism for making joint decisions and setting directions with regard to the production, availability and use of geospatial information within national, regional and global policy frameworks. Led by United Nations Member States, UN-GGIM aims to address global challenges regarding the use of geospatial information, including in the development agendas, and to serve as a body for global policymaking in the field of geospatial information management.
Sustainable Development Goals – Examples:

**UN-GGIM – Linking Data, Policy, People**

**SDG ISSUES**

- Climate change
- Desertification, land degradation and drought
- Disaster risk reduction
- Forests
- Oceans & Seas

**The 3D Nation**

Elements of the 3D Nation concept.
COUNTRY MAPPING ACTIVITIES

National topographic mapping of Land
Infrastructure
Forestry
Vegetation
Port and Shoreline Mapping
1. Executive Summary

National Enhanced Elevation Assessment (NEEA)

The U.S. Geological Survey (USGS) and other members of the National Digital Elevation Program (NDEP) sponsored the first-ever national assessment to document business use requirements for and benefits of national enhanced elevation data that would significantly expand national elevation data availability, quality and usability. The goal of the assessment was to develop and refine requirements for a national program and to identify program implementation alternatives, costs and benefits for meeting priority national elevation data needs. The assessment quantifies answers to three key questions.

1. Is it more cost effective for the government to manage these activities within the context of a national program?
2. Are there additional national or agency benefits derived from such a strategy?
3. What does the optimized program look like?

The assessment results provide significant evidence that an enhanced national elevation program could provide conservatively-estimated net benefits between $116M/year and $620M/year and Benefit/Cost Ratios between 4.3 to 1 and 4.9 to 1, depending upon options implemented.
Critical Elements for Success: 3DEP

- Establish the requirements
- Determine the political and economic drivers
- Remove organizational silos,
- Remove redundancy - map it once, not many times
- Determine the cycle and refresh rates
- Establish relevant standards
- Conduct capacity planning

UN-GIM Efforts for National Mapping: Shoreline

Oceans, seas and marine resources are increasingly threatened, degraded or destroyed by human activities, reducing their ability to provide crucial ecosystem services. Important classes of threats are, among others, climate change, marine pollution, unsustainable extraction of marine resources and physical alterations and destruction of marine and coastal habitats and landscapes. The deterioration of coastal and marine ecosystems and habitats is negatively affecting human well-being worldwide.

Good governance, an enabling environment, sustainable land- and marine- based human activities, and adequate measures will be required to reduce the negative anthropogenic impacts on the marine environment, for example due to a more sustainable use of resources, changes in production and consumption patterns and improved management and control of human activities. Projects and measures should ideally be designed and implemented in an integrated, cross-sectoral and cross-scale manner, in line with the ecosystem approach and involving all stakeholders.
**Managing the Future of the Coasts**

- The world has 356,000 KM of coastline – World Factbook
- 40% of the world’s population lives in the Coastal Zone – United Nations Data
- Most of the world’s Mega Cities are in the Coastal Zone
- Shoreline morphology is constantly changing
- The Benthic Zone management is critical to human survival
- Aggradation zone and flood mapping for rivers and coasts impacts humans worldwide

**National Shoreline Mapping**

Living shorelines use plants or other natural elements—sometimes in combination with harder shoreline structures—to stabilize estuarine coasts, bays, and tributaries.

- One square mile of salt marsh stores the carbon equivalent of 76,000 gal of gas annually.
- Marshes trap sediments from tidal waters, allowing them to grow in elevation as sea level rises.
- Living shorelines improve water quality, provide fisheries habitat, increase biodiversity, and promote recreation.
- Marshes and oyster reefs act as natural barriers to waves. 15 ft of marsh can absorb 50% of incoming wave energy.
- Living shorelines are more resilient against storms than bulkheads.
- 33% of shorelines in the US will be hardened by 2100, decreasing fisheries habitat and biodiversity.

Hard shoreline structures like bulkheads prevent natural marsh migration and may create seaward erosion.
**Topo Bathy Lidar is critical for**

- Confirms storm surge models
- Determine Coastal Resilience
- Coastal flooding predictions
- GIS analysis
- Benthic habitat assessment
- Ports assessment (key economic engines)
- Sea level rise impact zones

**Coastal Mapping Challenges**

- Wind and Wave Loads
- Tide
- Weak Geodetics
- Resources
- Anthropogenic Influences
- Operational Issues
- GPS Information
- Water clarity
- Flight restrictions
Coastal Mapping Purposes

Charts for safety in navigation

Maps for Coastal Intelligence and resiliency

Emergency response

Example of the populations use of the data

*It is critical to make data and information available to the authorities and also the population*
The Data Management Structure

- Data Strategy and Architecture
- Data Integration
- Organizational Alignment
- Security and Privacy
- Governance
- Master Data Policy
- Data Quality
- Solution Management
- Metadata Management
- Analytics
- Dashboards, Scorecards and Reporting
Data Storage Options

The Cloud

aws

Google

Azure
Important Associations

**VISION:** To be a collaborative platform to advance the role of geospatial industry and strengthen its contribution in world economy and society

**Mission:** To be a catalyst for intra and inter industry knowledge exchange and co-creation of larger business opportunities for geospatial industry enhancing its value impact through policy advocacy, business development and collaborative programs.
U.S. Geospatial Association for Commercial Firms

MAPPS is the only national association of geospatial, mapping and photogrammetry firms with the following objectives:

- **Advocate** on Capitol Hill for sound geospatial policy and legislation
- **Expand** the geospatial market and create growth opportunities
- **Provide** professional recognition for innovation and projects
- **Increase** private sector use by government entities
- **Serve** as the voice of the private geospatial firms
- **Enhance** ability to participate in the free enterprise market
- **Promote** business interests and contest unfair competition
- **Offer** engaging business networking, professional knowledge exchange, and educational programs

Riegl and ESRI – LMAP Initiative
**LMAP Initiative**

**Store, Manage, & Organize**

LiDAR collections within the ArcGIS Platform using best practices

**Search, Filter, quickly Find & Acquire**

Individual LiDAR tiles or entire collections utilizing a map based web application

**Cloud Based**

Requires no additional user software

**Scalable**

Manage all your LiDAR collections in an efficient, cost effective manner

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**Quantum Spatial Inc.**

- Largest geospatial solutions provider in North America including imaging, remote sensing, modelling, visualisation and GIS.

- RIEGL Topo-Bathy LiDAR for 6 years and have scanned over 3.5 million acres.

- Inspired by LMAP Initiative to help organise projects and promote customer feedback loops while utilising licenses and products already at their disposal.
Quantum Spatial Inc. – Task

- Contracted by NOAA (National Oceanic and Atmospheric Administration) to collect topobathymetric LiDAR and areal photography over river delta regions of Chesapeake Bay in Virginia and Maryland
- Dates: Jan 2017 and early 2020
- Project data will enable:
  - Shoreline characterization
  - Nautical charting
  - Geodesy
  - Marine resource management
Primary Data Source

• RIEGL VQ-880-G Bathymetric LiDAR

Additional Data

• LiDAR derivatives
• Project Flightlines
• Water Quality
• Turbidity Measurements
• Survey Points
• Acquisition Photos
Quantum Spatial Inc. – Implementation

Innovation in 3D
Examples: Around the Globe

Project Example of Coastal Island – Topo LiDAR Only
Project Example – Seamless Topo-Hydro

Example – Overlayed with Imagery; 7 m resolution RGB
River Mapping

The top left image is the orthoimagery with a cross section of LiDAR returns in red. The middle image is a 3D representation of the gridded bathymetric model with classified LiDAR cross section. The bottom image is the LiDAR alone highlighting two pools in the river.

Ocean Performance
Underwater Features

Green (Seamless) topobathy DEM

Incredible Detail
Coastal Wetlands Restoration

Airborne Laser Bathymetry – Hardware and Software Updates
VQ-880-GH and VQ-880-G II

Airborne Laser Scanning system for combined hydrographic and topographic surveying

Camera configuration:
- 2 PhaseOne cameras (RBG and NIR)
  - up to 100 MPixel CMOS without FMC or
  - up to 80 MPixel CCD with FMC
- Dedicated data recorder enables high image rate
- IR channel
  - Significantly improved ranging performance
  - Higher rep rate (up to 900 kHz)
- Green channel
  - Improved waveform storage capability (longer sample blocks)
  - Higher rep rate (up to 700 kHz)
## VQ-880-GH, VQ-880-G II

### key specifications

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### VQ-880-GH, VQ-880-G II

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*www.riegl.com*  
*Innovation in 3D*  
*Copyright RIEGL Laser Measurement Systems GmbH © 2018 – All rights reserved.*  
*February 2018*  
*multiple time around processing*
VQ-880-GH
System configuration & interfaces

• weight: 70 kg (depending on configuration)
• dimensions: 490 x 660 x 580 mm³, mounting flange 580 mm x 580 mm

VQ-880-G II
System configuration & interfaces

• weight: 70 kg (depending on configuration)
• dimensions: Ø524 mm x 780 mm
VQ-880-GH, VQ-880-G II
System configuration & interfaces

- Gbit Ethernet
- high-speed fiber link to RIEGL DR1560 data recorder
- 18-32 V DC supply, 400 W power consumption
- integrated IMU/GNSS
- RIEGL DR1560 for data storage
- IX controller for imagery storage

Software updates

- Refraction correction
- Depth bias correction
- Depth as an attribute
- More user-selectable parameters
- Total Propagation Uncertainty
  - Determination of point-specific TPU values (dry land and subsea)
  - Include TPU values in LAS export
- Full waveform analysis
  - Point-wise classification (surface, volume, bottom)
  - Bias-free determination of sea surface location
  - Turbidity estimation
  - Improved resolution of water surface and ground for shallow water
**Inherent Advantages of RIEGL**

- High laser repetition rates
- Superb signal processing
- Excellent system design & integration
- Short pulse laser shots
- Complete software package

**Why RIEGL?**

- Excellently suited for combined land and hydrographic airborne survey
- High-accuracy ranging based on echo digitization and online waveform processing with multiple target capability
- High spatial resolution due to ultra high laser repetition rates
- Compact, rugged and light-weight modular configuration, compatible with standard airborne platforms
- Optional waveform data output, data accessible with RiWAVELib
- RiHYDRO and RiProcess Processing Software