

RIEGL Government and Industry Market Development:

Mapping the Globe

James van Rens
(Represented by Lingxiao Zhu)
11/19/2018



Innovation in 3D

Innovation in 3D



- » **RIEGL Intro**
- » **LIDAR as a Critical Geospatial Technology**
- » **Inherent Advantages of RIEGL**
- » **Country Statistics (UN)**
- » **UN-GGIM**
- » **National Mapping:**
 - Topo, Boundary, Shoreline
- » **National Mapping Critical Elements:**
 - Requirements, Political and Economic Drivers, Multiple Silos, 'Map it once, not many times', Refresh Rates, Standards and Capacity planning
- » **Tools:**
 - LIDAR, IFSAR, Photogrammetry, Surveying GCP, Satellites
- » **Data formats:**
 - LAS, LAZ, OPEN Source
- » **Software:**
 - ESRI and Open Source
- » **Data Storage Options**
- » **Website for Product Distribution**
- » **ASPRS, ISPRS, THOSA, IFHS, IHO**
- » **MAPPs and WGIC: How they Work**
- » **Examples:**
 - USA, Netherlands, Norway, 3DEP Website, NOAA National Shoreline Mapping and Charting
- » **Data Examples**
- » **Point cloud Visualizations**



Innovation in 3D



Remote Sensing and LiDAR

- **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.**

Innovation in 3D



Authoritative Data

Spatial Data

Any data that contains a "locational" component

Geospatial Data

Spatial data that contains a location on the Earth. A subset of spatial data.

- * Aerial photos (image only)
- * Mailing lists (addresses)
- * Phone book (addresses)
- * Deed (legal description)
- * Hunting districts (refers to other landmarks)
- * Airline schedule (cities are locations)

Georeferenced Data

Geospatial data whose location is determined by a standard system of coordinates. A subset of geospatial data:

- * Remotely sensed data that is digitally tied to the earth (rubbersheeting)
- * Streets coverage with embedded addresses
- * Cadastral parcel layer
- * USGS topographic map
- * GCDB

Authoritative Data

- * Certificate of Survey
- * Public Land Survey System (PLSS)
- * Geodetic Surveys

Data Sweet spot

Topographic Surveys

Innovation in 3D



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

Innovation in 3D



Country Statistics (UN)




RIEGL®

Innovation in 3D

Geospatial Impact on Statistics


Modernization of Official Statistics

National Addressing




Cabo Verde

Data Collection




Mapping




Ireland

Dissemination: Open Data



United Kingdom


Applied: Social Issues




West Africa

Operations/Work Force Management

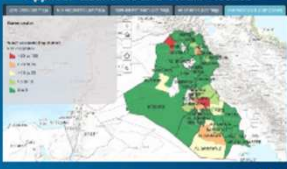
Command & Control Framework





Rwanda

Applied: Economic and Health Issues




Iraq

www.riegl.com Copyright Innovation in 3D

RIEGL®

Innovation in 3D

UN-GGIM (United Nations Global Geospatial Information Management)



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

www.riegl.com Copyright RIEGL Laser Measurement Systems GmbH © 2018 – All rights reserved. Innovation in 3D

Sustainable Development Goals – Examples:

Innovation in 3D



UN-GGIM – Linking Data, Policy, People

SDG ISSUES

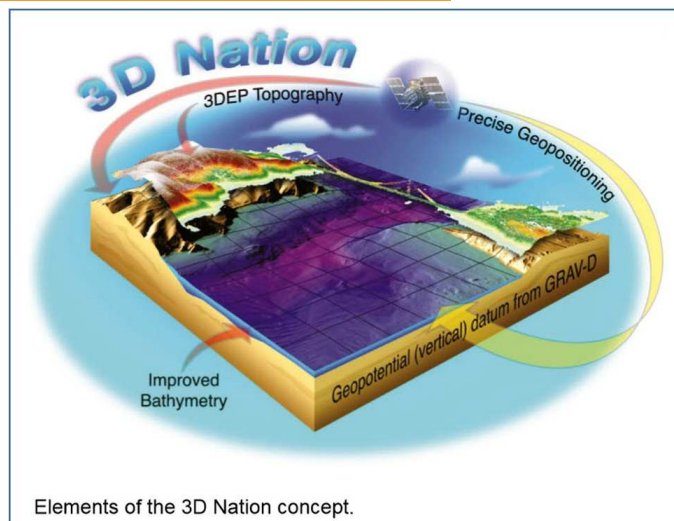
- [Climate change](#)
- [Desertification, land degradation and drought](#)
- [Disaster risk reduction](#)
- [Forests](#)
- [Oceans & Seas](#)



Innovation in 3D




The 3D Nation




Elements of the 3D Nation concept.

Innovation in 3D




Smart Cities and Countries



www.riegl.com Copyright RIEGL Laser Measurement Systems GmbH © 2018 – All rights reserved. Innovation in 3D

Innovation in 3D



COUNTRY MAPPING ACTIVITIES

- National topographic mapping of Land**
- Infrastructure**
- Forestry**
- Vegetation**
- Port and Shoreline Mapping**

www.riegl.com Copyright RIEGL Laser Measurement Systems GmbH © 2018 – All rights reserved. Innovation in 3D

National Mapping Policy Formation

[neaa final-report revised-3-29-12.pdf](#)

1. Executive Summary

National Enhanced Elevation Assessment (NEEA)

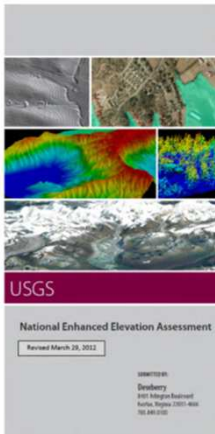
The U.S. Geological Survey (USGS) and other members of the National Digital Elevation Program (NDEP) sponsored the first-ever national assessment to document business use requirements for and benefits of national enhanced elevation data that would significantly expand national elevation data availability, 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.

USA National Topo Map – 3DEP

Dewberry



Innovation in 3D



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

Innovation in 3D



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.

Innovation in 3D



Managing the Future of the Coasts

- The world has 356,000 KM of coastline – World Factbook
- 40% of the worlds 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

Innovation in 3D



National Shoreline Mapping

NOAA LIVING SHORELINES SUPPORT RESILIENT COMMUNITIES

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 U.S. will be hardened by 2100 , decreasing fisheries habitat and biodiversity.	Hard shoreline structures like bulkheads prevent natural marsh migration and may create seaward erosion .
--	---	--	--	--	--	---

The National Centers for Coastal Ocean Science | coastalscience.noaa.gov

Some graphics courtesy of the Integration and Application Network, University of Maryland Center for Environmental and Estuarine Science (umces.edu/ianigdl).


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**

Innovation in 3D




Coastal Mapping Purposes

- Charts for safety in navigation**
- Maps for Coastal Intelligence and resiliency**
- Emergency response**

www.riegl.com Copyright RIEGL Laser Measurement Systems GmbH © 2018 – All rights reserved. Innovation in 3D

Innovation in 3D




Example of the populations use of the data

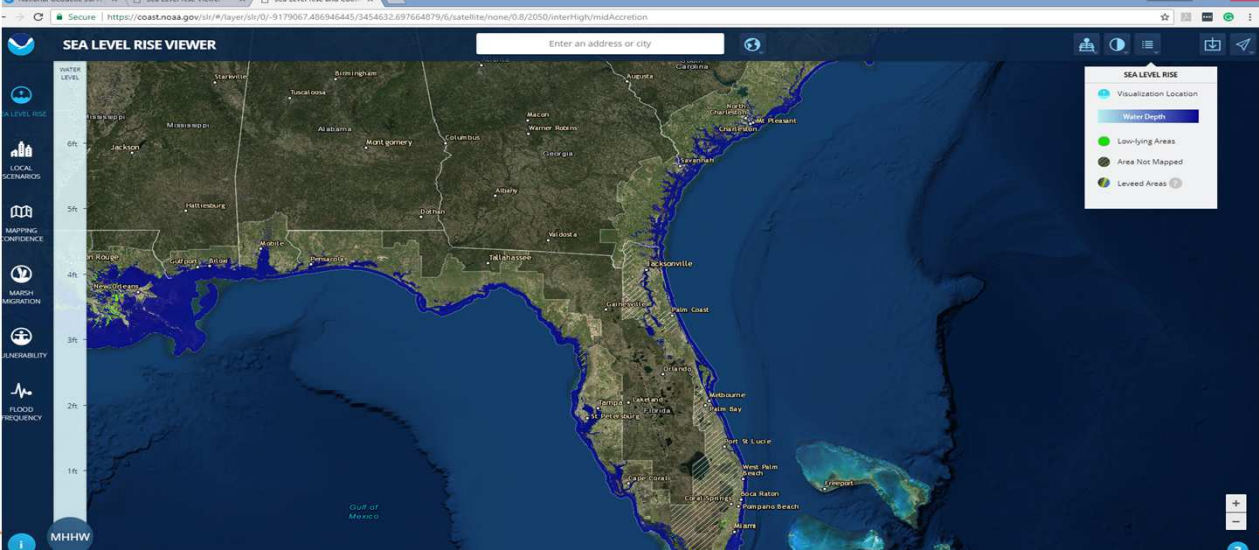
It is critical to make data and information available to the authorities and also the population

www.riegl.com Copyright RIEGL Laser Measurement Systems GmbH © 2018 – All rights reserved. Innovation in 3D

Innovation in 3D



NOAA Sea Level Rise Viewer



SEA LEVEL RISE VIEWER

Enter an address or city

SEA LEVEL RISE

- Visualization Location
- Water Depth
- Low-lying Areas
- Area Not Mapped
- Leveled Areas

WATER LEVELS

6ft

5ft

4ft


3ft

2ft

1ft

MHHW

Innovation in 3D



NOAA Data Distribution Portal



NOAA Shoreline Website

A Guide to National Shoreline Data and Terms

Mapping History Applications Data Access Policy and Management

Home > Data Access >

NOAA NATIONAL SHORELINE

Purpose and Potential Application: This shoreline was originally intended to support NOAA nautical chart production. Other applications include shoreline change analysis, boundary determination, and cartographic representation.

Originator(s): National Oceanic and Atmospheric Administration (NOAA) National Geodetic Survey (NGS)

Abstract: These shoreline data represent a vector conversion of NOAA National Ocean Service (NOS) raster shoreline manuscripts (T-sheets) and aerial imagery from the year 1953 to the present.

Access: [NOAA Shoreline Data Explorer](#)

Scale(s): 1:5,000 to 1:20,000

Coverage: Continental U.S., with Washington, Maine, and the Great Lakes only partially represented; Hawaii and portions of Alaska, Puerto Rico, and the U.S. Virgin Islands are also included.

Source Data: NOAA shoreline manuscripts (T-sheets) and aerial imagery


Spatial Reference: Geographic coordinate system (decimal degrees); Horizontal Datum - North American Datum of 1983 (NAD83)

Tidal Datum: Mean high water (MHW) and mean low water (MLW)

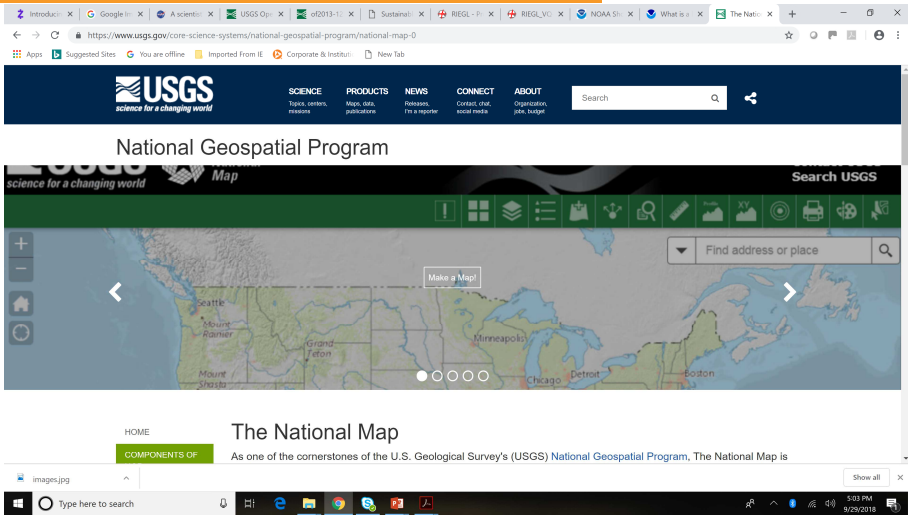
Data Format: ESRI shapefile. Data is distributed by project area. Projects are defined by geographic location and time period. The shoreline is seamless within each project.

Accuracy: Vector data were derived from rectified raster images of NOS coastal survey maps using ArcInfo processing software. Vector shoreline extracted from map images adequately represents the shoreline shown on original NOS source surveys. The absolute value of the overall predicted horizontal accuracy has not been determined. However, the reports associated with the project maps describe the process of producing the map source and include the horizontal control layout and, if aerotranslated, the fit-to-control statistics. One may refer to the March 6, 1993, edition of the Journal of Coastal Research for an article entitled "Historical


www.riegl.com Copyright RIEGL Laser Measurement Systems GmbH © 2018 - All rights reserved. Innovation in 3D

Innovation in 3D 

USGS DATA DISTRIBUTION PORTAL




www.riegl.com Copyright RIEGL Laser Measurement Systems GmbH © 2018 – All rights reserved. Innovation in 3D

Innovation in 3D 

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

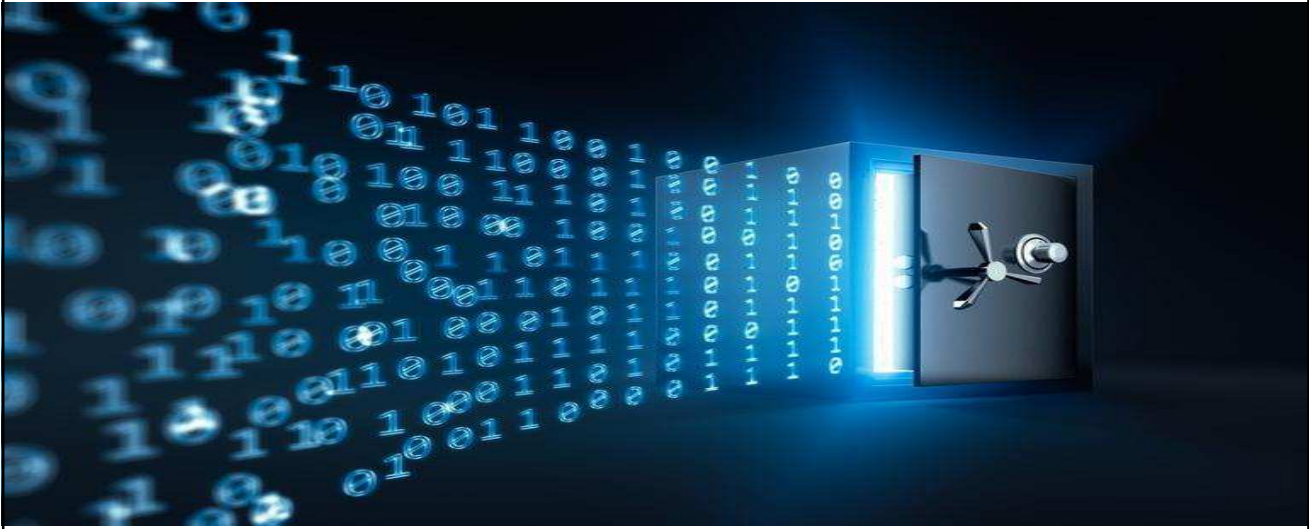


www.riegl.com Copyright RIEGL Laser Measurement Systems GmbH © 2018 – All rights reserved. Innovation in 3D

Innovation in 3D



Data Storage Options



Innovation in 3D



The Cloud



Innovation in 3D

RIEGL®

Important Associations



information from imagery



IHO



THSOA



Making location count.



THE IMAGING & GEOSPATIAL INFORMATION SOCIETY

www.riegl.com Copyright RIEGL Laser Measurement Systems GmbH © 2018 – All rights reserved. Innovation in 3D

Innovation in 3D

RIEGL®

Industry Associations

VISION: To be a collaborative platform to advance 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.



www.riegl.com Copyright RIEGL Laser Measurement Systems GmbH © 2018 – All rights reserved. Innovation in 3D

Innovation in 3D



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



www.riegl.com Copyright RIEGL Laser Measurement Systems GmbH © 2018 – All rights reserved.

Innovation in 3D




Riegl and ESRI – LMAP Initiative



www.riegl.com Copyright RIEGL Laser Measurement Systems GmbH © 2018 – All rights reserved.

Innovation in 3D

Innovation in 3D




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


www.riegl.com Copyright RIEGL Laser Measurement Systems GmbH © 2018 – All rights reserved. Innovation in 3D

Innovation in 3D



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.



www.riegl.com Copyright RIEGL Laser Measurement Systems GmbH © 2018 – All rights reserved. Innovation in 3D

Innovation in 3D



Quantum Spatial Inc. – Task

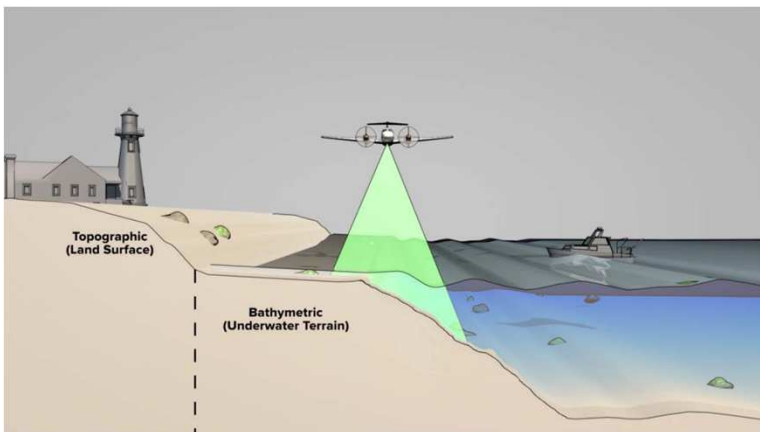
- Contracted by NOAA (National Oceanic and Atmospheric Administration) to collect topobathymetric LiDAR and aerial photography over river delta regions of Chesapeake Bay in Virginia and Maryland
- Dates: Jan 2017 and early 2020
- Project data will enable:
 - Shoreline characterization
 - Nautical charting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



Innovation in 3D



Quantum Spatial Inc. – Bathymetric LiDAR

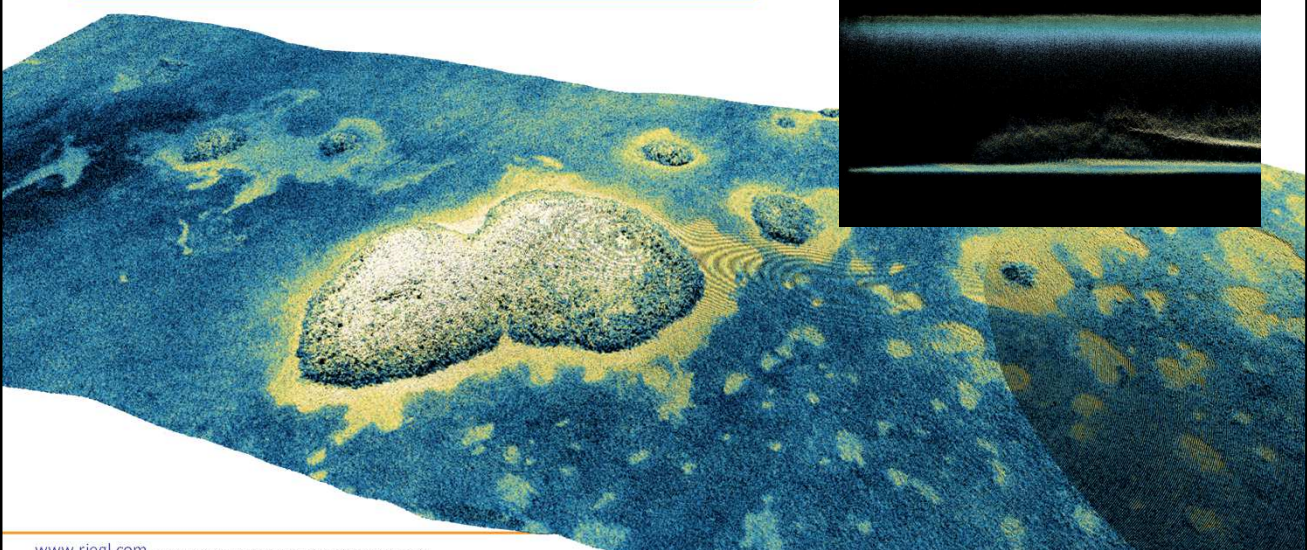


Images in this slide courtesy of Quantum Spatial Inc.

Innovation in 3D

RIEGL®

Bathymetric LiDAR



www.riegl.com Copyright RIEGL Laser Measurement Systems GmbH 2018 - All rights reserved

Innovation in 3D

RIEGL®


Quantum Spatial Inc. – Data Sources

Primary Data Source

- RIEGL VQ-880-G Bathymetric LiDAR

Additional Data

- LiDAR derivatives
- Project Flightlines
- Water Quality
- Turbidity Measurements
- Survey Points
- Acquisition Photos



www.riegl.com Copyright RIEGL Laser Measurement Systems GmbH 2018 - All rights reserved

Innovation in 3D

Innovation in 3D

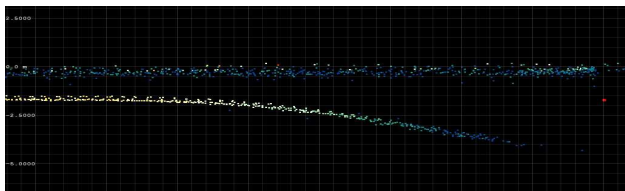
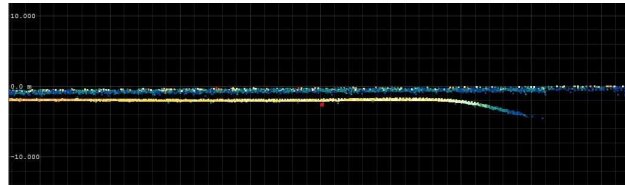


Quantum Spatial Inc.

NOAA Chesapeake Bay CROSS-SECTION MAP
2/15/2018 MISSION



Tide Station: Lewistown, VA (8655750) Mean range 1.24 ft.				
	Start Time	Tide Level (ft)	End Time	Tide Level (ft)
Predicted 20% Tide Window	17:11	0.248	21:49	0.248
Observed 20% Tide Window	17:30	0.248	21:30	0.248
Time of Flight	17:56	0.097	21:13	0.142



Images in this slide courtesy of Quantum Spatial Inc.

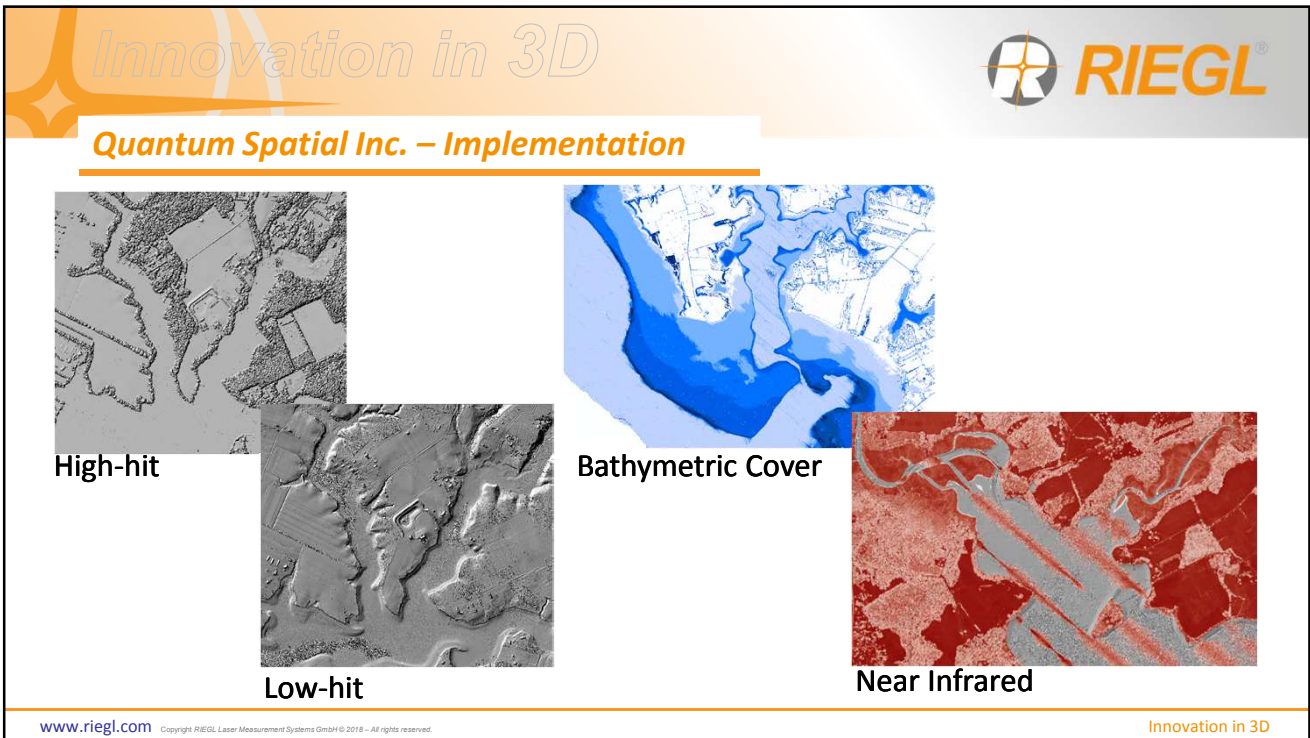
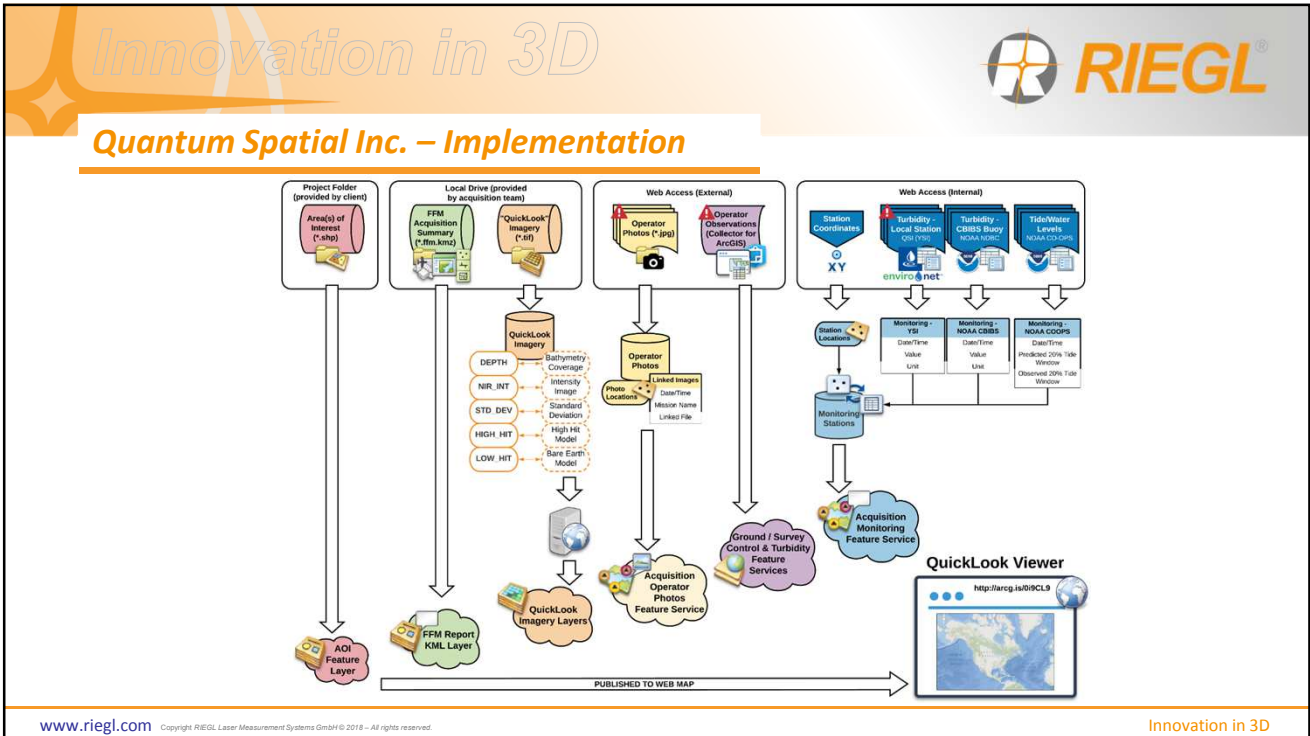
Innovation in 3D



Quantum Spatial Inc. – Implementation

The collage shows several web interfaces:

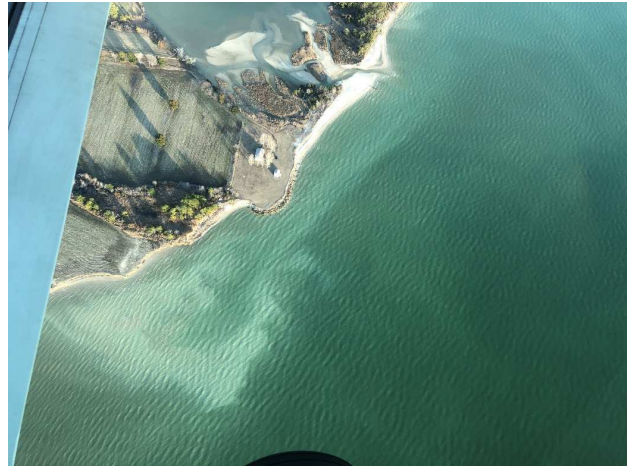
- enviro.net**: A dashboard with a sidebar menu and a main content area displaying data for station TE0A036712.
- NOAA National Data Buoy Center**: A page for Station 44042 - Potomac, MD, with a search bar and navigation links.
- Chesapeake Bay Interpretive Buoy System**: A page with a map of the bay and a 'Data Graphing Tool' showing a line graph of Turbidity (NTU) over time for Potomac.
- TIDES & CURRENTS**: A page with a table of tide data for various dates and times.



Innovation in 3D



Quantum Spatial Inc. – Implementation



Innovation in 3D



Quantum Spatial Inc. – Implementation

QuickLook Viewer Application Quantum Spatial, Inc.

Find address or place

Layer List

- Operational layers
- Acquisition Monitoring
- Acquisition Operator Photos
- NOAA_Chesapeake_Bay_Turbidity
- NOAA_Chesapeake_Bay_ATPs_HCPs
- Chesapeake Bay Topobathy - Areas of Interest
- ChesapeakeBayPilot_LAS_Index
- Topobathy FFM Report (Chesapeake Bay)
- QuickLook Imagery - NIR Intensity Image
- QuickLook Imagery - Standard Deviation of Last Returns
- QuickLook Imagery - Bathymetry Coverage (Depth)
- QuickLook Imagery - High Ht Model
- QuickLook Imagery - BareEarthModel
- Monitoring (NOAA NDBC - CBIBS)
- Monitoring (NOAA CO-OPS)
- Monitoring (Local YSI Station)

Potomac - PL

Type of Station: Turbidity - Buoy
Location: Near Point Lookout, MD
Owner: Chesapeake Bay Interpretive Buoy System, NOAA NDBC
URL: Click [here](#) for more information about this station.

Edited by megatack on 6/1/18 at 9:16 PM

Related tables:

- Monitoring (NOAA NDBC - CBIBS)
- Monitoring (NOAA CO-OPS)
- Monitoring (Local YSI Station)

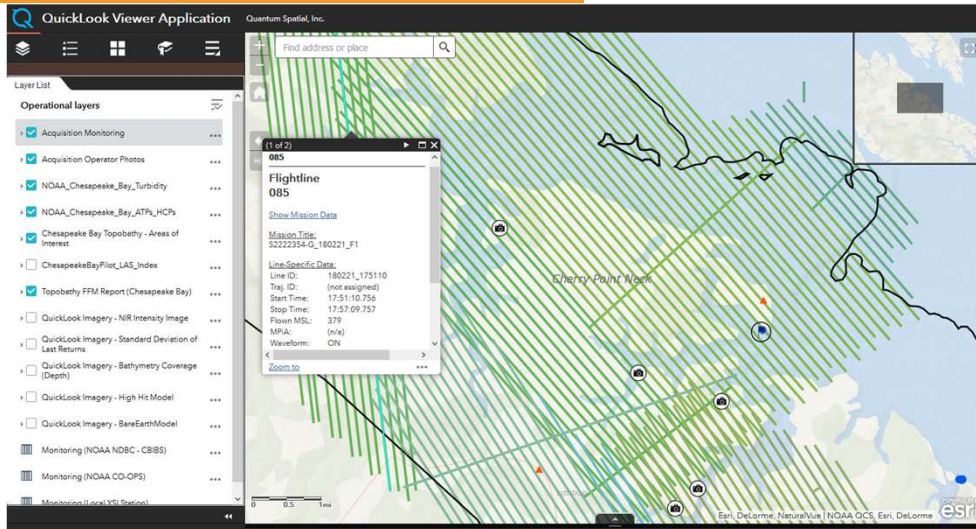
Zoom to

Esri, DeLorme, NatureView | NOAA OCS, Esri, DeLorme

Innovation in 3D



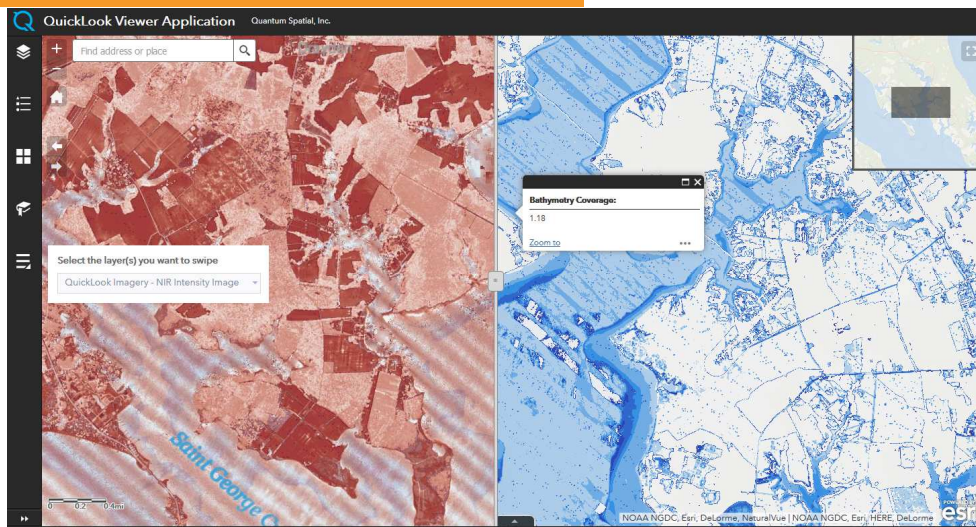
Quantum Spatial Inc. – Implementation



Innovation in 3D



Quantum Spatial Inc. – Implementation



Innovation in 3D



Open Source

www.riegl.com Copyright RIEGL Laser Measurement Systems GmbH © 2018 – All rights reserved. Innovation in 3D

Innovation in 3D



Open Source Video Created by...

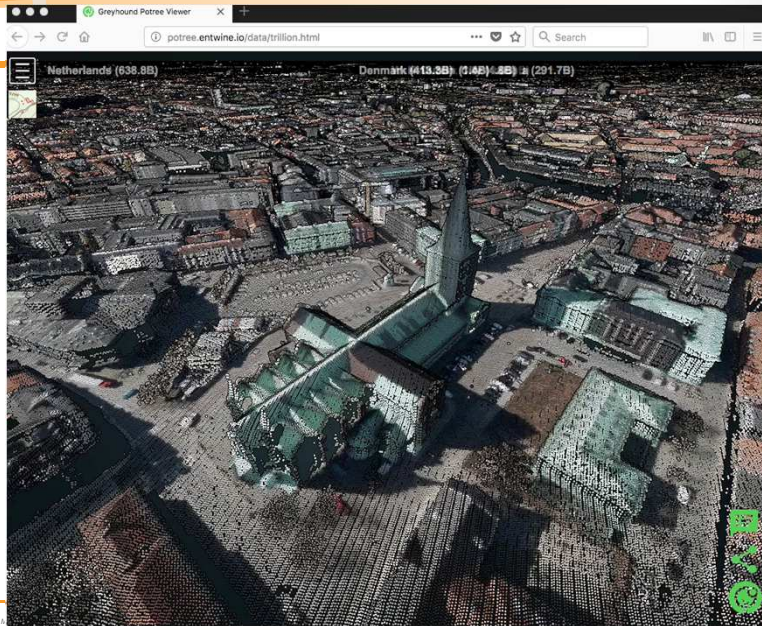
hobu

 **pdal.io**  **entwine.io**

libLAS  **greyhound.io**

www.riegl.com Copyright RIEGL Laser Measurement Systems GmbH © 2018 – All rights reserved. Innovation in 3D

Examples: Around the Globe



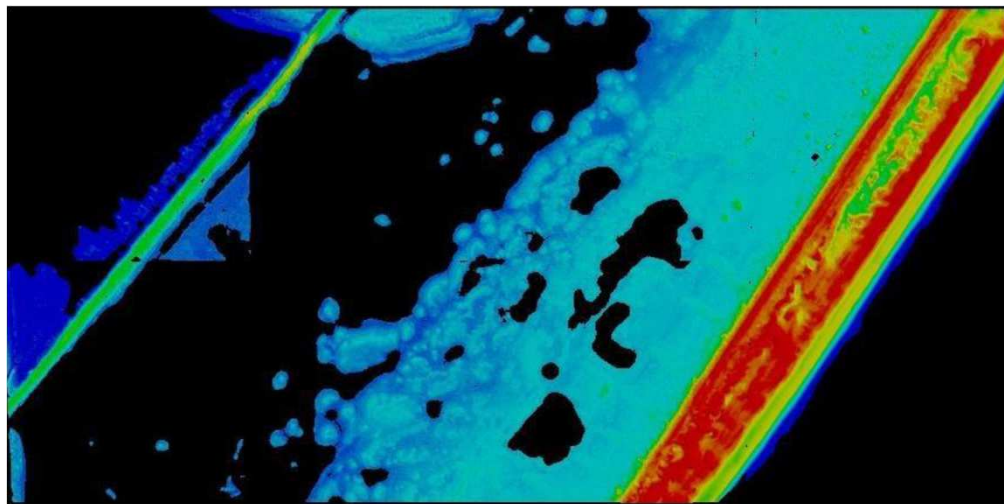
www.riegl.com Copyright RIEGL Laser

Innovation in 3D

Innovation in 3D



Project Example of Coastal Island – Topo LiDAR Only



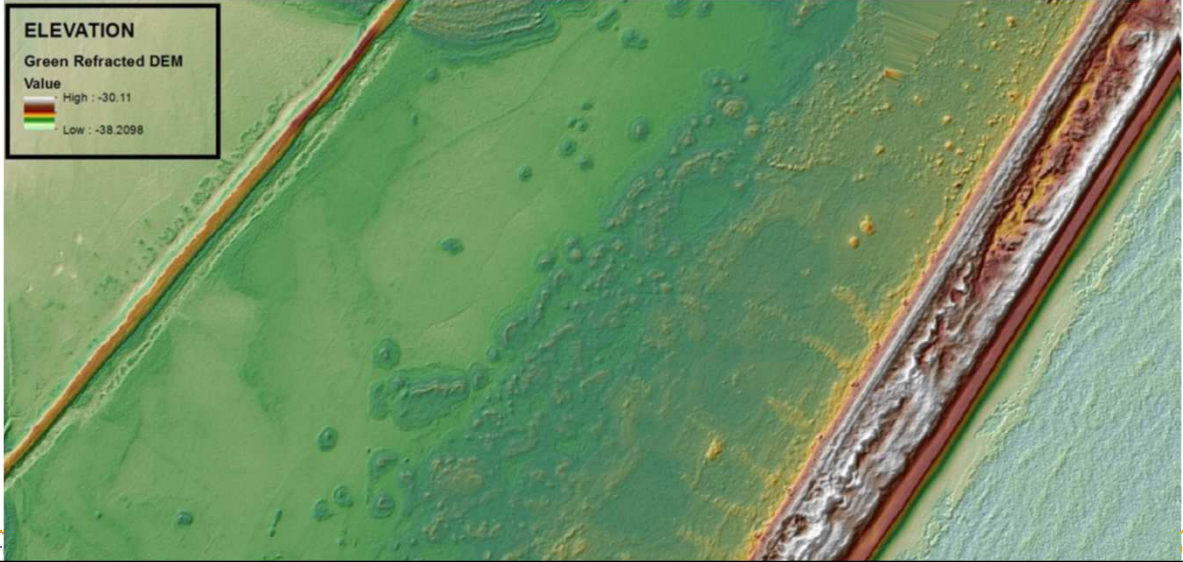
www.riegl.com Copyright RIEGL Laser Measurement Systems GmbH © 2018 – All rights reserved.

Innovation in 3D

Innovation in 3D



Project Example – Seamless Topo-Hydro



Innovation in 3D



Example – Overlaid with Imagery; 7 m resolution RGB



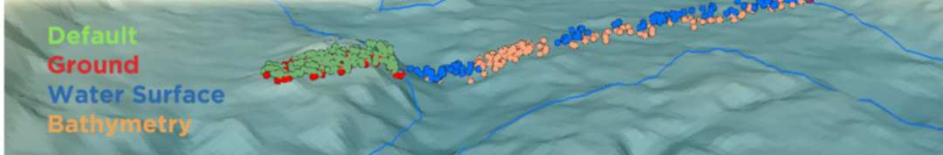
Innovation in 3D



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.



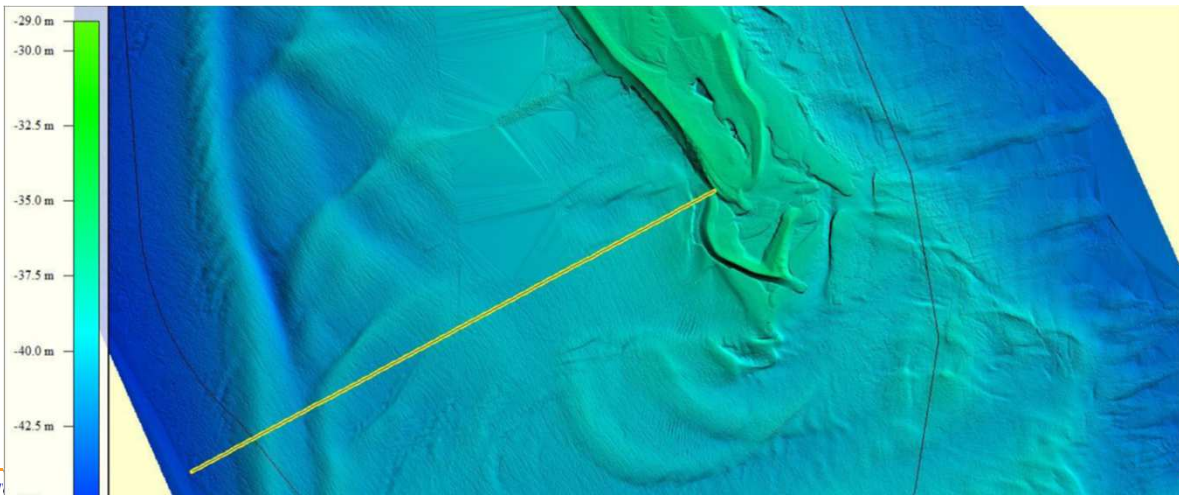
www.riegl.com

novation in 3D

Innovation in 3D



Ocean Performance



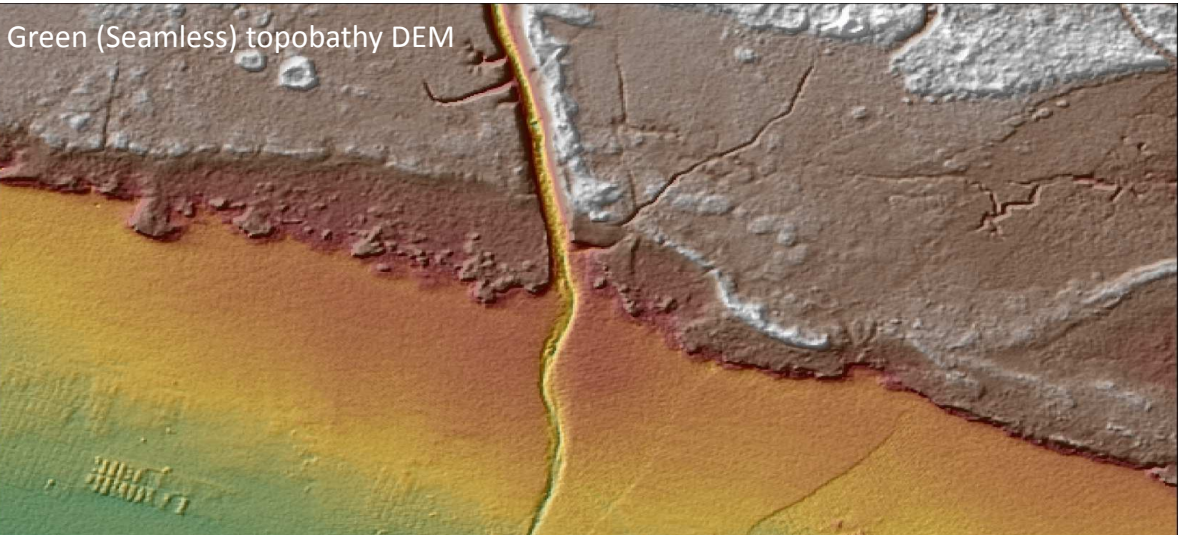
ww

3D

Innovation in 3D



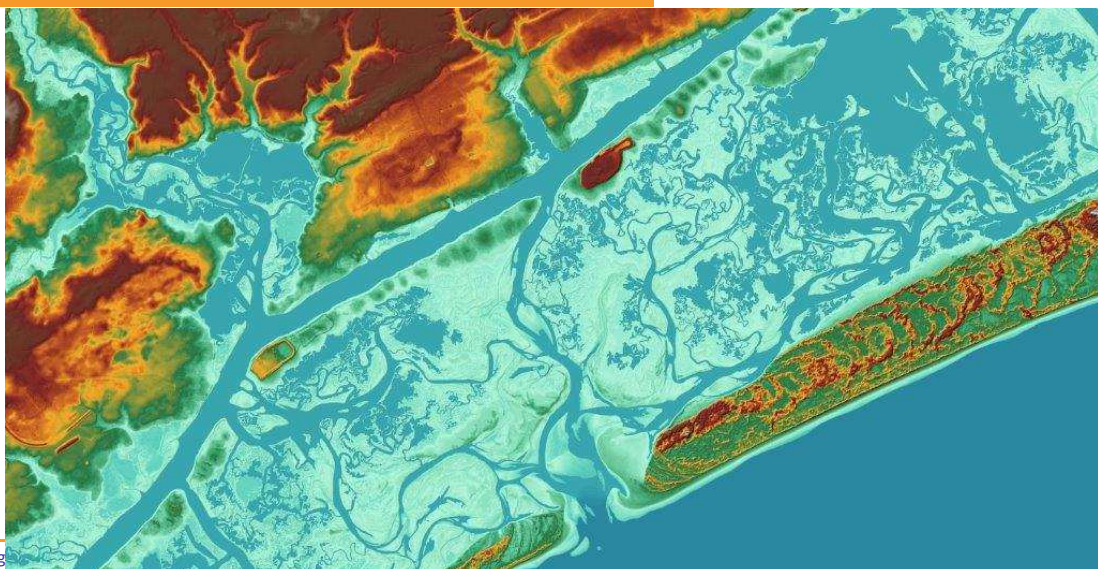
Underwater Features



Innovation in 3D



Incredible Detail



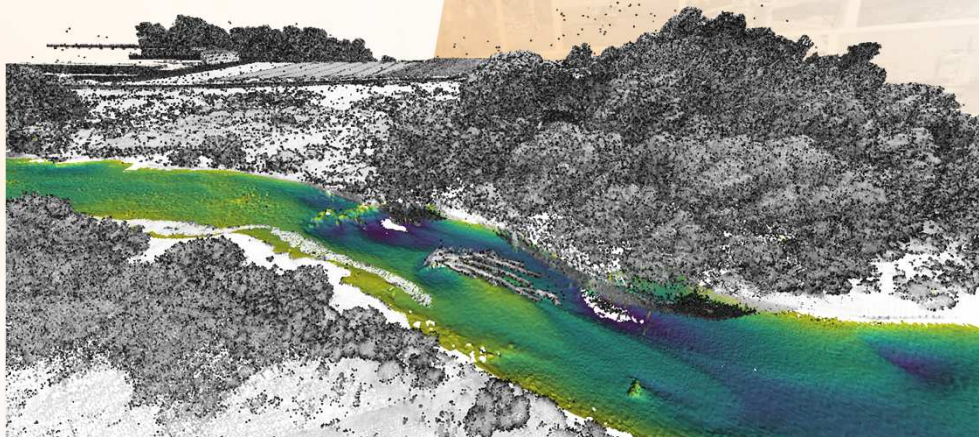
Innovation in 3D



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


wavelength	532 nm (visible green light)
measurement range <i>topography</i>	2500 m at $\rho \geq 20\%$ 3600 m at $\rho \geq 60\%$
measurement range <i>hydrography</i>	1.5 Secchi depth bright ground
ranging accuracy	25 mm
Scanner field of view	40°
Laser beam divergence	selectable, 0.7-1.7 mrad
measurement rate	up to 700 kHz
scan speed	up to 80 revolutions/second
laser safety	Laser Class 3B
multiple time around processing	yes


February 2018
Innovation in 3D





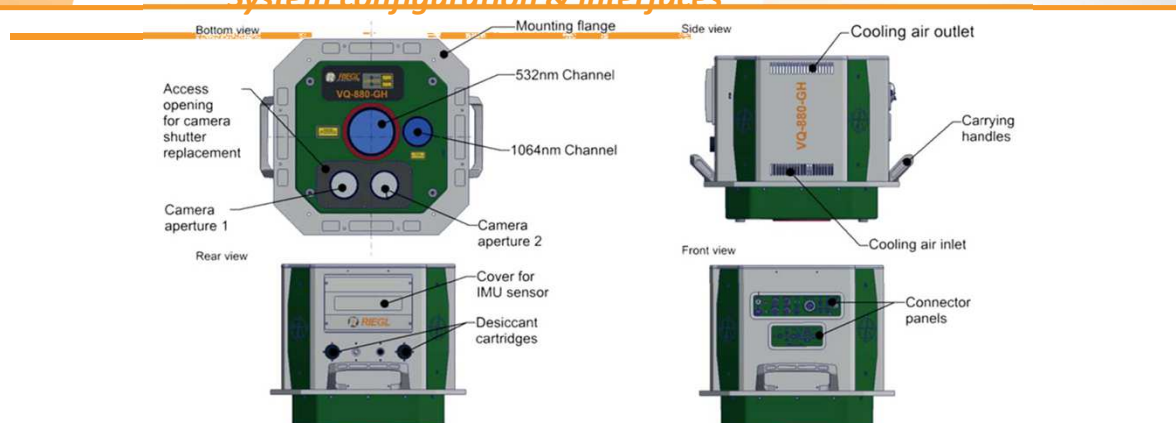
VQ-880-GH, VQ-880-G II key specifications

wavelength	1064 nm (IR)	
measurement range <i>topography</i>	1800 m at $\rho \geq 20\%$ 2800 m at $\rho \geq 60\%$	@ 150 kHz laser PRR
ranging accuracy	25 mm	
Scanner field of view	40°	
measurement rate	up to 279 kHz @ 900 kHz laser PRR	
scan speed	up to 200 revolutions/second	
laser safety	Laser Class 3B	
multiple time around processing	yes	



February 2018
Innovation in 3D

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

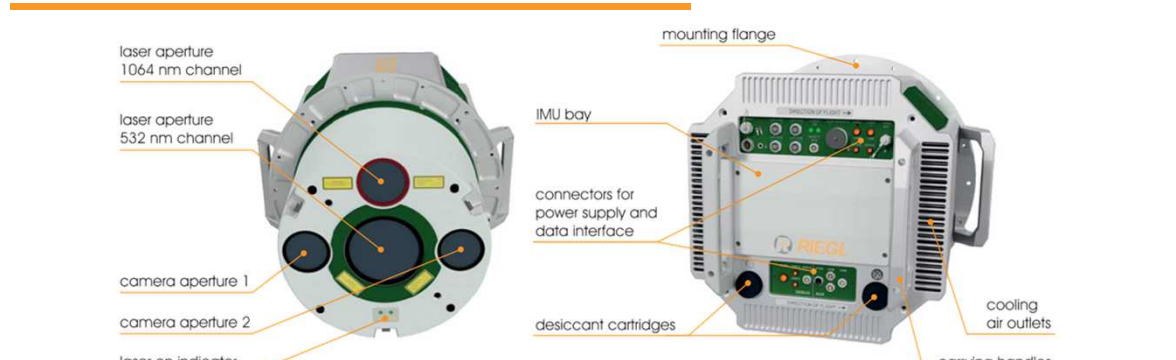


www.riegl.com Copyright RIEGL Laser Measurement Systems GmbH © 2018 – All rights reserved.


February 2018
Innovation in 3D

VQ-880-G II System configuration & interfaces





- weight: 70 kg (depending on configuration)
- dimensions: Ø524 mm x 780 mm



www.riegl.com Copyright RIEGL Laser Measurement Systems GmbH © 2018 – All rights reserved.

February 2018
Innovation in 3D



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



VQ-880-GH




VQ-880-G II






www.riegl.com Copyright RIEGL Laser Measurement Systems GmbH © 2018 – All rights reserved.

February 2018
Innovation in 3D



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



www.riegl.com Copyright RIEGL Laser Measurement Systems GmbH © 2018 – All rights reserved.

February 2018
Innovation in 3D

Innovation in 3D



Inherent Advantages of RIEGL

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



Innovation in 3D



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





Thank you
for your kind attention!



Copyright RIEGL Laser Measurement Systems GmbH © 2018 - All rights reserved
Use of this presentation other than for personal purposes requires RIEGL's written consent.
The presentation is compiled with care. However, errors cannot be fully excluded and alternations might be necessary.



Innovation in 3D