

## Utilizing Dynamic Maps to Analyze AUV Pipeline Inspection Survey Datasets

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# Agenda

- 1. History
- 2. Conventional vs. Pipeline Inspection Sensors
- 3. Data Resolution / Challenge
- 4. Mosaic Datasets
- 5. ArcGIS Add-in
- 6. Demo

### **History**

- Oceaneering acquired C&C Technolgies in April 2015
- First commercial Autonomous Underwater Vehicle (AUV) survey services for Oil & Gas Exploration
- > 350,000 kilometers
- > 100,000 mission hours
- 74 clients worldwide
- 460 projects
- 14 countries





### **Conventional Sensor Data**



Multibeam Bathymetry

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#### Side Scan Sonar







#### Subbottom Profiler



### **Pipeline Inspection Sensor Data**





### **Laser Point Cloud**

**Pipeline Buoyancy Collars** 





## **Sensor Resolution / Data Size**

#### Laser

- 5mm resolution
- 1 survey line ~ 16M points / km
- 3 survey lines ~ 48M points / km
- 30 km pipeline ~ 1.44B points

#### Camera

- 4mm resolution
- 1 survey line ~ 400 photos / km
- 3 survey lines ~ 1.2k photos / km
- 30 km pipeline ~ 36k photos



# Challenge

How do we visualize, analyze, and deliver these high resolution datasets?

- Requirements
  - Integrated with ArcGIS
  - Leverages existing technology
  - Has necessary tools to do analysis and reporting
  - Uses standard deliverable formats (SSDM, PODS, GDB, etc.)
  - Allows for quick playback of survey data
  - Simultaneous, synchronized views of data





#### **Mosaic Datasets**

#### **ArcGIS Add-in**







### **Georeferenced Images**





### **Find Optimal Seamlines**





# **Apply Seamlines**





# **Apply Seamlines**





### **Blend Along Seams**





### **Mosaic Example – Pipeline Mats**











Laser **DEM** 



**Shaded Relief** 





# **ArcGIS Add-in**

#### **Features**

- Linked to ArcMap
- Dynamic map windows
- Events
- Profiles
- Report tools
- Navigation controls
- Measure tool





	Pipeline Inspection		
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	Pipeline Events	🖅 🖃 🗹 Environmental Sample	
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□ 2016_OII_921321_PL		Eeature Name	
Pipeline Inspection **	Preid Joint	- Trench - axis	
🗉 🗹 Station Markers	A Engineering Feature	- Trench - edge	
Pipeline Events		Dicturbed Sediment Area	
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Seabed Feature	$\bigcirc$	Survey Reference Location	
Survey Measurement	0	DVL Calibration	
	🖃 🗹 Free Span	Positioning Check	
Survey Navigation Trackline     Survey Navigation Trac	-	SBES/MBES Calibration	
🗉 🗹 Proposed Survey Run Line	Buried Section	USBL Calibration	
🕀 🗹 Bathymetry Contour		Survey Navigation Trackline	
	Pipe Crossing	<ul> <li>AA - AUV Reference Position</li> </ul>	
Chart, Alignment Sheet Index Map     Parters		Proposed Survey Run Line	
□ Masters	Anomaly	— Proposed Run Line	
Gide Scan Sonar Mosaic		🗏 🗹 Bathymetry Contour	
		<ul> <li>Major Contour</li> </ul>	E Destant
⊞ MBES DEM     ■	🖃 🔽 Coverage Gap	- Minor Contour	Kasters
Photo Mosaic		Survey Keysheet (Outline)	⊞ Backscatter
	Intervention	Other Non Specific	Side Scan Sonar Mosaic
	Ŷ	Chart, Alignment Sheet Index Map	MBES Hillshade
Laser_Slope Mosaic	Lateral Buckling	Alignment Chart	
	_		🗉 🔲 Photo Mosaic
	Top of Pipe		Laser DEM
			표 🔲 Laser Shaded Relief Mosaic
	As Built Pipeline		



# Demo



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# Thank You for Your attention! Questions?



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