Development of an Automated Dredged Material Measurement System for Dump Scows

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Automated Scow Load Measurement System

- **Purpose**: Monitoring mechanical dredging projects based on sediment dug in addition to hydro survey
- **Objective**: Develop a system to measure the dredged sediment load of a scow, not including the water
- **Approach**
  - Integrate COTS camera system, photogrammetry and CHL software
  - Demo/evaluate/refine system on NWP-funded dredging projects
  - Keep dredging industry informed
  - Transition to private industry to operationalize

J.E. McAmis, Baker Bay, WA 2017

Automated Scow Load Measurement System

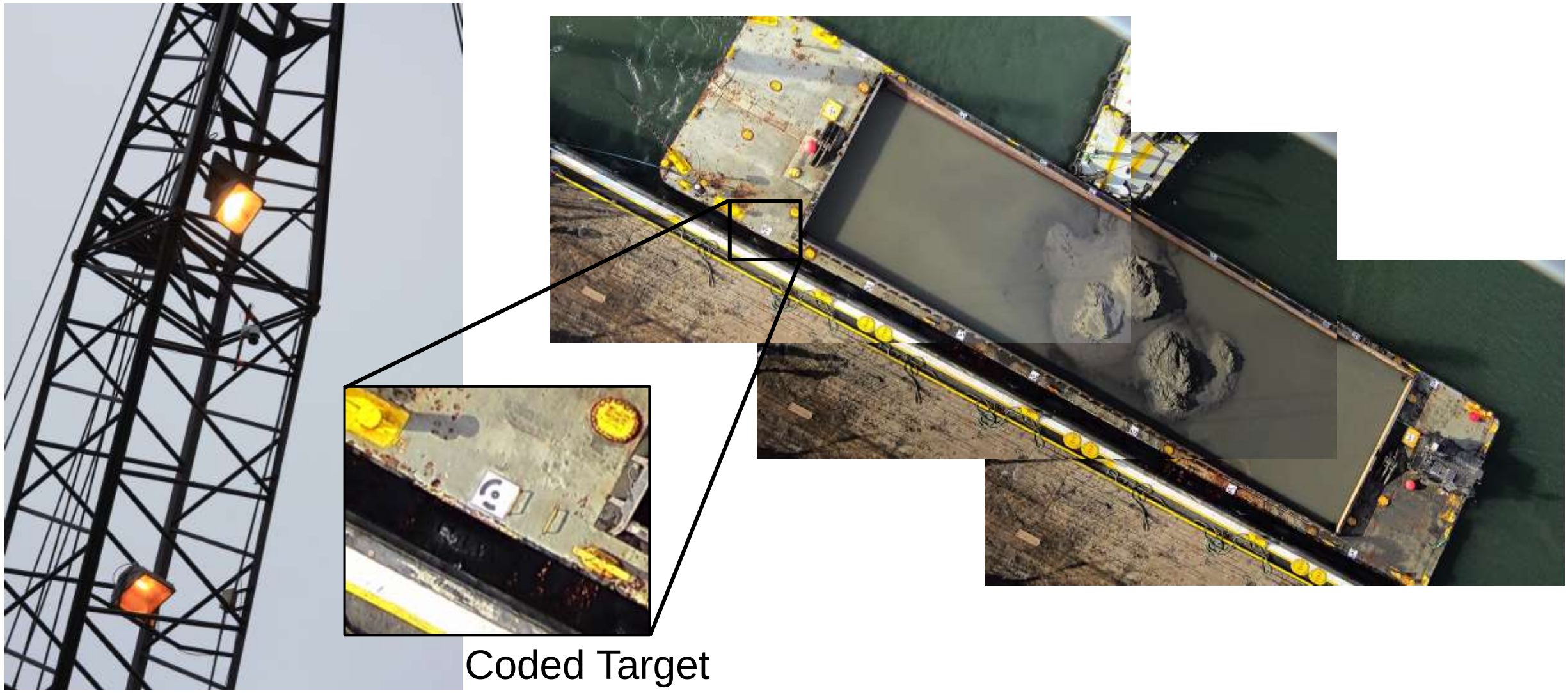
- Summary of Activity
  - Initial development
  - Field test, Baker Bay 2017
  - Second iteration development
    - New hardware
    - Semi-automation scheme
  - Field test, Baker Bay 2018
  - Planning transition field use

J.E. McAmis, Baker Bay, WA 2018

VESSEL, Video Evaluation of Scow SEdiment Load

4k Security Camera

VESSEL, Video Evaluation of Scow SEdiment Load

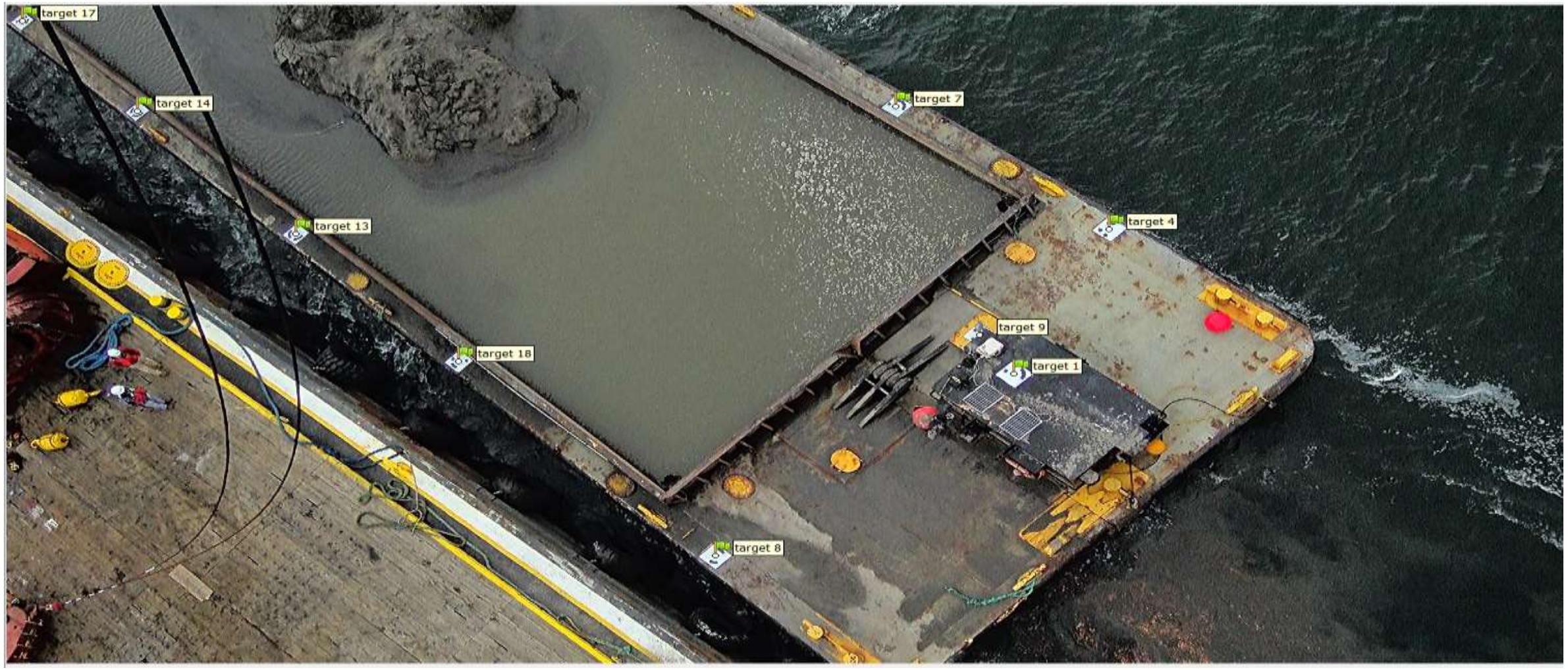


Coded Target

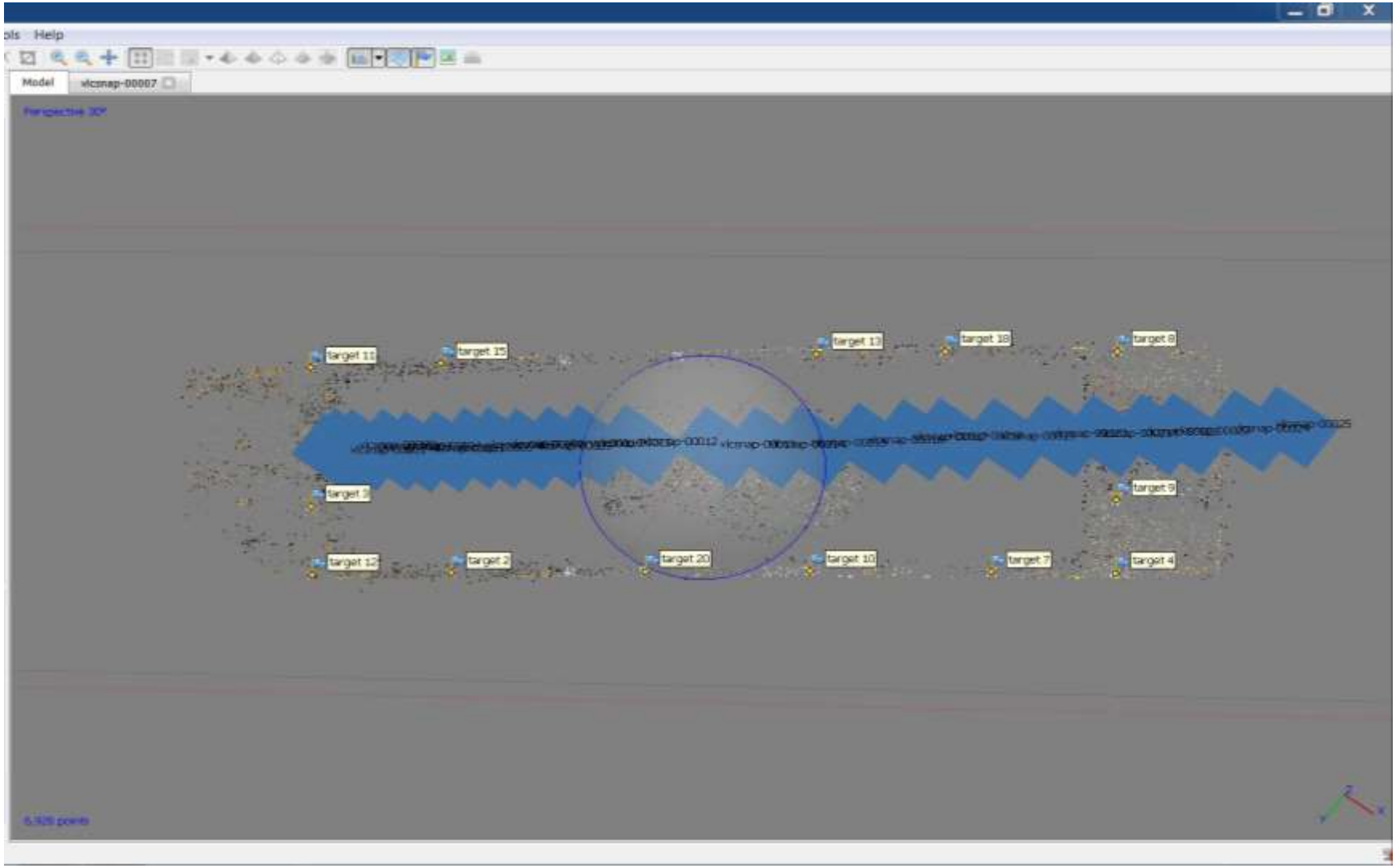
Coded Targets

- Coded Targets are placed and measured all over the scow.
- Create a reference system for the software.
- This is done once during initial installation.

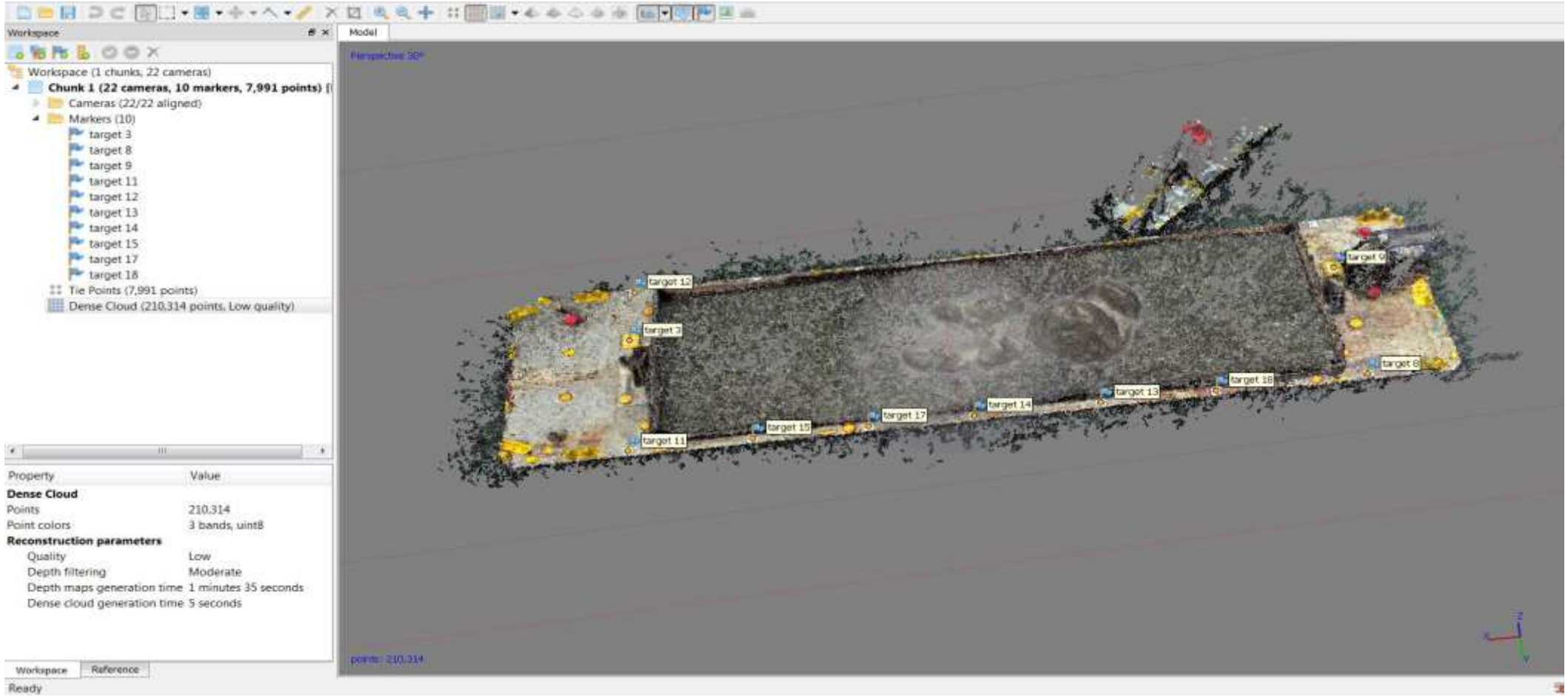
Recognize Coded Targets



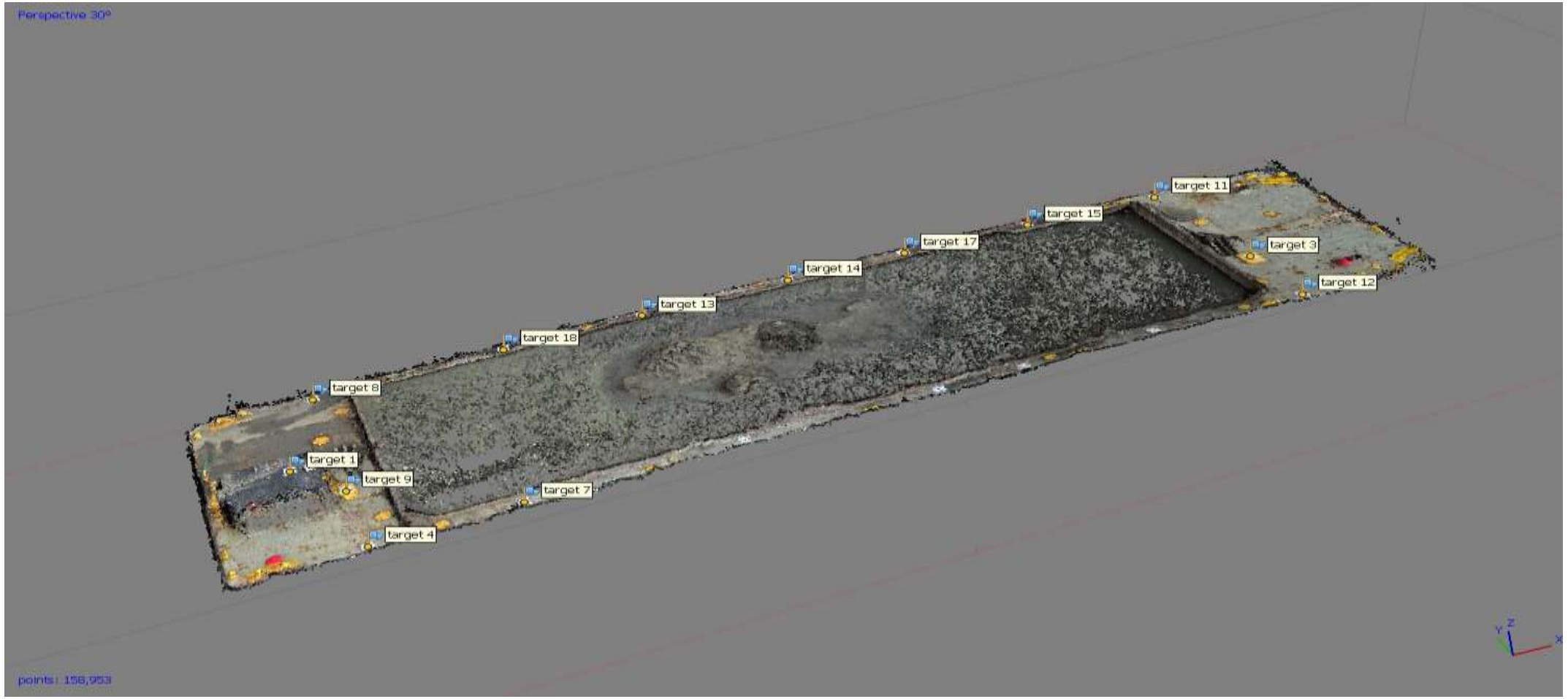
Alignment of cameras/photos



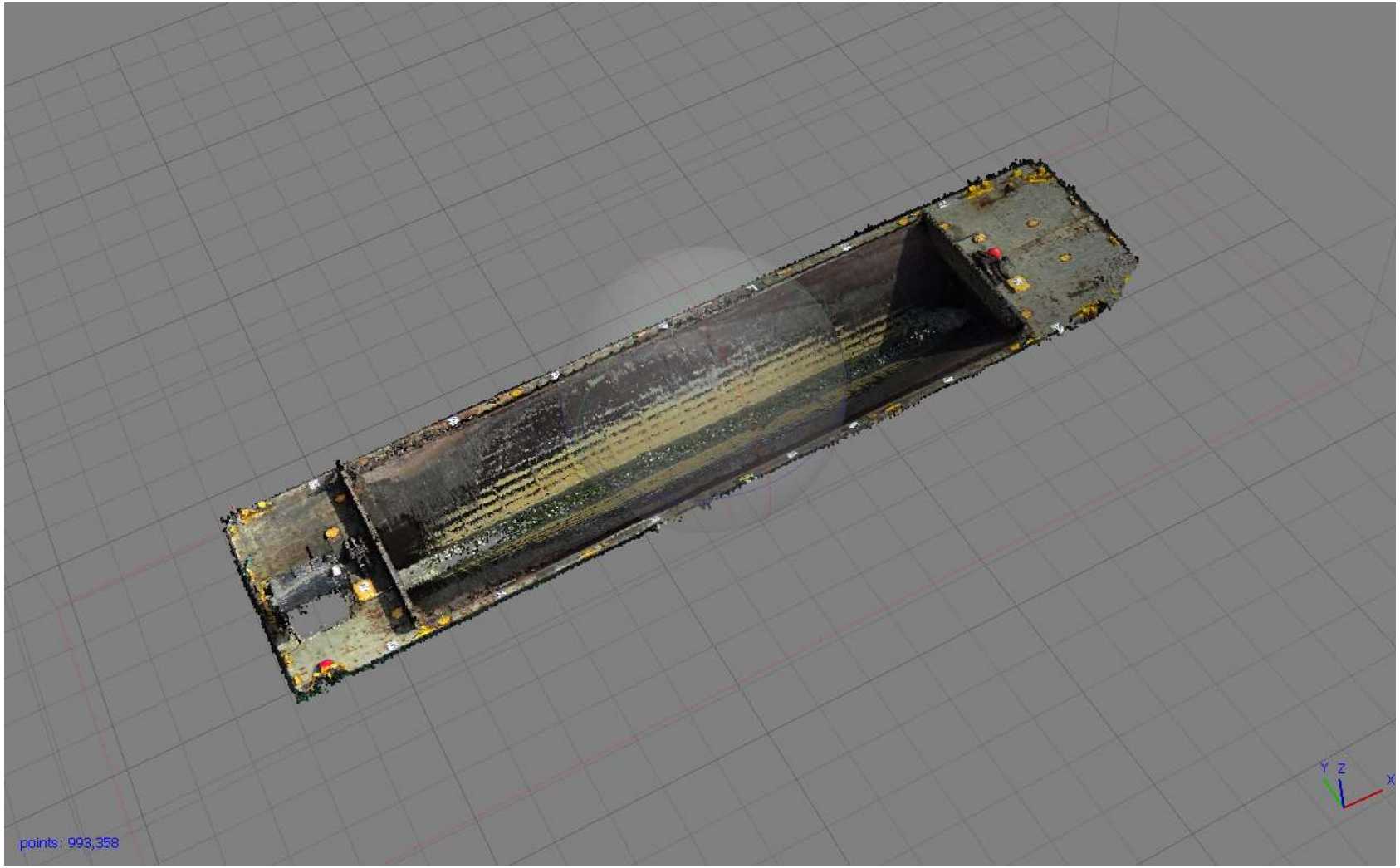
Dense Point Cloud



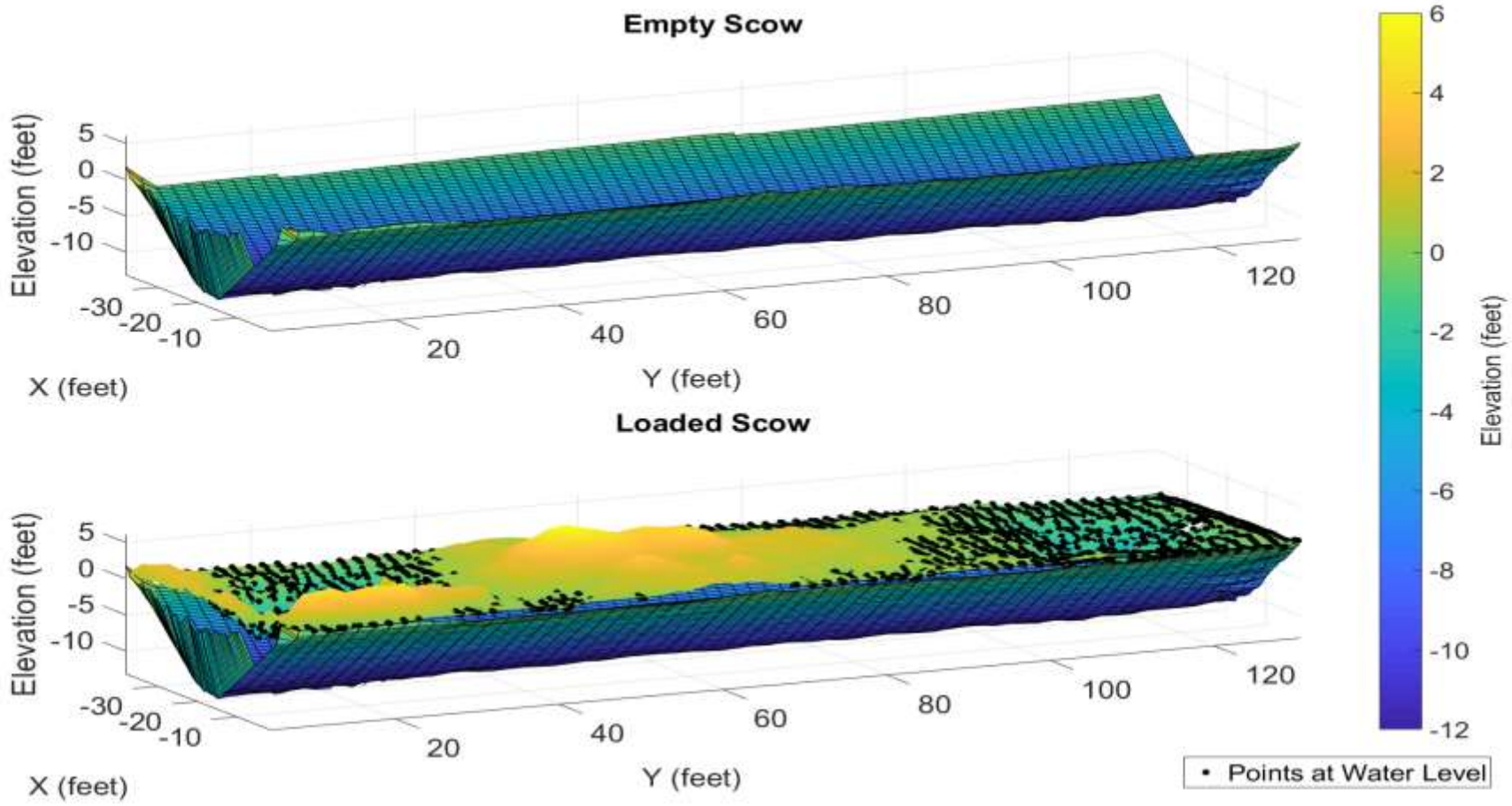
Loaded scow model



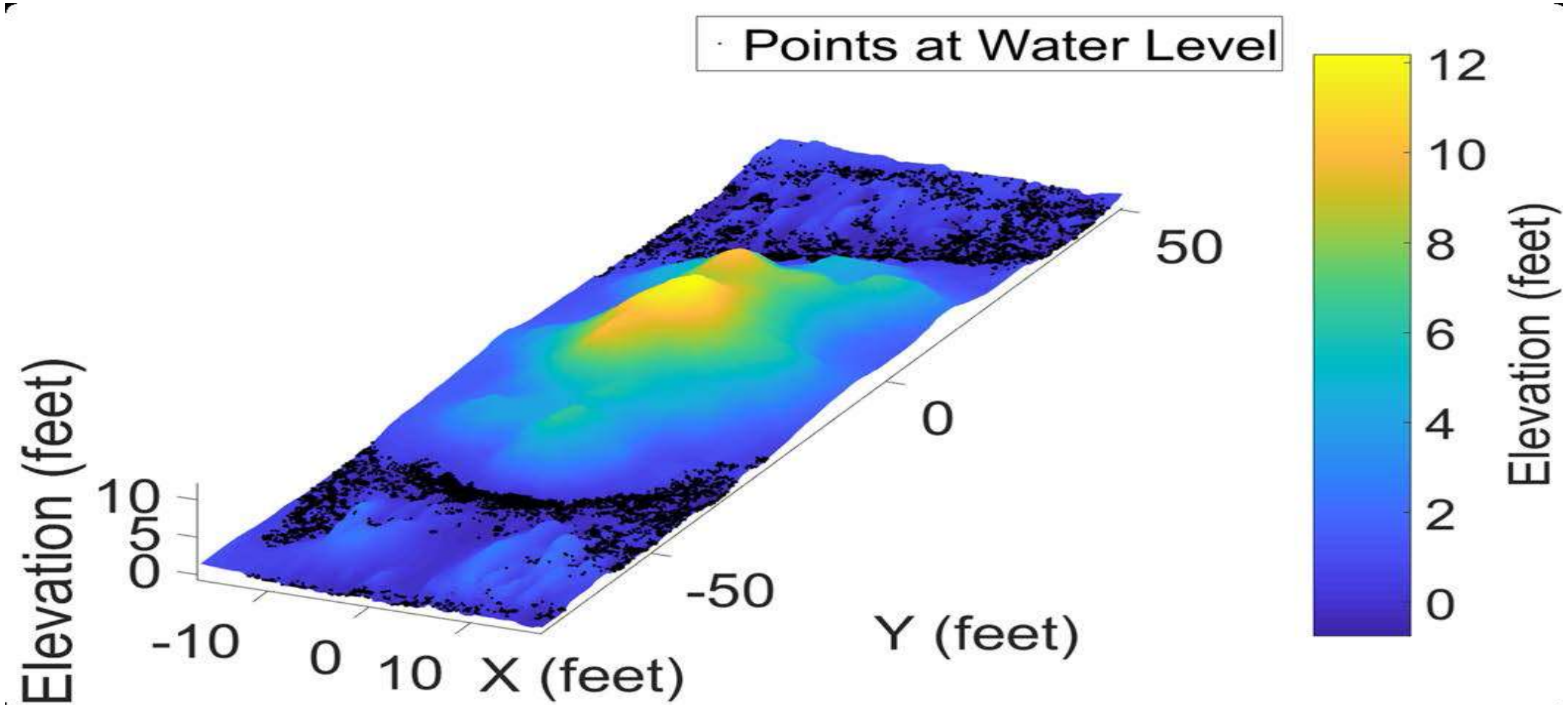
Empty Scow model



Compare Empty vs. Loaded Scow

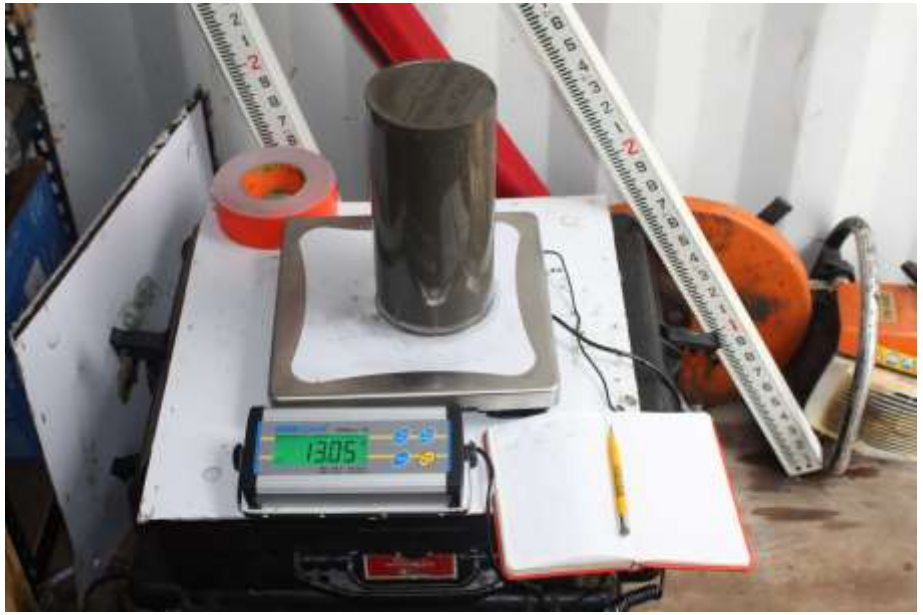


Identify Waterline



External Data Input

- DQM data for draft and mass from scow displacement table
- Possibly use DQM hopper ullage sensor data in future
- Bulk density of emergent and submerged sediment and hopper water



Final Step

$$V_{ss} = \frac{V_s \rho_W - m_s}{\rho_W - \rho_{ss}}$$

Where:

V_{ss} is the volume of the submerged sediment,
V_s is the volume of the submerged sediment and water,
ρ_W is the density of water,
ρ_{ss} is the bulk density of the submerged sediment, and
m_s is the mass of the submerged sediment and water.

Manually sounding the scow hopper

Manually sounding the scow hopper

VESSEL Data Summary

2017

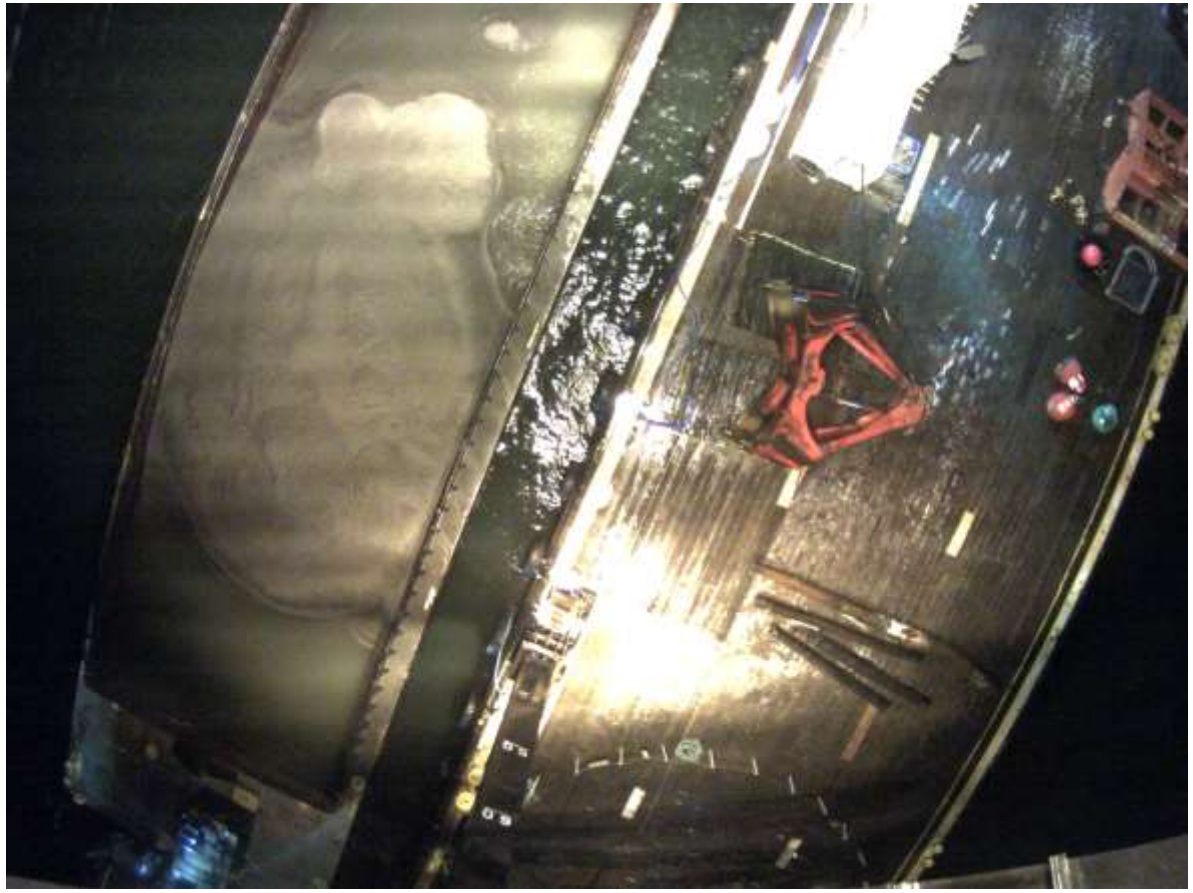
Load #	Manual Sounding	VESSEL	%error	
99	1265	1248	7.4%	
103	1210	1267	12.5%	
111	1311	1320	7.9%	
113	1240	1258	8.9%	
117	1180	1237	13.4%	**Average**
118	1245	1323	14.4%	**10.8%**

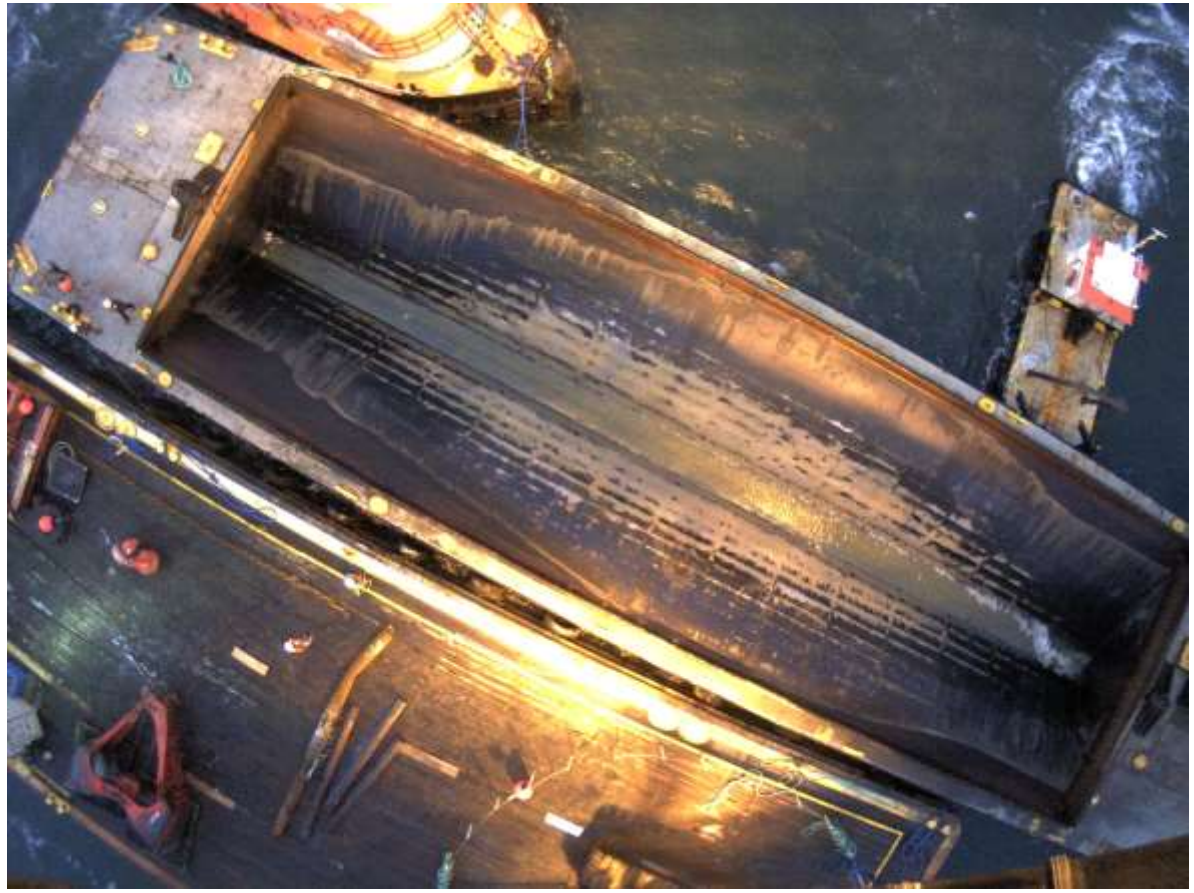
2018

Load #	Manual Sounding	VESSEL	%error	
256	917	937	2.2%	
260	1048	1130	7.8%	
264	998	1055	5.7%	
267	860	856	0.5%	
269	1038	1146	10.4%	
271	1064	1106	3.9%	**Average**
275	1052	1129	7.3%	**5.4%**

Water drops on the camera

Night Operation





Questions