

Detection of geometric deformations on maritime technical structures through Unmanned Aerial Systems.

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Introduction

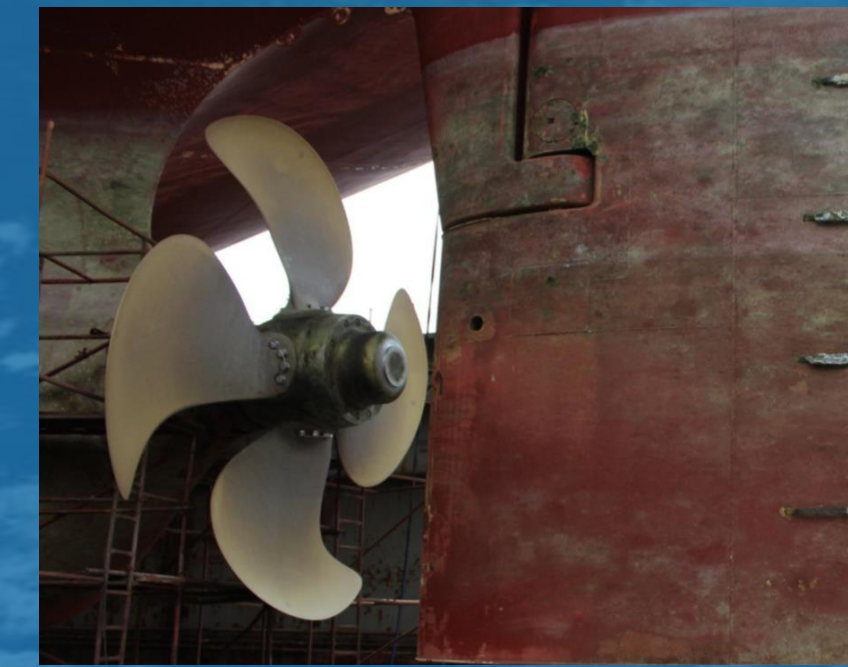
Geometric representation, documentation and inspection of the energy related infrastructure on the oceans, like ships, is essential for the prevention of accidents or failures that may lead to enormous environmental disasters. The subject of the present study is to provide an inspection methodology with the aid of an Unmanned Aerial Vehicle for checking the geometrical consistency of structural elements for liquid / gas transport vessels.

Problem – Objectives

The sea introduces a challenging environment since the related entities, including oil platforms, transport ships, etc., reside on a constantly moving and unstable base. Thus, classic topographic surveying fails to establish accurate control points.

Thus the challenge is to provide a semi-automatic methodology for data collection and deformation estimation, providing accurate localization for ship inspectors.

Application testbed



In the shipyard for repair...



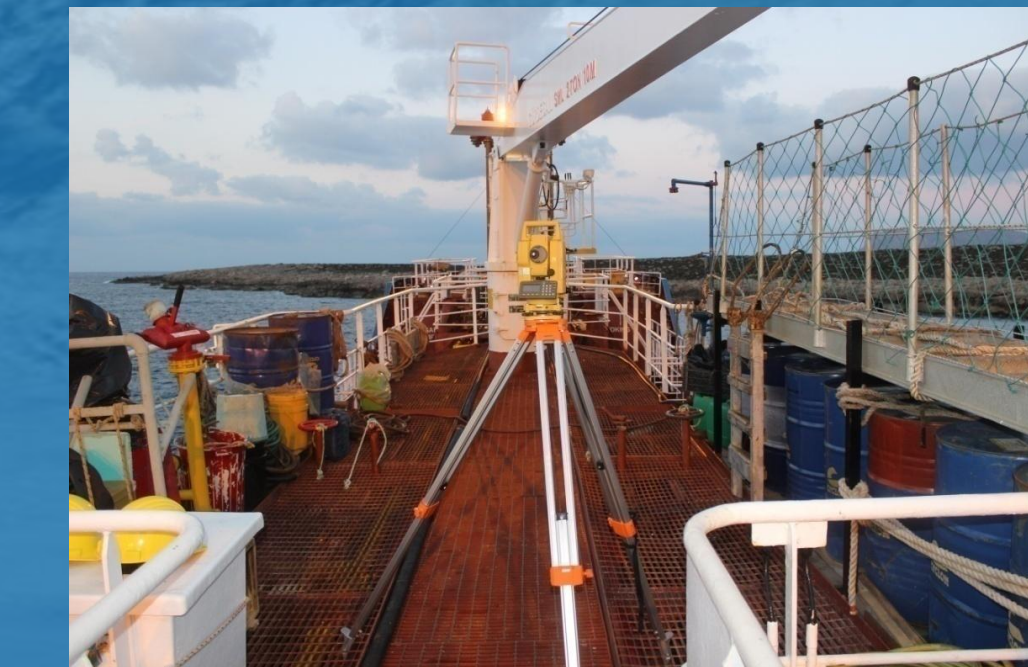
...or in the sea

Novel Control point establishment

Coordinate system needed to localize deformations, breaks, rust, fractures



Establishing Control Points by using a total station on the ship, thus compensating movement of the sea.



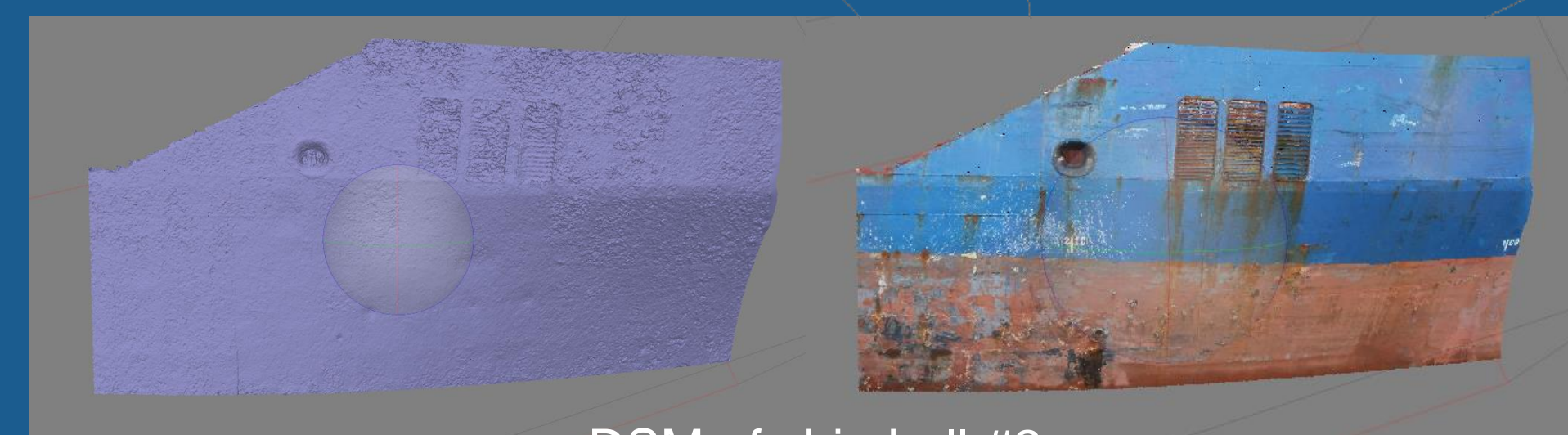
Prototype drone acquiring ship hull images



Photogrammetric products

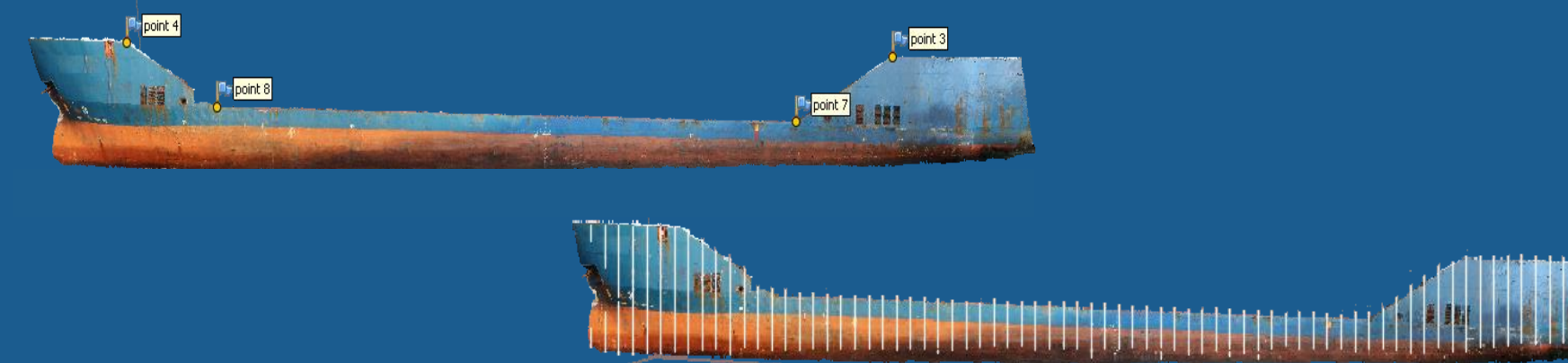


3D reconstruction of ship #1

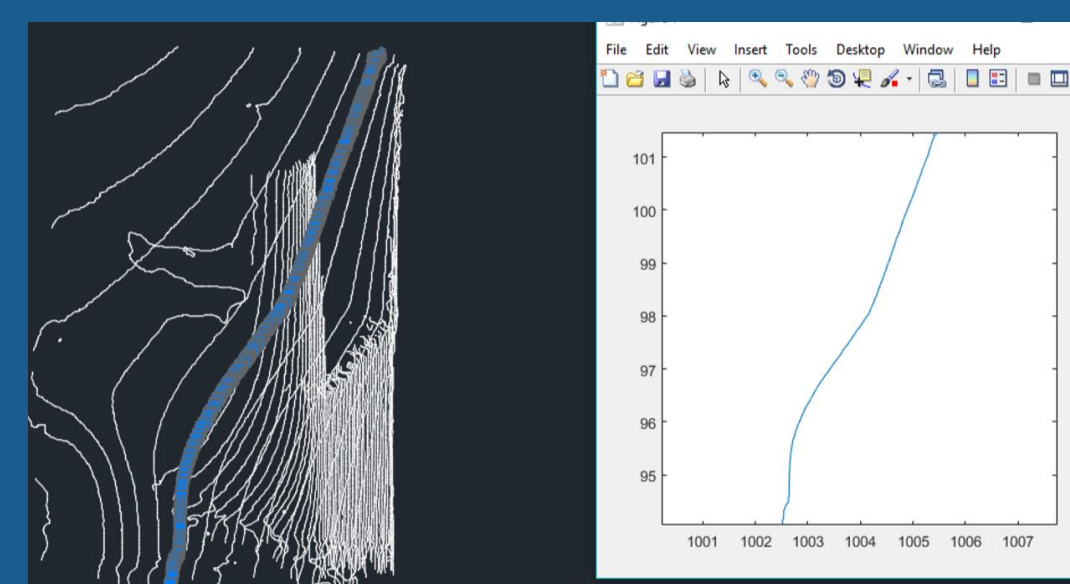
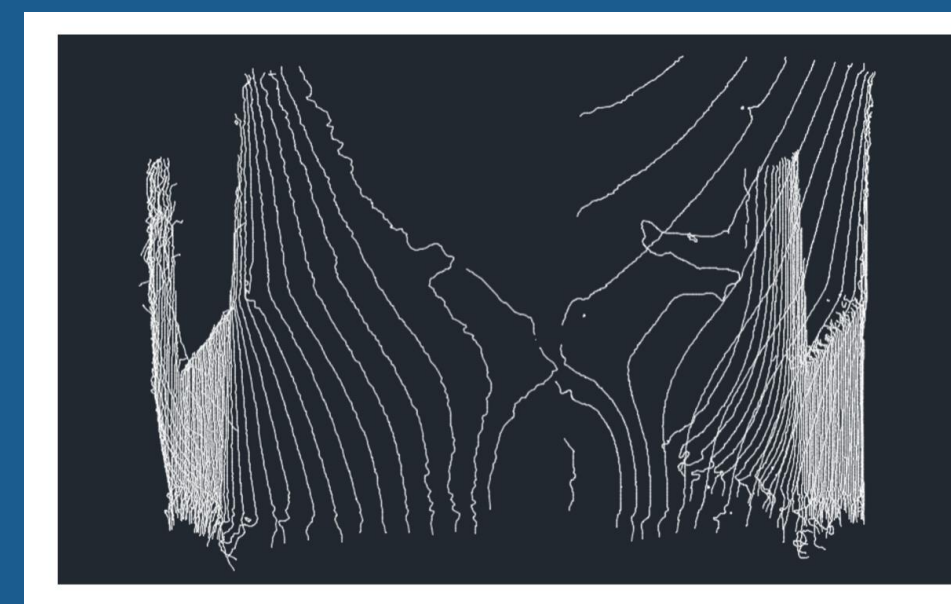


DSM of ship hull #2

Geometric deformation detection



- Acquire cross sections through the hull;
- Adjustment of best fit curves or theoretic hull lines to estimate deformation;
- Find threshold deviation and provide coordinates of candidate deformation point.



Results- Discussion

Geometric evaluation of assembled ships is an important function of shipbuilding, as it allows the monitoring of changes including normal wear and tear or collision implications and provides the prospect of intervention, protection and maintenance.

Under this course of the study, novel methods of coordinate establishment for photogrammetric control point acquisition are applied under varying ship mounting conditions.

The three-dimensional surface models are created while vertical cross-sections are formed and compared with the theoretical construction hull curves in order to:

- verify the overall geometry of the adjusted surfaces,
- identify any defects on the surface of the ship, and
- provide coordinates and analytics for the specific deformations.

The results show strong comparative advantages of the proposed methodology in terms of cost, time, accuracy, in relation to current control practices.