NOTICE OF UNIVERSITY ORAL

GEODESY AND GEOMATICS ENGINEERING

Master of Science in Engineering

Auke van der Werf

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Head Hall – Room E-11

Board of Examiners:
Supervisor: Dr. John Hughes Clarke, GGE
Examining Board: Dr. David Wells, GGE
Dr. Karl Butler, Geology
Chair: To Be Announced

Mast Tracking Capability of EM3002d Using Water Column Imaging

ABSTRACT

When a wreck or other hazard to navigation is found, it is necessary to determine the least depth above it to ensure safety of navigation. For objects with a high aspect ratio such as masts this is particularly difficult. Single beam, lidar and even conventional multibeam bottom detection routinely fail to solve these. In these instances the International Hydrographic Organization (IHO) require that the position and least depth has to be determined with an alternate method. The Dutch Navy (and others) currently have to use a mechanical bar sweep which is extremely expensive.

Previous trials of the Ocean Mapping Group have demonstrated that multibeam Water Column Imaging (WCI) has the potential to reveal mast-like objects in the water column. The difference with conventional multibeam measurements is that WCI records the signal for each physical beam along the whole water column. WCI was originally designed for fish finding not for depth measurements. The current output is an image rather than a discrete solution. The challenge is to convert this image data into robust depth detection. Two steps are involved: (1) we have to select the most likely echo candidate in the imaging space and (2) we have to transform to a depth in the geographic frame. The first issue can be dealt with using operator selection or image analysis. The problem is that the features are ambiguous (otherwise bottom detection would have succeeded in the first instance). For the second issue we need to re-point the angle and range from (1), then we have to recreate the sounding geometry at transmit and receive in order to determine the beam's geographic launch angle, perform a ray trace, and reduce the solution to the vessel reference point. While these transformations are well understood for conventional bottom detections, incomplete information is currently retained for the water column data structure.

As part of this thesis field trials were executed to collect Water Column Imaging (WCI) data for this research. Data were collected with a Dutch Navy survey launch of a wreck on the Dutch Continental Shelf. A "bar-sweep" toolkit special for wreck least depth determination was developed in Swathed. The "bar-sweep" toolkit was designed to locate, determine and calculate the least depth of the mast. A significant component of this research was to transform the water column data to depths in the geographic frame, to calculate the depth and position of each sample in the water column image. Subjective analysis of data around mast-like objects was undertaken to calculate the least depth of the mast. This method was implemented for 20 passes over a wreck and the solutions agree within 10 cm vertically (2σ), and meet IHO Special Order vertical accuracy.

Faculty Members and Graduate Students are invited to attend this presentation.