DATE: March 9, 2024
TO: Model International Conference Committee
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SUBJECT: Research Proposal of Submarine multi-beam survey line

STATEMENT OF RESEARCH QUESTION

My research aims to address the optimization of multibeam echo sounding (MBES) survey line planning to enhance the efficiency and accuracy of underwater terrain mapping. The primary research question focuses on how geometric modeling and optimization algorithms can be integrated to address critical issues in MBES technology such as terrain representation, swath width, overlap rates, and data omission rates.

BACKGROUND OF THE PROBLEM

The project is significant due to the essential role of accurate bathymetric data in underwater exploration and monitoring. Traditional single-beam sounding techniques are limited by linear data collection paths, leading to gaps between survey lines. Recent advancements in MBES offer a solution by covering wider areas per sweep. However, the efficiency and accuracy of MBES are influenced by survey line design, making optimization a critical challenge to address for improving seabed mapping practices.

PROJECT GOAL AND OBJECTIVES

The goal of this project is to develop an optimized design of survey lines for MBES that improves mapping efficiency and accuracy. The objectives include:

To describe the relationship between swath width, depth of water, and overlap rates of adjacent survey lines using trigonometric and planar geometric analysis.

To construct models that account for varying depths and terrain slopes in rectangular marine areas.

To determine the shortest set of survey lines that ensures a specified overlap rate between adjacent swathes and complete coverage of the targeted area.

To optimize survey line layouts based on single-beam depth data to fully cover the target area while minimizing total survey length and avoiding excessive overlap.

WORK PLANNED

The project is planned over a 2-month period, segmented into phases:
Phase 1: Literature review and model development. 1 week
Phase 2: Model development for the remaining problems and initial testing. 1 week
Phase 3: Optimization algorithm application and model refinement. 2 weeks
Phase 4: Final testing, analysis of results, and dissemination preparation. 1 week

ANTICIPATED RESULTS

Expected outcomes include a set of optimized models for MBES survey line planning, contributing to the advancement of underwater mapping technologies. The results will be

disseminated through academic publications, presentations at conferences specializing in marine surveying and geomatics, and integration into practical guidelines for conducting MBES surveys.

Conclusion

In conclusion, this research proposal sets forth a comprehensive plan to enhance the efficiency and accuracy of underwater terrain mapping through the optimization of multibeam echo sounding (MBES) survey line planning. By integrating geometric modeling and optimization algorithms, this project aims to address the limitations of current seabed mapping practices, thereby improving the collection and analysis of bathymetric data.

The anticipated results promise to make a significant contribution to the field of marine surveying and geomatics, offering practical solutions for the challenges faced in underwater exploration and monitoring. Through the successful completion of this project, I expect to set new standards for MBES survey line design, ultimately leading to more precise and efficient underwater mapping techniques.