engagement with the NSF Center for Trustworthy Scientific Cyber Infrastructure (CTSC) [4]. This program encompasses a set of policies and procedures as listed below:

- Master Information Security Policy & Procedures: represents the core information security policies and procedures, including information security-related roles and responsibilities; references to other, special purpose policies; and the core procedures for developing, implementing, and maintaining the information security program.
- Acceptable Use Policy: set of rules that a user must agree to follow in order to be provided with access to a network and/or resources. Used to reduce liability and act as a reference for enforcement of policy.
- Access Control Policy: defines the resources being protected and the rules that control access to them.
- Asset Management Policy: requirements for managing capital equipment including: inventory, licensing information, maintenance, and protection of hardware and software assets
- Information Classification Policy: used to ensure consistency in classification and protection of data.
- Disaster Recovery Policy: contains policies and procedures for dealing with various types of disasters that can affect the organization.
- Personnel Exit Checklist: form to be completed at the end of employment that addresses revoking access to resources, physical space and the return of organizational assets.
- Incident Response Procedures: a pre-defined organized approach to addressing and managing a security incident.
- Password Policy: a set of rules designed to establish security requirements for passwords and password management.
- Physical [and Environmental] Security Policy: details measures taken to protect systems, buildings, and related supporting infrastructure against threats associated with their physical environment.
- Training and Awareness Policy: outlines an organization's strategy for educating employees and communicating policies and procedures for working with information technology (IT).

Regular vulnerability scans/audits (both internally and externally) are also performed to the OOI CI.

V. CONCLUSION

The OOI network was designed to support of the needs of users to conduct research across a wide range of science themes, within an expandable observing infrastructure that spans widely differing ocean domains. The network is designed to provide observations of processes at multiple oceanographic scales, from ocean basin to continental shelf, over time scales from, short-term episodic events to decadal cycles.
OOI CI has initiated its operational phase and data (including science, engineering and data products) flowing from those instruments is freely available to users. The OOI CI portal provides all data, metadata and data processed via conventional algorithms or direct retrieval from OOI storage or data archives. Data quality and data management will utilize generally accepted protocols, factory calibrations and at sea calibration procedures.
During the first months of its operation, OOI community has been growing every day and is made up of a diverse set of users from 180 different organizations from around the world. At least 500 people has already registered on the OOI Data Portal, it has 3,000 unique visitors to the OOI website each month. In June alone, users downloaded over 6TB of data.

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OOI is a NSF-funded effort and involves teams from Consortium for Ocean Leadership, Woods Hole Oceanographic Institution, Oregon State University, University of Washington, Rutgers University, Raytheon and RPS ASA. This document summarizes the contributions from these teams. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

ID47- OBSTACLE DETECTION ALGORITHM OF LOW COMPUTATIONAL COST FOR GUANAY II AUV

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Abstract – Obstacle detection is one of the most important stages in the obstacle avoidance system. This work is focused to explain the operation of a designed and implemented for the overall detection of objects with low computational cost strategy. This strategy of low computational cost is based on performing a spatial segmentation of the information obtained by the SONAR and determine the minimum distance between the SONAR (AUV) and the obstacle.

Keywords – Obstacle Detection, Real Time, Low Computational cost.

I. INTRODUCTION

The obstacle avoidance system for AUVs are divided into two phases: the first obstacle detection and the second consisting of a strategy of evasion. At work [1], an obstacle avoidance system was designed for the vehicle Guanay II. In this work, the phase of obstacle detection is subdivided into three general stages. The first stage corresponds to the configuration of SONAR and communication with the control unit. The second stage is related to the configuration of the operating parameters of obstacle detection system [2]; these parameters affect the execution time of the algorithm. Finally, we have in the third stage the strategy of obstacle detection, from the data provided by the SONAR.
Initially in previous work [3], we have designed and implemented a detection strategy, based on the identification of objects automatically on an image, constructed from data provided by the SONAR.
The measured time of execution of this strategy is 22.7s. At that time, it includes the time for the acquisition of measurements (10.89s), the time used to process the image and perform the obstacle detection (11.89s).

According to the exposed in [1], if the AUV is moving at a speed of 1m / s, the distance traveled by the AUV before the system can take a decision that will avoid a collision is 23 m, which generates a high risk of collision with sudden obstacles. To avoid this problem, this paper proposes to reduce the execution time of the step of the algorithm that is responsible for processing information and perform the object detection. We have designed and implemented an algorithm of low computational cost, which is explained in the next section.

II. ALGORITHM FOR OBSTACLE DETECTION OF LOW COMPUTATIONAL COST

The global strategy of obstacle detection of low computational cost that is proposed uses the same acquisition stage that the algorithm presented in [3]

The new stage is responsible for processing information and detect obstacles, this stage is divided into two blocks, the first the segmentation of data and the second analysis of each sector and determining the value of interest.

The first block, divided into three sectors of 30º the area scanned by the SONAR (see Fig. 1). In previous work [2], the operating parameters of the SONAR were defined. We have contemplated a scan area of 90º, with a step of between beams of 0.9º and 400 samples per beam.

Each sector consists of 33 beams, which generates 33 data vectors. In this case we obtain a matrix of 400 (samples) X 99 (vectors).

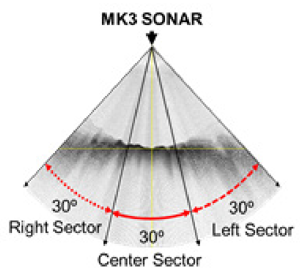

Fig 1. Sectorization of the scanned area

In the second block, it is analyzed in real time, each of the 33 vectors corresponding to the sector in the which the beam is located. Each vector is analyzed, and the minimum distance between SONAR and the obstacle is calculated for each vector. Finally, a global minimum distance is determined for the sector.

The beam goes through the different sectors until completing the area of 90º, at each point the process is repeated and the minimum distance (SONAR - obstacle) is calculated for each sector.

Finally, as a result of this strategy to overall detection of the obstacle, we obtain the minimum distance between the SONAR to obstacle for each of one of three sectors, allowing us to determine the globally location of the obstacle.

These 3 values are used as input variables in obstacle avoidance algorithm exposed in [1].

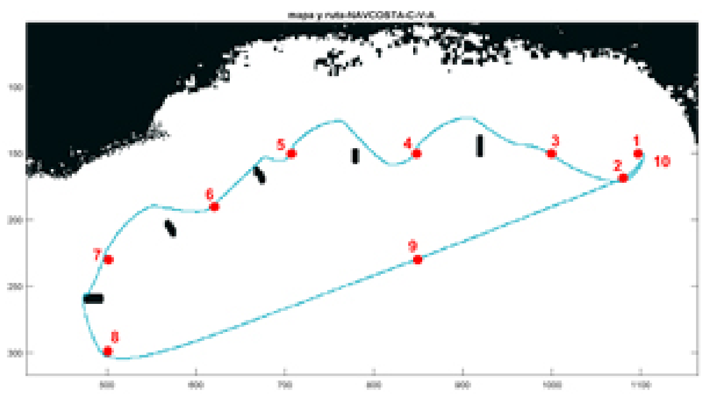

Fig 2. Simulation result

III. RESULTS

In experimental tests, the measured time of the execution of this strategy of obstacle detection algorithm is 0.198s. By contrast, for the algorithm used in [3], which does not divide the image and processes the full image, the runtime measured is 11.89s. Therefore, we have achieved a reduction of 51.2%.

The total execution time of the algorithm, considering the different stages is now the 11.08s, the which allows to obtain a distance traveled by the AUV of 11.08m at a speed 1m/s, this decreasing the risk of collision with sudden obstacles.

Using the new strategy to overall detection of the obstacle and obstacle avoidance algorithm presented in previous work [1], we obtain the simulation result shown in Fig.2.

IV. CONCLUSIONS

We have designed and implemented a new strategy of obstacle detection, which has a lower computational cost reducing the initial cost in 51.2%. Reducing the risk of collision with sudden obstacles.

This reduction is a consequence of that the new algorithm uses an array of less dimensions, and that the processing and data analysis is performed directly on the vectors and not on a pre constructed image.

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