



NORBIT SECURITY

**DIVER DETECTION IN SHALLOW WATERS
WITH
NORBIT FLS and GUARDPOINT TRACKING SOFTWARE**

Introduction

Enemy or terrorist divers can pose serious threat to sensitive installations, naval and commercial ports, critical infrastructures (such as power plants), naval vessels, superyachts, cruise ships, LNG terminals, etc. Smuggling operations are also reportedly carried out by divers.

In the past decades, the potential threat posed by enemy divers has been enhanced by the most recent advancements in the areas of underwater navigation technology, personal mobility and underwater communication technologies.

Diver Detection Sonars (DDS) are acoustic devices which, when coupled with a proper specialized software, are used for detection, tracking and classification of divers and submerged diver/swimmer delivery vehicles (DDVs / SDVs).



Introduction

Time is of the essence. The capability to alert the security personnel in time for their intervention is crucial. The critical information delivered by the DDS are the classification of the type of threat (closed/open circuit diver, underwater vehicles), direction of the threat, speed, bearing and estimated time to target.

Diver Detection Systems serve a variety of underwater security applications, primarily offshore installations, ports, coastal and river facilities, ships and pipelines. The noise in the signal caused by passing vessels, large sea mammals or school of fish make the job of the tracking software particularly difficult - when the goal is to create the minimized number of false alarms.

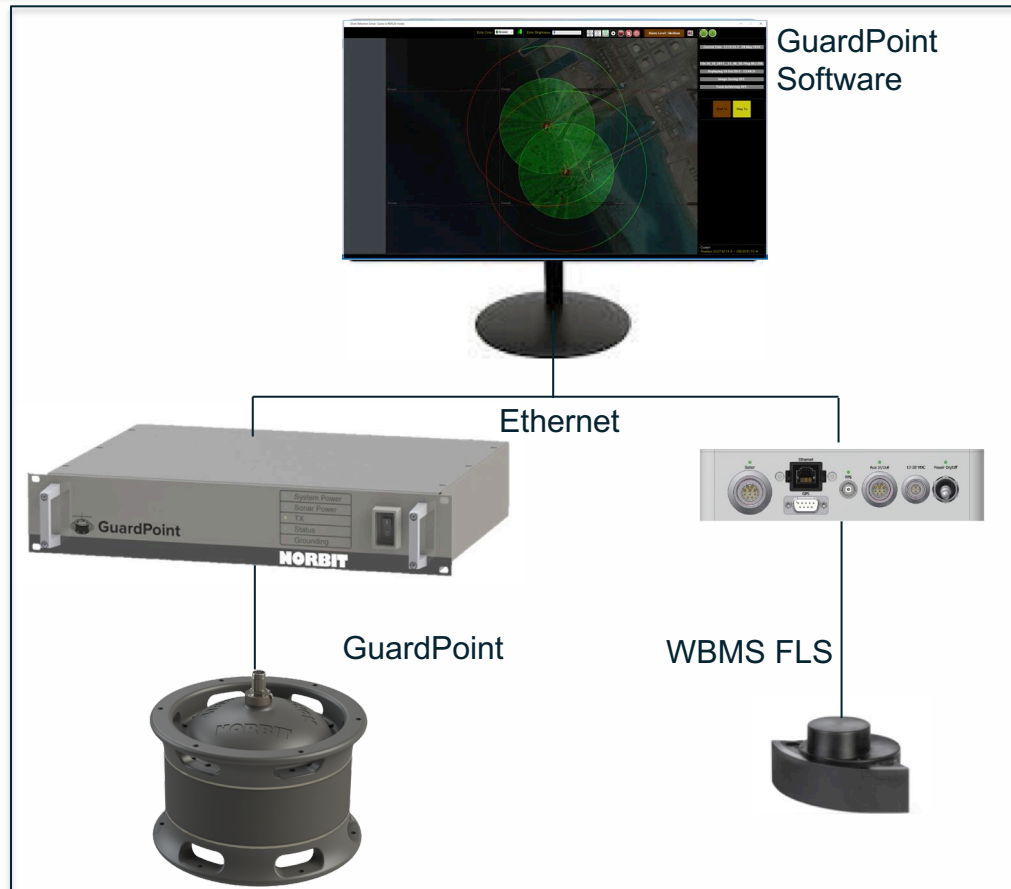




NORBIT's GuardPoint Tracking Software is designed to detect, track and classify divers and underwater submersibles. It is generally interfaced to GuardPoint Diver Detection Sonars and it can also be interfaced to NORBIT Wide Band Multibeam System (WBMS) FLS (Forward Looking Sonar) sonars to comply with a variety of security projects.

Single or multiple sonar heads (GuardPoint and the commercially available WBMS FLS sonar heads) are inter-operable in a variety of configurations to adapt to different environmental conditions.

GuardPoint Diver Detection Sonar provides long range detection and tracking of underwater targets, while WBMS FLS provides shorter range detection and tracking.





Diver Detection Tests in Shallow Waters

NORBIT recently conducted a test with the Armed Forces of a NATO country to test the capability of GuardPoint Tracking Software interfaced with WBMS FLS sonar.

The test was carried out next to the Special Forces and the Army Helicopter Base and in very shallow waters of a river where depth is only between 1 and 2 m and visibility is only 5 to 10 cm. The use of WBMS FLS was preferred because of the shallow water conditions.

During the tests, the Special Forces and Army deployed both open and closed-circuit divers for a variety of test scenarios run in daytime and at night.

Since the area presents many disturbances, including high level of surface, bottom and volume reverberations and high shipping density, this was the perfect simulation of a possible real-life application of the system.

Divers During the Tests at Night





Preparation

1. Bathymetric site survey using NORBIT iWBMS Multibeam Sonar and iLIDAR Laser Scanner
2. Sound speed profile measurement for sonar performance prediction
3. Pier installation

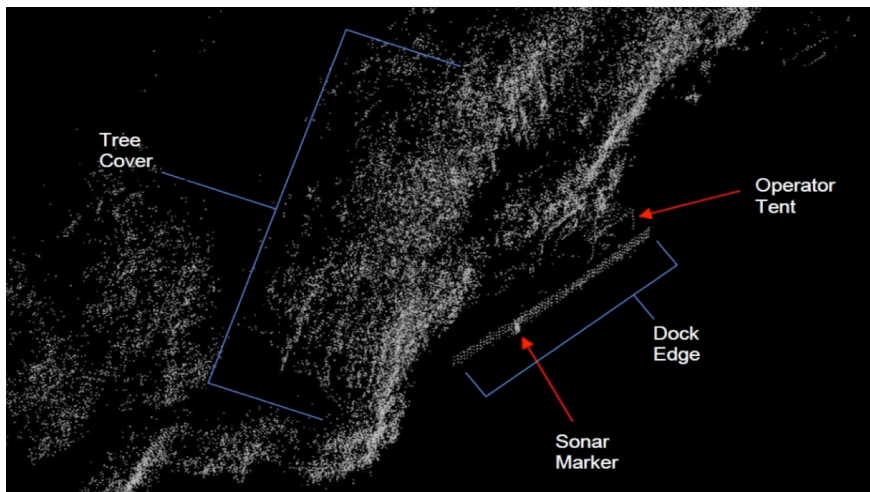


Portable Command and Control Station

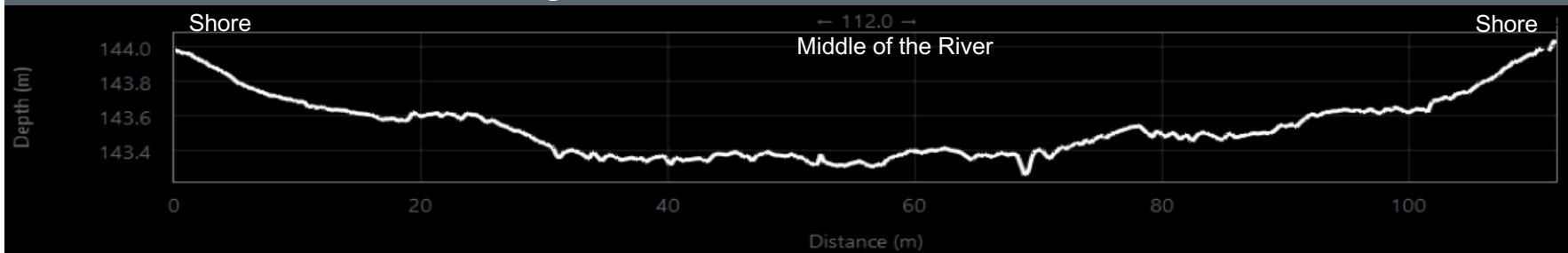


WBMS FLS attached to the Pier

3-D Point Cloud View of the Test Site



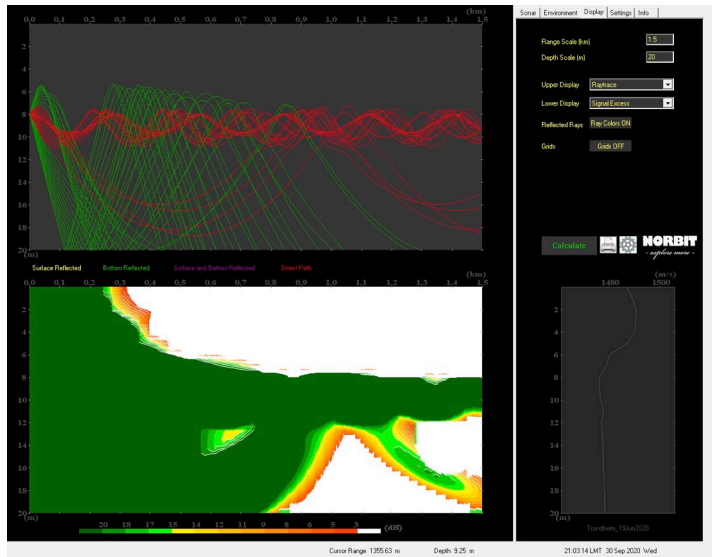
Cross Section of River in Local Height Transformation



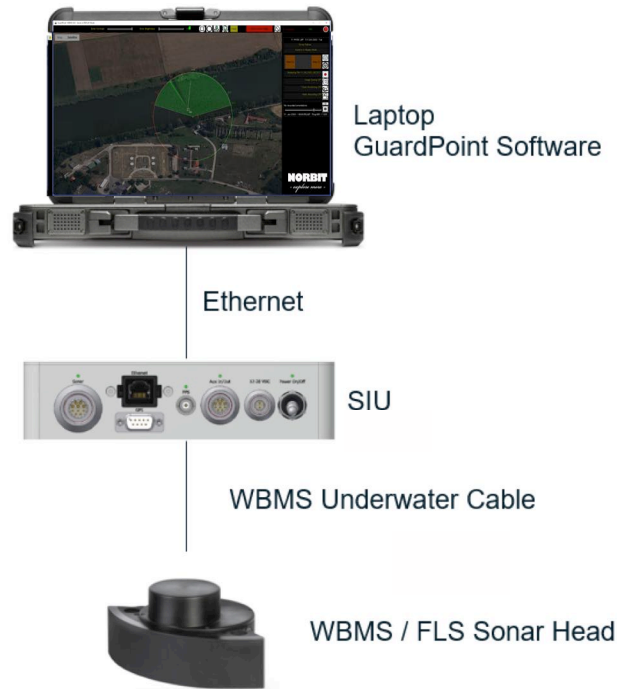


Performance Prediction with NORBIT NORTrace

Performance of a sonar can vary -even on a daily basis- depending on environment conditions (e.g., temperature, rain, salinity). NORTrace is a sonar performance prediction software estimating sonar signal propagation underwater with given environmental parameters. Prediction is based on Ray Theory with validated Noise, Sonar, Target and Environment models. We used NORTrace to estimate range and probability of detection to optimize sonar parameters and deployment depth.



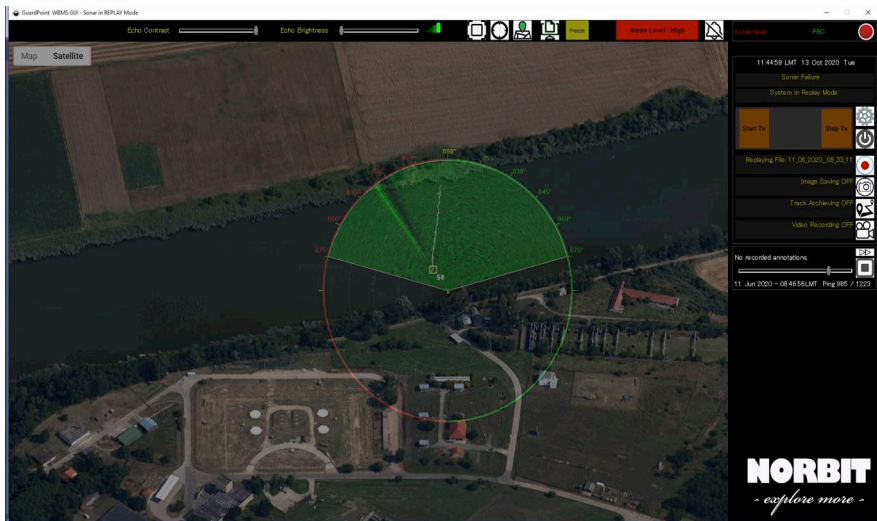
System Configuration for the Test





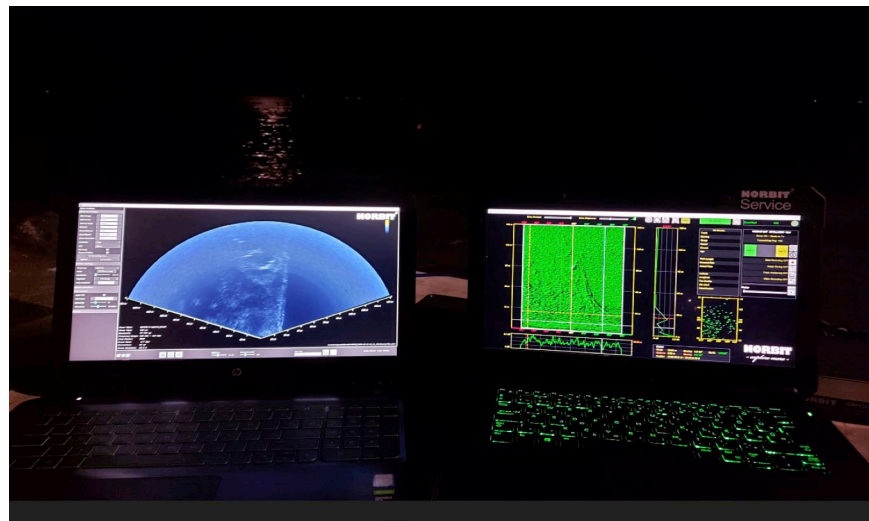
GuardPoint Displays The Area Monitored

The image below shows the area of the river being monitored together with the overlaid sonar images.



Adjustment Cross-Check

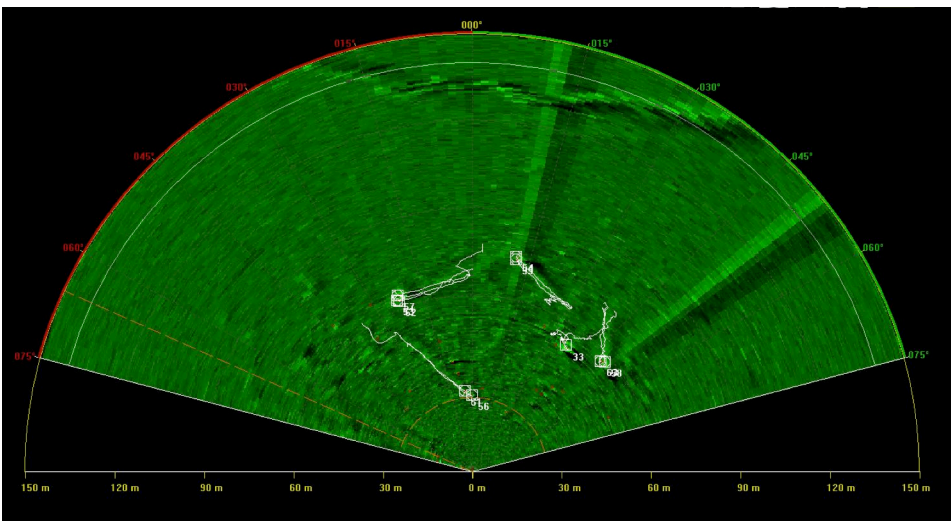
Checking sonar settings using WBMS FLS User interface (left) and GuardPoint User interface (right).





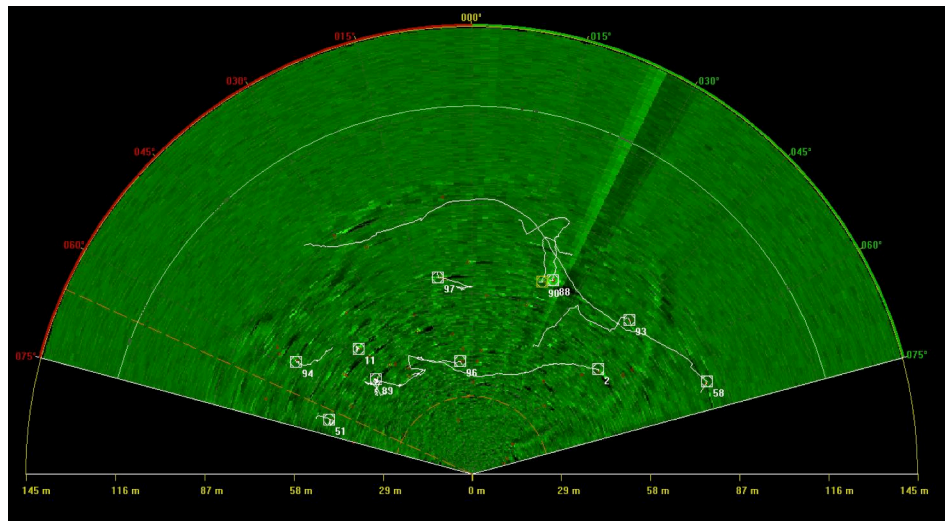
Individual Diver Groups Detection

Four Diver Groups (10 Divers in Total) Tracked and Classified



High Number of Diver Tracks

11 Divers Tracked and Classified

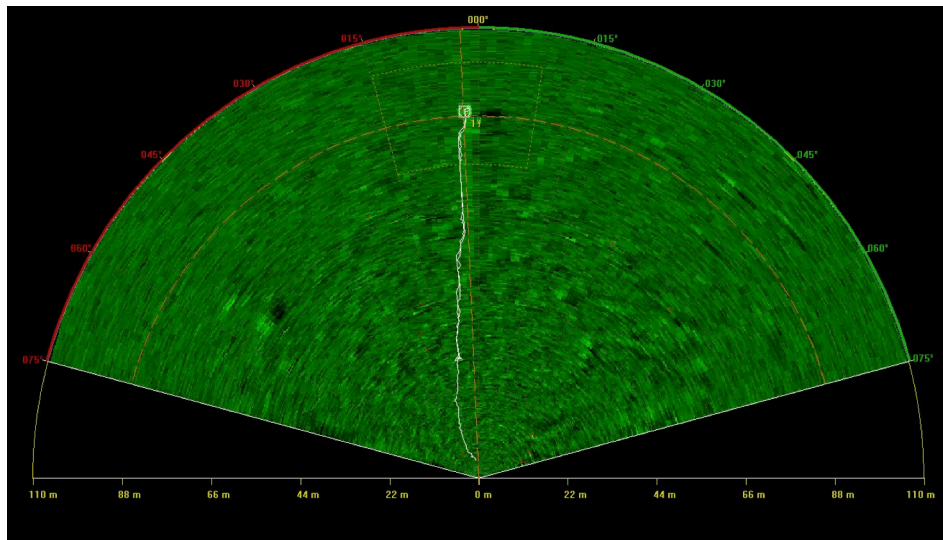


GuardPoint Tracking Software automatically marks classified divers with a white square box on automatically positioned range and bearing with uniquely given ID. Also track trajectory is marked to indicate the latest positions where divers were underwater.



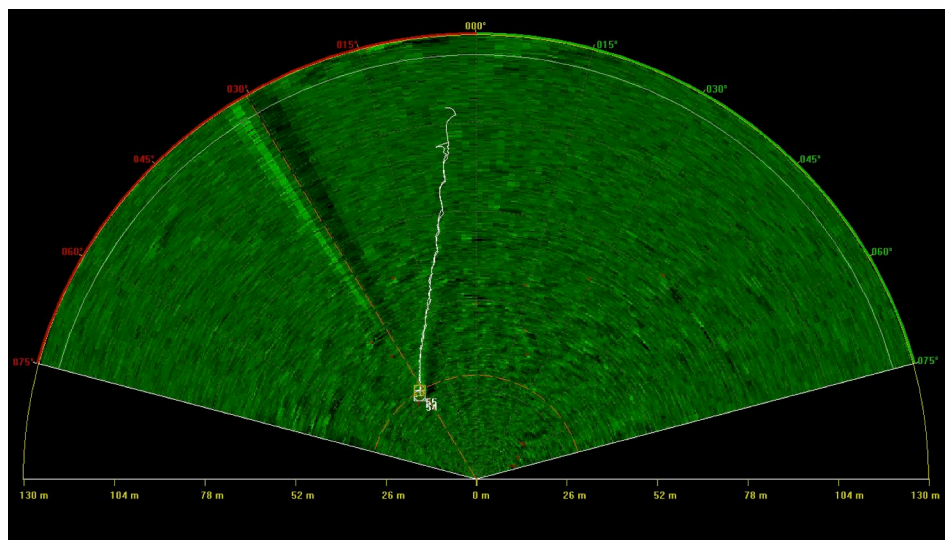
Test of Tracking Over Long Ranges Divers Swim Away From the Sonar

Divers Swim Away From the Sonar



Test of Tracking Over Long Ranges Divers Swim Towards the Sonar

Divers Swim Towards the Sonar



GuardPoint Tracking Software outputs the position of the diver, the direction and the estimate of the time to reach the sensitive point. The response team has all the information needed to intervene on time and to prevent a breach.

Tests Performed	Tracking	Classifying	Results
Close-Formation Diver Groups			All six divers tracked and classified successfully.
Individual Groups of Divers			11 divers distributed in four individual mission groups of divers tracked and classified successfully.
High Number of Divers			6 divers in close-circuit and 5 divers in open-circuit breather tracked and classified successfully.
Swimming Towards Sonar Swimming Away from Sonar			Consistently tracked and classified in the whole swimming path.

Conclusions

- Underwater threats were automatically detected, tracked and classified in a challenging environment with very low false alarm rates.
- WBMS FLS + GuardPoint Tracking Software demonstrated to be a light-weight and portable system to support rapid and easy installations for underwater surveillance.
- NORBIT's GuardPoint Software was very easy to operate even for operators not familiar with sonar operations.
- Several display formats are available, assisting the sonar operator with a better interpretation and localization of the threats.
- No internet connection was required during the operation to maintain a "Stealth" and "Secure" operation and data processing.

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~ explore more ~

A night-time scene on a boat. Several divers are in the water, illuminated by a bright yellow-green light. A red and white buoy is visible in the water. A person is standing on the boat, looking out at the divers. The background shows a dark lake and trees under a dark sky.

Diver Detection Sonar