RANGER

Newsletter #4

MAY 2017

RANGER

RAdars for loNG distance maritime surveillancE and Search and Rescue opeRations

www.ranger-project.eu

Contents

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Dear Readers,

Welcome to the fourth issue of the RANGER newsletter.

RANGER is a 42-month European project, co-funded by the European Union's Horizon 2020 research and innovation programme. The consortium comprises 10 partners from 7 countries, in a balanced blend of technology providers, domain experts, and end- users, namely Radar-technology industrial organizations, academic/research institutes, high-tech SMEs, and highly relevant end-user organizations.

RANGER combines innovative Radar technologies with novel technological solutions for early warning, in view of delivering a surveillance platform offering detection, recognition, identification and tracking of vessels, beyond current radar systems' capabilities, thus drastically improving the response and intervention capacity of European Search and Rescue operations.

This issue features an interview of Dr. Angelos Amditis, Technical Manager of the RANGER project, who provides an overview of the expected RANGER benefits and technology advances while highlighting the core components of the RANGER system, and a study on Radar Cross Section, realized by Diginext.

Enjoy reading and don't forget to visit our website for more information!

The Project Coordinator EXUS

Project News & Meetings

Interview with Dr. Angelos Amditis, Technical Manager of RANGER project

Dr. Angelos Amditis (Electrical and Computer Engineer, PhD, MBA) is Research Director in the Institute of Communication and Computer Systems (ICCS) and member of its Board of Directors. He is also founder and Head of the I-SENSE Group. In the frame of the RANGER project, Dr. Amditis, holds the role of Technical Manager. His efforts concentrate in the coordination of all technical activities of the project, while also leading the work on the definition of the RANGER architecture and interoperability with legacy systems. In the following interview, Dr. Amditis, gives us an overview of the expected RANGER benefits and technology advances, reports on the latest project developments, highlights the core components of the RANGER system and explains why RANGER is significant for the enhancement of maritime surveillance and Search and Rescue operations.

Dr Amditis could you give us an overview of the expected RANGER benefits and technology advances?

RANGER will facilitate the improvement of the sea-border surveillance operations by overcoming the limitations of existing sensing means and the inherent difficulties of the task at hand. The sheer size of the monitored area, the complexity introduced by the numerous islands/islets and in some cases, the proximity of the departure points with respect to the defined borders, call for a solution such as RANGER providing accurate, fast and efficient detection while being cost-efficient both in terms of ownership but also in terms of operations and maintenance. Nevertheless, the most important contribution of RANGER will be to significantly progress the accuracy and long distance detection, identification and recognition capacity for small boats, thus drastically improving the response and intervention capacity of European SaR services and personnel, and severely reducing the expected number of casualties in the Mediterranean basin, whether it is the Greek archipelago, the southern Atlantic or the open seas of Italy and France.

What are the pillars and core components of the overall RANGER system architecture?

RANGER exploits the benefits derived from different recent ground-breaking research results in photonic and microwave technologies, Over-The-Horizon (OTH) and Photonics –Enhanced (PE)-MIMO Radar technologies, machine learning and data fusion mechanisms, advanced decision support systems and data analytics algorithms. All these technologies are combined, along with interoperability means and advanced user interfaces in order to deliver the overall RANGER platform.

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With regard to the OTH Radar technology, the consortium will build on the most advanced OTH radar ever developed for maritime traffic surveillance, namely the Stradivarius High Frequency Surface Wave Radar 14,15 (HSFWR), and improve it to detect smaller targets over the horizon as well as to support maritime semi-closed sea zones. The RANGER PE-MIMO Radar, on the other hand, will be developed in order to overcome limitations that are of major importance in effective maritime surveillance and SaR operations, mainly related to achievable resolution, maximum number of targets detectable, and the capacity to detect fast manoeuvring, small to mid-size vessels.

Building on the aforementioned ground-breaking radar technologies that will provide enormous detection range extending over the horizon and unprecedented high resolution allowing for the accurate identification and recognition of small, fast manoeuvring vessels, RANGER will develop a platform that supports maritime surveillance operators and consequently maritime security operations. The core processing pillars of the platform consist of a data fusion module, a machine learning module and an early warning engine that will provide hybrid tracking capabilities, efficient threat classification and early warnings and notifications. Furthermore, the interoperability layer of the RANGER platform is another important pillar that consists of suitable gateways and data sharing mechanisms for seamless integration with legacy systems as well as compatibility with the CISE framework.

Finally, an advanced user interface that will act as the front-end application of the standalone version of the RANGER platform will enable operators to efficiently handle, manage and exploit the RANGER results including enhanced 2D/3D visualization of tracks, alerts and notifications providing layered and targeted display of multiple sources of information as well as a combined overall situation awareness picture.

The project is currently going through the initial phase of its design and implementation. At what stage is the development of the RANGER system and what is the approach and methodology followed?

The RANGER design and implementation follows an iterative and incremental design process. First the EU policies and practices as well as the ethical aspects of maritime surveillance have been analyzed, and the end-user requirements and the respective system requirements have been derived in order to build the framework for the RANGER platform design and implementation. A site survey has been conducted in close co-operation with the Greek authorities while a second site survey with the French authorities is scheduled. A technical steering group involving all technical partners has been established in order to facilitate the step-by-step design process that can be easily adapted throughout the whole life-cycle of the project. Currently the 1st version of the RANGER architecture is in progress, while a second version will follow at a later stage. The design of the OTH and PE-MIMO radar has started, including a detailed schedule of hardware and software modules implementations, while the functional and non-functional aspects of the RANGER system modules and services have been defined. The integration process will include test sessions, on-site integration testing and pilot demonstrations following specific use cases.

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Why is interoperability with legacy systems important and what will be your approach to address it?

Interoperability with legacy systems is important because, in essence, it enhances maritime situational awareness, which is a key enabler of the overall safety, security and environmental protection of the EU maritime domain. In addition to that, interoperability enhances the effectiveness of the operational activities of the maritime authorities and of the management of resources (both human and capital). Furthermore, it increases cooperation and sharing of information which leads to more efficient responses to real-time events at the maritime environment such as accidents, security threats, and other incidents. Last but not least, interoperability enhances the overall competitiveness and demand for interoperable surveillance capabilities, opening up new market and work opportunities.

With regard to our approach to addressing interoperability, RANGER will incorporate information from existing legacy systems and enable the seamless integration of external maritime surveillance and information systems by implementing the necessary IT infrastructure and by applying suitable communication and data sharing mechanisms based on existing technologies currently deployed in maritime surveillance and monitoring systems as well as emerging ones.

How will you validate the RANGER platform?

Two cross-country and cross-organization pilots will be performed in two phases each. The first one will be implemented in France, with the collaboration of technical partners and French end-user partners (DMA). Similarly, the same approach will be followed in a completely different Maritime environment, with numerous islands in contrast to the open sea environment of the first pilot that the Aegean Sea in Greece offers. The pilot will be conducted by the Greek authorities (Hellenic Navy and Hellenic Coast Guard), supported by the technical RANGER partners.

As mentioned before, these two pilots will be conducted in two phases, where the period between the first and the second phase will act as the optimization phase after the validation of the RANGER platform in the first phase. This is indeed necessary also for the training of data fusion and machine learning algorithms, as well as for any required refinement of software and hardware components. Thus, the second phase will be the demonstration of the improved RANGER platform in real environment allowing for the envisioned TRL6 level of the whole platform. Even though the two pilots are conducted in two territories, the validation scenarios from one phase to the other may differ, resulting in four discrete pilots conducted during the project. Detailed description, scope and validation criteria will be defined during the project implementation phase. It is worth mentioning that in both pilots the RANGER platform performance will be also benchmarked against the corresponding detection capabilities of legacy surveillance systems in place. For this purpose, two independent, end-user oriented teams will monitor the pilots execution and validate the results from the perspective of RANGER operator and already existing Command and Control Center operator respectively, to showcase the technical superiority and operational benefits that RANGER is offering.

Study on Radar Cross Section Evaluation

by consortium partner DIGINEXT*

RADAR CROSS SECTION IN THE HIGH FREQUENCY BAND

INTRODUCTION

One of the main goals for the RANGER project is to improve small vessel detection at long distance based on an High Frequency Surface Wave Radar (HFSWR). Radar Cross Section (RCS) is an important parameter in the radar equation that helps in calculating the detection range of the target. The detection capabilities constitute a function of this RCS parameter, of the propagation losses and noise level which are different for each frequency.

RADAR CROSS SECTION SIMULATION AND VALIDATION

To realize the study, the software "CST Micro Wave Studio EM solver" was used in calculating the RCS of ships. The choice of an approach to calculate RCS for different ships and different frequencies has been validated by a comparison with literature and actual measurements of Stradivarius (figure 1).

PART	DIMENSION
Maximum Length	200m
Maximum Breadth	26m
Height of Hull	19.3m
Height of Bridge	19m

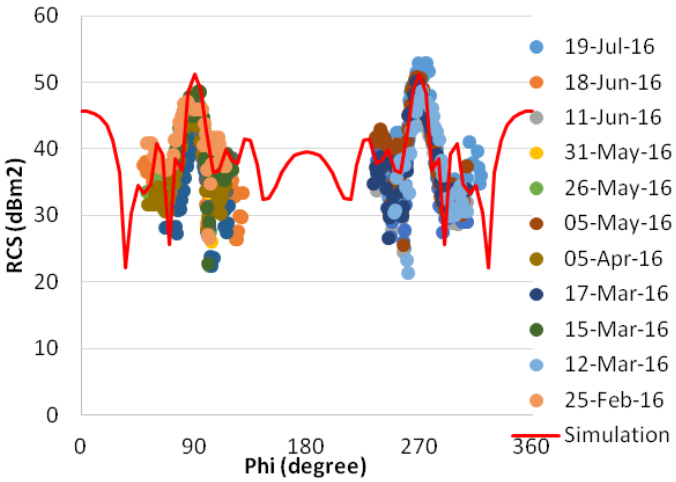

Figure 1: Euro Cargo Simulation. Phi is the looking angle of the radar (0^0 is the front of ship, 180^0 back, 90^0 and 270^0 are the side).

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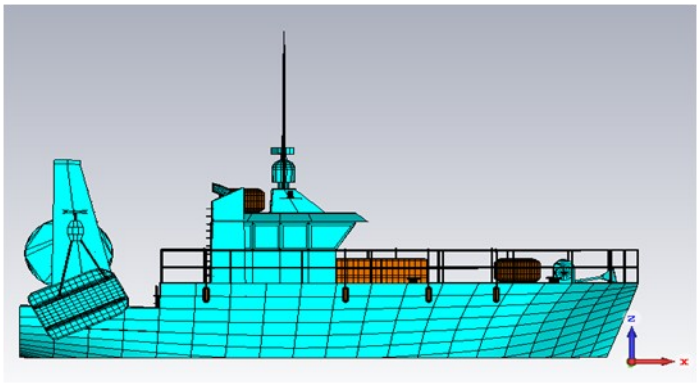
SMALL SHIP RADAR CROSS SECTION SIMULATION

In this project, we focus on the RCS simulation of small vessels . On figure 2 is the RCS of a small fishing trawler boat.



PART	DIMENSION
Maximum Length	14m
Maximum Breadth	5.1m
Height of Hull	2.06m
Height of Bridge	5.4m
Height of Antenna	9m

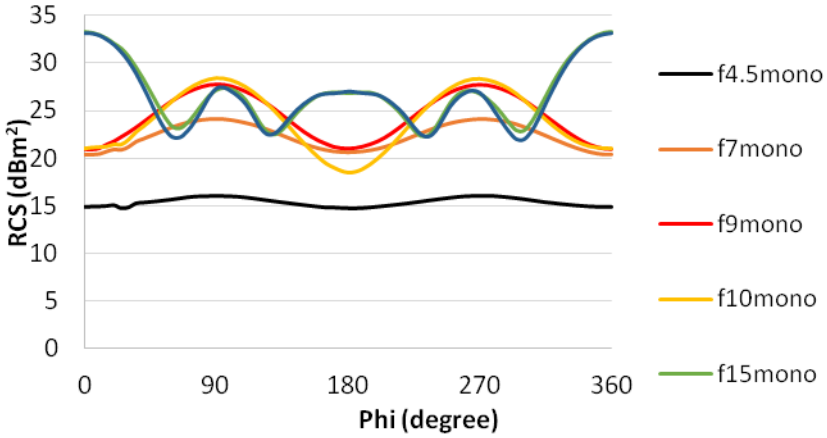


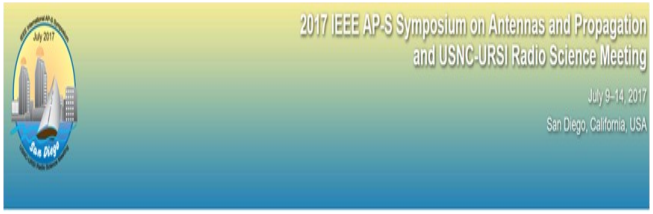
Figure 2: Fishing Trawler Simulation.

FUTURE PROSPECTS

The RCS simulations allow us to estimate for each kind of vessels and each kind of maritime surveillance configuration (propagation losses, noise level and range surveillance) the best trade off between frequencies.

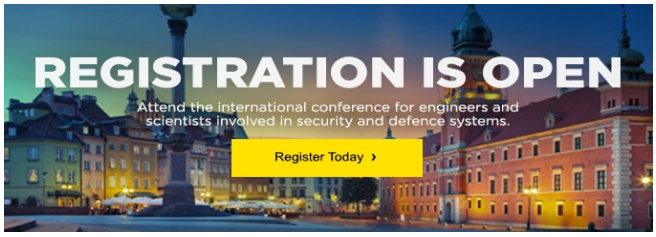
*Main result from a global study by B. Gopalakrishnan

Related Conferences & Events



2017 IEEE International Symposium on Antennas and Propagation & USNC-URSI Radio Science Meeting, 9-15 Jul 2017, San Diego, CA, USA

http://2017apsursi.org/



SPIE security & defence 2017, 11-14 September 2017 (conference), 12-13 September 2017 (exhibition), Warsaw, Poland

http://spie.org/conferences-and-exhibitions/security-and-defence

European Microwave Week (EUMW), 8-13 October 2017, Nuremberg, Germany

http://www.eumweek.com/

AUSA Annual Meeting and Exposition, 9-11 October 2017, Washington DC, United States

http://ausameetings.org/2017annualmeeting/

IET International Conference on Radar Systems 2017, 23-26 October 2017, Belfast, United Kingdom

http://events.theiet.org/radar/

RANGER

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You can also keep up with more of what is happening at RANGER project by following us on:

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THE CONSORTIUM

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