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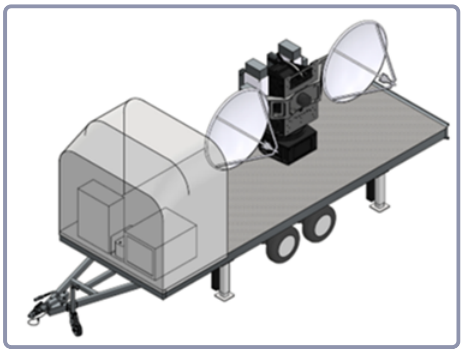
DyRaM Demonstrator

The Cutting-Edge Solution for Accurate RCS Measurement of Maritime Vessels in the Open Sea

Introduction

The DyRaM Demonstrator is a cutting-edge radar cross-section (RCS) measurement system specifically designed for maritime targets. This innovative system is capable of measuring and verifying the highly variable RCS of objects coated with smart tuning multifunctional metasurfaces. Built for outdoor use, the DyRaM system is transportable, easy to implement, and self-powered, ensuring seamless operation in various environments. Operating within a frequency range of 8 to 12 GHz, the system is equipped with a modular architecture that allows for efficient data handling and control, enabling real-time operation. It features two transmitter channels that can function simultaneously or alternately, along with two simultaneous receiver channels, ensuring comprehensive polarimetric measurements of the radar cross-section. The DyRaM Demonstrator represents a versatile and powerful solution for accurately measuring the radar cross-section of maritime targets, providing reliable data for security, monitoring, and research applications.



The Cutting-Edge Solution for Accurate RCS Measurement of Maritime Vessels in the Open Sea

The DyRaM system is composed of two primary segments: the ground segment and the target segment, which are connected through a dedicated data link. The ground segment is mobile and mounted on a trailer for easy relocation, integrating multiple subsystems:

System Description

Radar Sensor & Antenna Sub-system:

The radar sensor transmits and receives radar signals via the antenna, connected through radiofrequency coaxial cables.

Telemetry Sub-system:

This tracks the antenna's geographical position and orientation, ensuring it stays pointed at the target. It measures Euler's angles and location to maintain Line of Sight (LOS).

Antenna Positioner:

Equipped with motors and encoders for azimuth and elevation control, managed via a Programmable Logic Controller (PLC).

PLC-Controlled Auto-Leveling System:

Ensures stability of the trailer during measurements.

Data Network:

A 1 Gbit/s Local Area Network (LAN) interconnects subsystems like the camera, telemetry sensors, control PC, and positioner panel PC. A 10 Gbit/s point-to-point connection ensures high-speed data transfer between the radar and the processing PC.

Power Source:

The ground segment is powered by a standard 220VAC external
power supply.

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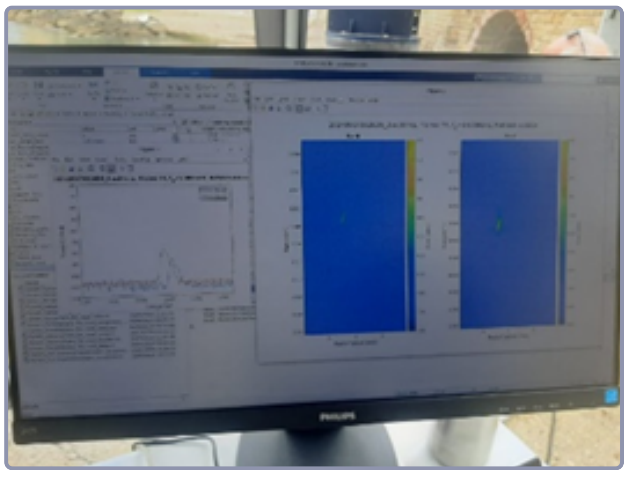
System Performance and Competitive Strengths

- **Dynamic RCS Measurement:** Fully polarimetric radar module for total RCS and High Resolution Range Profiles (HRRPs), supporting hourglass plots and 2D ISAR images.
- **High Precision Tracking:** Dual inertial navigation systems ensure accurate antenna-target alignment, even during dynamic movements.
- **Versatile Targeting:** PLC-controlled antenna positioner for precise azimuth and elevation adjustments, ensuring accurate radar targeting.
- **Real-Time Video Framing:** Integrated IP camera provides continuous optical feedback, synchronized with radar data for enhanced situational awareness.
- **High-Speed Data Connection:** 1 Gbit/s LAN for local connections and 10 Gbit/s link for real-time radar data processing.
- **Calibration:** Calibration procedure guarantees optimal radar measurement accuracy in any condition.
- **Mobile System:** Mounted on a trailer for easy relocation, allowing RCS measurements in different environments without fixed infrastructure.
- **User-Friendly Interface:** Integrated GUI for real-time system control, data monitoring, and camera visualization.



Real-Time Monitoring and Data Analysis

Control unit of the DyRaM system

Technical Specifications

Measurement System Capabilities

Operational Band	8 – 12 GHz
TX/RX Polarization	Dual-pol Tx simultaneous or alternated Dual-pol Rx simultaneous
Range Resolution	Up to 1 m
Ship Tracking	Provided by real-time GPS tracking
Measurement Output	Total RCS HRRP (for hourglass plots and ISAR)

RF Performance

Instantaneous Bandwidth	Up to 150 MHz
Dynamic Range	≥ 55 dB
NERCS (Noise Equivalent RCS, or minimum detectable RCS at the target distance)	10dB sm @10Km (HRRP) -20dB sm @15Km -Tint 1s (ISAR)
RCS accuracy	<5 dB

Pulse Operation

PRF	Up to 20 KHz
HRRP acquisition rate	Up to 20k profiles per second
Tx to Rx gate delay	6 µs – 87 µs

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