RADAR SIGNAL ANALYSIS TRAINING

Course overview

ROHDE&SCHWARZ

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AT A GLANCE

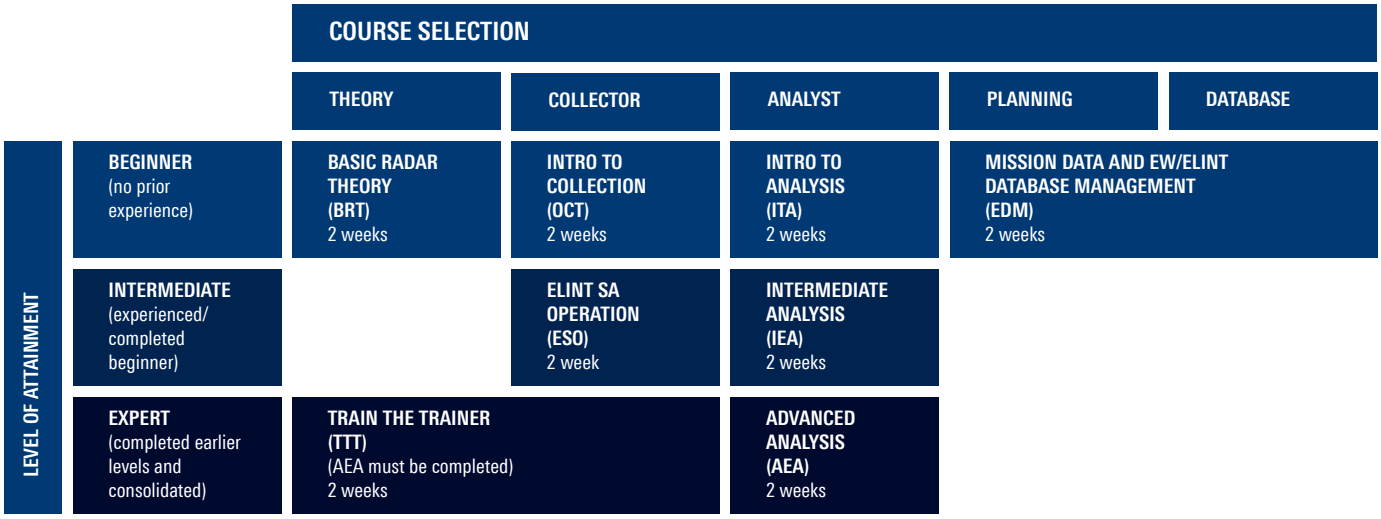
Radar signal analysis training courses from Rohde&Schwarz are a combination of instruction in theory and practical exercises covering the topics most important to the radar collection and reconnaissance process. Practical exercises are explained and performed directly on an ELINT reference system.

The courses are divided into three competency levels, which allows trainees to build on their existing knowledge and skills. All of the courses are instructor-led and include hands-on sessions. The instructors evaluate trainees using a mixture of question-and-answer sessions, continuous assessment and a final exam.

Brief course description

- The Basic Radar Theory (BRT) course introduces trainees to the basic principles of radar theory and radio wave propagation. The course quickly progresses to a description of the characteristics of pulsed radar and provides a detailed description of the radar parameter.
- The Introduction to Radar Signal Collection (OCT) course focuses on radar signal collection techniques. This course highlights some of the challenges collection operators face in the modern radar environment and how to overcome them.
- The ELINT Sensor Operational (ESO) course provides enhanced ELINT collection knowledge including direction finding with a standalone ELINT sensor or geolocation using an ELINT sensor network. It also covers important topics like operational planning and automatic deinterleaving.
- The ELINT analysis training is divided into three separate courses:
  - The Introduction to Analysis (ITA) course covers the introduction to the R&S®TPA technical pulse analysis software to illustrate radar signal fingerprints.
  - The Intermediate ELINT Analysis (IEA) course includes a description of different analysis techniques for radio frequency agility, intrapulse modulation and interpulse modulation accompanied by hands-on exercises.
  - The Advanced ELINT Analysis (AEA) course covers first-line analysis and in-depth analysis techniques.
- Two other operationally important courses for ELINT missions are the ELINT Mission Management (EMM) course and ELINT Database Management (EDM) course. These courses provide trainees with the knowledge to understand the functionalities of the Rohde&Schwarz Mission Data Manager and practical handing of the Rohde&Schwarz database.
- The Train the Trainer (TTT) course is designed to provide competency in the area of training in the context of operator courses (OCT, ESO), analysis courses (ITA, IEA, AEA), as well as the database (EDM) and mission management (EMM) course. The TTT includes management of ELINT training courses aimed at practical and theoretical training goals on a reference system.

ELINT training overview



Note: To reach the higher levels of attainment, the corresponding lower level courses must first be completed, following by appropriate time for consolidation and satisfactory completion of job qualification taskbooks.

COURSE OVERVIEW

Basic Radar Theory (BRT) course
- Pre-course reading booklet
- Radar theory and radio wave propagation
- Introduction to radar parameters and measurement
- Introduction to radar operating modes
- Hands-on exercise
- page 4

Introduction to Radar Signal Collection (OCT) course
- Hands-on scenario based collection course
- Radar signal collection techniques
- Challenges faced by radar signal collectors
- page 5

Introduction to ELINT Analysis (ITA) course
- Hands-on training using R&S®TPA software
- Analysis of 12 basic radar signals
- Introduction to radar parameters
- Introduction to interpulse modulation
- Introduction to radio frequency agility
- Introduction to intrapulse modulation
- page 6

Intermediate ELINT Analysis (IEA) course
- Hands-on training using R&S®TPA software
- Analysis of 13 complex radar signals
- Interpulse modulation description and analysis techniques
- Intrapulse modulation description and analysis techniques
- Scan description and analysis techniques
- page 7

Advanced ELINT Analysis (AEA) course
- In-depth signal analysis function
- Hands-on exercise with post-event analysis
- High-value radar signals
- page 8

ELINT Sensor Operational (ESO) course
- Sensor capabilities
- Operation overview
- Operational planning
- Geolocation and direction-finding workflow
- Introduction to R&S®RPP real-time pulse processing
- Data flow and exchange
- page 9

Mission Data Management (EMM) course
- Introduction to the mission manager role
- Handling the R&S®MDM application
- Real-time pulse processor application
- page 10

ELINT Database Management (EDM) course
- Introduction to ELINT, EW and EOB database
- Introduction to Rohde&Schwarz database management
- Usage of R&S®RA-PS-RREF for data entry and data handling
- page 11

ELINT Train the Trainer (TTT) course
- Handover of training material and knowledge
- Qualification (empowerment)
- Trainer assessment
- Building a training scenario
- Introduction pulse sequencer and signal generator
- page 12

ORDERING INFORMATION

Designation	Type	Order No.
Basic radar theory (BRT)	R&S®EL-TR-BRT	3076.1607.02
Introduction to radar signal analysis (OCT)	R&S®EL-TR-OCT	3076.1613.02
Introduction to ELINT analysis course (ITA)	R&S®EL-TR-ITA	3076.1620.02
Intermediate ELINT analysis course (IEA)	R&S®EL-TR-IEA	3076.1636.02
Advanced ELINT analysis course (AEA)	R&S®EL-TR-AEA	3076.1659.02
ELINT operator sensor course (ESO)	R&S®EL-TR-ESO	3076.1642.02
Mission data management course (EMM)	R&S®EL-TR-EMM	3076.1668.02
ELINT database management course (EDM)	R&S®EL-TR-EDM	3076.1665.02
ELINT train the trainer course (TTT)	R&S®EL-TR-TTT	3076.1671.02

BASIC RADAR THEORY (BRT) COURSE

10 days

ELINT operator

Max. 10

Classroom

English

Overview

- Pre-course reading booklet
- Radar theory and radio wave propagation
- Introduction to radar parameters and measurement
- Introduction to radar operating modes
- Hands-on exercise

In this course, trainees learn basic radar theory and how to identify and measure the basic radar fingerprints. It also offers a description of radio wave propagation, including anomalous propagation, (e.g. interference) and its effects. The course lessons follow a logical sequence.

The training focuses on a number of different radar applications and describes radar operating modes. Real-world radar applications are referenced to support the parameters that are introduced in the course.

A prerequisite for this course is familiarity with the basic principles of mathematics. Trainees are supplied with a booklet containing a pre-course reading prior to the start of the course. We strongly recommend that trainees read this booklet, work through it and understand the examples before starting the course.

There are no other prerequisites for the Basic Radar Theory course. The ten-day course is conducted as classroom instruction. Course materials comprise the pre-course reading, lecture slides, trainee guide and flash cards and are supplemented by hands-on exercises.

ELINT console

INTRODUCTION TO RADAR SIGNAL COLLECTION (OCT) COURSE

10 days

ELINT analyst

Max. 8

Classroom/reference system

English

Overview

- Hands-on scenario based collection course
- Radar signal collection techniques
- Challenges faced by radar signal collectors

The radar signal collection course is a mixture of classroom instruction in theory and practical signal collection exercises.

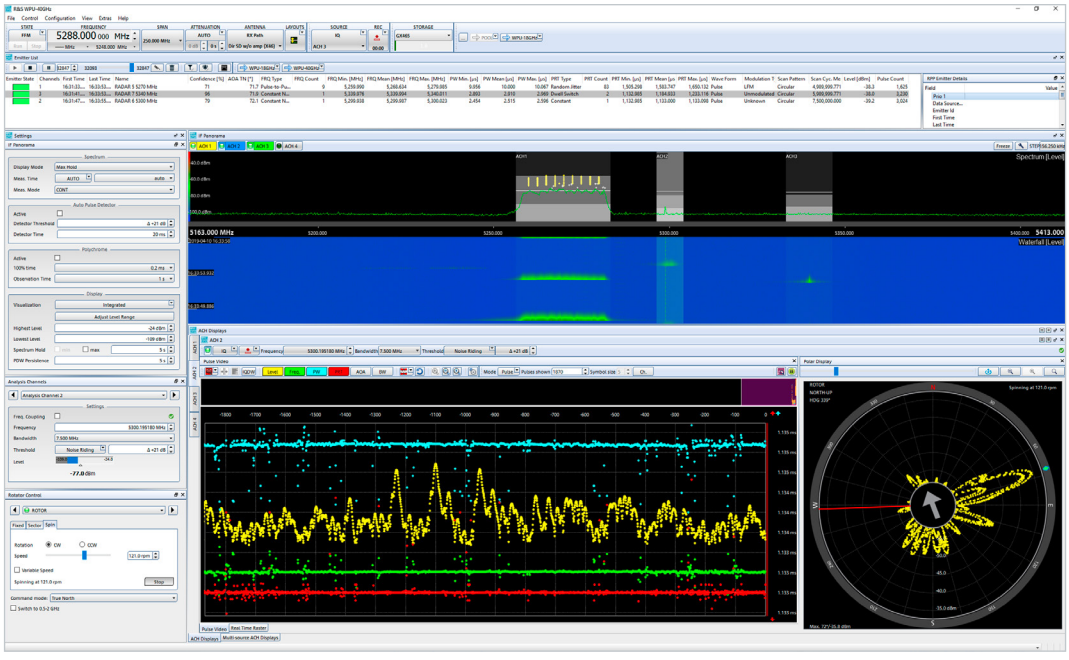
Trainees learn the theory and principles behind radar signal collection as well as the challenges collectors face in today's radar environment.

On completion of instructor-generated exercises, trainees are able to perform signal collection tasks. Collection tasks include different scanning functionalities, tuning high-end wideband receivers and manual signal interception and recording. Core elements of the course include handling different data types, data flow and specific collection tasks in the ELINT collection system software.

Trainees are advised to attend the Introduction to Radar Signal Collection course before factory acceptance tests (FAT) or site acceptance tests (SAT) for new ELINT collection systems.

Due to the specific requirements of radar signal collection, we recommend that trainees complete and pass the Basic Radar Theory course (or other similar courses) prior to starting the Introduction to Radar Signal Collection course.

The ten-day course is conducted as classroom instruction. Course materials comprise lecture slides and a trainee guide, which are supplemented by hands-on exercises. The prerequisite for this course is the Basic Radar Theory course.



R&S®WPU-CTL control software

INTRODUCTION TO ELINT ANALYSIS (ITA) COURSE

10 days

ELINT analyst

Max. 8

Classroom/reference system

English

Overview

- Hands-on training using R&S®TPA software
- Analysis of 12 basic radar signals
- Introduction to radar parameters
- Introduction to interpulse modulation
- Introduction to intrapulse modulation
- Introduction to radio frequency agility

The course provides a hands-on introduction to radar parameters. Trainees analyze and document 12 basic radar signals using the R&S®TPA software.

First, trainees analyze a simple radar signal with relatively easy-to-measure parameters, and then quickly progress to more complex radar signals that use different interpulse modulation types, intrapulse modulation and radio frequency (RF) agility.

The signals used in the course are designed to highlight analysis procedures and ensure that trainees develop the correct techniques they will need to analyze commonly observed radar signals.

The course also covers filtering and removing unwanted interfering signals and explains some of the anomalies that occur during radar analysis. The mathematics included in the course are limited to what is necessary for radar signal analysts to work effectively. The mathematics used by radar designers and engineers cannot always be used by analysts and is therefore not covered in this course.

The course lasts ten days and can be delivered in any suitable classroom environment with the right IT equipment and teaching aids. The prerequisite for this training is the Basic Radar Theory course.

INTERMEDIATE ELINT ANALYSIS (IEA) COURSE

10 days

ELINT analyst

Max. 8

Classroom/reference system

English

Overview

- Hands-on training using R&S®TPA software
- Analysis of 13 complex radar signals
- Interpulse modulation description and analysis techniques
- Intrapulse modulation description and analysis techniques
- Scan description and analysis techniques

This course builds on the analysis techniques covered in the Introductory Radar Signal Analysis course and describes further techniques that enable trainees to deal with more complex analysis challenges.

Trainees learn to recognize a number of commonly encountered interpulse modulation types, the most effective ways to measure them and the advantages and disadvantages of each modulation type.

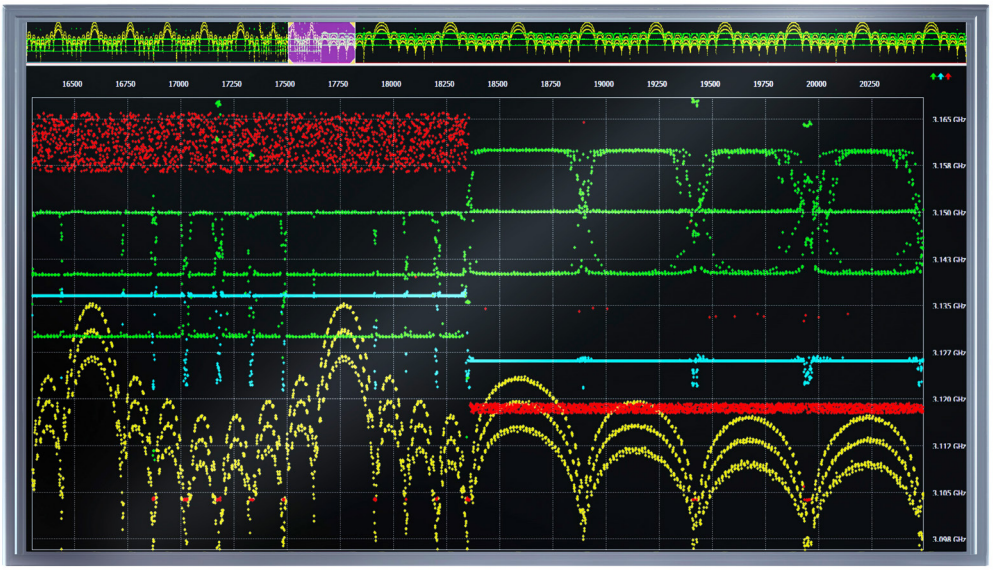
The course contains a number of modules focusing on intrapulse modulation types, how to analyze them and the advantages and disadvantages of each modulation type.

The analysis modules also contain detailed descriptions of different scan techniques commonly used by radar systems and how to identify and measure them.

One of the modules includes a detailed description of FMCW signal analysis. The techniques used to recognize and analyze RF agile radar signals are explained during the course.

All signal analysis is conducted using the R&S®TPA software. Comparable to the introductory radar signal analysis course, trainees are required to analyze and measure the parameters of a total of 13 complex radar signals.

The Introduction to ELINT Analysis course is a prerequisite for the Intermediate ELINT Analysis course. The course can be delivered in any suitable classroom environment with the right IT equipment and teaching aids.



R&S®TPA technical pulse analysis

ADVANCED ELINT ANALYSIS (AEA) COURSE

10 days

ELINT analyst

Max. 8

Classroom/reference system

English

Overview

- In-depth signal analysis function
- Hands-on exercise with post-event analysis
- High-value radar signals

The Advanced ELINT Analysis course comprises practical signal analysis exercises. The knowledge level of the course builds on the Intermediate ELINT Analysis course.

The trainee analyzes replays of radar signals using R&S®TPA software. This course consolidates previously learned analytical techniques and introduces more in-depth analysis techniques and typical analysis issues.

The techniques start with first line analysis (FLA) and continue with functional radar mode identification. The individual exercises are combined with post-event analysis. The high-value radar signals contain current radar fingerprints.

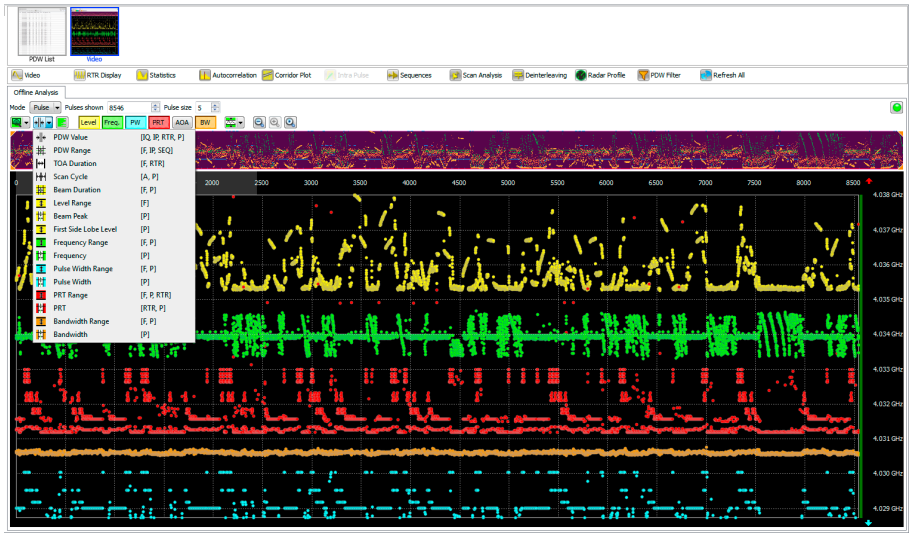
The following radar characteristics are covered:

- Frequency modulation on pulse (FMOP)
- Pulse to pulse agility
- Dwell, switch, stagger, burst
- Multi radio frequency

Different radar types from various sources:

- Military aircraft
- Active electronically scanned array (AESA)
- Search radar
- Special air radar
- Naval search radar
- Radar in tracking mode

The ten-day course can be conducted in any suitable classroom environment with the right IT and teaching aids. The Intermediate ELINT Analysis training course is a prerequisite of the Advanced ELINT Analysis course.



R&S®TPA technical pulse analysis

ELINT SENSOR OPERATIONAL (ESO) COURSE

10 days

ELINT analyst

Max. 8

Classroom/reference system

English

Overview

- Sensor capabilities
- Operation overview
- Operational planning
- Geolocation and direction-finding workflow
- Introduction to R&S®RPP real-time pulse processing
- Data flow and exchange

This practical and theory based course focuses on the deployment of ELINT sensors and the operational workflow of a complete ELINT system.

The course is designed to impart an understanding of ELINT sensors and how to operate them. Trainees are introduced to the possible applications of ELINT sensors.

Another important topic covered is direction finding and geolocation with sensor solutions. Furthermore, the special features of mission planning are explained and applied in practical exercises.

The training tools used in this course are the R&S®WPU-CTL and R&S®RPP. The R&S®RPP enables real-time recognition of detected radar signals by comparing pulse-describing data words with radar profile information and reporting any matches found to the operator.

Exercises in the ten-day training course are conducted on an ELINT reference system from Rohde & Schwarz. The prerequisite for this training is the Introduction to Radar Signal Collection course.

MISSION DATA MANAGEMENT (EMM) COURSE

10 days

ELINT analyst

Max. 8

Classroom/reference system

English

Overview

- Introduction to the mission manager role
- Handling the R&S®MDM application
- Real-time pulse processor application

This course is designed to teach the use of the R&S®MDM for mission preparation and operation.

Trainees learn how to create ELINT mission data by importing approved radar mode descriptions that typically come from ELINT or EW databases. These radar mode profiles are then used to create a mission specific library (mission data file (MDF)) for the R&S®RPP de-interleaver and/or optimized scan jobs for the R&S®WPU2000 ELINT receiver.

R&S®MDM mission data manager

Existing mission data, mission data files and scan jobs can also be maintained, updated and exported. For mission operation, trainees learn how to use previously created mission data in the ELINT collection system.

The first step in ELINT collection is usually to import mission data from the ELINT mission management. The ELINT operator selects the required data and uploads the MDF file to the R&S®RPP and the scan job to the R&S®WPU2000.

The R&S®MDM can also be used to update or extend the mission data accompanying the ELINT mission; for instance, to enhance identification results from the ELINT system.

The ten-day course comprises exercises on an ELINT reference system from Rohde & Schwarz. The prerequisites for the training is the introduction to Radar Signal Collection course.

ELINT DATABASE MANAGEMENT (EDM) COURSE

10 days

ELINT analyst

Max. 8

Classroom/reference system

English

Overview

- Introduction to ELINT, EW and EOB database
- Introduction to Rohde&Schwarz database management
- Usage of R&S®RA-PS-RREF for data entry and data handling

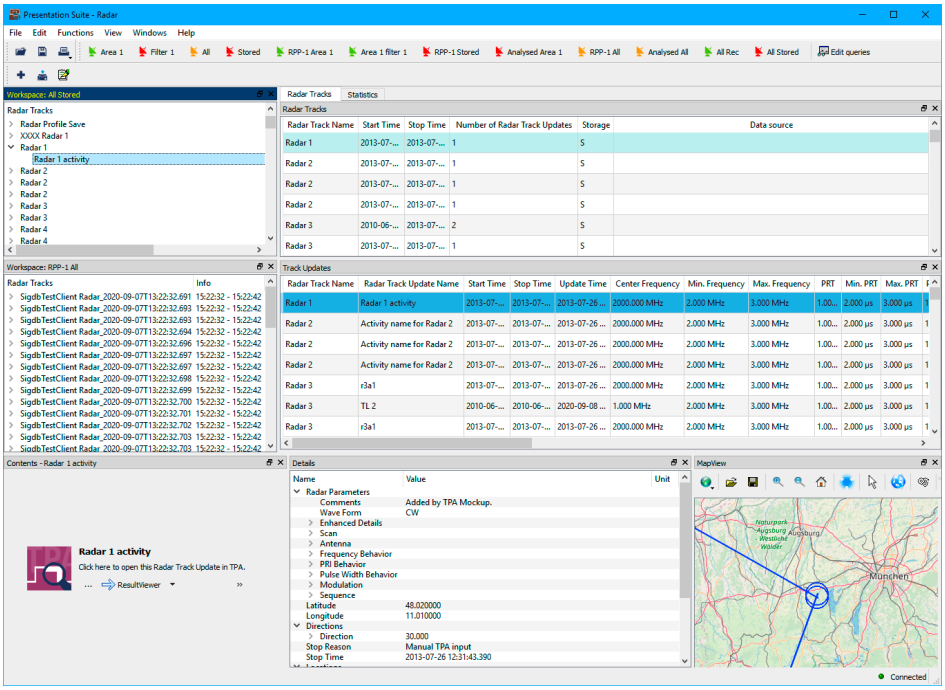
This course combines classroom instruction with practical exercises focusing on building and deploying an ELINT database and populating it with accurate and relevant data.

Trainees will get a general understanding of ELINT, EW and electronic order of battle (EOB) databases and their use in the context of ELINT and EW.

The principles of ELINT, EW and all-source data entry are covered in the classroom instruction and practiced in hands-on exercises. Trainees also learn how to construct an EOB.

The training uses the R&S®RA-PS-RREF database presentation suite software to create and maintain technical and tactical data represented in terms of basic organizational units and the relationships that can exist between them.

Exercises in the ten-day training course are conducted on a ELINT reference system from Rohde & Schwarz. The prerequisite for this training is the Introduction to Radar Signal Collection course.



R&S®RA-PS-RAD presentation suite radar

ELINT TRAIN THE TRAINER (TTT) COURSE

10 days

ELINT analyst

Max. 8

Classroom/reference system

English

Overview

- Handover of training material and knowledge
- Qualification (empowerment)
- Trainer assessment
- Building a training scenario
- Introduction pulse sequencer and signal generator

This course combines classroom instruction with practical training focusing on qualifying future ELINT trainers for internal ELINT training. Trainees will get a general understanding of the content and knowledge contained in the training material.

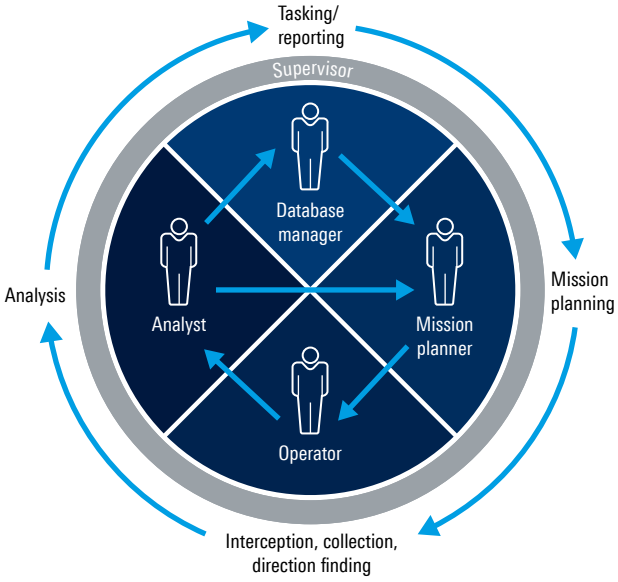
The course material includes ELINT operator training, ELINT analysis training, ELINT mission data management and ELINT database management. Furthermore, trainees learn the principles of preparing, generating and using ELINT training scenarios.

Trainees carry out practical training on the topics of radar basics, signal analysis, ELINT operation, signal collection and ELINT data handling.

As part of this course, they receive a detailed introduction to operating R&S®Pulse Sequencer Software in combination with signal generators from Rohde&Schwarz.

The ten-day course is conducted in a classroom and the exercises on an ELINT reference system from Rohde&Schwarz.

Operational roles and workflow



ROHDE&SCHWARZ TECHNOLOGY ACADEMY

Practical knowledge. Industry insight. Real experts.
Driven by decades of experience and strong industry insights, we present the Rohde&Schwarz technology academy. The training center was created to provide you the best technical training courses available on the market and help you further evolve your valuable skills and gain deep knowledge through a range of high-quality, practical training courses delivered by manufacturer-certified, real-world experts. What is the best training approach for you? Take a look at the three types of training we offer.

The SIGINT and Electronic Warfare Academy is integrated into the existing structure of the Rohde&Schwarz technology academy with a dedicated area for proposals and to contact the training team (in-service support).

Get in touch with us today!

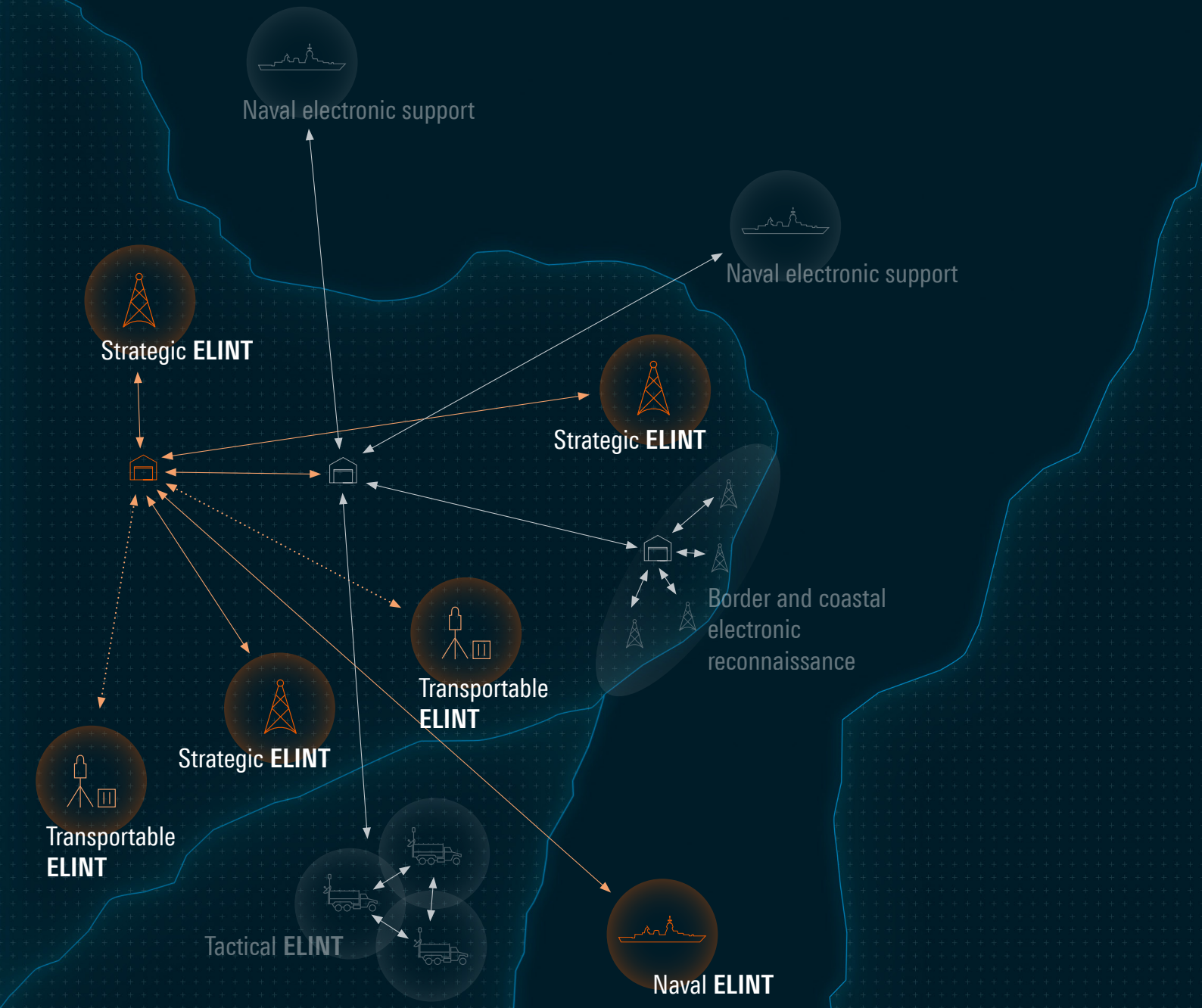
ACTIONABLE INTELLIGENCE FOR PROTECTION AND PARTNERSHIP

Collecting radar signals of interest, enriching national databases, offering actionable intelligence for protection and partnership

National sovereignty relies on knowledge generated by ELINT systems to prepare for conflicts and maintain independence from second- and/or third-party intelligence information.

Increased resilience is one of the contributions that ELINT systems offer. By identifying threats, vulnerabilities can be detected and subsequently minimized.

Protection of national and allied assets against radar threats is ensured when intelligence is disseminated directly to field elements. ELINT systems are also a means of deterrence and demonstrate own capabilities.



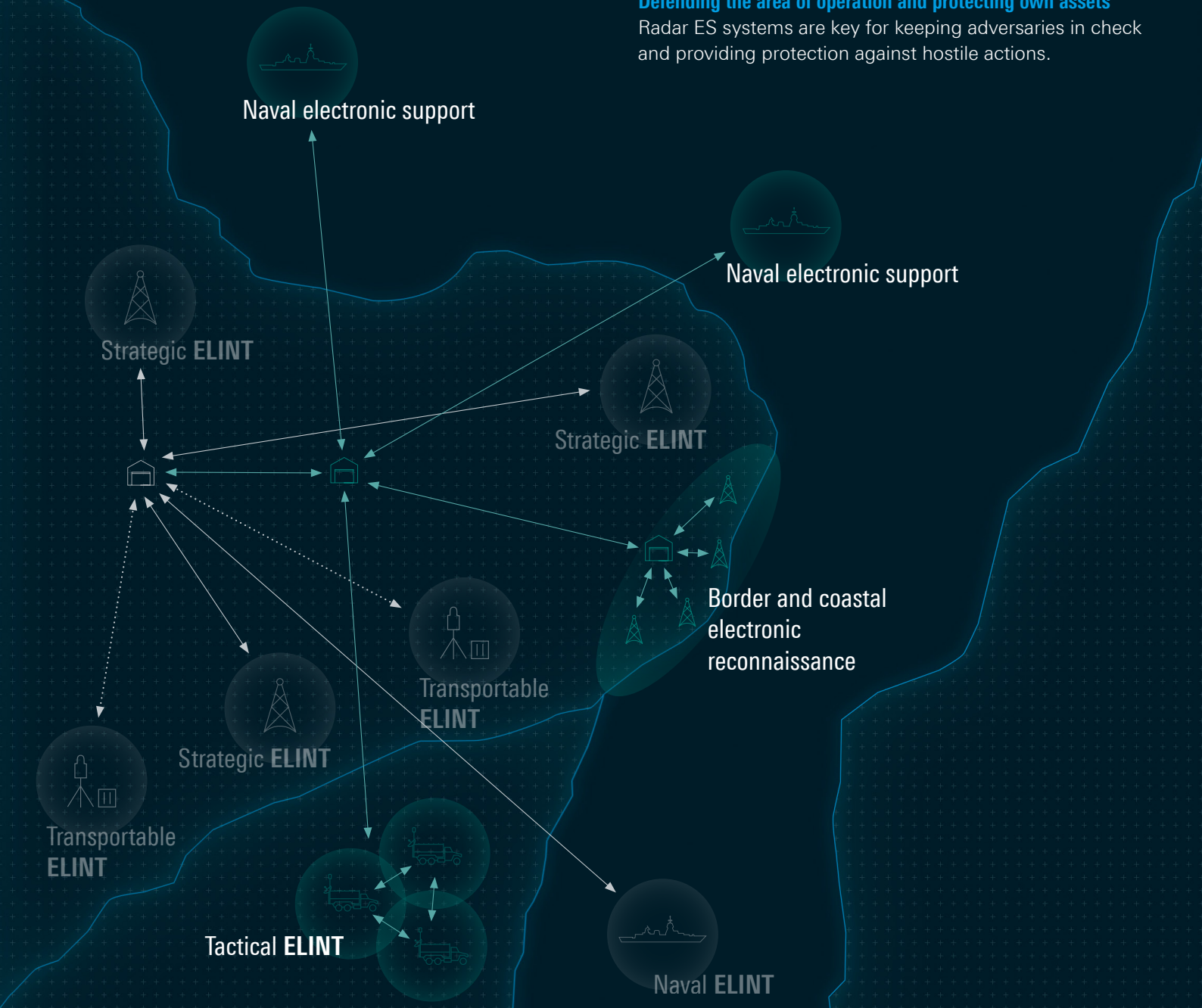
COMPREHENSIVE OPERATIONAL PICTURE FOR SITUATIONAL AWARENESS AND SELF-PROTECTION

Timely, precise emitter detection and direction finding at long distances for enhanced situational awareness and fast, reliable threat recognition

Preparing for crisis to prevent conflict
Radar ES systems can recognize and analyze unknown emitters to help reveal new and unusual patterns.

Establishing and maintaining control over the sea and critical infrastructure
Radar ES systems support comprehensive situational awareness and deep understanding of the area of operation.

Defending the area of operation and protecting own assets
Radar ES systems are key for keeping adversaries in check and providing protection against hostile actions.



Service at Rohde&Schwarz
You're in great hands

- Worldwide
- Local and personalized
- Customized and flexible
- Uncompromising quality
- Long-term dependability

Rohde&Schwarz

The Rohde&Schwarz technology group is among the trailblazers when it comes to paving the way for a safer and connected world with its leading solutions in test&measurement, technology systems and networks&cybersecurity. Founded 90 years ago, the group is a reliable partner for industry and government customers around the globe. The independent company is headquartered in Munich, Germany and has an extensive sales and service network with locations in more than 70 countries.

www.rohde-schwarz.com

Sustainable product design

- Environmental compatibility and eco-footprint
- Energy efficiency and low emissions
- Longevity and optimized total cost of ownership

Certified Quality Management
ISO 9001

Certified Environmental Management
ISO 14001

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PD 3685.0140.62 | Version 01.00 | June 2024 (ja)
Radar signal analysis training
Data without tolerance limits is not binding | Subject to change

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