

We connect  
your naval  
forces

 **ROHDE & SCHWARZ**



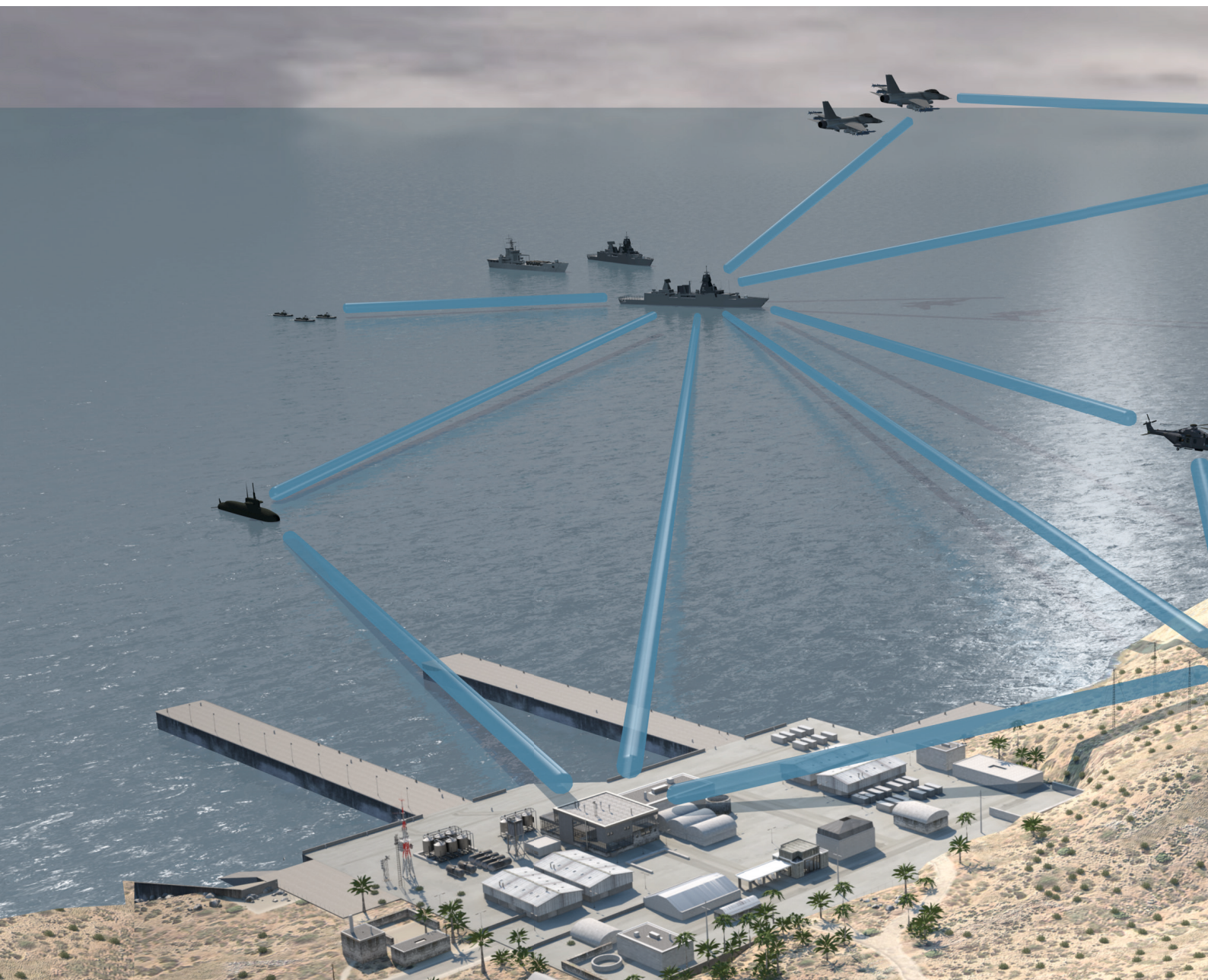
# Expertise in naval communications systems

## At a glance

The days in which a radio operator used Morse code to communicate via a ship's only radio are long gone. Today's military vessels are equipped with state-of-the-art command centers featuring complex facilities for communicating on board and externally. These communications systems must ensure reliable, jam-resistant and encrypted information exchange, especially in case of a military emergency. Interoperability continues to play a key role, and not just between the individual branches of a country's armed forces. It is also a prerequisite for joint operations and for Partnership for Peace (PfP) missions. As network-centric operations become increasingly important, there is a growing demand for standardized voice and data communications protocols and for advanced software-defined radios (SDR). Military messaging in particular is increasingly vital for mission success.

One of the technical challenges for a ship's communications infrastructure is the need for interference-free, simultaneous, robust use of all radio channels on board.

Communications between all types of naval platforms.



There are, however, only a few locations on deck that are suitable for setting up antennas. This is why broadband antennas and integrated antenna concepts as well as concepts for transmitters/receivers and filters/combiners are urgently required to reduce the number of necessary antennas.

Rohde&Schwarz has decades of experience in naval communications. As a system integrator, the company offers impressive single-source communications solutions for modern naval applications. These solutions meet complex requirements and provide outstanding reliability to ensure information superiority in any type of scenario.

Rohde&Schwarz offers the following:

- ▮ System solutions for all naval platforms
- ▮ Solutions for combined and joint missions
- ▮ Secure communications through TRANSEC/COMSEC
- ▮ IP on board, on land and in the air
- ▮ Complete, single-source systems

### **Integrated communications systems (ICS): from system design to integration on board**

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# Integrated communications systems (ICS): from system design to integration on board

## Scalable solutions for different types of naval platforms

Rohde&Schwarz provides highly scalable ICS solutions, covering systems for all classes of naval vessels – from light aircraft carriers (CVL) and amphibious support ships (LPD, LPH, etc.) to large (command) frigates, and from corvettes, fast attack craft (FAC), offshore patrol vessels (OPV) and inshore patrol vessels (IPV) to small, fast interceptors (RHIB). RHIBs are typically equipped with just one radio line, which is used for both voice and data communications. Information exchange capabilities make it possible for units to report their own position and situation and receive target data – describing the target's position, track and speed – from the mother ship. However, larger vessels with multiple communications lines need a digital communications network (DCN) to serve as a backbone for both internal and external communications and to manage dynamically switched communications circuits in line with

mission requirements, i.e. “functional chains” from sink/source to antenna. Modern naval communications scenarios are based on wide area networks at sea as well as on shore. To meet these requirements, Rohde&Schwarz provides solutions for shore stations and land-based communications networks that are fully integrated with naval radiocommunications.

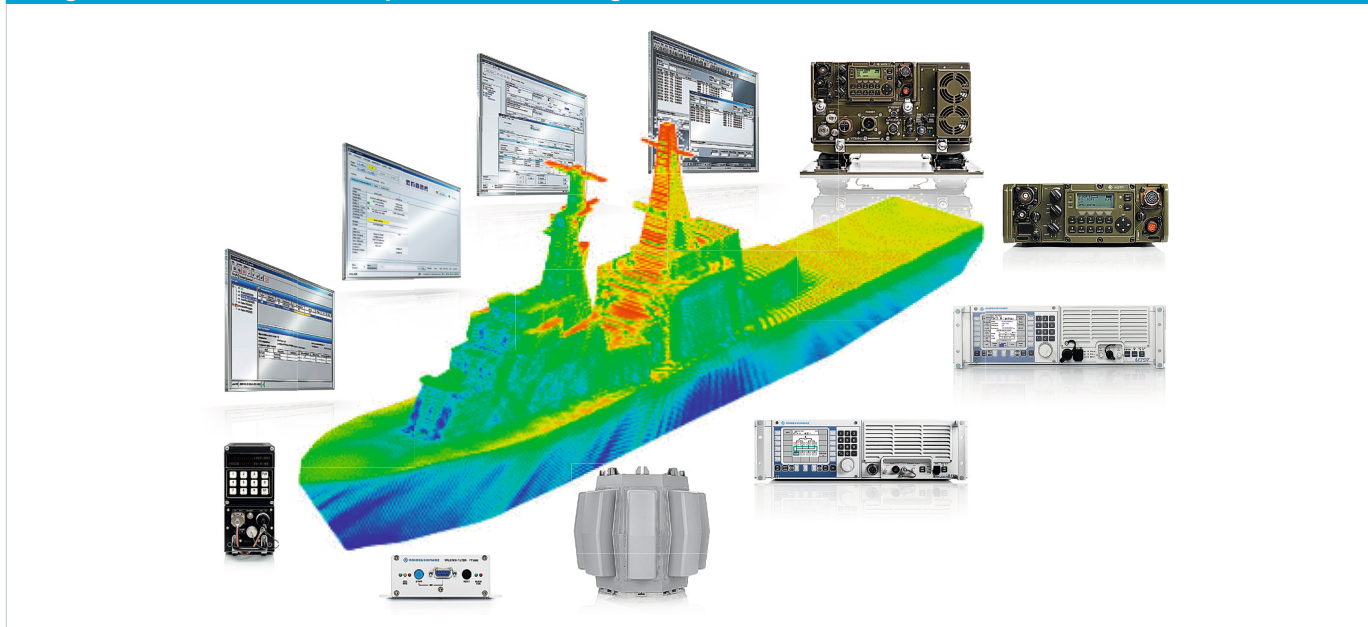
## Complete, single-source ICS solutions

For more than 30 years now, Rohde&Schwarz has equipped naval platforms around the world with integrated communications systems (ICS). As a system integrator, the company delivers turnkey solutions. Based on the customer requirements and on the concept of operations (CONOPS), the company builds a customized system and puts it into operation. After the system has been delivered to the customer, Rohde&Schwarz follows up with training and service support during operation. As part of the system design process, Rohde&Schwarz also provides the following services:

- Testing of the overall system's electromagnetic compatibility (EMC)
- Antenna studies for optimizing the positioning of antennas on the upper deck, especially for HF antennas
- Propagation calculations (far-field diagram) for shore stations and ships for predicting communications coverage

Thanks to a tightly meshed network of subsidiaries and offices around the world, Rohde&Schwarz is able to offer its customers on-site support by specially trained service personnel, even during the utilization phase.

## Integrated communications systems from a single source



# IP – the future of communications networks

Naval missions cannot achieve success without secure, robust exchange of information between a shore-based headquarters and the units at sea. Such network centric operations require standardized message formats, transport protocols and transmission methods. Similar to civil operations, advanced military networks on land and at sea also make use of the Internet protocol (IP).

## IP over air (IPoA) in radios

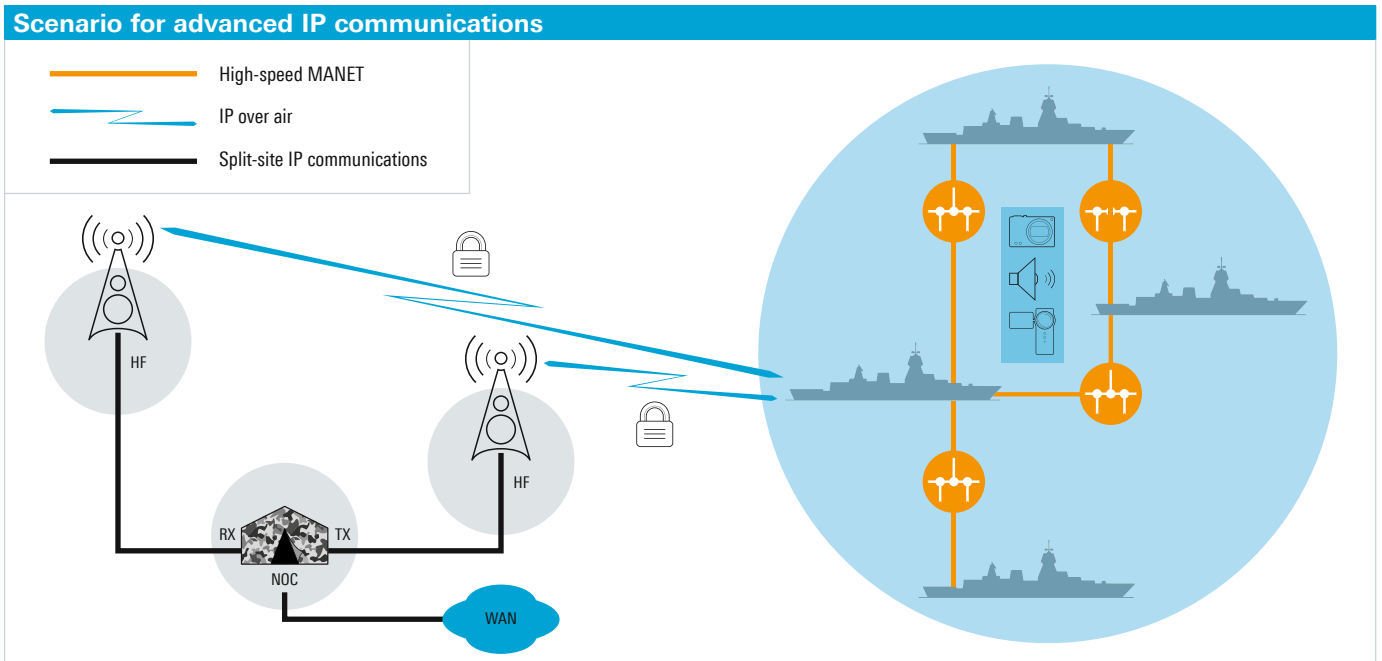
State-of-the-art Rohde&Schwarz radios feature an IP interface. IP-based applications use this interface to transport data over radio networks. In Rohde&Schwarz radios, IP over air (IPoA) protocols that have been specially optimized for radio applications ensure error-free, robust, encrypted transmission of data. Since these Rohde&Schwarz radios are able to process IP data directly, they integrate very tightly into the ICS.

## Mobile ad hoc network (MANET) with high data rates

Today's data applications must be able to transmit radar tracks, situation reports (SITREP) and general text messages and they increasingly require integration of digital media (images, audio, video) and Microsoft Office documents. The significance of video transmissions and video conferencing is growing, too. Despite the use of state-of-the-art data compression methods, video transmission requires high data transmission rates. Thanks to the integration of external components, the R&S®M3SR Series4400 radio permits operation of a self-organizing IP-based mobile radio network in the VHF/UHF frequency band with data transmission rates in the Mbit/s range.

## Ultramodern split-site IP solutions for shore stations

On land, too, the trend is moving away from TDM-based approaches toward IP-based networks. Today, Rohde&Schwarz is able to offer a split-site solution where detached transmitters and receivers from the R&S®M3SR Series4100 family are connected to a naval command center. A split-site controller uses standard IP network connections to control the transmitters and receivers at the TX and RX sites. The transmitters and receivers can be assigned to a split-site pair by simply selecting the IP addresses of the desired radios.



# Custom voice and data communications solutions

To ensure network centric operations, a modern navy needs applications for secure information exchange. The customized solutions offered by Rohde & Schwarz meet the specific requirements of today's naval forces. Such requirements range from simple chat applications that are sufficient for small boats to a distributed nationwide military message handling system that integrates the entire fleet into a single, homogeneous communications infrastructure.

## R&S®Postman III

R&S®Postman III, a third-generation radiocommunications system for state-of-the-art IP-based data transfer, offers key applications such as e-mail, chat, file transfer and blue force tracking. Its integrated radio protocols have been optimized for advanced, IP-capable radios in HF and VHF/UHF radio networks. The system also supports conventional radios with serial data interface.

R&S®Postman III supports multiline operation, which means that several radio lines are used simultaneously to exchange information with multiple network entities. R&S®Postman III automatically selects a line suitable for communicating with the remote partner. Based on the data gained from the combined use of the various R&S®Postman III applications, it is possible to generate and distribute a common situational picture. This is a crucial prerequisite for enabling coordinated action in naval operations.

## R&S®MMHS

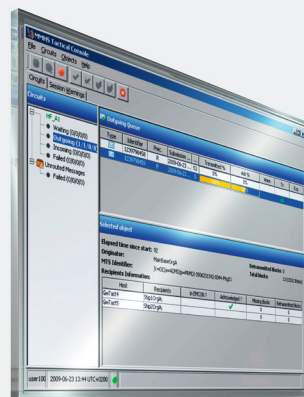
R&S®MMHS is a military message handling system in line with the STANAG 4406 NATO standard. It is an all-in-one solution for communications using wireline LAN/WAN infrastructure as well as radio networks. Especially the implementation of STANAG 4406 Annex E significantly improves data exchange in radiocommunications scenarios.

R&S®MMHS supports the most important military message formats, i.e. STANAG 4406, STANAG 5066 and ACP 127, as well as e-mail. Regardless of the message formats used, one common mailbox provides users with an overview of all messages to be handled.

Rohde & Schwarz radiocommunications racks.



R&S®Postman III.



An integrated security framework based on public key infrastructure (PKI) allows messages to be encrypted and then authenticated with a digital signature. This ensures confidential handling of messages as well as the authenticity of the user's identity and the message.

Central management makes it possible to administer a nationwide message handling system from a single location with a minimum of staff. Organizational changes or changes in the communications structure are consistently distributed to all stations via replication mechanisms.

R&S®MMHS meets the requirements for broadcast and ship-shore systems (BRASS) and is ideal as a state-of-the-art addition to or replacement of ACP 127 systems.

### R&S®STANAG 5066

R&S®STANAG 5066 is a communications solution for the robust, highly secure exchange of data using HF radio networks, enabling interoperable communications within joint and allied forces. It supports data exchange via e-mail, chat, fax and IP-based applications, including extensive capabilities for remote control of radio equipment. The widely used ACP 127 legacy message handling system can be enhanced with automatic error correction mechanisms.

One of R&S®STANAG 5066 most powerful features is its ability to master changing HF transmission conditions: Methods for automatically adapting to various HF propagation conditions, for selecting the optimum configuration prior to a transmission and for using an adaptive data rate during a transmission have been implemented to maximize communications accuracy and minimize transmission times.

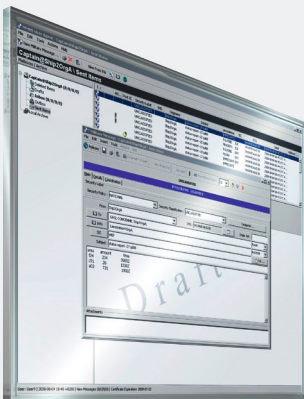
### R&S®SIMCOS II

R&S®SIMCOS II, a second-generation signal management and control system, manages communications equipment in both ship and shore environments. It controls a DCN's digital communications switch to establish local functional chains for various applications between radios, modems, crypto devices and communications endpoints (audio units and data ports).

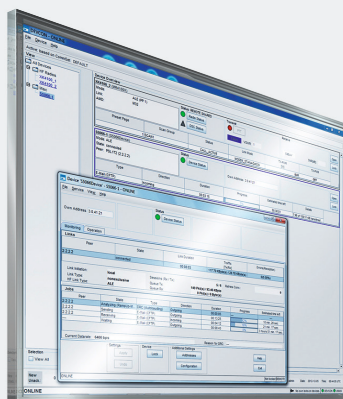
R&S®SIMCOS II manages the communications infrastructure on board vessels, with a focus on external radiocommunications. Wizard-assisted setup of communications lines from source to sink, correct configuration of parameters and continuous equipment status monitoring are some of the benefits that R&S®SIMCOS II provides.

Extensive remote control capabilities make it possible to change the settings for a radiocommunications device or immediately report a critical device status or fault that has automatically been detected.

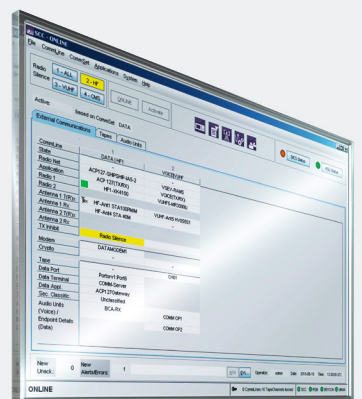
R&S®MMHS.



R&S®STANAG 5066.



R&S®SIMCOS II.



# Software defined radios for voice and data

## Radios for every type of mission

All R&S®M3SR Series4400 VHF/UHF radios for line-of-sight communications and the R&S®M3SR Series4100 HF radios for beyond-line-of-sight operation fully fit into integrated communications solutions. In this way, Rohde&Schwarz offers solutions for naval communications scenarios such as shore to ship, ship to shore and ship to ship. Stationary HF radios installed in 19" racks on a frigate, for example, are completely interoperable with mobile R&S®M3TR multiband VHF/UHF plus HF radios that are employed on rigid-hulled inflatable boats (RHIB). For communications across all branches of the armed forces, Rohde&Schwarz offers the R&S®M3AR airborne radio that allows encrypted communications with air force pilots in order to coordinate air support at sea, for example.

The space for installing transmit antennas is limited on board ships. Rohde&Schwarz solves this problem by providing broadband HF systems that enable multiple transmission systems to transmit simultaneously via specially adapted broadband antennas. In addition, broadband systems can either be operated in single-line mode, for example using four lines with 1 kW each, or in combiner mode, with a transmit power of 4 kW. If the ambient conditions require cooling of the broadband HF systems beyond standard air cooling, high-performance water cooling is used.

## Standard protocols and proprietary solutions available for data transmission

Rohde&Schwarz radios can transmit data using different COMSEC and TRANSEC processes. Standardized waveforms, such as those defined in line with the NATO HF House concept, have been integrated. In the VHF/UHF range, besides HAVE QUICK I/II and SATURN, there are also R&S®SECOS and R&S®SECOM-V. These waveforms, which were developed by Rohde&Schwarz, allow encrypted, secure data transmission.

Radios of the R&S®M3xR product families.





# Ease of operation

In order to get by with as few personnel as possible on board, military communications systems must be easy to operate, install and configure.

## Centralized setup, configuration and status monitoring

Automatic processes help users avoid errors and system inconsistencies during initial configuration, putting into operation or when changing settings or workflows due to operational requirements. R&S®RNMS3000 is a configuration tool that supports centralized radiocommunications network management and consistently transfers all settings to the relevant radios. In networked systems, this is accomplished via IP networks whereas in mobile systems, fill devices are used to perform this task.

## Support during missions

The Rohde & Schwarz communications systems have been designed with a focus on user-friendly operation. Integrated automation and help features enable operating personnel to work efficiently and keep errors to a minimum.

A discovery tool integrated into R&S®Postman III automatically detects all radios present in a system, including their settings, and makes it possible to easily configure communications lines.

The services included in the R&S®MMHS military message handling system simplify routine tasks in radiocommunications. With a click of a mouse, an operator can, for example, automatically test radio lines that are used to exchange data with other stations.

Optimum data transmission in HF radio channels of different qualities requires extensive parameterization of STANAG 5066. By using the R&S®STANAG 5066 solution, the operator can select the required system settings for each channel quality.

R&S®SIMCOS II allows users to predefine different communications scenarios. This permits fast, error-free configuration of communications lines, because all required parameters have been set in advance.

Operating a naval system.



# Information security – a must

In military communications, security has top priority. Preventing unauthorized access to confidential information is imperative. It is also necessary to ensure that encrypted and unencrypted information always remain separated. In addition, the radiocommunications channels must be jam-resistant.

## COMSEC/TRANSEC

Ensuring communications security (COMSEC) requires encryption of the information to be transmitted. To meet such requirements, Rohde&Schwarz offers external encryption devices such as the ELCRODAT 4-2 that has been approved for communications classified up to NATO COSMIC TOP SECRET. For non-NATO missions, an export version – the R&S®MMC3000 – is available. The R&S®M3TR, R&S®M3SR Series4100 and R&S®M3SR Series4400 radios offer embedded COMSEC solutions.

Transmission security (TRANSEC) is implemented by frequency hopping. Since the transmission frequency rapidly changes, jamming is nearly impossible. For Rohde&Schwarz radios, frequency hopping techniques are implemented in the R&S®SECOM-H HF waveform and in the R&S®SECOM-V, R&S®SECOM-P and R&S®SECOS VHF/UHF waveforms.

## Red/black separation

In addition to COMSEC/TRANSEC, ensuring a strict separation of unencrypted and encrypted information on different transmission channels is often a crucial requirement for military communications. On board naval vessels, this red/black separation is implemented by separate switches for the red and black sides. To provide red/black separation not only for data channels, but also for remote control links to the radio, Rohde&Schwarz offers the R&S®FT5066 trusted filter. This filter ensures that only defined data can be sent from an application to the radio and back.

ELCRODAT 4-2 multimode encryption device.



R&S®FT5066 trusted filter.



# ALE extension from Rohde & Schwarz

The ALE standard is used for establishing a point-to-point data connection with a dedicated ALE radio address. When a network operating center (NOC) consisting of several radio lines using ALE-3G is employed, STANAG 4538 requires each radio to have a unique ALE address. When a ship calls a certain NOC, it has to know the ALE address of the radio it is calling. If the radio being called is currently busy with another ALE radio link, it cannot answer the link establishment request, and the ship placing the call has to wait. In a standard ALE-3G system, all available radios at a called station would have to be requested sequentially, which would result in major time delays.

## Address pools for ALE-3G

The solution to this bottleneck is a Rohde & Schwarz specific extension of the ALE standard based on ALE address pools. With this extension, a ship uses a pool address to call a shore station. As a result, there is no longer just one dedicated radio available at the addressed shore station,

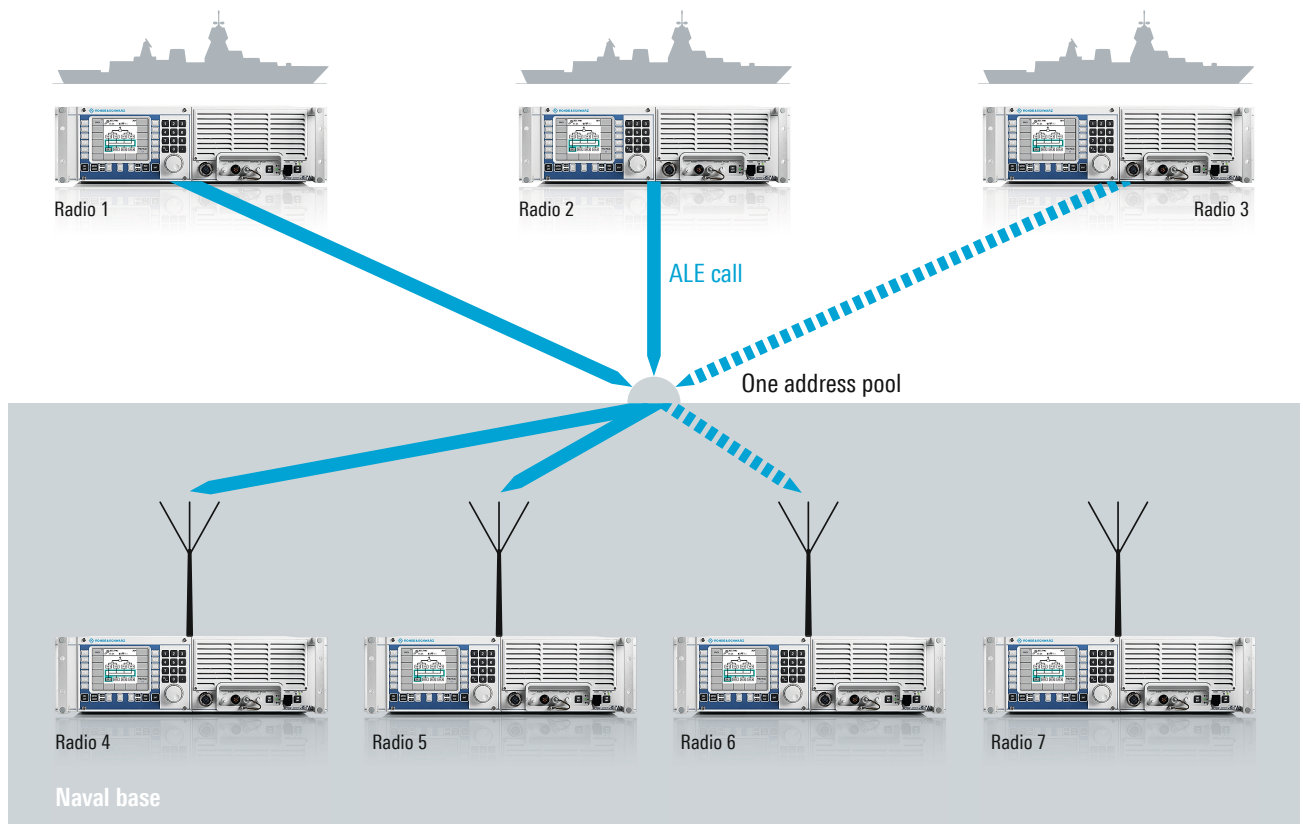
but rather an entire set of radios. The shore station automatically provides a vacant radio when available.

The ALE-3G radio pool concept provides the following advantages:

- A calling station does not need to know which of the radios at the called station is capable of answering the link establishment request
- If one radio within an ALE-3G radio pool fails, the remaining radios in the pool can compensate for this loss; this enables the radiocommunications network to achieve higher availability
- Depending on the amount of communications traffic, radios can be added or deleted from a radio pool dynamically without the need to update the addresses for the entire fleet
- If the number of radios in a pool changes, there is no need to inform other stations; radio pools are managed locally

This Rohde & Schwarz specific extension of ALE-3G operation is a proprietary solution. Radios belonging to a Rohde & Schwarz ALE-3G pool operate, of course, in line with the ALE-3G standard and are compatible with any other standard ALE-3G or ALE-2G radio.

## Flexible ALE call management by addressing a pool of radios



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