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**TECHNISCHE
OPLEIDINGEN
KONINKLIJKE
MARINE**

**SEWACO VII
System
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WT 030400
WT 150400**

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DESCRIPTION OF SYSTEMS

M FRIGATE

TECHNICAL MANUAL SEWACO VII

CHAPTER 1

CHAPTER 2

Approved by the department of Weapons and Communications Systems of the *Directie Materieel Koninklijke Marine* (Equipment Branch, Royal Netherlands Navy), no. WS 004517/559 dd. 04-02-97

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ATTACHMENT

FOREWORD

This manual describes the integrated SEWACO VII system of the M frigates as a single complete functioning system and provides the user and those maintaining the system insight into the way in which the various hardware and software components of the system function in cooperation with each other. In order to do this a description is given of the (sub-)systems/installations forming the structure of SEWACO VII, with the most important specifications and possibilities, the interfaces between these (sub-) systems/installations and the necessary platform provisions. Functional chains are also dealt with and related to the operational task. A functional chain is defined as the total of the hardware and software which is required to carry out a particular operational task. Finally, a summary of the diagnostic possibilities of the system is given.

- Chapter 1: describes all SEWACO equipment per BSMI no. OPM. The BSMI nos. which are not related to SEWACO equipment are included in Chapter 4 (e.g. Automatic Telephone exchange)
- Chapter 2: describes the functional chains.
An addition to these functional chains is at present being prepared by CAWCS. As soon as the CAWCS part is ready it will be included as "Technical Manual Software SEWACO VII" of the Description of Systems for the M frigate.
- Chapter 3: summarizes the most important specifications per BSMI.
"System Service Diagrams" are included as additions to Chapters 1, 2 and 3. These SSDs show the most important (functional) hardware connections and other points of reference.
- Chapter 4: provides an overview of the necessary platform provisions (power and cooling). Also included is a summary of the distribution of nautical data and finally a summary of the most commonly used interfaces with their specifications.
- Chapter 5: gives a summary and short description of the diagnostic possibilities per BSMI within the SEWACO VII system.

Detailed descriptions of the hardware systems are given in the installation manuals.

Detailed descriptions of the operation of the various systems by means of the Operational Program is given in the Manual Operational User HOGKM017.

A description of how to load the Operational Program, technical data logging, settings (baud rate, hardware addresses etc.) and system management is given in the CSOM SEWACO VII (Computer System Operators Manual) of CAWCS.

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CHAPTER 1:

STRUCTURE OF THE SEWACO VII SYSTEM

1. Structure of the SEWACO VII system

1.1. Introduction

The Sensor Weapons and Command System SEWACO VII is installed on the Multi-purpose (M) frigates of the Karel Doorman class. The Karel Doorman class replaced the Roofdier and the van Speijk class which were taken out of service in the 1980s.

1.1.1. Description of task

Illustration 1-1-1 shows the principle tasks of a SEWACO system in abstract form. A SEWACO system has various sensors which collect information about the surroundings and possible threats. This information is evaluated and tactical decisions taken on the basis of the picture of the threat/surroundings provided by the evaluation. These decisions result in actions which have further consequences for the threat/surroundings.

The staff requirements describe the tasks of the M frigate in principle. The tasks are sub-divided into the following:

Time of War:

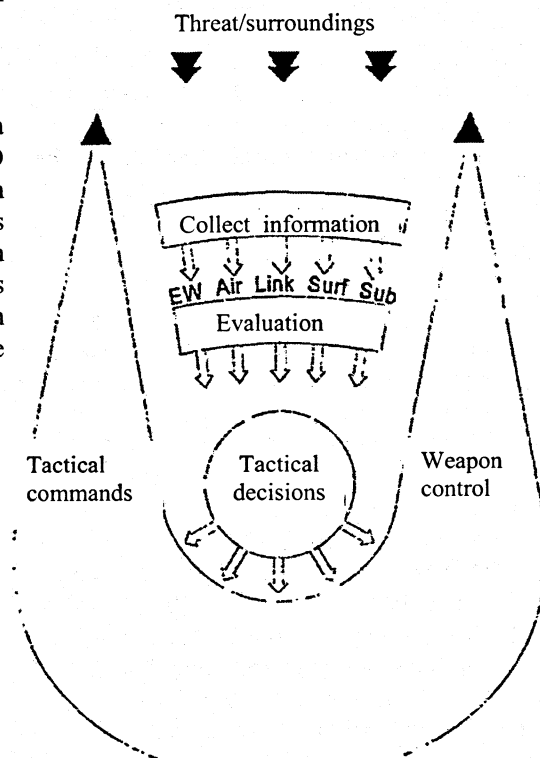
- within the Nato alliance guarantee the supply lines to Europe
- to find and destroy surface vessels and submarines
- to stop and investigate suspicious vessels.

Time of increased tension or crisis:

- to carry out surveillance
- to shadow or mark suspicious vessels or units belonging to a possible opponent
- to stop and investigate merchant shipping and fishing vessels
- to protect Dutch interests, in particular in territorial waters and the seas above the Dutch section of the continental shelf.

Time of peace:

- to support the foreign policy of the Dutch government through a maritime presence
- to prepare and train for tasks in wartime or time of crisis both nationally and with our allies;
- to carry out preventive surveillance, supervise adherence to the regulations applying and to carry out search operations on behalf of various departments in territorial waters and the seas above the Dutch section of the continental shelf (for example, smuggling and localizing environmental pollution);
- to provide assistance in times of disasters;
- to provide search and rescue services.



Illus. 1-1-1 Principle tasks of the Sewaco system

In order to perform these tasks the M frigates of the Karel Doorman class are able to:

- carry out reconnaissance, patrols and identification tasks
- carry out shadowing or marking operations
- take action against surface forces
- take self-defense against attack from the air
- take actions against submarines
- stop and investigate merchant shipping and carry out other policing services
- provide assistance in times of disasters and help alleviate the consequences of disasters at sea.

1.1.2. Concept of the SEWACO VII System

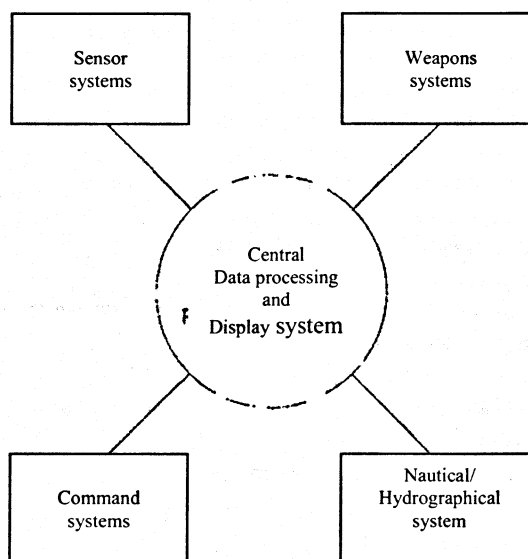
In developing the SEWACO-AOR system the following principles have been adopted on the basis of the description of tasks to be carried out:

- if one (sub)system/installation should be out of action this must not result in the entire SEWACO system becoming unusable. This means that essential systems must be duplicated (redundancy principle).
- (battle) tasks must be able to be carried out in the most efficient manner possible. This is achieved by:
 - controlling all systems as far as possible at a distance (from the central command post);
 - integrating all systems in one SEWACO system as far as possible;
 - automating processes which can be carried out more rapidly or better by a computer than an operator.
- faults in installations must be able to be localized as rapidly as possible and preferably from one central point. The operational program must include an on-line diagnostic function, which protects the availability of the systems and provides assistance in locating faults.

The above-mentioned principles have been implemented in the SEWACO VII system as far as possible. Illustration 1-1-2 shows how the various systems are grouped around a central Data processing and Display system. A great deal of redundancy is incorporated in this Data processing and Display system.

The SEWACO VII system consists of:

- Sensor systems:
 - EOVS sensors;
 - radar sensors;
 - optical sensors;
 - NBC sensors;
 - underwater sensors;
- Weapons systems:
 - EOVS weapons systems
 - guided weapons and cannon systems
 - underwater weapons systems
- Command systems:
 - information processing systems (central data processing and display system);
 - communication systems;
- Nautical/hydrographical system:
 - compass/log/stabilization installations
 - meteo-installations
 - positioning installatio



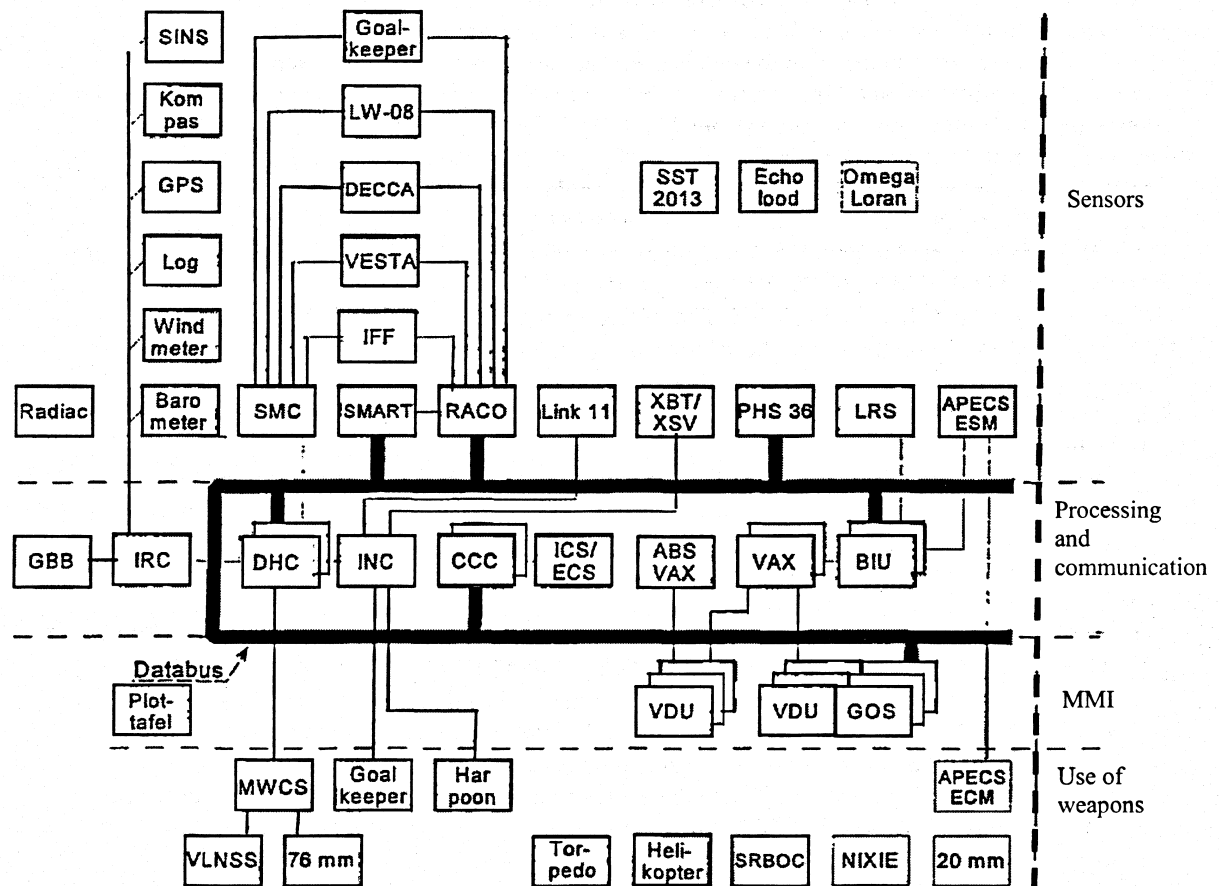
Illus. 1-1-2 Structure around central system

1.1.3. Extent of the SEWACO VII System

The most important sections of the SEWACO VII system are shown in illustration 1-1-3. The relation of the various sections to illustration 1-1-1 is as follows:

- the sensors collect information about the threat/surroundings
- the sensor information is evaluated, partly automatically and partly by the user, in the section processing/MMI (Man Machine Interface)
- the available weapons systems are included in use of weapons.

A complete summary of all SEWACO installations is given in paragraph 1.1.3.2 according to the BSMI numbering (Basic document Standard Materials Classification), and including the MSB classification and the most important functions. Because of their central place in the structure, the data processing and display systems are treated separately in paragraph 1.1.3.1.



Illus. 1-1-3 Total structure of the SEWACO VII installations

1.1.3.1. Central data processing and display system (MME and Processing system)

The central data processing and display system consists of a cluster of computer systems and display units which are connected (directly/indirectly) to a databus and includes the following BSMIs:

BSMI	Name	Type
• 2311	Computer sub-system DAISY	DAISY VII
• 2312	Mass memory/messages sub-system	SYK-04/00
• 2313	Display units sub-system	SYC-01/00
2314	Data transport sub-system	
2318	Communication control sub-systems	SYK-06/00

The databus (2314) consists of three separate bus cables. Data traffic is distributed to the various users connected to the bus through these cables. If one or two cables should be interrupted the traffic is redistributed over the remaining cable(s).

The computer cluster consists of:

- two redundant Data Processing Computers (DHC), type SMR4 (2311)
- two redundant Communication Control Computers (CCC), type SMR4 (2318)
- Interface Computer (INC), type SMRμ (2311)
- two redundant VAX computer systems, which are connected to the databus via the BIU (2312).
- two Bus Interface Units (BIU), including Optical Storage System (OSS). The BIUs are fitted with a number of 68000-family process cards. The BIU provides some of the necessary calculating power for the computer cluster and also acts as the interface function for various systems with the databus (2312).

The display unit sub-system (2313) consists of 16 identical General Operator Stations (GOS) including built-in Video Display Units (VDU), and 13 stand-alone VDUs.

The GOS consoles are connected to the databus and are used mainly for the presentation of realtime operational information and for operating the SEWACO VII system. For this purpose each GOS is fitted with a 19" colour monitor and various Input Designation Devices (IDD), such as keyboards, handwheels, roller ball and lightpen.

The Radar Convertor (RACO) (2311) converts raw radar video into a format that can be presented on the colour monitor. In principle an operator can carry out his tasks from any GOS station.

The VDUs are connected to both VAX computers and are used mainly for consulting and updating the databases stored in the VAXs (OD) and for diagnostics (WD). Some of the VDUs are also connected to the General Operations Installation VAX. The VDUs in the GOS consoles, in the chart table, in the Command Post, on the bridge and in the saloon can also show TV/video signals.

A large part of the functionality of SEWACO VII is provided by the Operational Program. An introduction to the OP is given in the appropriate paragraph.

1.1.3.2. Other BSMIs

2110 EOVS sensors

- 2111 Radar Search and Localize Receiver APECS II SPR-07/00
 This is the ESM part of the combined APECS II ESM/ECM system. The system can automatically detect, localize, analyse and identify (radar) transmissions in the frequency range 0.5 - 18 GHz. The APECS II is completely integrated into the system via the BIU (in Computer room Sewaco Fore). The installation is operated and displayed on a GOS. The Mixer Pulse Blanking Unit (MPBU), which ensures that the APECS II is blanked for own radar transmissions, is included in this BSMI.

- 2112 EOVS Receiver installation SRR-15/01
 Radio transmissions in the frequency range 300 kHz - 1000 MHz can be detected and analyzed with this installation. It is only placed on board for special operations.

2120 Warning radars

- 2121 Radar Sensor Management Installation
 The installation consists of a Sensor Management Cabinet (SMC) and is used :
 • to convert raw (primary) radar video into digital radar plots by means of video extraction and for automatic tracking of radar contacts;

- for processing secondary video (IFF and VESTA);
 - integrating IFF and VESTA in the central system.
- The installation is fully integrated in the system.

2122 Sea warning radar installation DECCA SPS-15/00

The DECCA is an I-band radar installation, which is primarily used as navigation radar. As well as this the installation can be used as sea warning radar and to a limited extent as helicopter control radar. The video can be displayed on the bridge and in the command post (on the GOSs and on a separate radar display unit). The installation is integrated with the SMC and the RACO.

2123 Air warning radar installation LW-08 LW-08/02

The LW-08 is a high power D-band radar for the construction of an air image to a maximum distance of 128 DM with the aid of the LIN and MTI video. The installation also has a separate SURF video channel. The installation is integrated with the INC (remote control), the RACO (raw video display) and the SMC. The installation is operated and displayed on a GOS.

2124 Target acquisition radar installation SMART DA-08/6LS

The SMART is a 3D F-band radar. The system can automatically detect and track air and sea targets. The system is also equipped with FC channels for very accurate tracking of surface targets when using the OTO-MELARA 76 mm cannon. The SMART is fully integrated into the system via the RACO (raw video display) and the databus. The installation is operated and displayed on a GOS.

2125 IFF Interrogator radar installation SPX-01/00

IFF (Identification Friend or Foe) serves to establish the identity of vessels and aircraft and is used in both military organizations and civilian aviation. The IFF interrogator sends out interrogator pulses. If an IFF transponder receives these pulses it will transmit answer pulses back. The answer pulses contain certain information depending on the mode of the interrogation:

- mode 1 and 2 identification of ships, aircraft and helicopters; military
- mode 3/A identification for air traffic control; military/civil
- mode C height information; military/civil
- mode 4 encoded; military

The IFF interrogator is integrated in the system via the RACO and the SMC.

2126 IFF Transponder radar installation SPX-02/00

The IFF transponder provides answers when interrogated by other units. The installation is not integrated.

2127 Helicopter control installation VESTA SRQ-11/00

It is often difficult to follow/direct low-flying helicopters with the on-board radar systems. Therefore, every helicopter is equipped with a VESTA transponder, which responds with a recognition code if this is triggered by a radar signal in the band 1 - 10 GHz. The responses (VHF band) are processed on board by the VESTA system and displayed on the GOSs. The VESTA is integrated in the system via the RACO (raw video display) and the SMC. The installation is operated and displayed on a GOS. The VESTA can be used in combination with the LW, the SMART and the DECCA.

2140 NBC sensors

2141 Radiac installation Mk22NRS

De radiac installation detects radioactive fallout. Sensors are fitted in various positions on the outside decks and throughout the ship. The installation is integrated with the IVS (platform computer), because the primary processing takes place in the TC, and an alarm is also given in the Command Post

2150 Underwater sensors

2151 Sonar installation PHS-36

The PHS-36 is a hull-mounted sonar installation, which can work both actively and passively. The installation can automatically detect and track underwater contacts and is fully integrated into the system via the databus. The installation is operated and displayed on a GOS.

2153 Sea Surface Temperature Recorder Sonar 2013

This stand-alone installation measures the surface temperature of the sea water with a sensor placed under the waterline. The measured temperature is plotted on a paper roll.

2154 Expandable Bathymograph System Sonar XBT/XSV PRS-02/01

The installation determines the speed of sound underwater as a function of the depth. In order to do this a probe is launched which sinks at a known speed and sends information back to the system while doing so. Two different types of probes are used:

- XBT probe This measures the temperature as a function of the depth. The system can calculate the speed of sound from this with the help of additional information. A plot of either the water temperature or the speed of sound can be chosen.
- XSV probe This measures the speed of sound directly as a function of the depth. The results are recorded. The installation is integrated into the central system via the INC.

2156 Towed Array Sonar installation ANACONDA SQR-02/00

The ANACONDA is a passive Long Range Sonar (LRS) for (automatic) detection, classification and tracking of underwater noise in the frequency band 10 - 4000 Hz. An acoustic array is towed behind the ship to act as sensor. The installation is fully integrated into the system via the BIU (in Sewaco Computer room aft). The system is operated and displayed on a GOS.

2210 EOY weapons systems

2211 Misleading jammer transmitter APECS II SLQ-04/00

This is the ECM part of the combined APECS II ESM/ECM system. The system can jam a maximum of 16 transmitters simultaneously in the band 8 - 17 GHz. The system is controlled from the ESM part.

2212 Launching system SRBOC Mk36Mod1

Rockets with radar reflecting material (chaff) can be launched with the Super Rapid Bloom Offboard Chaff launching system. The purpose of chaff clouds is to mislead enemy missiles. The system is stand-alone.

2220 Guided weapon and cannon system

2221 Short and Medium Range Air Defense system MWCS

The Multi Weapon Control System (MWCS) is to combat air and surface targets. The system consists of:

- two Separate Tracking and Illumination Radars (STIR) for tracking and illuminating targets
- two redundant STIR Control Consoles (SCC). The SCCs form the heart of the MWCS and are positioned in the Command Post. The system is operated from one SCC, the other SCC is a slave.
- Vertical Launching System (VLS) with 16 missiles (NSSM)
- Cannon system 76mm Oto Meirar

The MWCS is fully integrated in the system via both DHCs.

2222 Anti-ship Guided weapon system HARPOON
 The Harpoon weapon system is used for combatting surface targets up to a distance of 75 NM with the help of a missile RGM84A block IC. The system is fully integrated via the INC and can be operated both from the central system and to a limited extent locally.

2223 Short range Defense system Goalkeeper SGE-30
 The Goalkeeper has been developed to combat rapidly approaching and rapidly manoeuvring targets at short range. The system is integrated in the central system via the INC but can also work fully autonomously and automatically. As well as this, the video of the search radar can be displayed on the GOSs via the RACO.
 The system consists of:

- search radar (I band)
- track radar (I and K band)
- Weapon Control Console (WCC) for control and local operation
- 7-barrel 30mm Gatling gun with firing speed of 4200 shots per minute.

2224 Short range Defense system 20 mm machine gun OERLIKON
 The Oerlikon 20mm machine gun is a stand-alone weapon for use against air and sea targets.

2226 Salute cannon 40mm
 The salute cannon is a stand-alone weapon for ceremonial use.

2230 Underwater weapon systems

2231 Torpedo weapon system Mk32Mod9
 The stand-alone (ships) torpedo weapons system (STWS) is intended primarily for use against submarines. The torpedos can also be launched from a helicopter.

2232 Torpedo Countermeasure System NIXIE AN/SLQ-25KM
 The NIXIE is a stand-alone misleading installation against torpedos. A towed body which sends out acoustic jamming signals is towed behind the ship.

2310 Information processing systems

2315 Data link installation Link 11
 The purpose of the Link 11 installation is to exchange tactical details between (Naval) Combat Systems on different platforms by means of an encoded connection. The installation is integrated in the system via the INC.

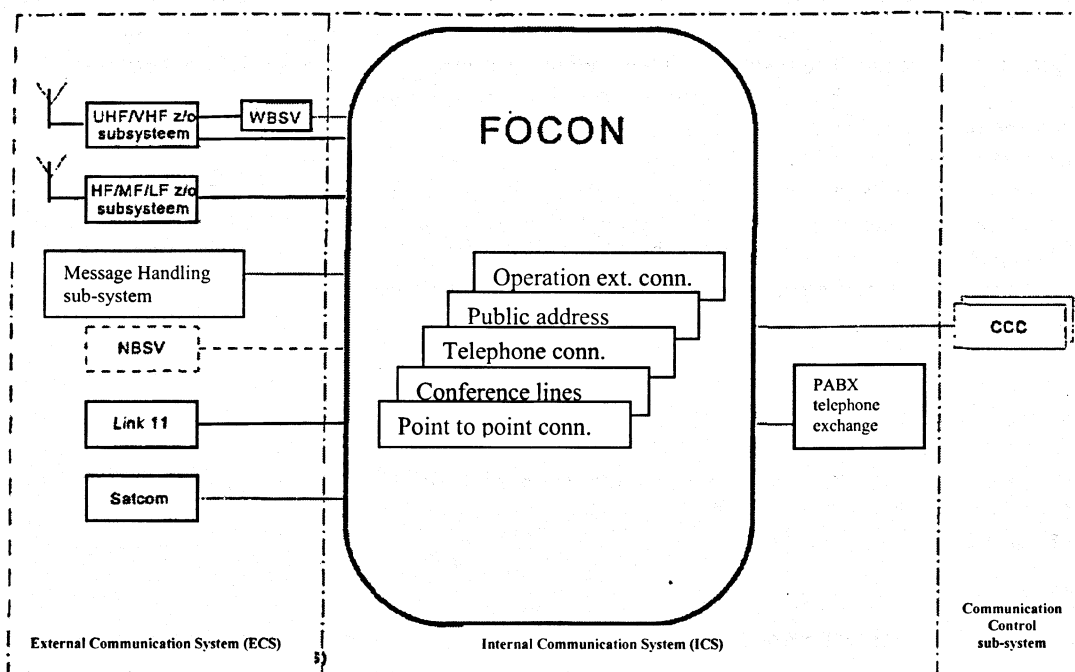
2316 Plotting table installation COINS TSP3592
 The Compact Integrated Navigation System (COINS) is a computer controlled plotting table which provides assistance for safe navigation. The installation is provided with all the necessary information via the IRC broadcast output.

2317 General operations installation SYK-05/00
 The general operations installation consists of a stand-alone VAX computer system with ancillary equipment for carrying out various administrative tasks.

2320 Communication systems

The Ships Integrated Communication System (SINCOS) is built up around a Fiber Optic Communication Network (FOCON), as shown in illustration 1-1-4. FOCON provides the internal communication functions such as point-to-point connections, conference lines, telephone connections and public address. External connections can also be made using the FOCON system.

Almost all the external communication equipment can be programmed from a GOS. The communication system is integrated into the central system via the two Communication Control Computers.



Illus. 1-1-4 Ships Integrated Communication System (SINCOS)

2321 UHF Transmit/Receive sub-system SRC-38/00
 This system consists of eight UHF-transceivers, one of which can also be used in the VHF band. The Vinson Wide Band Secure Voice (WBSV, BSMI 2326) is fitted on six transceivers.

2322 VHF Transmit/Receive sub-system SRC-39/00
 This system consists of a mariphone transmitter/receiver and a "guard-receiver".

2323 HF/MF/LF Transmit/Receive sub-system SRC-40/00
 This system consists of:

- four 1 kW transmitters connected to a wide-band antenna system (HF band).
- two 1 kW transmitters connected to a narrow-band antenna system (HF band)
- twelve receivers (LF/MF/HF band)
- one emergency transmitter/receiver

2325 Integrated Radio, Intercom and Telephone sub-system (GRIT) SIC-15/00
 This system is built up around a glass fiber bus. The following basic units are connected to this bus:

- thirty Multi Function Terminals (MFT). A MFT is a programmable unit with which a user can maintain several internal and external connections simultaneously
- twenty-eight Bus Access Concentrators (BAC). Various types of interfaces can be placed in a BAC for connecting equipment to FOCON. The PABX telephone exchange, the Single Function Terminals (SFT) and the external communication equipment are all connected to the BACs.
- two Data Channel Concentrators (DCC). The DCCs form the interface between FOCON and the Communication Control Computers.

- six Automatic Coupling Units (ACU). The ACUs ensure that the consequences of a breakdown in the FOCON bus are minimized by the automatic selection of another fiber glass connection.

2326 Message Handling Sub-system SGC-16/00
This includes the TTWs, modems and encoding equipment. The system has 6 Vinson Wide Band Secure Voice units. Narrow Band Secure Voice equipment can also be placed.

2327 Public Address System SIQ-03/00
The installation consists of a public address cabinet with amplifiers for the various public address systems. The loudspeakers are connected to the public address cabinet by a separate cable network (outside of FOCON).
The engine room is fitted with a FM loop public address system which can be listened to with special headsets.

2332 TV and Video distribution system SRQ-08/00
This system distributes both the AMUS video signals and the operational video signals from the cameras (8) and the video recorders (2).

2333 Amusement Radio and TV installation SRR-29/00
The Amusement Radio and TV installation (AMUS) provides on board amusement and educational programmes.

2334 Underwater telephone installation UT 2000
The Underwater telephone installation (OWT) is used to communicate with another OWT (e.g. on a submarine) by means of telephony or telegraphy. The installation is integrated in FOCON via BAC.

2335 SHF Satellite Communication Installation SRC-49/00
The SHF Satcominstallation provides radio communication in the frequency band 7.2 - 8.4 GHz via a geo-stationary satellite. At the present time the installation is stand-alone, but will be integrated into FOCON in the future.

2336 Satellite Communication Installation INMARSAT JUE-45A/MK2
INMARSAT is a commercial satellite communication system for telephony and telefax..
The system is stand-alone and works on frequency 1.5 GHz.

2410 Compass/Log/Stabilization installations

2411 Information Retransmission Installation. SEN-10/00
The Information Retransmission Cabinet (IRC) forms the heart of the installation. The IRC receives information from various nautical sensors. These details are processed by the IRC and distributed to the different users. The IRC also forms the interface between the SEWACO VII system and the automation platform.
This installation also contains various indicators (Numerical Indicators, daughter compass indicators, course indicators, roll and pitch indicators, wind direction and speed indicators) which are controlled from the IRC.

2412 Compass and Navigation delay installation SJN-17/00
This installation consists of a NATO-SINS ring laser compass and the Mk29 (mod 0/mod IA) gyrocompass. Both compasses supply course and stabilization values. The NATO-SINS compass also supplies coordinate values, based on the navigation dealy principle.
Both compasses are integrated in the IRC.

2413 Log installation SJL-04/00

The EM log measures the speed of the ship through the water and also records the distance travelled. Measured values are sent through to the IRC.

2420 Meteo installations

2421 Wind measurement

SML-10/00

The wind direction and speed are measured by two sensors on the yard and sent through to the IRC. The values measured are corrected in the IRC according to fixed calibration details.

2422 Barometer

DB-IA

The measured air pressure is sent through to the IRC.

2423 Weather chart plotting system Furuno

FAX 214

The Furuno weather chart plotter is a system for receiving and plotting weather charts. It has a built-in receiver, but can also be connected to a HF receiver, (BSMI 2323), via FOCON.

2424 Weather satellite installation

Skyceiver 8

This is a stand-alone installation, which will be placed on board in the future.

2430 Position determining installations

2431 Satellite Navigation Installation GPS

NAVSTAR/GPS

NAVSTAR/GPS uses satellites to determine the geographical position of the ship to within 100 metres (civilian mode) or 16 meters (military mode).

The information is sent through to the central system and to the SINS via the IRC. The GPS data can also be read on the receiver on the bridge.

2433 Omega Installation

SRR-30/00

This installation consists of two stand-alone position determining installations: an Omega navigator (JLA-104) and a Loran C navigator (JNA-761).

2434 Echograph installation

The Atlas Echograph 481 measures the depth underneath the keel. The results are displayed on a recorder and on displays on the bridge and in the command post.

1.1.4. Operational Program

The Operational Program is built up from the following parts:

- **Infrastructure**

The software infrastructure is responsible for:

- the data communication within the SEWACO VII system
- managing the system resources
- managing the various system/application functions
- managing the interface between an application function and the system.

- **System/application functions (SF/AF)**

System/application functions are responsible for carrying out certain tasks/functions. The following SF/AF form part of the Operational Program of Sewaco VII:

- DH1 Data Processing Responsible for all data processing tasks
- EW1 Electronic Warfare Responsible for all APECS-II related tasks
- HMS Hull Mounted Sonar Responsible for all PHS-36 related tasks

- TAS Towed Array Sonar Responsible for all ANACONDA related tasks
- CM1 Communications Responsible for all SINCOS related tasks
- IH1 Information Processing Responsible for all "Information Processing" tasks
(Operational databases, acoustic and diagnostic)
- MH1 Message Processing Responsible for all message processing tasks
- TMA Target MotionAnalysis Responsible for all TMA tasks (determination of target
details from measurements)
- TR1 Trainer Responsible for carrying out simulations for training
purposes

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1.2. Central data processing and display system (MMI and Processing system)

1.2.1. General

The central data processing and display system (see illustration 1-2-6) consists of a cluster of computer systems and display units which are connected directly or indirectly on a databus and includes the following BSMIs:

BSMI	Name	Type
• 2311	Computer sub-system DAISY	DAISY VII
• 2312	Mass memory/messages sub-system	SYK-04/00
• 2313	Display units sub-system	SYC-01/00
2314	Data transport sub-system	
2318	Communication control sub-systems	SYK-06/00

A large part of the functionality of the SEWACO VII is determined by the Operational Program. An introduction to the OP is given in paragraph 1.2.5.1.

1.2.2. Data bus

The data bus (see illustration 1-2-1) works according to the CSMA/CD principle (Carrier Sense Multiple Access with Collision Detection: no central control system, the user has to gain access by means of a particular protocol) and consists of:

- 3 separate triax cables (transport medium)

Bus taps. These are to allow signals to be branched off and on the data bus.

A maximum of two users can be connected to one bus tap. Both ends of the triax cable must be closed with a 50 Ω resistor. A jumper has to be placed in the bus tap for this purpose.

- BICLs (Bus Interface Control Logic) or SLANCs (Signal Local Area Network Controller); these function as the interface between the bustap and the databus user and are placed in the cabinet of the user concerned.

A maximum of 4 bustaps can be connected to a BICL and a maximum of 2 on a SLANC.

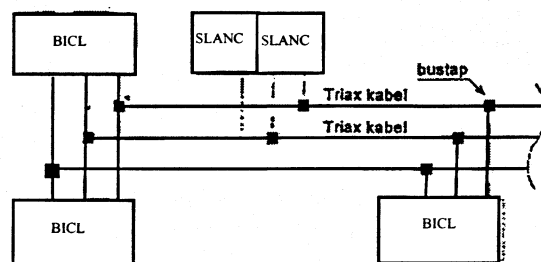
Data traffic for the users connected to the data bus is divided over the three bus cables. If a fault should develop in one or more of the cables then the data traffic is redistributed over the remaining cable(s), with the exception of the RACO RIMs (RADAR CONvertor, Radar Image Memory).

1.2.3. Computer cluster

The computer cluster is situated in the Computer Room Sewaco Fore and in Computer Room Sewaco Aft and consists of:

- two redundant Data Processing Computers (DHC), type SMR4 (2311)
- two redundant Communication Control Computers (CCC), type SMR4 (2318)
- one Interface Computer (INC), type SMR/z (2311) (only in Computer room SEWACO Fore)
- two redundant VAX computer systems, which are connected to the data bus via the BIU (2312).
- two Bus Interface Units (BIU), including Optical Storage System (OSS). The BIUs are fitted with a number of 68000 processor cards. The BIU provides part of the necessary calculating capacity for the computer cluster and also controls the interface function for various systems such APECS II, Anaconda and VAX (see illustration 1-2-6) with the data bus (2312).

Illus. 1-2-1 Databus



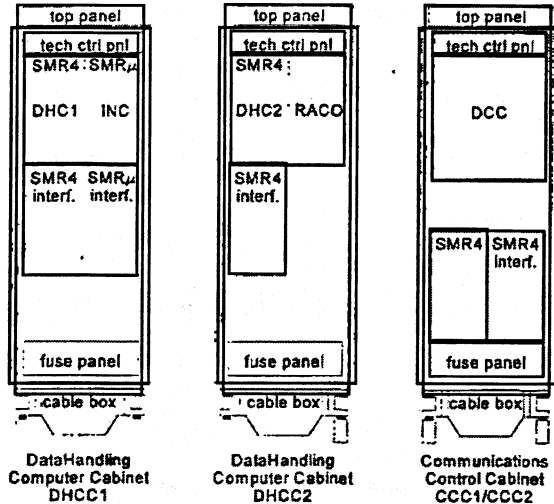
The bus taps marked with a * are closed off by a 50 Ω resistor

1.2.3.1. SMR4/SMR_μ

The computer family SMR (Signal Microminiature Calculator) consists of the following types:

- SMR, first placed on board the GW frigates around 1970.
- SMR-S, (small)
- SMR_μ, (micro)
- SMR4 (4th generation)

Both SMR4s and SMR_μ's are placed on board the M frigates.



The computer cluster consists of 4 SMR4s, which are connected to the data bus by means of a BICL. The SMR4 is a general purpose, multiprocessing computer for real-time applications with an internal memory of 1M Word (or 4M Word).

Two SMR4s are used as data processing computers and are situated in DHCC1 and DHCC2 (see illustration 1-2-2). The DH-SMR4s are connected via ICIs with:

- Interface computer (INC) SMR_μ
- Video extractor computers (VEX1 and VEX2) SMR_μ (see SMC, BSMI 2121)
- MWCS Stir Control Consoles (SCC GUN and SCCNSSM) SMR_μ
- Information Retransmission Cabinet (IRC)

Illus. 1-2-2 Overview of Computer cluster

Two SMR4s are used as communications control computer and are situated in CCC1 and CCC2 (see illustration 1-2-2). The CCC-SMR4s are connected with FOCON (DCC) via an IRC.

The computer cluster contains one SMR_μ, the Interface computer (INC) in DHCC1. The SMR_μ is a general purpose computer for real-time applications, with basic memory of 64 kWord, which can be increased to 2MWord by a pager. The INC has a 192kWord memory. A major part of the DH-OP runs on the INC (see paragraph 1.2.5.1). The following systems are connected to the INC:

Goalkeeper (ICI)

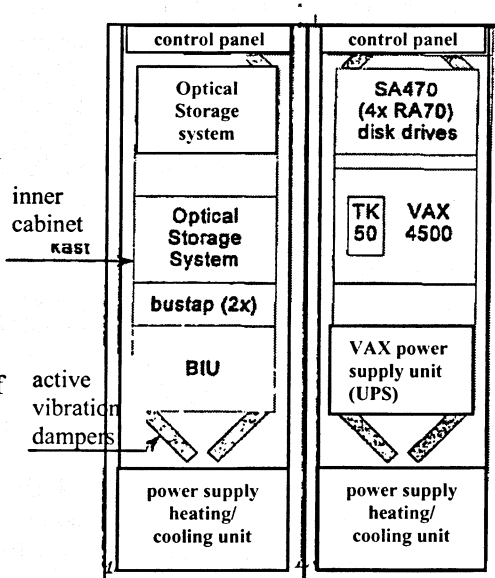
- Harpoon (NTDS and ALT3)
- XBT ALT3
- Link 11 (NTDS)
- LW-08 ALT3

1.2.3.2. PROTEC CABINET

Civil computer systems are also used on board the M frigates. In order to protect these systems against conditions which can occur on a warship (such as shock, vibration, large differences in temperature and voltage), this equipment is placed in PROTEC cabinets (see illustration 1-2-3). The conditions in the inner cabinet of the PROTEC cabinet, helped by the active vibration dampers, are acceptable for civil systems. The PROTEC cabinets are situated in Computer room Sewaco Fore and Aft.

1.2.3.2.1. VAX

The computer cluster consists of 2 identical VAX4500 computer systems, including 4 disk drives (RA70) and



a tape unit (TK50). The VAX is connected to a BIU through two parallel Local Area Networks. (The LAN consists simply of a bustap, without coax cable). The equipment is situated in the PROTEC cabinet.

1.2.3.2.2. BIU

The BIU provides the interface function between the VAX computers, APECS (BIU-I) and ANACONDA (BIU-2) and the databus. The Optical Storage System is also connected to the BIU. The OSS consists of 2 groups of 7 optical drive units for reading and writing optical disks. The function of the drives is described in CSOM.

A number of processor, interface and memory cards are placed on a VME bus in the BIU. The BIUs are not completely identical.

BIU 1 is connected with:

- Databus (via SLANC card and 3 bustaps)
- VAX-1 (via SLANC card and 2 bustaps)
- APECS II (via ICI)
- OSS (via SCSI)

BIU 2 is connected with:

- Databus (via SLANC card and 3 bustaps)
- VAX-2 (via SLANC card and 2 bustaps)
- LRS (via ICI and RS-422 interfaces)
- OSS (via SCSI)

1.2.4 Display units sub-system

The display unit sub-system (2313) consists of 16 identical General Operator Stations (GOS) including built-in Video Display Units (VDU), and 13 stand-alone VDUs. Illustration 1-2-8 shows an overview of the arrangement of the GOSs in the command post.

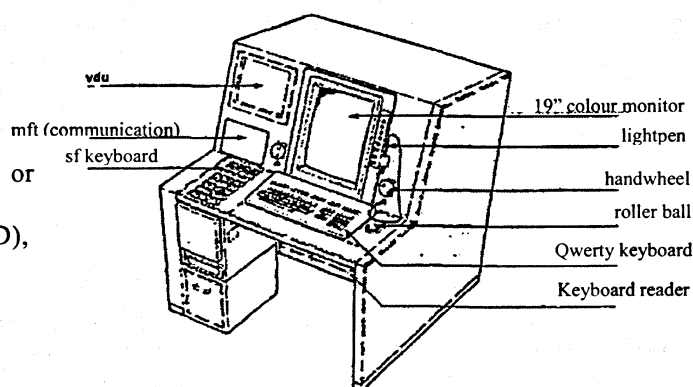
The GOSs are connected to the databus and their main use is for displaying realtime operational information and for operating the SEWACO VII system. In order to do this the GOS is equipped with a 19" colour monitor, a lightpen and an Input and Designation Device Unit (IDD) with connected keyboards, handwheels, a roller ball and a keycard reader. The Radar convertor (RACO) (2311) converts raw radar video into a format that can be displayed on the colour monitor.

In principle an operator can carry out his tasks from any GOS. The VDUs are connected to both VAX computers and are used principally for consulting and making changes in the databases stored in the VAXs. Some of the VDU are also connected to the VAX of the General Operations installation. The VDUs in the GOSs, on the bridge (OvdW), on the plotting table in the Command post and in the saloon can also display TV video signals which are connected to the video bus.

1.2.4.1. GOS

A GOS consists of:

- GOS console (see illustration 1-2-4) containing the following equipment :
 - 19" colour monitor
 - Lightpen (can be connected either left or right of the monitor)
 - Input and Designation Device (IDD), with the following connected:
 - 2 handwheels
 - Roller ball
 - Special Function Keyboard. This keyboard has 32 keys whose functions are determined by the Operational Program.



Illus. 1-2-4 GOS console

- The function of the keys is shown in a LED display above the keys.
- QWERTY keyboard. This keyboard is used for both the VDU and the GOS. The Operational Program determines what the keyboard is connected with.
- Keypad reader. This can be used to identify the user.
- GOS Drive Unit; the 16 GOS Drive Units are situated in 8 GOS Drive Cabinets in the Electronic Cabin. The GOS Drive Unit provides for the image that is displayed on the 19" monitor, the interfacing with the IDD and the lightpen and the communication with the databus via a BICL.

The block plan of a GOS is shown in illustration 1-2-9. The image on a GOS is built up from four different work stations which can be displayed over one another in the output area. The bottom lines of the screen form the support area. Messages about the status of the GOS are displayed here.

1.2.4.2. Video Display Unit

The VDU is a DEC VT-220 compatible monochrome terminal, with a number of extra options, which is suitable for use on board naval vessels. The options are:

- 3 RS422 interfaces, of which only one is active at any one time. Interfaces 1 and 2 are connected with Sewaco VAX Fore and Aft respectively. The Operational Program determines which of the two interfaces is active. Interface 3 is used on 5 VDUs for a connection to the General Operations VAX (Bureaus OD, ADMIN, TD, WD and BEVO). This interface can only be activated from the Setup menu.
- The VDUs in the GOS consoles, on the plotting table in the Command post, on the bridge (OvdW), and in the saloon can also display TV/video. A maximum of 16 TV channels can be programmed, of which 12 are actually used.

16 VDUs are fitted in the GOS consoles and there are also 13 stand-alone VDUs.

1.2.4.3. Radar Converter

The Radar Converter (RACO) converts raw radar video into an image that can be displayed on the GOSs. These radar images are sent over the databus. The RACO is situated in Data Processing Computer Cabinet 2 in the Computer room Sewaco Aft (see Illustration 1-2-2). The block plan of the RACO is shown in Illustration 1-2-10. The RACO consists of 2 RACO banks. Only one primary radar video can be selected for each bank. Secondary videos can also be mixed in. Primary radar video includes LW and SMART. Secondary radar video includes IFF and VESTA. A RACO bank can make a maximum of 3 radar images from the video, whereby the operator can set the scale to be used. A total of 6 images are placed on the databus.

The RACO can be operated completely from a GOS. However no ticks can be selected. This is a hardware setting on the SMC.

1.2.5. Operational Program

1.2.5.1. General

The SEWACO VII system Operational Program is built up from System functions (SF)¹. The mapping of the SFs on the hardware is shown in Illustration 1-2-7. SFs are responsible for carrying out certain related tasks. SF are sub-divided further into "main functions" and "functions". As described in Paragraph 1.2.3. the computer cluster of the SEWACO VII system consists of

¹ Although a formal distinction must be made between System and Application functions depending on the level used to communicate with the infrastructure, both types of function are termed System functions here.

several computers, with some of these computers being redundant. This has consequences for the OP and the SFs. The following is important here:

- "Distributed" If an SF is spread across more than one processor it is termed a "distributed SF". In this case the SF is built up from a Front End (FE) and one or more Back Ends (BE). The communication between the SF and the rest of the system still runs via the FE.
- "Non-distributed" The SF only runs in one processor.
- "Duplicated" Because the computer systems are carried out redundant the SFs concerned must also appear twice. Only one of the duplicated SFs is active and carries out all the tasks of the SF. The passive SF receives data from the active SF in order to update the internal memory so that it is possible to switch which SF is active at any random moment (active becomes passive and vice versa). After switching computers it can take a few minutes before the SF/AF is available again. In the case of a "distributed SF" only the FE is duplicated.
- "Non-duplicated" The SF only appears once.

The architecture model is shown in Illustration 1-2-5. The Operational Program consists of the following layers:

- Infrastructure
 - Standard Process Interconnection Layer
 - Management & Control Layer
 - Presentation Layer
- System/application functions (SF/AF)

1.2.5.2. Infrastructure

1.2.5.2.1. Standard Process Interconnection Layer

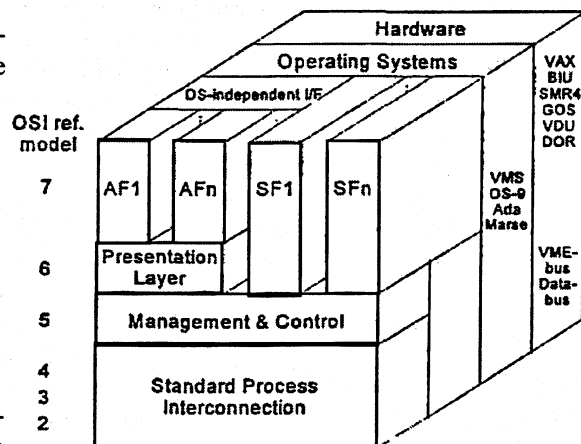
This layer is responsible for the data communication between software functions, both within one computer system and between different computers via the databus. The Signal systems make use of COMPASS2, in the BIU/VAX of SPIN (supplied by CAWCS). SPIN/COMPASS supplies the following services:

- Data communication
- Setting up and interrupting functional interfaces
- Redistributing data traffic over the databus during faults/repair of the databus cable.
- Distribution of system time
- Diagnostics

1.2.5.2.2. Management & Control Layer

This layer contains:

- **Resource management.** This "main-function" contains the functions given below for controlling the databus, GOS, VDU and mass-memory (TK.50 and optical disks):
 - Diagnostics Collection and transfer of BITE results and heartbeat messages from the relevant systems to IH1 and carrying out tests on request of IH1.
 - GOS/VDU allocation In and out logging of GOS workstations and VDUs and selection of work packets.
 - Databus management The initial distribution of traffic over the databus and initializing the connections with the equipment connected to the databus.
 - Optical disk management Control of reading and writing data on the optical disks.



Illus. 1-2-5 Architecture model

- **Import/Export** Importing and exporting databases on the Winchester Disk Drives in the VAX by means of an optical disk or a TK.50 tape.
- **System monitor** Recording events, such as logging in and out and selection of work packets so that the status of the system can be called up at any particular moment.
- **Operator database management** Changing the operator database (on WDD), in which the privileges of the users are stored.
- **Application management.** This "main-function" arranges for the integration of the software functions in the system, spread over the various computers. Application management is responsible for the following tasks:
 - **Fault detection and "state transition"** The "heartbeats" of the various computers of the infrastructure are guarded in this function. If a (redundant) computer is no longer available the SF in the other computer is made active. It is also possible to make an SF active or passive manually and this function then ensures that no more than one duplicated SF is active at the same time. A part of "state transition management" is supplying information to SPIN in order to create the correct functional interfaces.
 - **Distribution of system data** System data (such as date, time, course, sailing speed and position) is provided by the system function DH1. This information is made available to the local SFs by the infrastructure.
 - **Loading the OP** The infrastructure is responsible for loading all "non-distributed" SFs and all FEs of "distributed" SFs.
 - **Replay** This function stores tactical data and synthetic radar and sonar data on mass-memory and displays it later as required on a GOS.
 - **Training** This function supplies the facilities for on-board training sessions.

The above tasks are distributed over the software modules as shown below:

- MC 1 Management and Control for the SMR4 computers
- MC2 Management and Control for the VAX computers
- MC3 Management and Control for the BIUs
- SV1 Supervisor for the SMR4 oriented SFs
- SV2 Supervisor for the VAX oriented AFs
- LP 1 Load Program
- DM 1 Disk Management for the WDDs
- OM 1/2 Management for the optical disks
- EWCO EW Converter
- SOCO Sonar Converter
- TRI Training
- TMA Target Motion Analysis

1.2.5.2.3. Presentation Layer

The presentation layer functions as interface between an Application Function independent of a computer platform and the rest of the system.

1.2.5.3. System functions

System functions are responsible for carrying out certain tasks/functions. The following SF/AF form part of the Operational Program Sewaco VII:

- DH1 Data Processing, responsible for all data processing tasks (incl DAISY)
- EW1 Electronic Warfare, responsible for all APECS-II related tasks
- HMS Hull Mounted Sonar, responsible for all PHS-36 related tasks

- TAS Towed Array Sonar, responsible for all ANACONDA related tasks
- CM1 Communications, responsible for all SINCOS related tasks
- IH1 Information Processing, responsible for all Information Processing tasks (operational databases, acoustic and diagnostics)
- MH1 Message Handling, responsible for all Message Handling tasks
- TMA Target Motion Analysis, responsible for all TMA tasks (determining target details from localization measurements)

Where relevant every SF is divided into the following "main functions":

- Build in test equipment (BITE) Responsible for starting/controlling tests within an SF (both FE and BE) and reporting the results to IH1.
- Man Machine Interface (MMI) Responsible for setting up and interrupting the connection with a VDU and/or a GOS (via the infrastructure), and for receiving and sending data.
- Initialization Responsible for allocating initial values to the various variables and initializing the interfaces with the BEs after starting an SF.
- Shadowing Responsible for the exchange of data between the active and passive (duplicated) SF.
- Mass Memory Access Responsible for reading and writing data from/to the WDD (VAX) and the optical disks via the infrastructure. Examples are:
 - Import/Export of databases
 - Logging data on DOR
 - Downloading from the OP
- BE downloading Responsible for loading the OP in the BEs (by a distributed SF)
- Functional communication Responsible for the communication via functional interfaces.
- Operational Processing This main function includes all the functions necessary for carrying out the operational tasks of the OP. The Operational Processing Main Function per SF is discussed in the following paragraphs.

1.2.5.3.1. DH1

The system function DH1 is responsible for all data processing tasks and consists of the following functions:

- System data Responsible for:
 - Data exchange with the IRC
 - Data exchange with NATO-SINS (via the IRC)
 - Data exchange with GPS (via the IRC)
 - Calculation of the movement of own ship and the position of the ship (geographically and within tactical grid), wind details, drift and the system time.
 - Sending platform information (received via the IRC) to TAS
 - Sending XBT data to IH1
 - Sending time and geographical position to the infrastructure.

-
- **Track management** Responsible for maintaining system tracks in the MTS (main track store):
 - Processing operator input with reference to system tracks
 - Initiating, updating and correlating tracks as a result of track information received from:
 - Link 11
 - MWCS
 - Goalkeeper
 - Radar sensors (Correlation and Radar Track Control)
 - APECSII(EW1)
 - PHS-36 (HMS)
 - ANACONDA (TAS)
 - **Correlation and radar track control** This function is responsible for correlating radar tracks both among themselves and with the MTS, so that the information in the MTS is updated. This function also ensures that track information from one radar channel is supplied to the other channels as help in the automatic tracking process. The radar channels are:
 - LW-MTI
 - LW-LIN
 - SMART air
 - Goalkeeper search
 - VESTA
 - LW/Decca surface
 - SMART surface
 - SMART FC/SP windows
 - Simulation
 - IFF
 - **Radar channel control** This function forms the interface between the radar channels hardware (SMART, VESTA, VE-air mti, VE-air lin and VE-surf) and the rest of the SF DH1. Information for remote control of SMART and VESTA is sent by this function.
 - **Radar automatic tracking** This function is responsible for automatic tracking of targets in the VE related radar channels (LW-air lin, LW-air mti, surf and IFF).
 - **Plot display control** This function supplies the radar plot and radar track data (primary & secondary) which can be displayed on the GOS.
 - **Remote control** Processes the operator input for operating the LW-08, the RACO, the VESTA and the SMART from a GOS.
 - **LW-08 control** This function deals with the exchange of information with the LW-08 (status information and Remote control data).
 - **RACO control** This function regulates the control of RACO
 - **IFF** Responsible for sending the correct commands to IFF VE. A target can be interrogated in more than one mode, after which the replies are processed.
It is also possible to interrogate in the omni-mode during one revolution. The results are only displayed as RACO video or as IFF plot.
 - **Link-11** This function regulates setting up and maintaining a Link-11 connection.
 - **Harpoon** Data exchange with the Harpoon weapon system
 - Processing operator input
 - Supplying display data (engagement information and missile status)
 - **Torpedo** Provides assistance when using torpedoes (engagement planning, torpedo settings and advi
-

MWCS	• Data exchange with the MWCS • Processing operator input • Processing for primary MWCS functions (Engagement orders and DOGAS orders) and for secondary MWCS function (intercept calculation, investigation and sector search) • Supplying display information
Goalkeeper	• Data exchange with Goalkeeper • Processing operator input
SRBOC	• Controlling the Goalkeeper in manual and semi-automatic mode.
Target evaluation	Supplying assistance when using the SRBOC (chaff launch advice) • Determines the "threat ranking" of all "Non-friendly air tracks" • Maintains available platforms/weapons systems • Provides assistance when using weapons systems (including trial/engagements) • Automatic "target designation" for the MWCS
Tactical manoeuvring and air control	This function carries out calculations for (trial) engagements of the own ship
General plot input data	• Information exchange with IH1 • Processing operator input
Tactical figures	• Calculation of display data for: • (F)FOC (Future) furthest on circle • circles • figures • backtracks • CPAs
Charts	• Processing operator input This function: • processs the operator inputs with respect to charts • calculates the position details for displaying the chart
Replay	This function controls display of an earlier saved "Tactical Picture" via the infrastructure
Simulation	This function: • generates track and display data for a maximum of 30 simulated objects. Supplies simulation data for the MWCS.
Softkey processing	This function processs operator inputs via the SKP.
Backend Communication	This function regulates the communication with the BE processors (INC, VEX1 and VEX2).

Map ping of DH1 over the processors									
Function	SMR4	INC	VEX1	VEX2	Function	SMR4	INC	VEX1	VEX2
system data	X	X	-	-	MWCS	X	X	-	-
track management	X	X	-	-	Goalkeeper	-	X	-	-
corr. and radartrack ctrl	X	-	-	-	SRBOC	-	X	-	-
radar channel control	X	-	X	X	target evaluation	-	X	-	-
radar automatic tracking	-	-	X	X	tact. manoeuvr./ air Ctrl	-	X	-	-
plot display control	X	-	-	-	general plot input data	X	X	-	-
remote control	X	-	-	-	tactical figures	-	X	-	-
LW-08 control	-	X	-	-	charts	X	-	-	-
RACO control	X	-	-	-	replay	X	-	-	-
IFF	-	X	X	-	simulation	-	X	-	-
Link 11	-	X	-	-	softkey processing	X	-	-	-
Harpoon	-	X	-	-	backend comm.	X	X	X	X
Torpedo	-	X	-	-					

1.2.5.3.2. EW1

The application function EW1 is responsible for all APECS-II related tasks and consists of the following functions

EW track management	This function processes the track updates and the identification results of APECS II, operator input, DH1 and simulation. It also supplies track information to DH1.
EW library management	This function is responsible for: • Downloading the ESM/ECM libraries in the APECS II • Initiating "queries" in the IH1 and APECS II databases • Maintaining the Priority Library Extension in the ESM database This function collects, converts and buffers the information which has to be logged and sends this to OM2.
EW datalogging	
EW MMI	This function processes the operator inputs and enables EW information to be displayed on the GOS.
ESM/ECM sub-system management	This function provides the communication with the APECS II system, including monitoring the ICI status and controlling the APECS II system time. Training: This function supports a maximum of 30 simulation tracks.

1.2.5.3.3. HMS

The application function HMS is responsible for all PHS-36 related tasks and consists of the following functions:

Remote control	This function is responsible for processing operator commands and controlling the PHS-36.
Alarm processing	This function processes the FM and CW alarms received (signals which are above a particular threshold level) as a result of active transmissions.
Trace processing	This function is responsible for starting, maintaining and deleting traces by "ping to ping" association of alarm data.
Passive data processing	This function is responsible for processing passive data (both TB and DEMON)
Track management	This function is responsible for maintaining HMS tracks (including controlling the 12 AT channels) and for updating track information to DH1.
Replay	This function is responsible for recording and replay of raw sonar data (via the infrastructure)
Training	This function is responsible for controlling the test generator. One simulation target can be generated under the control of TRI or by an operator (DH-track).

1.2.5.3.4. TAS

The application function TAS is responsible for all Anaconda related tasks and consists of the following functions:

Sensor management	This function is responsible for: • Anaconda settings • Controlling the total mission recorder • Controlling the TAS simulator. Two simulation targets can be generated either under control of TRI, DH1 or by an operator • Controlling the hard-copy recorder • Processing ambient noise data for IH1 • Controlling the audio bundle.
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Track management	This function is responsible for maintaining the various IAS tracks, controlling the track channels and sending track information to DH1 and TMA.
------------------	---

1.2.5.3.5. CM1

This system function is responsible for all SINCOS related tasks and consists of the following functions:

Reprogramming/BE communication	This function is responsible for programming the connections in FOCON (by changing the parameters in BACs and MFTs) and for the communication with FOCON.
Communication channel control	This function is responsible for setting up and maintaining communication channels and consists of the following tasks • Monitoring the working of the channels • Changing the configuration of a channel as a result of a fault in one of the components • Changing the settings of the various components
RATT processing	This function is responsible for the communication between MH1 and the relevant transmission and receive channels.
Connectivity	This function is responsible for the allocation of internal and external connections to the various users.

1.2.5.3.6. IH1

The application function IH1 is responsible for all Information Handling tasks and includes the following functions:

Operational information	This function is responsible for calling up and changing details from the following databases on a VDU: • Platform database • Weapon database • Sensor database • Mission database • Contact database The function also receives contact information from DH1.
Toteboard information	This function is responsible for designing, calling up and changing toteboards on a VDU.
Geographical information	This function is responsible for calling up and changing geographical information on a VDU.
General operations plot (GOP)	This function is responsible for monitoring and displaying GOP data on a GOS. The data consists of geographical information, mission information, and contact information.
Tactical operations (TOC)	This function is responsible for sending geographical information which can be displayed on a GOS under the tactical image. 3 different TOCs are sent, namely 8, 64 and 256 DM.
Acoustic information	This function is responsible for calling up and changing acoustic information in the platform database, the sensor database, the oceanographic database and the geographic database.
EW database server	This function processes information exchange with EW1 concerning platform, weapon and sensor information.

1.2.5.3.7. MH1

The application function MH1 is responsible for all message handling tasks and includes the following functions:

Interactive data manipulation	This function assists the user in preparing and processing messages (edit function)
-------------------------------	---

Dispatching	This function arranges the internal routing for sending a message.
Message sending	This function ensures that messages are sent in the correct format via CMI.
Message receiving	This function arranges the analysis of a message received via CMI. A message intended for the ship is sent through to "message distribution". A message that has to be relayed is sent to "message sending"
Message distribution	This function arranges for the internal distribution of messages to the distribution store of the user(s) concerned and in the OML. A user can save the message in his private store.
Channel monitoring	This function allows the operator to monitor in and out going messages
Electronic mail	This function makes it possible to send messages between VDU users.

1.2.5.3.8. TMA

The application function TMA is responsible for all TMA tasks and consists of the following functions:

Organizing process	This function is responsible for correlating and associating target details in such a way that one track is formed.
Calculation process	This function is responsible for carrying out calculations on the organized target details. This can take place via the MLE algorithm (the target may only have manoeuvred a max. of 4 times during a calculation) or via the RULES (the target may not have manoeuvred but the own ship may have).
Evaluation process	This function is responsible for evaluating the solutions after which the information can be transferred from the TMA tracks to the tactical image via the SFKs or sent via Link 11.

1.2.5.3.9. TRI

The system function TRI is responsible for all training purposes and can be used in the following functions:

Scenario distribution	This function supplies the periodic distribution of information comprising a simulated environment which is necessary for training purposes. This information is distributed to the following SF/AFs: • DH1; for simulation of radar data • EW1; for simulation of electronic warfare data • HMS; for simulation of Hull Mounted Sonar data • TAS; for simulation of Towed Array Sonar data and contains the following data: • system data; general environmental data • object data; maximum 30 targets
Scenario generation	This function is responsible for generating a simulated environment which is in agreement with a pre-defined scenario.
Instructors facilities	This function makes it possible for an instructor to carry out the following tasks using a VDU: • modification of a pre-defined scenario, before or during the generation of the scenario • start/stop the generation of the scenario • start/stop/modify/monitor the training

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1.15.2.	Equipment	AVBI	1-15-1
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1.15.2.2.	Status Indicator	AVBI	1-15-1
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1.17.1.	General	AVBI	1-17-1
1.17.2.	Equipment	AVBI	1-17-1
1.17.3.	Integration	AVBI	1-17-1

1.3. 2111 Radar Search and Localize Receiver (APECS II) SPR-07/00 2211 Misleading jammer transmitter (APECS II) SLQ-04/00

1.3.1. General

This BSMI no. includes the entire APECS II installation which consists of:

- a receiver part (SPR-07/00)
- a transmission part (SLQ-04/00)
- the blanking

The receiver and transmission parts are dealt with in this chapter; see Chapter 4.5 for the blanking.

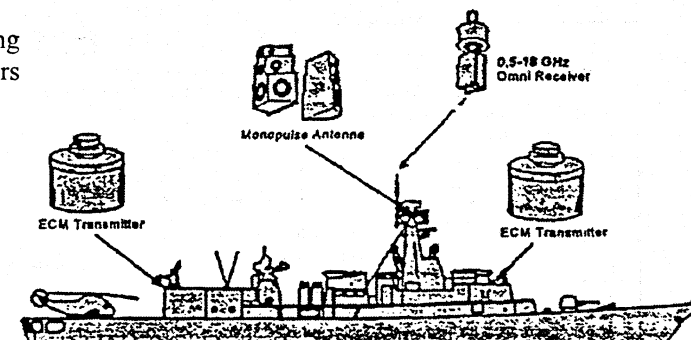
The APECS II (Advanced Programmable Electronic Countermeasures System) is an Electronic Warfare (EW) system that consists of an integrated Electronic Support Measures (ESM) and Electronic Counter Measures (ECM) system. The ESM part falls under BSMI 2111 and the ECM part under BSMI 2211. The entire APECS II system is described in this paragraph.

The APECS II can detect, localize, analyse, identify and jam radar emitters. The radar emitters found can also be displayed on a GOS. The ESM part receives in a frequency range from 0.5-18 GHz, split into: Band I 0.5 - 2 GHz, Band II 2 - 8 GHz and Band III 8 -18 GHz. The ECM part transmits in a frequency range from 8 - 17 GHz. The APECS II can follow a maximum of 200 radar emitters simultaneously. Only those radar emitters whose parameters are stored in the library can be identified after detection and analysis. After identification of a radar emitter the APECS II can jam this by sending out a signal identified in the ECM library. A maximum of 16 radar emitters can be jammed simultaneously.

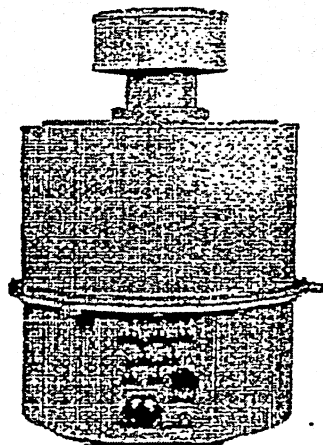
1.3.2. Equipment

The APECS II consists of the following parts (the positions of the various sensors are shown in Illustration 1-2111-1)

- Omni Receiver Unit
- Monopulse Receiver Unit (2)
- Remote Equipment Rack.
- Auxiliary Equipment-Rack
- Transmitter Unit (2)
- Hydraulic Power unit (2)



Illus. 1-2111-1 Sensors



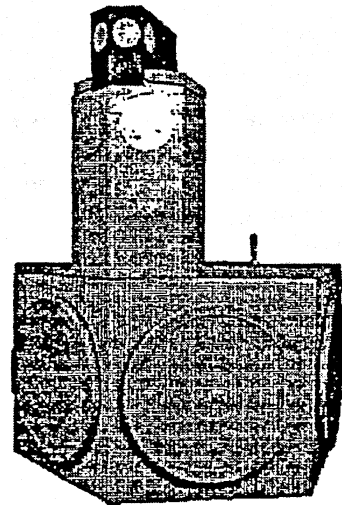
Illus. 1-2111-2 Omni Receiver Unit

1.3.2.1. Omni Receiver Unit

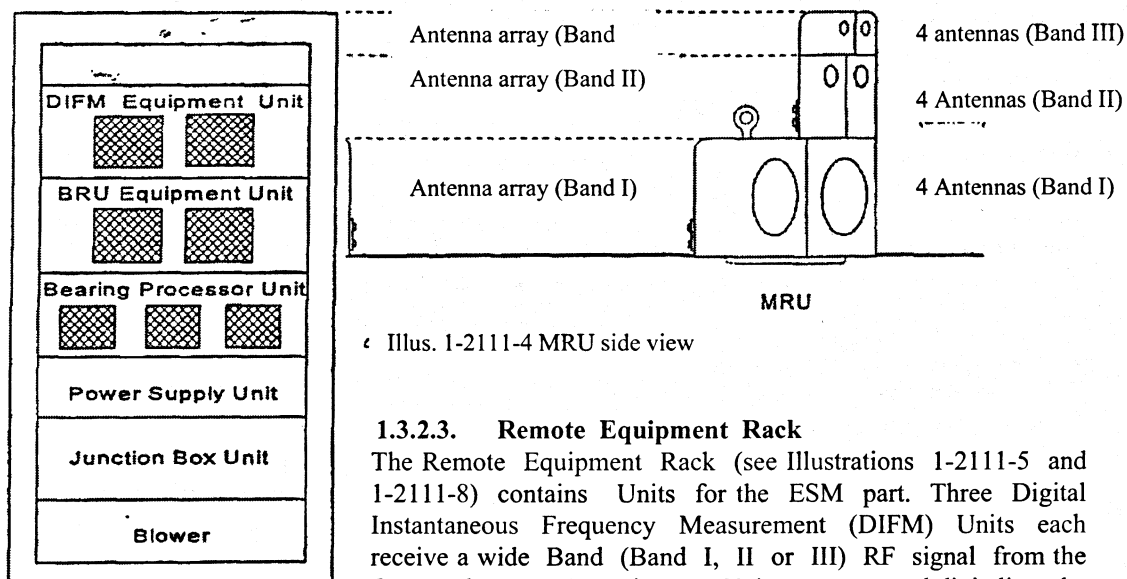
The Omni Receiver Unit (ORU) (see Illustrations 1-2111-2 and 1-2111-8) is situated on the UHF mast and consists of two omni-directional antennas with the necessary RF signal-processing. The antennas have working ranges of 0.5 - 2 GHz and 2 - 18 GHz respectively. A radar transmission is detected in the first place by the ORU. The detected radar emission is sent to the corresponding Digital Instantaneous Frequency Measurement (DIFM) Unit in the Remote Equipment Rack..

1.3.2.2. Monopulse Receiver Unit

There are two Monopulse Receiver Units (MRU) (see Illustrations 1-2111-3 and 1-2111-8) situated on the mast (SMART platform). MRU A is situated to the rear and MRU B to the front. The MRU localizes the radar transmission alone or with help from the other MRU. An MRU consists of three monopulse antennas placed one above the other with the necessary RF signal processing. Each monopulse antenna represents a particular frequency range (Band I, II or III). The bottom monopulse antenna is for Band I, the middle one for Band II and the top one for Band III. Each monopulse antenna consists of four antennas. Together the two MRUs form three antenna arrays (see Illustration 1-2111-4). An antenna array consists of two monopulse antennas (one from each MRU) in the same band. This means that an antenna array comprises $2 * 4$ antennas. The three antennas are used in each array in such a way that together they cover an area of 180 degrees. The radar emissions received by an antenna array are amplified, filtered and sent to the corresponding Bearing Receiver Unit (BRU) in the Remote Equipment Rack.



Illus. 1-2111-3 Monopulse Receiver Unit



Illus. 1-2111-4 MRU side view

Illus. 1-2111-5 Remote Equipment Rack

1.3.2.3. Remote Equipment Rack

The Remote Equipment Rack (see Illustrations 1-2111-5 and 1-2111-8) contains Units for the ESM part. Three Digital Instantaneous Frequency Measurement (DIFM) Units each receive a wide Band (Band I, II or III) RF signal from the ORU. The DIFM Equipment Unit measures and digitalizes the frequency of the RF signal. Three Bearing Receiver Units (BRU) contain part of the bearing and signal strength measuring circuits for the ESM. Each BRU processes one frequency range (Band I, II or III). The BRU converts the RF signal from the MRU into a log video signal. The Bearing Processor Unit (BPU) consists of central processing and control units for the bearing measurement circuits. The BPU calculates the bearing and signal strength on a pulse-by-pulse basis from the signals received from the BRUs and the DIFMs. The Junction Box Unit distributes the digital emitter data, audio signals and blanking signals between the various Units.

1.3.2.4. Auxiliary Equipment Rack

The Auxiliary Equipment Rack (see Illustrations 1-2111-6 and 1-2111-8) contains Units for the ECM part and the central processing of the APECS II. The Control Panel forms part of the ECM part containing choices such as local or remote (transmit override) prevention of transmissions.

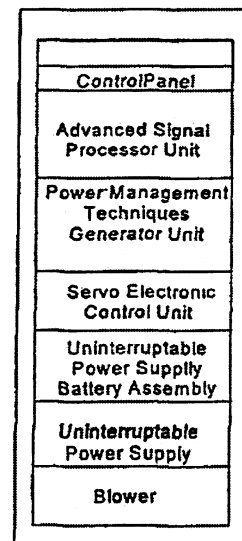
The Power Management Techniques Generator Unit (PMTG) which can track a maximum of 16 emitters generates the track parameters (realtime) for the ECM part.

The Advanced Signal Processor unit (ASP) is the central processor of the APECS II. Some of its functions are:

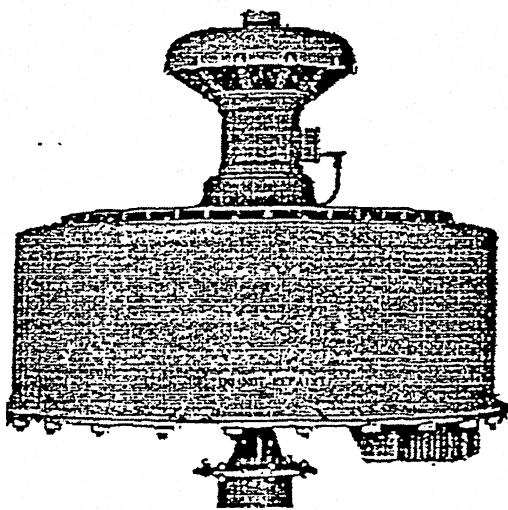
- communication with Data Processing
- comparison of emitter parameters with an ESM library
- supplying jamming parameters to the ECM sub-system
- generating and maintaining a database filled with active emitter signal reports

The Servo Electronic Control Unit (SECU) stabilizes the Transmitter platforms.

The Uninterruptable Power Supply (UPS) can provide power to the ASP, BPU and PMTG for 12 minutes in the event of a power failure so that the various libraries and data are not lost. This means that the APECS II can continue to carry out its functions during a short power failure and does not have to be restarted.



Illus. 1-2111-6 Auxiliary Equipment Rack



Illus. 1-2111-7 Transmitter Unit

1.3.2.5. Transmitter Unit

The APECS II has two Transmitter Units (see Illustrations 1-2111-7 and 1-2111-8) for jamming in the frequency range 8-17 GHz. Transmitter B is situated front fore and Transmitter A port aft. Together both transmitters cover the full 360 degrees. The Transmitter Unit has both low and high power RP components, two phased-array transmit antennas, high voltage power supplies, signal processing circuits and BITE circuits. The "counter measure" is achieved by low power modulation and RF components, which are provided with data by the Power Management Techniques Generator Unit in the Auxiliary Equipment Rack. There is a semi-omni antenna on the top of the transmitter which provides early information to the FML so that jamming can start at once. The transmitter is placed on a stabilized platform.

1.3.2.6. Hydraulic Power Unit

The APECS II has an HPU (see Illustration 1-2111-8) for stabilizing each of the transmitters. Both HPUs are controlled by the SECU in the Auxiliary Equipment Rack when in operational mode.

1.3.3. Integration

1.3.3.1. Integration in the central system

The APECS II is integrated in the central system via de BIU in computer room SEWACO Fore (see illustration 1-2111-9). The installation is operated from a GOS and the results are also displayed on this. It is not possible to operate the installation locally.

1.3.3.2. Integration at BSMI level

As well as integration in the central system, the APECS II is also integrated with the following BSMIs:

- 2221 Short and medium range Air Defense system STIR
- 2325 Integrated Radio, Intercom and Telephone sub-system
- 2335 SHF Satellite Communication Installation
- 2412 Compass and Navigation Delay Installation NATO SINS

1.4. 2112 EOVS Receiver installation SRR-15/01

1.4.1. General

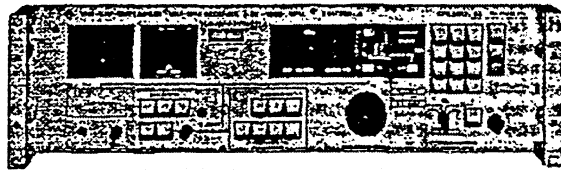
The purpose of the EOVS Receiver installation is to listen to, record and analyse (spectrum analyser) radio traffic from unknown sources. The EOVS Receiver installation is not permanently on board but is placed when required. An overview of the EOVS Receiver installation is shown in Illustration 1-2112-4. The EOVS Receiver installation consists of the following parts:

- UHF/VHF Receiver
- Receiver
- Revox Tape recorder (2)
- Radio Spectroscope

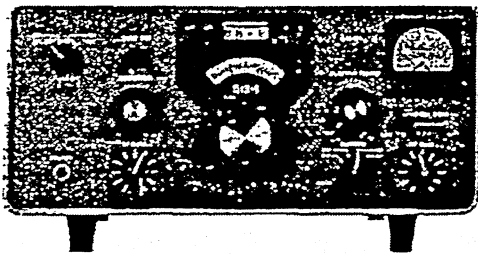
1.4.2. Equipment

1.4.2.1. UHF/VHF Receiver

The UHF/VHF Receiver ESM 500 A (see Illustration 1-2112-1) is a broad band receiver with frequency range from 20 to 1000 MHz and is suitable for AM, FM and SSB (LSB, USB and ISB) signals. The ESM 500 A also has facilities for scanning.



Illus. 1-2112-1 UHF/VHF Receiver ESM 500A



Illus. 1-2112-2 Receiver 51S-1

1.4.2.2. Receiver

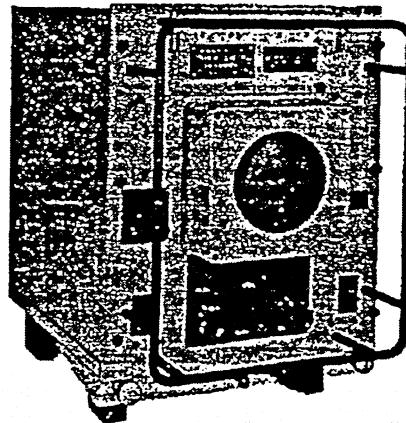
The Receiver 51S-1 (see Illus. 1-2112-2) receives USB, LSB, AM and CW signals in the frequency range from 0.2 to 30 MHz.

1.4.2.3. Revox Tape recorder

The Revox Tape recorder B77 is used to record the signals received on tape.

1.4.2.4. Radio Spectroscope

The Radio Spectroscope HTC-4701 (see Illustration 1-2112-3) is used in combination with a receiver in order to make all signals in the frequency range 100 kHz above or below the signal being received by the receiver audible at the same time. It is then possible to observe a frequency band of 200 kHz without having to adjust the tuning of the receiver.



Illus. 1-2112-3 Radio Spectroscope

1.4.3. Integration

The EOVS Receiver installation is connected with BAC 16 (Cabinet Group UC2 in the UHF Transmit/Receive sub-system) of the FOCON system (see Illustration 1-2112-4). The audio signal can be listened to via the FOCON system.

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1.5. 2121 Radar Sensor Management Installation

1.5.1. General

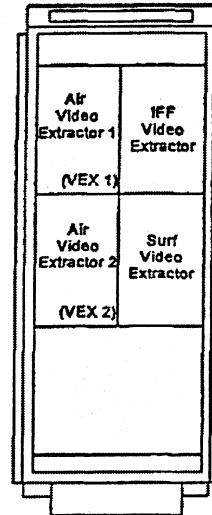
The purpose of the Radar Sensor Management Installation is:

- To convert raw (primary) radar video and IFF video into digital radar plots by means of video extraction and to automatically track radar contacts
- To send through Vesta data and tracks.

The Radar Sensor Management Installation consists of a Sensor Management Cabinet (SMC). This is situated in Computer Room SEWACO Fore.

The SMC (see Illustration 1-2121-1) consists of the following parts:

- Primary Video Extractor (3):
 - Air Video Extractor 1 for LW LIN video
 - Air Video Extractor 2 for LW MTI video
 - Surf Video Extractor for LW SURF or DECCA video
- IFF Video Extractor:
- Extractor Computer (2)
 - Video Extractor Computer (VEX) 1
 - Video Extractor Computer (VEX) 2



An overview of the Radar Sensor Management Installation is given in Illus. 1-2121-4.

Illus. 1-2121-1 Sensor Management Cabinet

1.5.2. Equipment

1.5.2.1. Primary Video Extractors

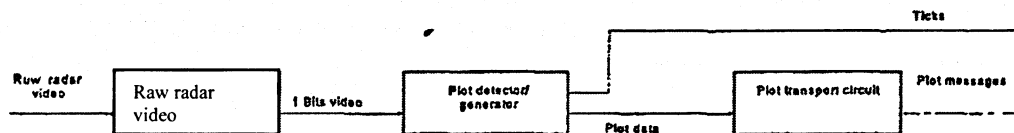
The working of the Primary Video Extractor is as follows (see Illustration 1-2121-2):

The analogue radar video is converted in the input circuit to 1 bits digital video. This video is filtered to remove noise and clutter. The digital video is converted in the Plot detector generator into radar plots (target position), after which these plots are sent as plot messages to the extractor computer via the plot transport circuit.

The following signals can be displayed on the GOSs for test purposes when in TICKS mode:

- Q : derived from the QVID impulse;
- LES : derived from the leading edge;
- CL : derived from the clutter value;
- GA : display the hardware generated gate-areas;
- TVID : free for displaying the test target video.

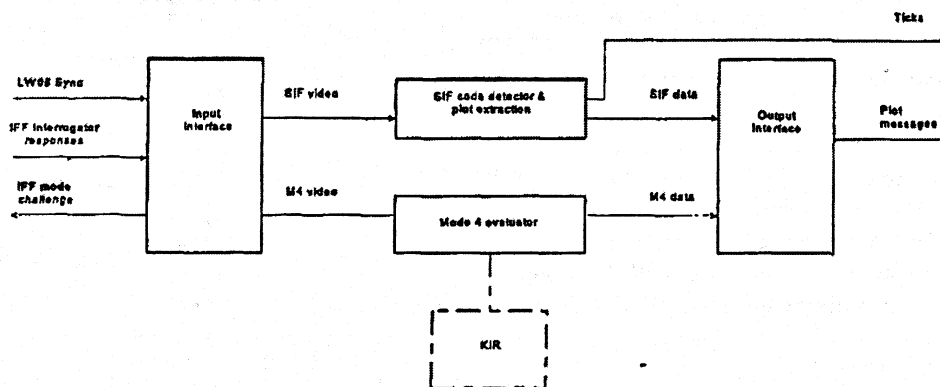
These ticks can be selected on the three Primary Video Extractors on the Sensor Management Cabinet.



Illus. 1-2121-2 Primary Video Extractor

1.5.2.2. IFF Video Extractor

The IFF Interrogator radar installation is a secondary radar installation. Separate circuits for processing the SIF (Selective Identification Features) answers (mode 1, 2, 3 and C) and mode 4 answers are present in the IFF Video Extractor (see Illustration 1-2121-3). The plot position and the SIF code of the interrogated transponder are determined from the SIF answers. The plot position and the mode 4 identification are determined from the mode 4 answers in combination with the KIR decoding computer. The results are sent to the Extractor Computer as plot messages.



Illus. 1-2121-3 IFF Video Extractor

1.5.2.3. Extractor Computers

The SMC contains two Extractor Computers (VEX 1 and VEX 2) of type SMR-μ (see Illustration 1-2121-4). The following messages are sent to VEX 1:

- plot messages, from Video Extractor (VE) AIR 1 and VE IFF
- track and control messages, from the VESTA via an ICI channel

The following messages are sent to VEX 2 :

- plot messages from VE SURF
- plot messages from VE AIR 2

A Back End (BE) from the system function DHL runs on both VEX Computers. The most important tasks of these BEs are:

- Automatic tracking of radar contacts
- Remote control/Data exchange with VESTA, via Extractor Computer 1
- Data exchange with DHC 1/2

1.5.3. Integration

1.5.3.1. Integration in the central system

Both VEX computers are connected with the SMR-4s of DHC 1 and DHC 2 through an ICI interface. The selected ticks of one of the primary video extractor are also sent to the RACO. The VE IFF ticks are displayed via the IFF installation.

1.5.3.2. Integration at BSMI level

As well as integration in the central system, the Radar Sensor Management Installation is integrated with the following BSMIs:

- 2122 Sea warning radar installation SPS-15/00
- 2123 Air warning installation LW-08
- 2125 IFF Interrogator Radar installation
- 2127 Helicopter control installation VESTA

1.6. 2122 Sea warning radar installation (DECCA) SPS-15/00

1.6.1. General

The Sea warning radar installation DECCA is an I-band radar which is used as:

- Navigation radar (primary)
- Sea warning radar
- Helicopter control radar (in emergencies)

The radar video from the DECCA is displayed on the:

- GOSs via the RACO
- Relative Motion Display Unit (RMDU) in the command post
- Color Tactical Display (CTD) on the bridge (Kelvin Hughes display unit)
- Viewing Unit on the bridge (commander's display unit)

An overview of the Sea warning radar installation is given in Illustrations 1-2122-8 and 1-2122-9. It consists of the following parts:

- Radar Head
- Interface Sub-system
- Radar Display Sub-system
- Ancillaries

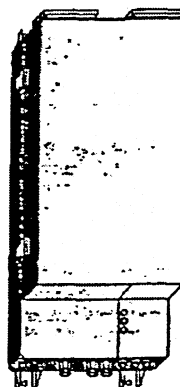
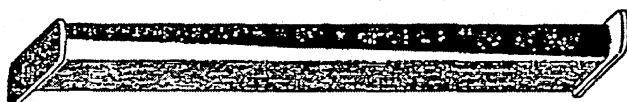
1.6.2. Equipment

1.6.2.1. Radar head

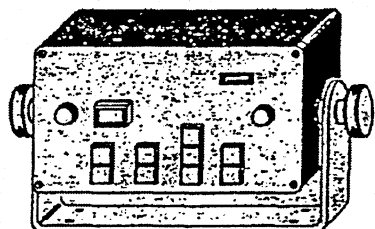
The radar head provides the radar data and consists of the following parts:

- Scanner, see Illustrations 1-2122-2 and 1-2122-10
- Turning Unit
- Transceiver Unit, see Illustration 1-2122-1
- Radar Control Unit, see Illustration 1-2122-3

Illus.. 1-2122-2 Scanner



Illus. 1-2122-1 Transceiver Unit



Illus.. 1-2122-3 Radar Control Unit

The scanner antenna, length 2.7 m, is driven by a Turning Unit and rotates at a speed of 24 r.p.m. The scanner is situated on the DECCA platform in the mast, but will be moved in the future to the bridge deck. The scanner antenna is connected with the Transceiver Unit by a waveguide. The Transceiver Unit has pulse power of 25 kW at frequency 9410 MHz $\pm$ 30 MHz. The Radar Control Unit controls the Transceiver Unit and the Scanner Turning Unit.

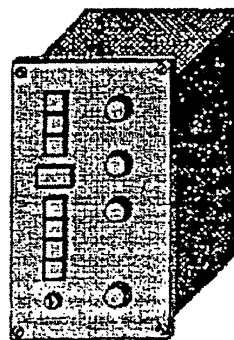
1.6.2.2. Interface Sub-system

The Interface Sub-system controls the following interfacing:

- Video interfacing
- Trigger interfacing
- Bearing interfacing

The Interface Sub-system consists of the following parts:

- Video and Trigger Interface Unit; this is placed in a sealed housing in Radar cabin 1. The unit provides the video and the triggering for the radar displays and also serves as interface to distribute the variable data to the external equipment.
- Video Remote Control Unit (see Illustration 1-2122-4); *Illus. 1-2122-4 Video Remote Control Unit* this is situated in the Command Post near GOS 5 (ZBOP). This unit sets the Decca video for the RACO for display on the GOSs.
- Video Processor (VP2); this is placed in a sealed housing and provides PRF correlation and pulse stretching for the RACO-Decca video. VP2 is controlled from the Video Remote Control Unit.
- Bearing Interface Unit; this is placed in a sealed housing in Radar cabin 1. The unit distributes the bearing data to the external equipment.
- Radar Slave Interface Unit; this is placed in a sealed housing in Radar cabin 1. The unit converts LW-08 radar data to suitable format for display on the CTD monitor and Viewing Unit on the bridge.



1.6.2.3. Radar Display Sub-system

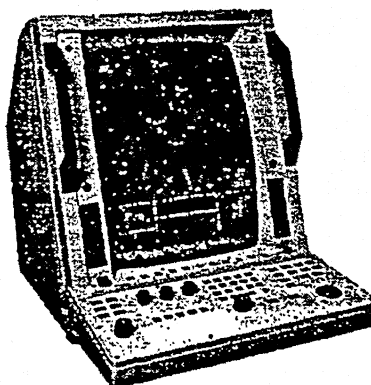
The Radar Display Sub-system consists of the following parts:

- Display Units
- Other parts

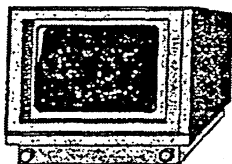
1.6.2.3.1. Display Units

The Display Units are:

- Kelvin Hughes Color Tactical Display (CTD), see Illustration 1-2122-5. The CTD is situated on the bridge and consists of a high resolution color monitor and a processor unit. The CTD can track contacts automatically and has facilities for displaying various details for navigation. Both Decca and LW-surf videos can be displayed on the CTD.



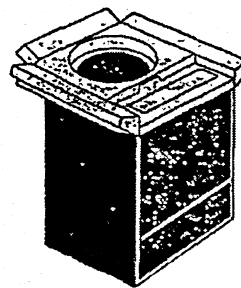
Illus. 1-2122-5 CTD monitor



Illus. 1-2122-6 Viewing Unit

Viewing Unit, see Illustration 1-2122-6. The Viewing Unit (commander's display cabinet) is situated on the bridge and consists of a 14" color monitor and the necessary drive circuits. Both Decca and LW-surf videos can be displayed on the Viewing Unit. The Viewing Unit is controlled by the Control Unit. The Control Unit is situated next to the Viewing Unit and is used among things for anti-clutter measures and selection of the range.

- Relative Motion Display Unit (RMDU), see Illustration 1-2122-7. The RMDU is situated in the Command Post and consists of a 16" display with an auxiliary (VESTA-video) input facility. The VESTA video and the DECCA video can be displayed together depending on the position of the coax switch above the RMDU.



Illus. 1-2122-7 RMDU

1.6.2.3.2. Other parts

The other parts are (see Illustration 1-2122-8):

- TxRx Selector; this is placed in a sealed housing with a switch panel in Radar cabin 1. The TxRx Selector is used to select either Decca or LW-surf video for the Viewing Unit.
- Remote Control Box; this is situated near to the Viewing Unit on the bridge. The Remote Control Box is used to operate the TxRx Selector at a distance.
- Slave Junction Box; this is placed in a sealed housing in Radar cabin 1. The Slave Junction Box sends the Decca video to the CTD and the Radar Control Unit.

1.6.2.4. Ancillaries

The Ancillaries (see Illustration 1-2122-8) are used to carry out a performance check. It is an autonomous system. The Ancillaries consist of the following parts:

- Performance Monitor Cavity Unit, mounted on the mast
- Performance Monitor Control Unit on the bridge

1.6.3. Integration

1.6.3.1. Integration in the central system

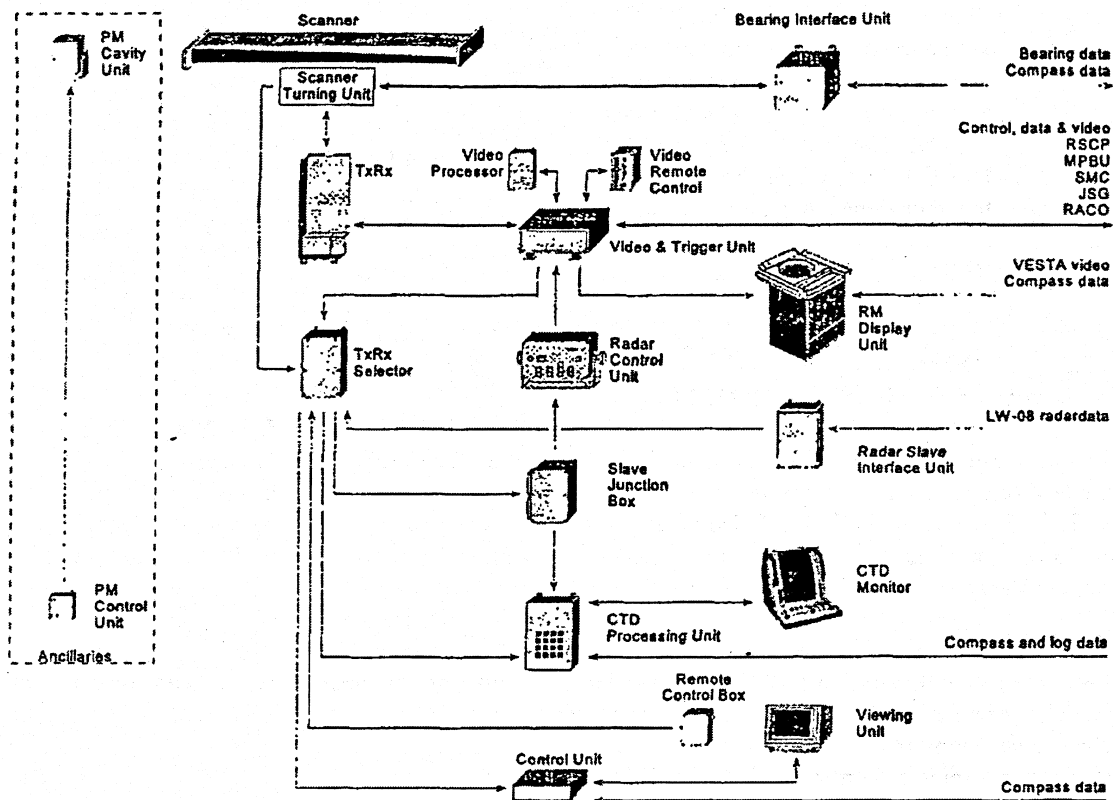
The DECCA is connected to the Data Processing Computer Cabinet 2 (RACO) and the Sensor Management Cabinet (VE-surf), see Illustration 1-2122-11 by coax cables.

- The Video Extractor in the SMC obtains video from a fixed set VP1. The video is converted to radar plots and tracks which are processed by the central system.
- The RACO obtains video from a VP1 /VP2-combination which can be influenced by the operator. The RACO converts the video to a format which can be displayed on the GOSs.

1.6.3.2. Integration at BSMI level

As well as integration in the central system, the sea warning installation is integrated with the following BSMIs:

- 2111 Radar Search and Localize Receiver APECS II
- 2121 Radar Sensor Management Installation
- 2123 Air warning radar installation LW-08
- 2127 Helicopter control installation VESTA
- 2411 Information Retransmission Installation.



Illus. 1-2122-8 Overview sea warning radar installation

1.7. 2123 Air warning radar installation LW-08/02

1.7.1. General

The air warning radar installation LW-08/02 is a high power long range D-band radar that is used for building an air image with the help of the LINEair Video (LIN) and the Moving Target Indication (MTI) channel. The system also has a separate SURF channel for sea warning. The radar can be operated locally or from a GOS using a Software Remote Control Panel.

The most important characteristics of the LW-08 radar are:

- long distance radar (128 NM) with resolution of 2.2 degrees
- small minimum range of 0.6 NM
- detection of air and surface targets
- high resistance to ECM

An overview of the LW-08 is given in Illustrations 1-2123-6 and 1-2123-7. The LW-08 consists of the following parts:

- Antenna system
- Transmitter Cabinet
- Receiver Cabinet
- Cooling Cabinet
- Hydraulic Power Unit

1.7.2. Equipment

1.7.2.1. Antenna system

The antenna system consists of the following parts:

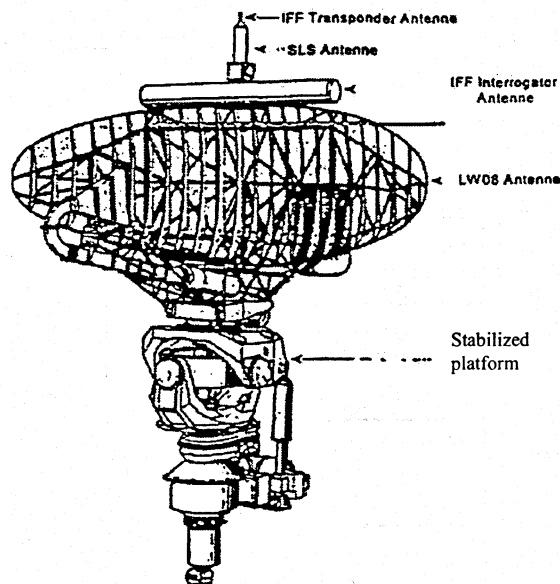
- LW-08 Antenna with SLS antenna
- Stabilized Platform

1.7.2.1.1. LW-08 Antenna with SLS antenna

The LW-08 Antenna (see Illustration 1-2123-1) consists of a stainless steel cosec² reflector with feedhorn, intended for the D-band (1.2 to 1.4 GHz). The antenna wave guide is fitted with a polarization unit for horizontal and circular scanning. An omnidirectional antenna is mounted on top of the antenna for Side Lobe Suppression (SLS). The antennas for the IFF Transponder and Interrogator are also mounted on the LW08 Antenna.

1.7.2.1.2. Stabilized Platform

The LW-08 Antenna is mounted on a lightweight platform that is stabilized for roll and pitch. The rotation speed of the LW08 antenna can be set with the stabilized platform to either 7.5 or 15 r.p.m.



Illus. 1-2123-1 LW-08 Antenna with SLS Antenna

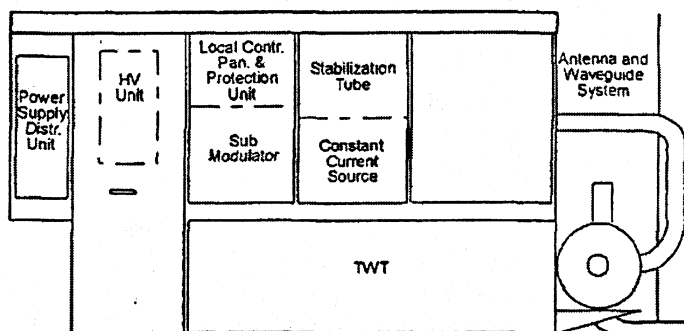
1.7.2.2. Transmitter Cabinet

The function transmission is situated in the Transmitter Cabinet (see Illustration 1-2123-2). This function supplies a high power impulse modulated RF signal. This high frequency signal is generated using a D-band Travelling Wave Tube (TWT). The TWT can be regarded as an amplifier with amplification factor of about 50 dB. The RF control signal for the TWT is generated by the function timing and frequency control (Receiver cabinet).

The RF output signal is led to the Antenna and Waveguide System, in order to be sent out by the LW08-antenna.

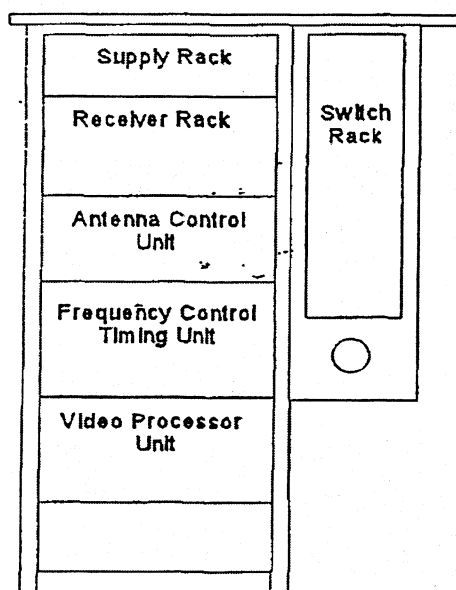
The Transmitter Cabinet has the following provisions for the TWT:

- High Voltage Supply (HV Unit + Stabilization Tube); for creating the necessary high voltage for the TWT (acceleration of electrons emitted from the TWT cathode)
- Sub-modulator; in order to avoid large heat dissipation in the TWT, the electron beam in the TWT is interrupted during the listening time
- Constant current source; for focussing the beam of electrons in the centre of the tube



Illus. 1-2123-2 Transmitter Cabinet

- Protection Unit for the transmitter; if it is likely that damage might ensue to the transmitter because of malfunction of one or more units the safety circuits will come into operation
 - Cooling for the transmitter; a number of the transmitter components are cooled with demineralized water
- The Transmitter Cabinet also has a Local Control Panel for the radar system and a Power Supply Distribution Unit which provides power for the various units in the Transmitter Cabinet and the antenna direction motor.



Illus.. 1-2123-3 Receiver Cabinet

The AW channel has the following parts:

- Moving Target Indication (MTI) video channel
- Linear (MTI) video channel

The SW channel has a LIN/LOG video channel

1.7.2.3. Receiver Cabinet

The Receiver Cabinet (see Illustration 1-2123-3) contains circuits which are necessary for receiving and detecting the RF echo signals coming from the primary LW-08 radar antenna and the SLS antenna. The detected signals are processed by video processing. The amplification of the receiver circuits is controlled by the Sensitivity Time Control (STC) and Automatic Gain Control (AGC) circuits. The following units realize the reception

- Receiver rack; this consists of an Air Warning (AW) and Surface Warning (SW) channel. The AW channel has a Pulse Compressed (PC) and a not Pulse Compressed (PCN) output. The AW/PC channel has a Pulse Compressor Circuit and a Side Lobe Suppression (SLS) circuit, which can be switched on. The SLS serves to suppress echoes which arise through the side lobes.
- Video Processor Unit, both the AW video (PC or PCN) and the SW channels of the receivers are processed in the video processor (including AGC). The Video Processor has an AW channel and a SW channel as output.

Frequency Control and Timing Unit; the Frequency Control Unit generates the RF input signal for the transmitter

The Timing Unit provides the necessary reference and control signals such as Sensitivity Time Control (STC) for processing the RF signals received.

The STC is an anti-jamming measure that prevents saturation of the receiver circuits and applies an amplification rule to obtain a constant noise level. The LW-08 has the following STC selection possibilities: STC AIR 1 (permanent), STC AIR 2 (switchable), STC AIR ANGEL, STC SURF I and STC SURF II.

The Receiver Cabinet also has a:

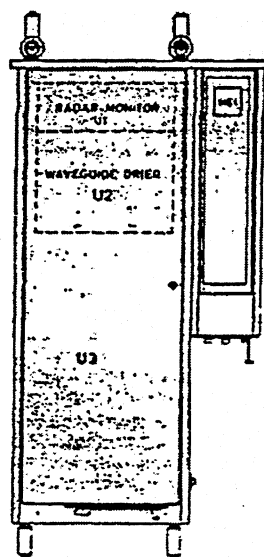
- Supply Rack to provide power for the various units in the Receiver Cabinet
- Switch Rack containing various power supply circuits, relay circuits and protection circuits for the Receiver Cabinet
- Antenna Control Unit containing regulating and protection circuits for the hydraulically controlled platform.

1.7.2.4. Cooling Cabinet

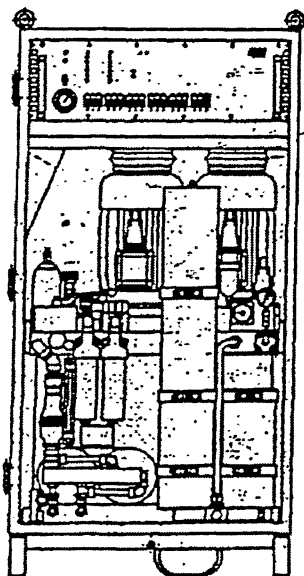
The Cooling Cabinet (see Illustration 1-2123-4) contains a support function to ensure correct working of the LW-08. The support function consists of the following parts:

- Wave Guide Drier; to supply dry air to the TWT and the waveguide system
- Cooling Unit; to supply demineralized water for cooling the transmitter components
- Power Distribution Unit; consisting of indicator lights for the power supply, fault indicator lights for the cooling system, test switches and a unit to check the quality of the cooling water.

The Cooling Cabinet also contains a Radar Monitor to check noise measurement and power measurements in the transmission circuit.



Illus. 1-2123-4 Cooling Cabinet



1.7.2.5. Hydraulic Power Unit

The Hydraulic Power Unit (see Illustration 1-2123-5) consists of two pump units to provide the oil flow for the hydraulic cylinders for the stabilized platform (the circuits for controlling the oil pressure are in the Receiver Cabinet). This cabinet also contains:

- Operating and fault indicator lights for local operation
- Monitoring and relay circuits for the bearing drive and oil pump motors

Illus.. 1-2123-5 HPU

1.7.3. Integration

1.7.3.1. Integration in the central system

The Video Processor (see Illustration 1-2123-6) is connected with the Data Handling Computer Cabinet 2 (RACO) and with the Sensor Management Cabinet (VEX) by coax cables. The FCU is coupled to the INC in DHCC1 via a DCL-ALT3 connection. The connection is used for operating the LW-08 from a GOS and for sending the status data of the LW-08 to DH.

The video signals are processed by:

- the Video Extractors in the SMC and are then converted to radar plots and tracks for display on the GOSs or
- the RACO and then converted to radar video for display on the GOSs.

1.7.3.2. Integration at BSMI level

As well as integration in the central system, the air warning installation is integrated with the following BSMIs:

- 2111 Radar Search and Localize Receiver APECS II
- 2122 Sea warning radar installation SPS-15/00
- 2125 IFF Interrogator radar installation
- 2126 IFF Transponder radar installation
- 2127 Helicopter control installation VESTA
- 2411 Information Retransmission Installation

1.27. 2317 General Managment installation SYK-05/00

1.27.1. General

The purpose of the general management installation is to carry out administrative tasks and tasks connected with taking supplies on board. Because the heart of the installation, the processor with the mother board, is commercial equipment supplied by Digital (VAX 8250) it is all situated inside a PROTEC cabinet.

The environment in the inner cabinet is kept at a suitable level for civil equipment by the use of active vibration damping which adequately reduces shocks and vibrations.

1.27.2. Equipment

1.27.2.1. Protec Cabinet

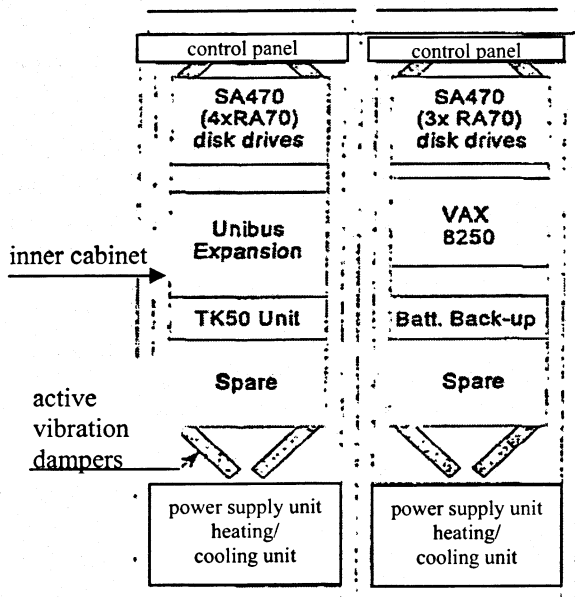
This system consists of two cabinets with the two inner cupboards being protected from too hefty shock and vibrational movements. The specifications of these cabinets are given in Chapter 3.30.

1.27.2.2. VAX-8250

This central DIGITAL processor forms the heart of the general management installation together with the VMS operational programme. It has a 64 MB internal memory. A tape drive unit TK50 is provided for creating backups.

1.27.2.3. RA70

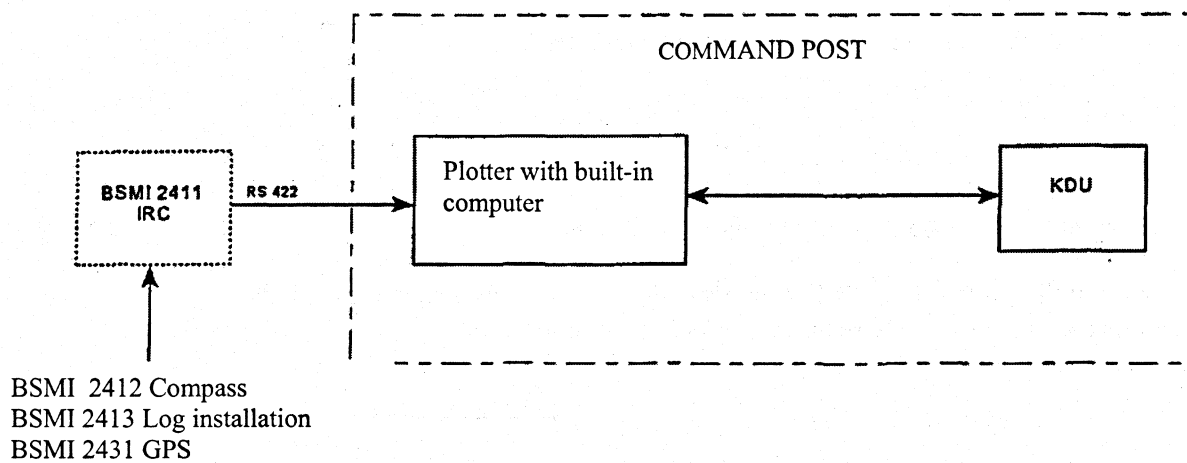
The disks in the General Management installation allow databases to be loaded and any storage of mass data to be accessed.



illus. 1-2317-1 Protec with General management installation

1.27.3. Integration

The General Management Installation is not integrated.



illus. 1-2316-3 Overview

1.26. 2316 Plot table installation TSP3592

1.26.1. General

This BSMI contains the COrapact Integrated Navigation System (COINS). The COINS is a far-reaching automated plotting table situated in the Command Post. The main function of COINS is safe navigation of the ship. The additional functions of COINS are:

- assistance in constructing display
- solving navigational problems and displaying solutions on the Keyboard Display Unit (KDU) and the Plotter with built-in Computer.

An overview of the COINS is given in Illustration 1-2316-3. The COINS has the following parts:

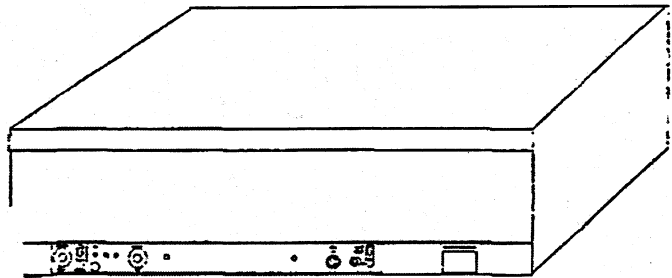
- Plotter with built-in Computer
- Keyboard Display Unit (KDU)

1.26.2. Equipment

1.26.2.1. Plotter with built-in Computer

The Plotter with built-in Computer (see Illustration 1-2316-1), or Integrated Navigation Computer and Plotter (INCAP), is situated in the Command Post. The built-in computer has the following parts:

- KDU microprocessor, processes the data which is entered by the operator through the KDU.
- memory modules, for saving information. There is a 64 kb EPROM and a 16 kb RAM memory.
- interface modules, for the connection between COINS and the ship's navigation system
- navigation computer, a microcomputer with a 16 bit microprocessor



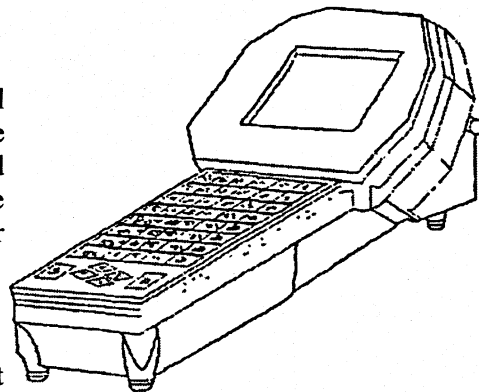
illus. 1-2316-1 Plotter with built-in computer

Both sea charts and blank plotting sheets can be placed on the plotter. The COINS can display the positions calculated by the system by means of a single light spot (a ray of light visible through the chart). Plotting information given by the light spot must be done manually. All navigational details, the course to be followed, other shipping information and the position of the own ship, are saved by COINS in a track database (track table). The track table has capacity for 128 tracks. An interface connects the plotting table with the Information Retransmission Cabinet (IRC). The IRC supplies the following information to COINS:

- Heading value (course)
- Ship's speed (log)
- Position (GPS or SINS)

1.26.2.2. Keyboard Display Unit (KDU)

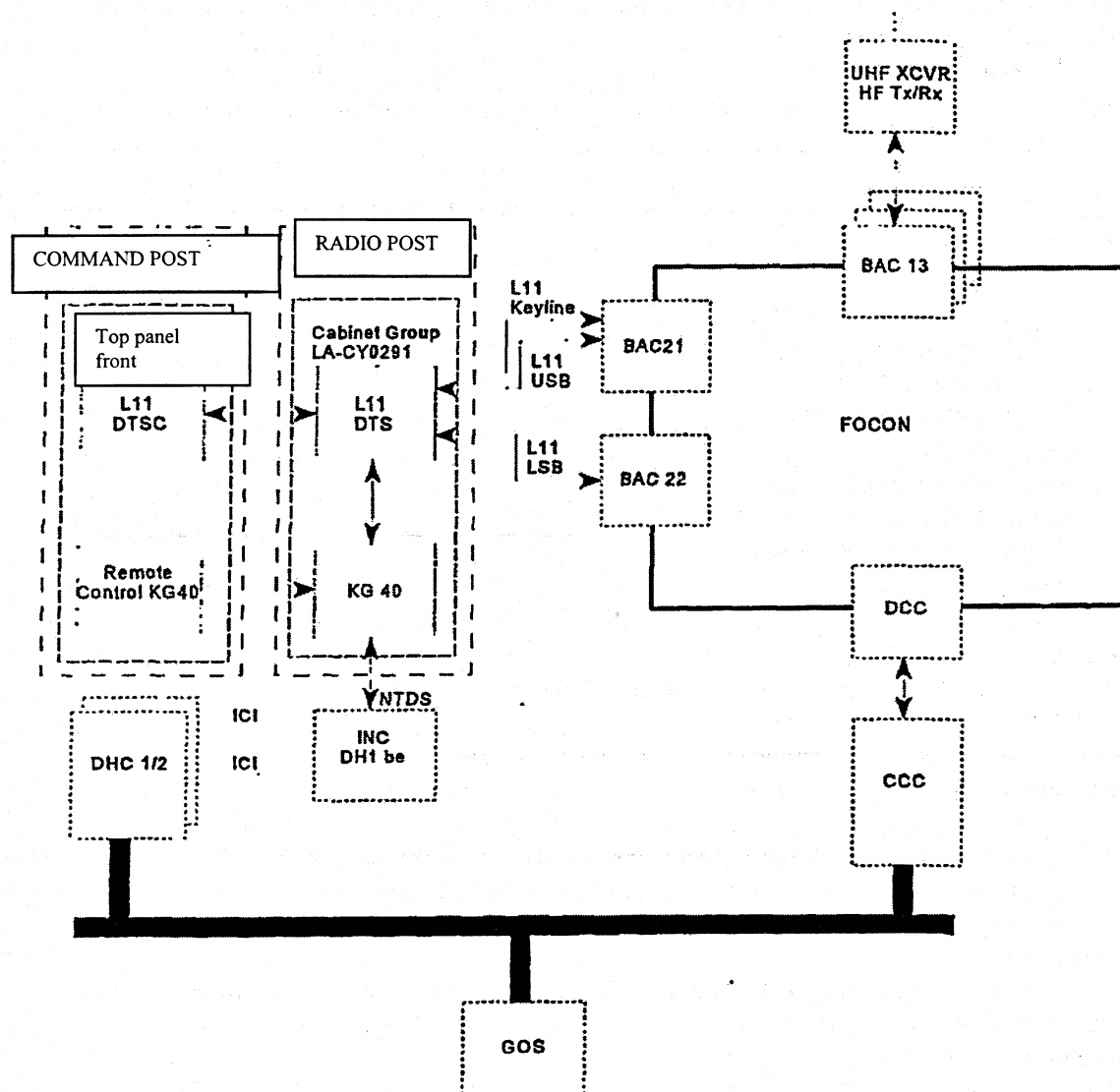
The KDU (see Illustration 1-2316-2) or hand held terminal allows communication between the operator and the plotting table. The operator can solve complicated navigational problems using the KDU and display these via a LCD display, and also on the plotting table. Error messages are also shown on the KDU.



illus. 1-2316-2 Keyboard Display Unit

1.26.3. Integration

The plotting table is connected only to the IRC broadcast interface.



illus. 1-2315-4 Overvie

- Mode PLAINTEXT, the other functions of the KG 40 are bypassed when in this mode. The KG 40 sends all information direct to Data Handling without first encoding or deciphering it.
- Mode POFA (Performance Operational Functional Analysis), this mode is not available on board the M frigates.

The standard setting for Link 11 during operational use is mode A2. If ships are sailing in close formation or are moored in the same harbour mode A1 can be used.

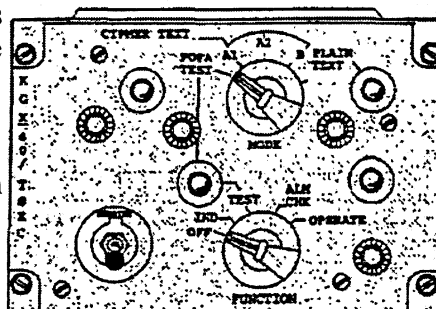
1.25.2.3. Remote Control KG 40

The KG 40 is operated by Remote Control (see Illustration 1-2315-3) from the Command Post.

1.25.3. Integration in the central system

The Link 11 installation (see Illustration 1-2315-4) is connected with:

- the Interface Computer in the Data Handling Computer Cabinet 1. This computer receives/sends data to the Link 11 installation.
- BACs in the FOCON network. The DTS can be coupled to a UHF or HF transmitter or receiver via FOCON. Link 11 is also coupled directly to XCVR 3 (UHF) or with Rx1/Tx1 (HF) in the FOCON bypass. The externally received tracks are displayed on a GOS.



illus. 1-2315-3 Remote Control KG 40

1.25. 2315 Data link installation (LINK 11)

1.25.1. General

The purpose of the Link 11 installation is the exchange of tactical details, such as system tracks, between the different automated units (ships, aircraft etc.), by means of a UHF or HF connection.

One of the participants in the link functions as the Net Control Station (NCS), the others as Net Picket Station (NPS). Data exchange takes place according to the so-called roll call method, i.e. the NCS determines which NPS may send data (this data is received by all participating units). The NCS can also send data itself. The responsibility of the NCS can always be transferred to a NPS forming part of the network. Because there can be only be one NCS the previous NCS therefore loses its function as NCS and simply becomes a normal NPS.

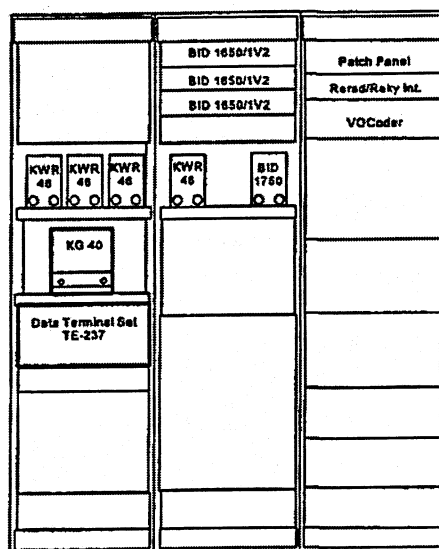
The Link 11 installation is coupled to a transmitter and receiver (via FOCON) and to Data Handling. An overview of the Link 11 installation is given in Illustration 1-2315-4. The Link 11 installation has the following parts:

- Data Terminal Set
- Data Terminal Set Control
- Encoding unit KG 40
- Remote Control KG 40

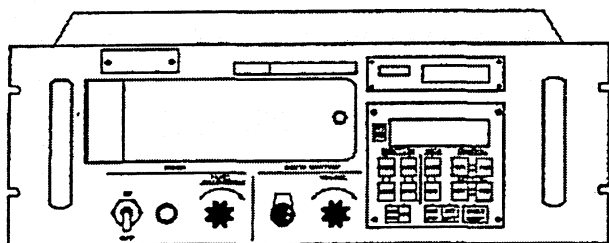
1.25.2. Equipment

1.25.2.1. Data Terminal Set

The Data Terminal Set (DTS), situated in Cabinet Group LA-CY/0291 in the Radio post (see Illustration 1-2315-1), converts the digital Data Handling information to a composite audio signal that is sent to a transmitter. The audio signal consists of 16 different frequencies which are modulated in each phase. The signal received is converted into digital info for Data Handling by the reverse process.



illus. 1-2315-1 Cabinet Group LA-CY/0291



1.25.2.2. Data Terminal Set Control

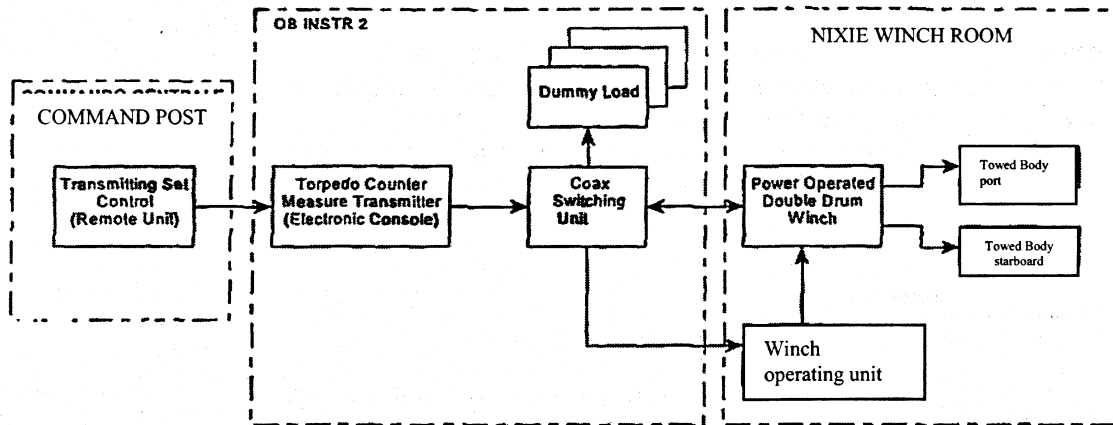
The Data Terminal Set Control (DTSC) (see Illustration 1-2315-2) is an operating unit for the DTS and is situated in the Command Post. The DTSC also provides a number of status signals and fault codes for the link connection.

illus. 1-2315-2 Data Terminal Set Control

1.25.2.3. Encoder unit KG 40

The KG 40, situated in Cabinet Group LA-CY/0291 (see Illustration 1-2315-1), is an encoding machine that is used for encoding Link 11 data. The KG 40 has five modes:

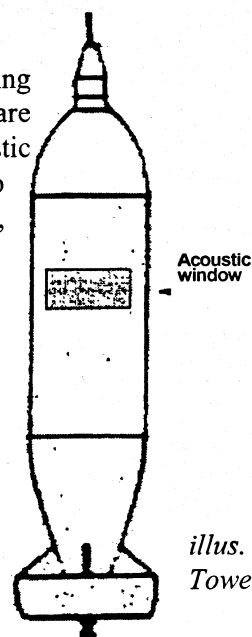
- Mode A1: in this mode the KG 40 generates the MIF (Message Indicator Frame) prior to the message segment in the transmission circuit. The KG 40, in the receiver circuit, must receive the MIF without faults in order to be able to transfer the following data segment to Data Handling.
- Mode A2: this mode is the same as mode A1 except that the receiving KG 40 may now receive the MIF with an uneven number of faults.
- Mode B, no MIF is used in this mode. Instead, every KG 40 is automatically set to a recognised pattern in the key register at the beginning of each transmission.



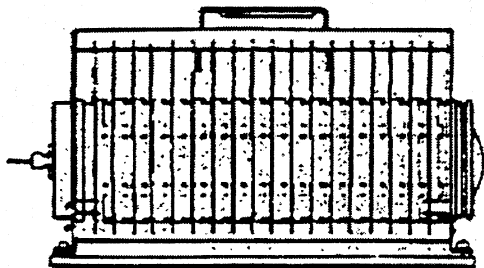
illus. 1-2232-8 Overview

1.24.2.3. Towed Body

The Towed Body (see Illustration 1-2232-3) contains the transducers for sending out the acoustic signals. The electrical signals from the Electronic Console are sent to the ceramic transducer elements which are surrounded by oil. Acoustic signals are sent out via the oil and the acoustic window. The NIXIE has two Towed Bodies available (port and starboard) which can both be pulled at once, but only one of these can send out signals at any one time.



*illus. 1-2232-3
Towed Body*



illus. 1-2232-4 Dummy Load

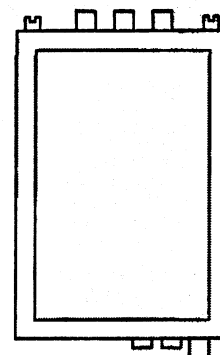
1.24.2.4. Dummy Load

The NIXIE has three Dummy Loads (see Illustration 1-2232-4), one for low frequency, one for medium frequency and one for high frequency.

The dummy loads are used for testing the system without using the towed bodies.

1.24.2.5. Coaxial Switching Unit

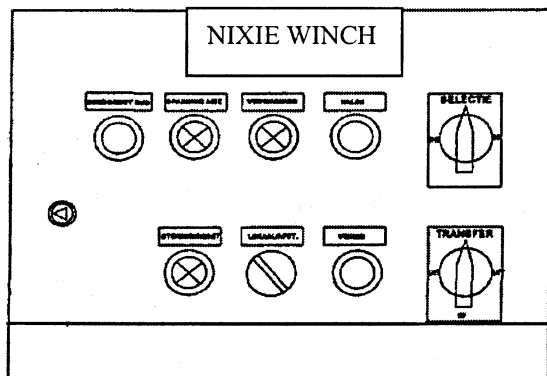
The Coaxial Switching Unit (see Illustration 1-2232-5) is a switching unit for switching between the dummy loads and the towed bodies.



*illus. 1-2232-5
Coaxial Switching
Unit*

1.24.2.6. Winch Operating Unit

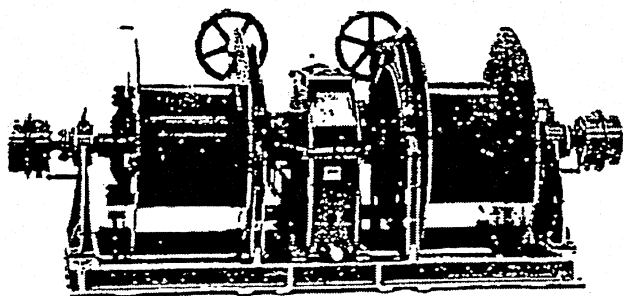
The winch operating unit (see Illustration 1-2232-6) runs the motor for the Power Operated Double Drum winch.



illus. 1-2232-6 Winch Operating Unit

1.24.2.7. Power Operated Double Drum Winch

The Power Operated Double Drum Winch (see Illustration 1-2232-7) rolls the two towing cables (port and starboard) in and out. One towing power cable contains three coax cables.



illus. 1-2232-7 Power Operated Double Drum Winch

1.24.3. Integration

The Nixie is not integrated.

1.24. 2232 Torpedo Countermeasure System (NIXIE) AN/SLQ-25KM

1.24.1. General

The NIXIE is a misleading installation for use against passive and active acoustic target-seeking torpedoes. A torpedo-shaped body is towed behind the ship by means of a towing and power cable. Transducers are positioned in the towed body which send out acoustic signals to mislead a target-seeking torpedo. The signals generated in the towed body have a higher sound level than the sound generated by the ship as a whole. The maximum towing length of the towed body is 1600 feet. The NIXIE functions in the first place as a decoy and in the second place as jammer. In order to be able to use the own torpedoes under the best possible circumstances it is possible to filter certain frequencies. The NIXIE has the following frequency bands:

- low : 17.0 -30.4 kHz
- medium : 29.6 - 51.7 kHz
- high : 50.3 -88 kHz

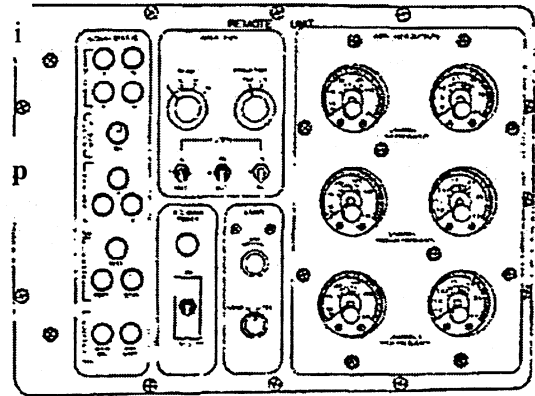
The four following transmission modes are available with the NIXIE:

- S-mode : swept frequency
- N-mode : noise
- P-mode : pulsed noise
- A-mode : alternate

An overview of the NIXIE is given in Illustration 1-2232-8.

The NIXIE consists of the following parts:

- Transmitting Set Control (Remote Unit)
- Torpedo Countermeasures Transmitter (Electronic Console)
- Towed Body (2) + 2 reserve bodies
- Dummy load (3)
- Coaxial Switching Unit
- Motor Controller Unit
- Power Operated Double Drum Winch



illus. 1-2232-1 Transmitting Set Control

1.24.2. Equipment

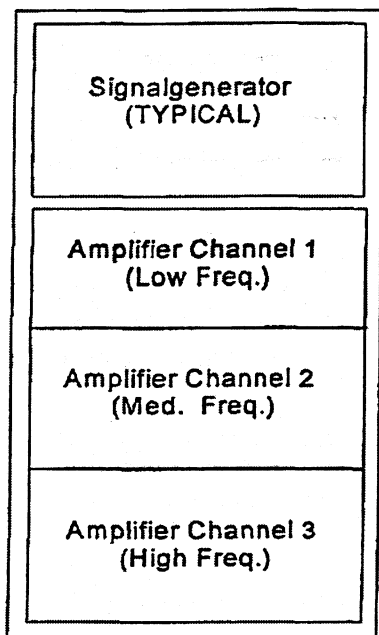
1.24.2.1. Transmitting Set Control (Remote Unit)

The NIXIE is controlled from the Command Post by remote control using the Transmitting Set Control (see Illustration 1-2232-1). The NIXIE can also be controlled locally from the Torpedo Countermeasures Transmitter.

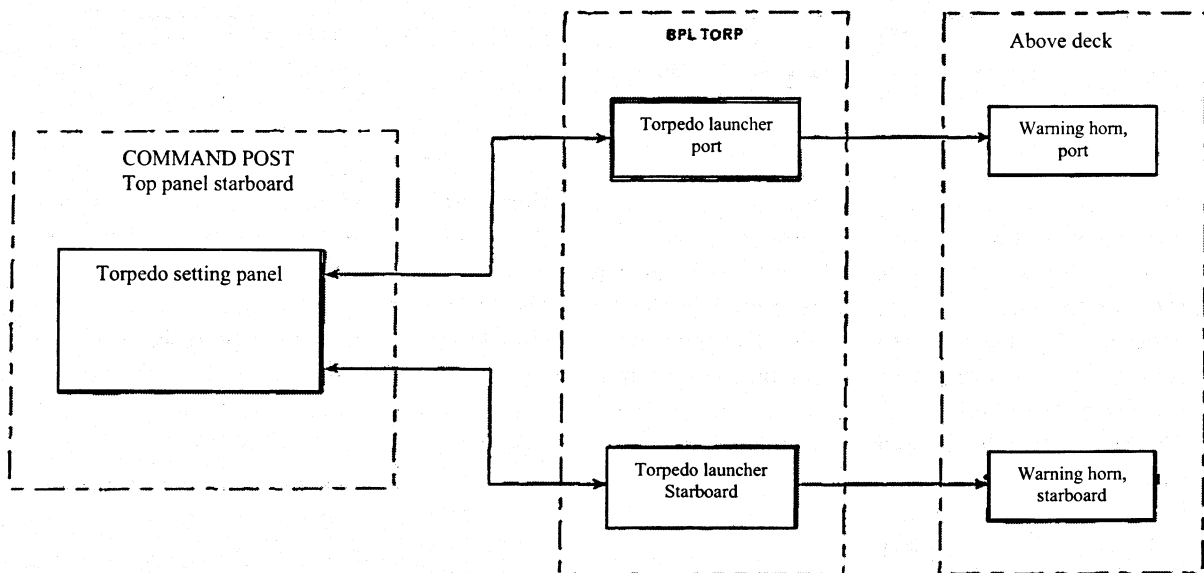
1.24.2.2. Torpedo Countermeasures Transmitter (Electronic Console)

The Transmitter (see Illustration 1-2232-2) produces and amplifies the electrical signals. These signals are sent through the towing and power cable to the towed body and then transmitted. The transmitter has the following parts: :

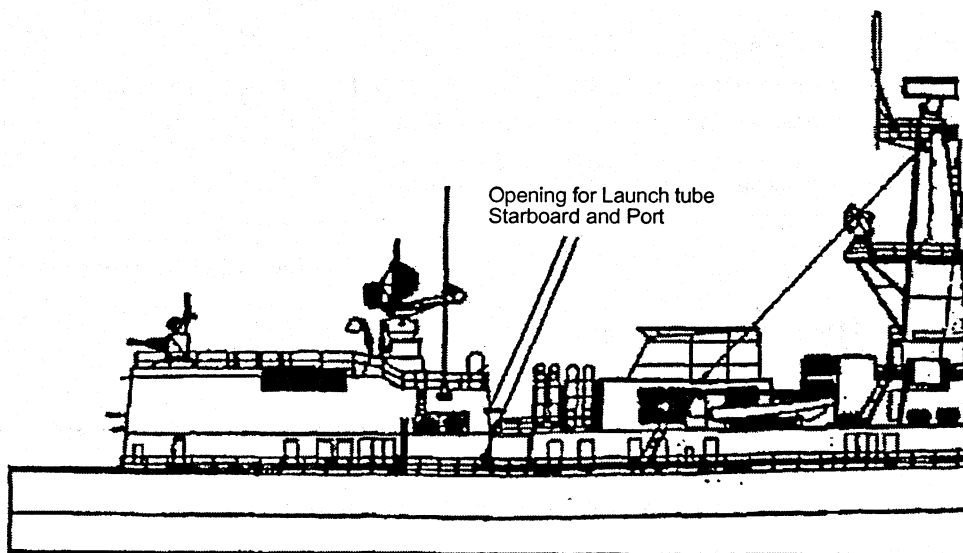
- Signal generator
- Amplifier channel I (low frequency)
- Amplifier channel 2 (medium frequency)
- Amplifier channel 3 (high frequency).



illus. 1-2232-2 Torpedo
Countermeasures Transmitter



illus. 1-2231-4 Overview

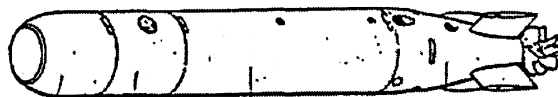


illus. 1-2231-5 Position on ship

1.23.2.2. Torpedo Mk 46 Mod 5 A(S) Open Ocean

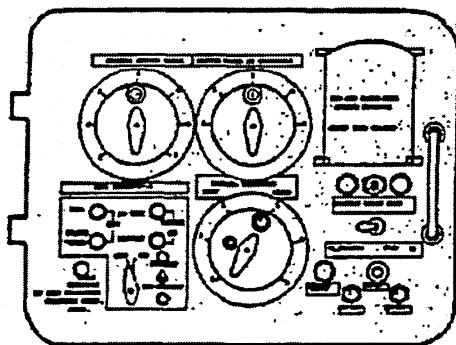
The Torpedo Mk 46 (see Illustration 1-2232-2) is an active (sonar) or passive/active target-seeking light-weight anti-submarine torpedo propelled by a combustion engine. The Torpedo is constructed from a:

- nose section (transducer, transmitter, receiver)
- warhead (explosives, detonator) or exercise head
- fuel tank (OTTO fuel II)
- tail with propulsion engine (tail fin with 2 concentric screws)



*illus. 1-2231-2 Torpedo Mk 46 Mod 5
A(S) Open Ocean*

The speed depends on the search modes and application and may be 36 or 43.5 knots. The total weight is 230 kg. The explosive charge is 96 lbs PBXN 103. The maximum range is 18,000 yards depending on the depth set. The operational depth is between 20-2000 ft.



illus. 1-2231-3 Torpedo setting panel Mk 264

1.23.2.3. Torpedo setting panel

Setting, checking and firing of the Torpedo weapon system is carried out by Remote control from the Torpedo setting panel Mk 264 Mod 3 (see illustration 1-2231-3) that is situated in the Command Post in the top panel near to the OBTL (Submarine Combat Team Leader).

1.23.2.4. Warning hooter

The warning hooter is used to signify that a torpedo is about to be launched.

1.23.3. Integration

The torpedo weapon system is not integrated but launching advice is given by the OP.

1.23. 2231 Torpedo weapon system Mk32 Mod9

1.23.1. General

The Torpedo weapon system is primarily intended for combatting submarines. The torpedoes belonging to this system can be launched from the following units:

- ship; from the launcher in the BPL TORP room to the outside (either to port or starboard)
- helicopter
- aircraft

The Torpedo weapons system can be used in the following modes:

- Tube mode; by launching through a torpedo tube. The torpedo moves in a snake-like searching pattern.
- Hats mode; the torpedo is launched from a helicopter. Launching angles of 35, 70, 95, 120, 150 or 180 degrees to the left or right are possible. The torpedo moves in a snake-like searching pattern.
- Air mode; the torpedo is launched by a helicopter or Maritime Patrol aircraft. The torpedo follows a circular path to a set target. The torpedo can be set to be passive/active (sonar).

The Torpedo weapon system is an autonomous system. Launching advice is provided by the Operational Programme. The system function Data Handling 1 calculates from input data the optimum use of this system and provides advice accordingly. The launching advice consists of a:

- setting advice (run out/no run out)
- manoeuvre advice (approach course and opening course)
- launching advice (launching course and gyro) depending on the type of attack chosen. The types of attack are:
 - Urgent (rapid launching is more important than accuracy)
 - Deliberate (launching from the best possible position, whereby accuracy is more important than speed).

An overview of the Torpedo weapon system is given in Illustrations 1-2231-4 and 1-2231-5. The Torpedo weapon system consists of the following parts:

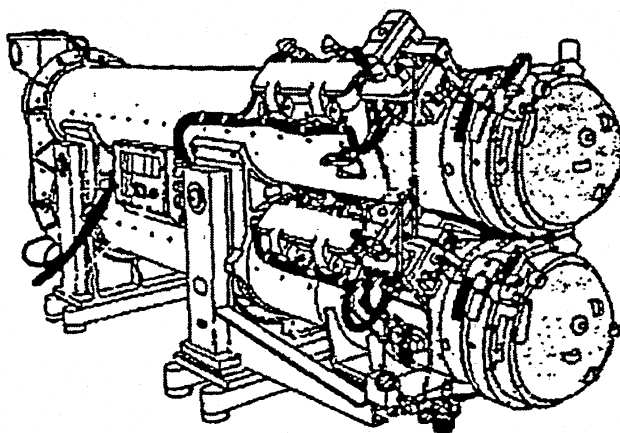
- Launcher (2)
- Torpedo Mk 46 Mod 5A (S) open ocean
- Torpedo setting panel Mk 264
- Warning hooter (2)

1.23.2. Equipment

1.23.2.1. Launcher

The launcher (see Illustration 1-2231-1) is type Mk 32 Mod 9 (identical to those on board the S and L frigates). The torpedo is loaded into the tube using a pneumatic tackle and loading gully. Initial settings are entered in the torpedo using the Torpedo setting, check and firing panel. If remote control firing from the Command Post fails the torpedo can be fired locally. The following settings can be made from the Command Post:

- tube selection
- search depth
- gyro angle
- run out/no run out.



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1.22. 2226 Salute cannon 40 mm

1.22.1. General

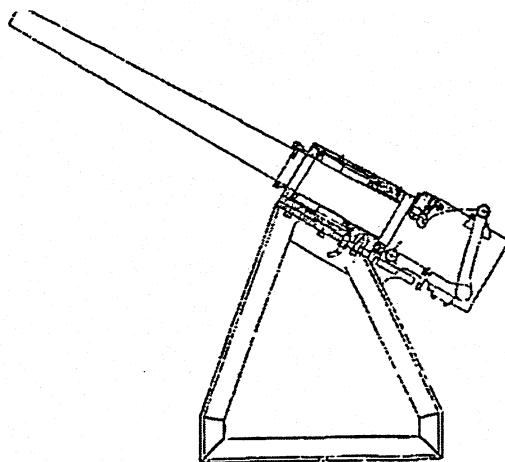
The purpose of the salute cannon is:

- so that warships of the Royal Netherlands Navy may give salutes if the nature of the voyage demands this
- to answer a salute from warships of foreign nations

The salute cannon (see Illustration 1-2226-1) is a cannon which is operated by hand. This means that the salute cannon is loaded by hand, is fired by means of a hand-pulled cord and that the empty shell case is picked up by hand after being discharged by the cartridge extractors. The barrel is closed by a vertical wedge which opens downwards and is fitted with the usual safety precautions. The salute cannon forms part of the fixed equipment and consists of the following parts:

- carriage
- cradle
- barrel
- breech
- breech block

The M frigate can be equipped with three 40 mm salute cannons no. 4, placed on the F deck, near to rib 97-129.



Illus. 1-2226-1 Salute cannon

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1.21. 2224 Short Range Defense System 20 mm Machine Gun (OERLIKON)

1.21.1. General

The 20 mm machine gun (see Illustration 1-2224-1) is placed on board for policing-type operations. There are two machine guns, one on the Starboard side and one on the Port side of the E deck, level with rib 97-121. The arrangement is a tripod style pivot with the gun carriage fitted on this. The cradle, for one weapon, is mounted on the carriage with two pins. The left-hand pin is fitted with a spring to keep the weapon in balance so that aiming is easier. The machine gun can only be operated manually. The gun is fitted with a safety pin which can either be in position FIRE or position SAFETY.

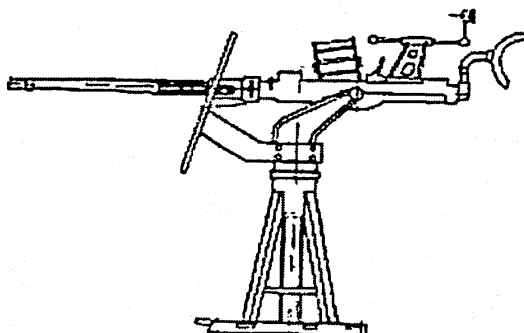
The weapon is fed from a cartridge drum which can hold a maximum of 58 cartridges. Firing speed is 465 – 480 shots a minute. The maximum effective shooting range is 1000 – 1200 yards. If the barrel becomes too hot this must be changed. Operational ammunition consists of:

- 20 mm cartridges, explosive tracer with percussion fuse
- 20 mm cartridges, explosive incendiary with

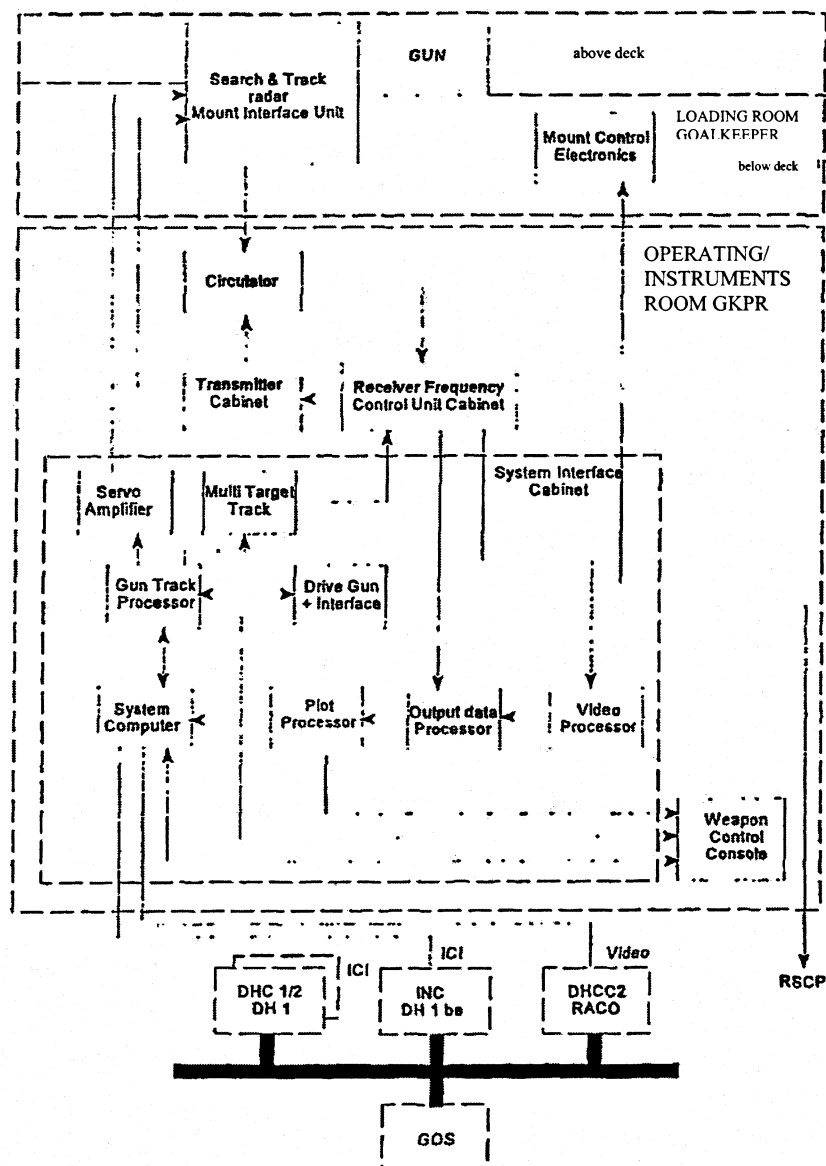
percussion fuse

Training ammunition consists of:

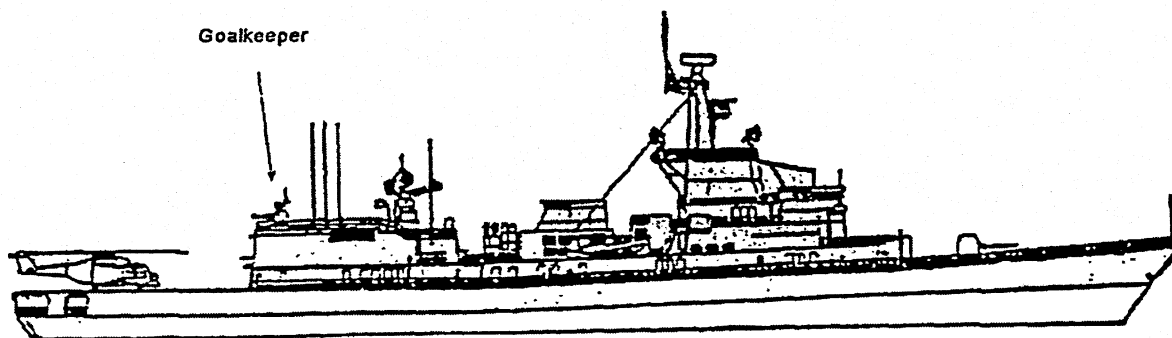
- 20 mm cartridges, training tracer ammunition with false fuse
- 20 mm cartridges, training ammunition with false fuse



illus. 1-2224-1 20 mm Machine gun



illus. 1-2223-7 Overview



illus. 1-2223-8 Position on board

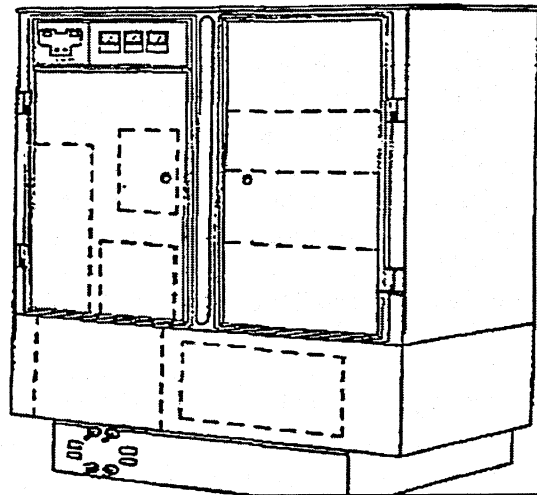
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1.20.2.11. Transmitter Cabinet

The Transmitter Cabinet (see Illustration 1-2223-6) consists of transmission components (RF-Circuit, TWT, High Voltage Circuit and Grid Modulator), a Monitor Panel, Protection Rack, facilities for fault monitoring and a Cooling Rack. The transmitter operates in the frequency range from 8500 to 9600 MHz and the output signal is produced by an I band Travelling Wave Tube (TWT) with output power of 100 kW.

The RF signal is generated in the REC/FCU and filtered before it is amplified in the TWT. The MTTU controls the transmitted PRF from the TWT via the Timing Unit in the REC/FCU. The high voltage required for the TWT cathode is generated and stabilized in the Transmitter Cabinet.

The cabinet is cooled by an internal cooling system. The heat exchanger is connected to the ship's water supply.



illus. 1-2223-6 Trans

illus. 1-2223-6 Transmitter Cabinet

1.20.3. Integration in the central system

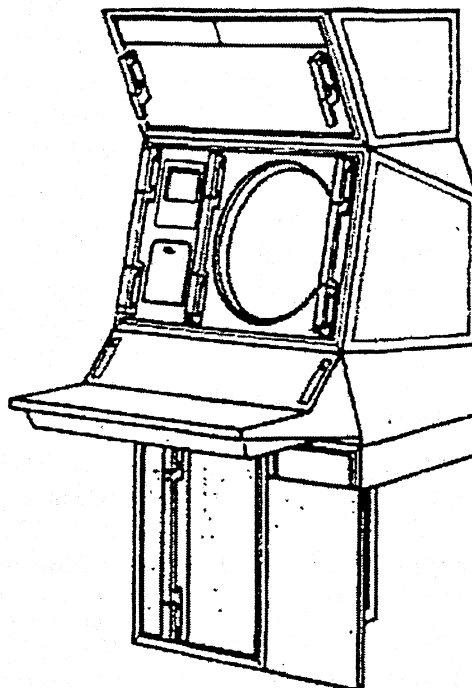
The SIC is connected by a coax cable with the RACO in order to display the GK search video on a GOS (see Illustration 1-2223-7). The SIC is also connected to the INC by means of an ICI. This interface allows the GK target and status information to be sent through to DH and the GK to be operated from DH.

The IRC supplies heading, roll and pitch values. There is an interface with the RSCP for authorization of the RF signal to be sent out. Finally, the Goalkeeper is integrated with the Mixer Pulse Blanking Unit used to blank the APECS II and DECCA in the I and K frequency band.

1.20.2.8. Weapon Control Console

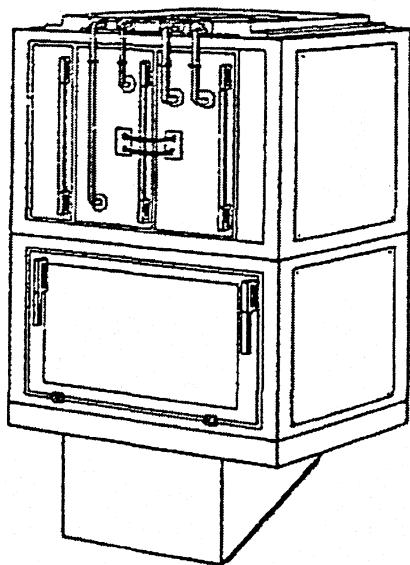
The Weapon Control Console (WCC) (see Illustration 1-2223-4) consists of a number of main panels with operating controls for the Goalkeeper. The operational use of the system and the display of the data is controlled fully by the WCC and can be operated by one person. The operator can follow the operational actions when in automatic mode and can carry out the actions when in the other modes. The information from the search radar is displayed by means of synthetic markers on the Labelled Plan Display (LPD).

Track radar information and TV camera video are displayed on the A-scope and TV monitor respectively. Selected system data is shown on the Alpha Numeric Display (AND). A Numerical Input Keyboard (NIK) is used for input of special data.



illus. 1-2223-4 Weapon Control Console

illus. 1-2223-5 Receiver/FCU Cabinet



1.20.2.9. Receiver Frequency Control Unit Cabinet

The Receiver Frequency Control Unit Cabinet (REC/FCU) (see Illustration 1-2223-5) consists of a Frequency Control Unit (FCU), a Search Receiver, a Timing Unit, a Power Supply and Blower Units. The FCU generates the following signals:

an RF signal, sent to the Transmitter for amplification.

Local Oscillator and the COHerent Oscillator signals, which are used by the Search and Track receiver.

clock pulses which are necessary for the radar synchronization in the Timing Unit.

The Search Receiver contains a Low Noise Front End Preamplifier (LNA) in order to avoid system degradation as a result of a low signal/noise ratio. The LNA output is split into two identical receiver channels. Each channel is fed by different signals from the Local Oscillator in order to combine the different RF pulses. Video processing of the search radar is carried out in the SIC.

The Timing Unit ensures that the transmission and receiving process is correctly synchronized for all operational modes. The Timing Unit also produces signals for target simulation, receiver calibration, noise measurement and Side Lobe Suppression (SLS) control.

The Power Supply Unit contains the Control Panel and Power Supplies for the REC/FCU. A blower provides cooling for the whole cabinet.

1.20.2.10. Bulk loader

The bulkloader is set up next to the weapon and is effectively identical to the ammunition drum. The bulk loader is used for rapid reloading of the ammunition drum.

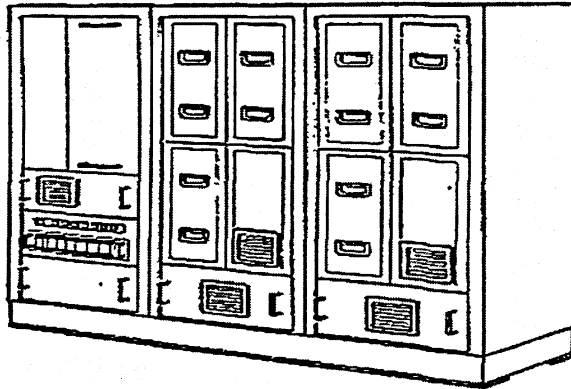
1.20.2.5. Mount Interface Unit

In order to limit the number of slip rings necessary for the Fire Control System a Mount Interface Unit (MIU) is required (see Illustration 1-2223-1). The MIU contains Power Supplies, S/D Converters and a Rate Gyro control. The MIU controls the transport of data between the components of the Integrated Turret and the other equipment which is situated below deck.

1.20.2.6. Mount Control Electronics Cabinet

The Mount Control Electronics Cabinet (see Illustration 1-2223-2) contains the electronics which are responsible for the interface between the System Interface Cabinet and the controls for the mount. The Mount Control Electronics is fitted in a unit consisting of three cabinets.

The three cabinets consist of the following parts: Local Control and Maintenance Panel, Fire limiting equipment, Test panel, Blower and Power Distribution Assembly, Filter and Circuit Breaker Assembly, Servo Amplifier Assembly, Cable Access Panel and a Transformer and Rectifier Assembly.

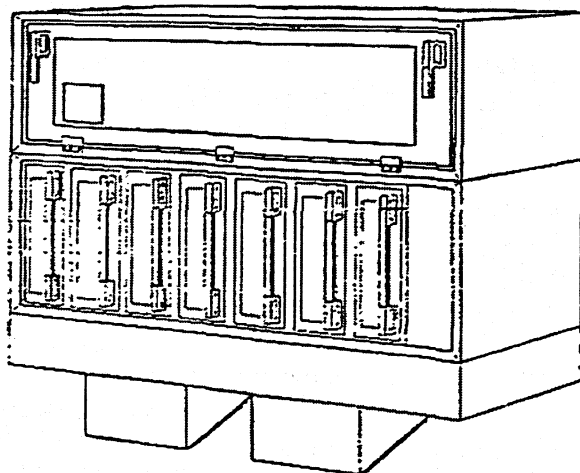


illus.. 1-2223-2 Mount Control Electronics Cabinet
1

1.20.2.7. System Interface Cabinet

The System Interface Cabinet (SIC) (see Illustration 1-2223-3) contains a Power Supply Panel, a System Computer, Video and Track Processing Circuitry, a Multi Target Track Unit, a Plot Processor, a Gun Track Controller and a TV Video Processing Circuit. There is also an Interface Unit which handles the data traffic between the SIC and the Receiver/FCU Cabinet, the Weapon Control Console and the Mount Control Electronics.

The Goalkeeper search video is processed in the SIC. It is first converted (A/D) into digital pulses after which pulse compression and FFT takes place. The output signal from the FFT process is sent to the Data Reduction Unit which converts the quantity of energy into a speed gate with adaptive threshold. It is then sent to the Video Extractor.



illus. 1-2223-3 System Interface Cabinet

The acquisition and tracking process is also carried out in the SIC. The track receiver is a linear monopulse receiver. The signal received is detected in I and Q phase sensitivity. The selection range in acquisition mode is obtained by use of an acquisition gate consisting of 32 small gates which together give an effective range of 700 m.

The acquisition and tracking process is based on coherent integration making use of the FFT process. The TV video process is also integrated into the SIC. The TV video is differentiated and added to a comparator for target tracking. The track gate is automatically set and based on information from each video line. This information determines the centre of the target.

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A Side Lobe Suppression (SLS) antenna is integrated in the search antenna to suppress any interrupting signal coming in via the side lobes, so that detection of targets in the side lobes is limited.

1.20.2.1.3. Tracking radar with TV camera

The tracking radar with TV camera (see Illustration 1-2223-1) is mounted on the weapon and consists of a tracking radar with a Rate Gyro Unit, a TV Camera, a Pedestal containing the drive (bearing and elevation), the slip rings and an Anti-vibration unit.

The tracking radar is of the cassegrain type and fitted with two monopulse horns, one for the I band and one for the K band.

The TV camera is for following the target visually. If the track system is not switched on a brake prevents movement of the antenna.

1.20.2.2. 30 mm Gatling Gun

The 30 mm automatic Gun system consists of the following main parts:

- The air-cooled seven barrel Gatling Gun (see Illustration 1-2223-1) with an ammunition feed system.
- Transfer Unit
- Conveyer belt
- Ammunition Storage Drum

The 30 mm automatic Gun is operated by the conventional Gatling system. This is characterized by the continuous rotation of the barrel and the movement of the Breech bolts in the opposite direction, driven by a rotating gearwheel.

The cartridges are grouped in axial sections which run from the top of the drum so that the projectiles point towards the middle. The cartridges are transported axially to the inward rotating part of the drum, called the helix. A scoop, mounted at the exit of the innermost drum, picks up the cartridges from the axial section and speeds them up towards the exit unit. This unit speeds up the cartridges once more and places them on a continuous conveyor belt formed from rounded elements.

The cartridges are removed from the conveyor at the Gun Interface by a Transfer Unit and placed in the open bolt position of the Gun. Empty cartridge cases and all misfires are put back onto the conveyor belt and transported to the final output from the feed system. They are then removed from the conveyor belt and placed back in the Linkless Storage Drum, where they remain until they are removed during the reloading operation.

1.20.2.3. Ammunition Feed and Storage System

The Ammunition Feed and Storage System (see Illustration 1-2223-1) consists of a Drum group, Loading Opening, Turn around unit and Fixed/Flexible chutes with conveyor belt. The ammunition feed and storage system both feeds in the 30 mm cartridges and removes empty or misfired cartridge cases.

1.20.2.4. Gun Control Electronics Cabinet

The Gun Control Electronics Cabinet (see Illustration 1-2223-1) consists of three parts, the two outermost parts each with four batteries and in the middle the part with the electronics consisting of a Gun Control Unit, Circuit Breakers and Line Capacitors, Battery Charger, Loading Motor Control and a Power Supply.

The Gun Control Electronics Cabinet controls the Gun Drive motor which in turn drives the ammunition feed. The batteries supply the power for the Gun drive motor.

1.20. 2223 Short Range Defense system (GOALKEEPER) SGE 30

1.20.1. General

The Goalkeeper is a short range defense system against low to medium height, fast-approaching targets with Radar Cross Sector of 0.1 m^2 . The process in the Goalkeeper system is completely automatic but can be manually interrupted. The system is also suitable for intercepting aircraft, helicopters and surface targets. In order to be able to carry out these tasks the Goalkeeper system has three main modes of operation:

- Automatic; detection, initiation, target evaluation, acquisition, tracking and destruction
- Semi-automatic; operator or Data Handling indicates the target after which detection, target evaluation and tracking are carried out automatically;
- Manual; manual firing, operator indicates the target, after lock-on the further process is automatic.

The processing of the various functions is carried out in a system that consists of three SMR μ s, a search radar and a Fire Control Track Radar with two frequency bands. These radars are completely integrated with a 30 mm Gatling Gun with firing speed of 4200 shots per minute using specially developed ammunition (Target Practice (TP) and Missile Piercing Discarding Sabot (MPDS)).

An overview of the Goalkeeper system is given in Illustrations 1-2223-7 and 1-2223-8. The Goalkeeper consists of the following parts:

- Integrated Turret
 - Radar antennas (above deck)
 - 30 mm Gatling Gun (above deck)
 - Ammunition feed and storage system (below deck)
 - Gun Control Electronics (below deck)
 - Mount Interface Unit (below deck)
- Mount Control Electronics
- System Interface Cabinet
- Weapon Control Console
- Receiver Frequency Control Unit Cabinet
- Transmitter Cabinet

1.20.2. Equipment 1.20.2.1. Integrated Turret

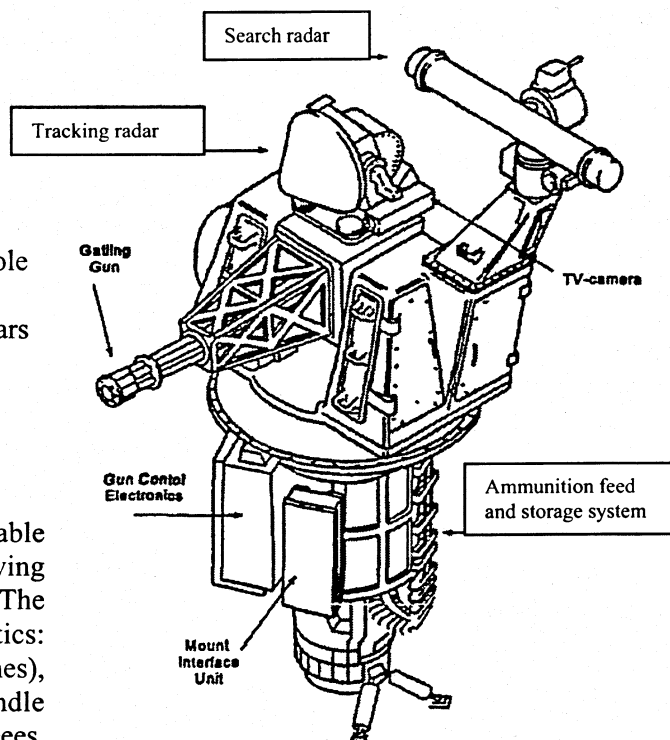
1.20.2.1.1. Radar antennas

The radar antennas, in conjunction with the whole system, can automatically detect and track fast moving air targets. The Goalkeeper has two radars (see Illustration 1-2223-1):

- Search radar
- Tracking radar with TV camera

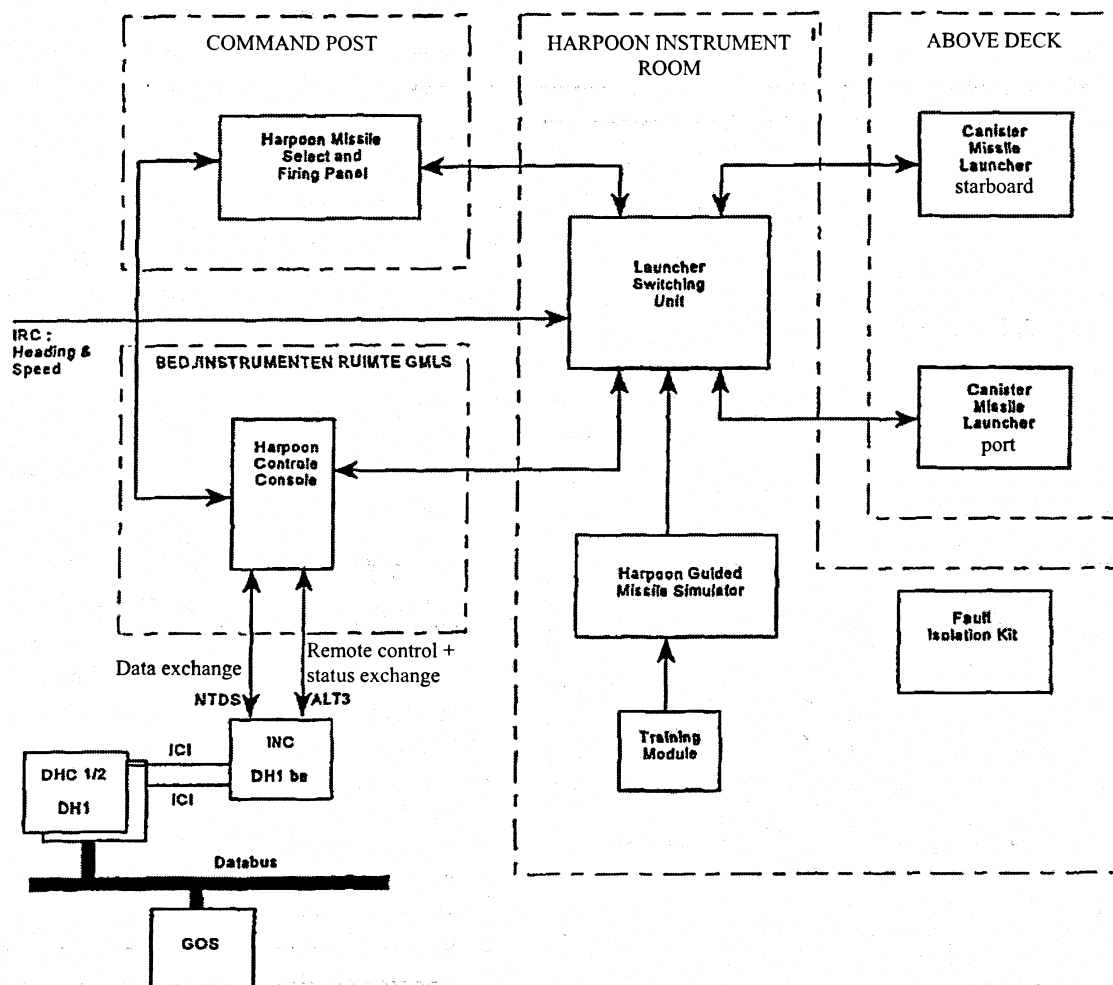
1.20.2.1.2. Search radar

The search radar is specially designed to be able to detect both low flying and steeply diving projectiles with a small reflecting surface. The search radar has the following characteristics: semi-omni directional (restricted by preset zones), frequency band 8500-9100 MHz (I band), bundle width horizontal 1.7 degrees, vertical 30 degrees, horizontal polarization and revolution speed of 60 revs per minute.

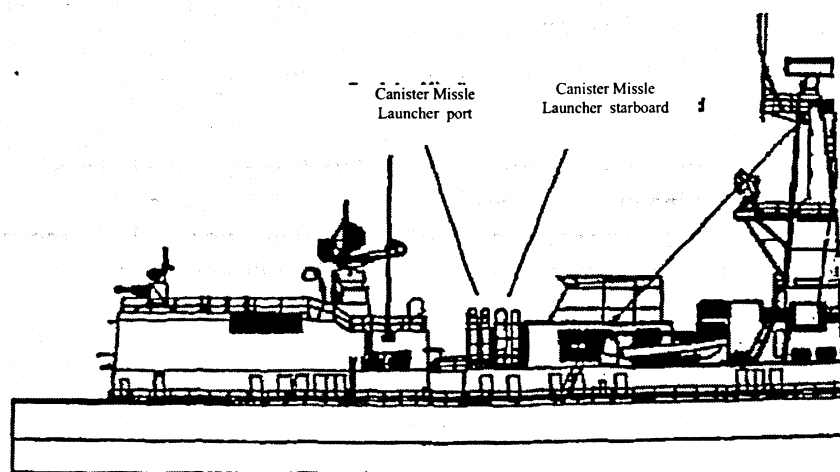


illus. 1-2223-1 Integrated Turret

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illus. 1-2222-8 Overview

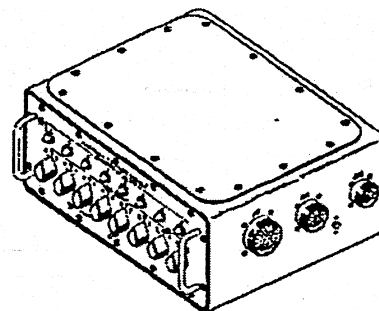


illus. 1-2222-9 Position on board

1.19.2.6. Training Module

The Training Module (TM) (see Illustration 1-2222-6) is used for training the operator. The TM is connected to the HCC and simulates a missile in the following situations:

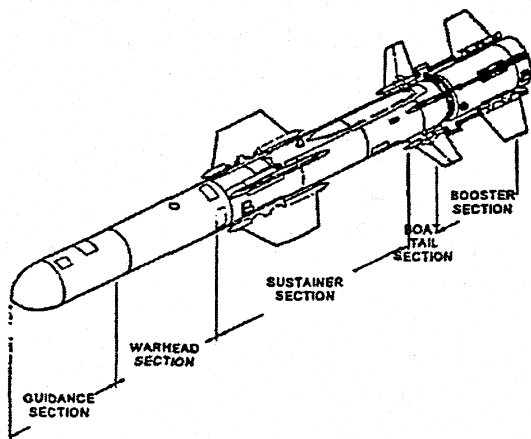
- H; missile in canister
- E; empty canister
- D; defect missile in canister



illus. 1-2222-6 Training Module

1.19.2.7. Fault isolation kit

The Fault isolation kit consists of test cards for use in locating faults in the Data Processor Unit and the Data Conversion Unit of the Harpoon Control Console.



illus. 1-2222-7 Harpoon Missile

1.19.2.8. Harpoon Missile

The Harpoon Missile (see Illustration 1-2222-7) is made up from five sections. These are:

- guidance section; a radome with an active radar, missile guidance unit, altimeter and flight controls
- warhead section; contains high explosives and an altimeter
- sustainer section; consists of a turbojet engine, fuel tank, missile wings, battery, and an electronic control amplifier
- boat tail section; steers the missile wings
- booster section; contains solid fuel, a booster firing mechanism and fins

The length is 4.5 m, diameter 0.35 m and weight 692 kg. The missile is put in place using one of the two Hoist Rotation Beam Assemblies.

1.19.3. Integration in the central system

The Harpoon weapon system is connected with the Interface computer in Data Handling Computer Cabinet 1 via the following two interfaces (see Illustration 1-2222-8):

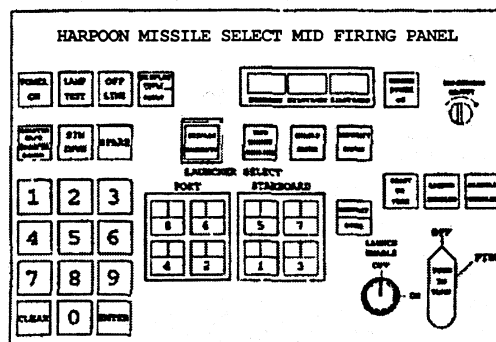
- NTDS interface, for exchange of data between Data Handling and the Harpoon Control Console
- ALT3 interface, for remote control and exchange of status between Data Handling and the Harpoon Control Console

The Launcher Switching Unit also receives course and speed information from the IRC. The installation can be operated locally and by remote control from a GOS

1.19.2.2. Harpoon Missile Select and Firing Panel

The Harpoon Missile Select and Firing Panel (see Illustration 1-2222-2) is situated in the Command Post and is used for local control. It has the following functions:

- data input
- data display
- test selections
- status indicators
- missile selections with status indicators
- launch control with status indicators

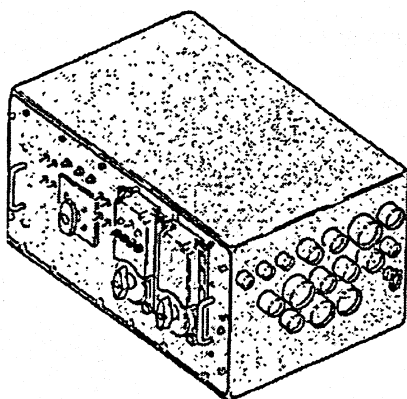


illus. 1-2222-2 Harpoon Missile Select and Firing Panel

1.19.2.3. Launcher Switching Unit

The Launcher Switching Unit (LSU) (see Illustration 1-2222-3) controls two Canister Missile Launchers each with four canisters (cells). The LSU has the following functions for this:

- Cell status
- Cell selection
- Fire control status (ready to fire)

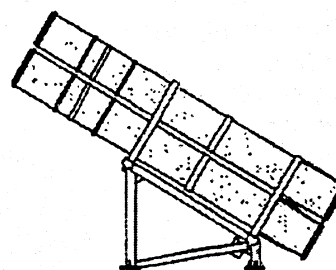
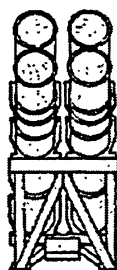


illus. 1-2222-3 Launcher Switching Unit

1.19.2.4. Canister Missile Launcher

The Canister Missile Launcher (CML) (see Illustration 1-2222-4) has four canisters in each of which a Harpoon can be placed. The ship has two CMLs; one on the port and one on the starboard side. A CML consists of:

- launcher support structure
- launcher relay assembly
- canister clamp frame assemblies
- wiring harness assemblies

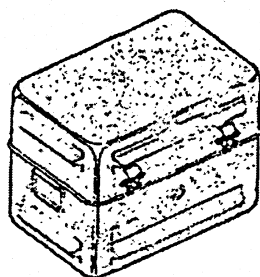


illus. 1-2222-4 Canister Missile Launcher

1.19.2.5. Harpoon Guided Missile Simulator

The Harpoon Guided Missile Simulator (HGMS) (see Illustration 1-2222-5) is used to test the Harpoon installation whereby:

- circuits in the HCC and LSU up to the missile are tested
- the test set itself is tested



illus. 1-2222-5 Harpoon Guided Missile Simulator

1.19. 2222 Anti-ship Guided Weapon System (HARPOON)

1.19.1. General

The Harpoon RGM84A Block 1c is an attack weapon (rocket) that can combat enemy surface targets beyond the reach of radar under all weather conditions. The Harpoon is a "fire and forget" weapon system with its own power supply (booster) and a high kill chance. The Harpoon makes use of its own radar (seeker max. 12 NM) in the last part of its flight. The Harpoon weapon system has eight missiles. Some characteristics of the Harpoon are:

- two firing modes:
 - Range and Bearing Launch (RBL) mode (with bearing and distance information)
 - Bearing Only Launch (BOL) mode; the Harpoon is only given a bearing and aims at the first target detected.
- three waypoints (fixed point where a bend max. 135 degrees can be made)
- maximum range 75 NM
- maximum speed mach 0.8
- warhead main charge consists of 97.5 kg DESTEX.

The Harpoon weapon can be operated in the following ways:

- Local control via the Harpoon Missile and Firing Panel (in the Command Post)
- Remote control via the GOS (using system function Data Handling 1)
OPM: firing always takes place from the HMSFP.

Launching methods can be set from the GOS (remote control) so that the Harpoon missile can be corrected for target movement, temperature and the true wind. Report back messages consist of system and missile status, display data, warnings and advice for the operator (alerts/advice). An overview of the Harpoon weapon system is given in Illustrations 1-2222-8 and 1-2222-9. The Harpoon weapon system consists of the following parts:

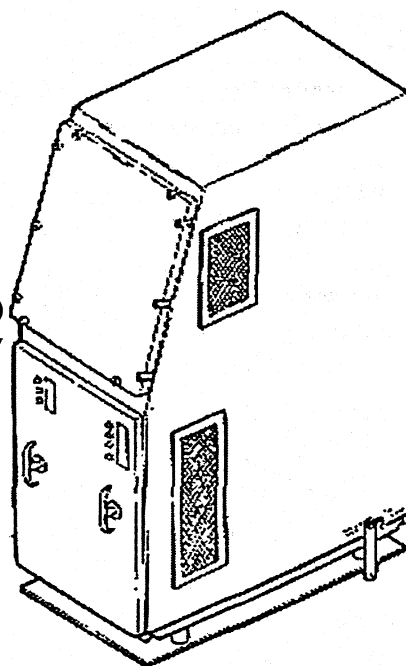
- Harpoon Control Console
- Harpoon Missile Select and Firing Panel
- Launcher Switching Unit
- Canister Missile Launchers; Port launcher (to Starboard) and the Starboard launcher (to Port)
- Harpoon Guided Missile Simulator
- Training Module
- Fault isolation kit
- Harpoon missile (8)

1.19.2. Equipment

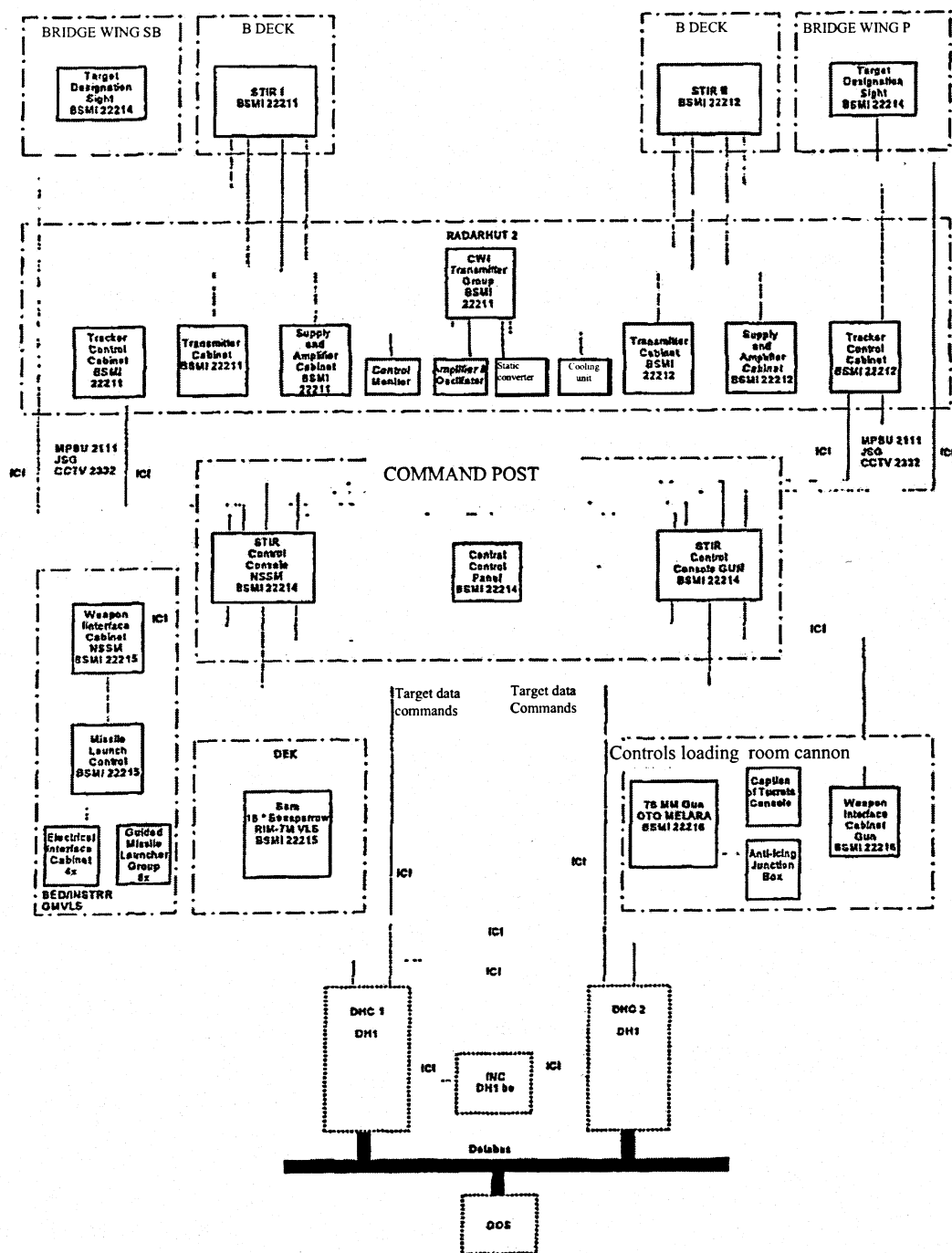
1.19.2.1. Harpoon Control Console

The Harpoon Control Console (HCC) (see Illustration 1-2222-1) receives, processes and distributes data and commands necessary for launching. The HCC consists of a:

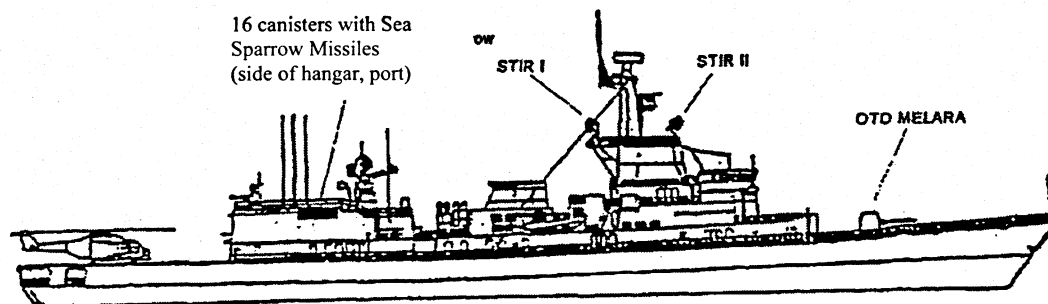
- Data Conversion Unit
- Data Processing Computer



illus. 1-2222-1 Harpoon Control Console

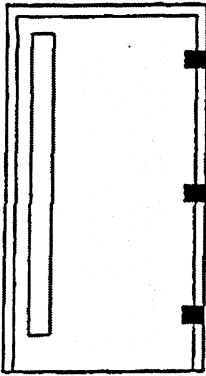


illus. 1-2221-17 Overview



illus. 1-2221-18 Sensors, launchers and cannon

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1.18.2.5.2. Weapon Interface Cabinet Gun

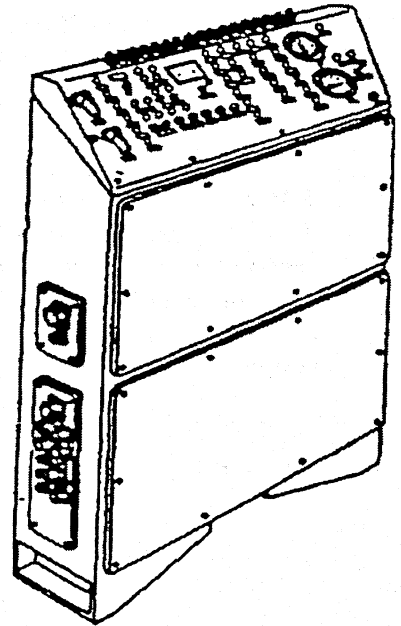
The cannon receives system commands via the Weapon Interface Cabinet (WIC) Gun (see Illustration 1-2221-15). The WIC carries out calculations, operates and controls the cannon.

illus. 1-2221-15 WIC GUN

1.18.2.5.3. Operating console (COTC)

Switches and push buttons are fitted on the operating console (see Illustration 1-2221-16), also called the Captain Of Turret's Console (COTC), which show the working of the turret. These make it possible to:

- provide the necessary power and make the turret ready for loading
- check the working of the turret in position REMOTE and while firing



illus. 1-2221-16 Operating console

1.18.3. Integration

1.18.3.1. Integration in the central system

Both SCCs of the MWCS are connected to the Data Handling Computers. The SCCs receive commands and target data from the system function DH1 running in DHC1 and 2 and the INC. The SCC send status details and return messages. Target acquisition is carried out from a GOS. The cameras on both STIR directors are connected by a coax cable with the ship's TV and Video distribution system. This allows the target to be viewed visually.

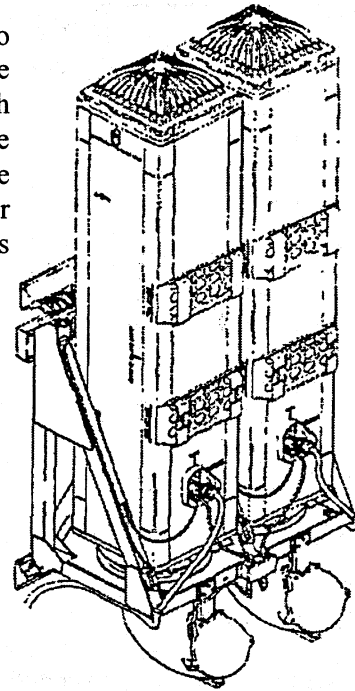
1.18.3.2. Integration at BSMI level.

As well as integration in the central system the Short and Medium Range Air Defense System MWCS is integrated with the following BSMIs:

- 2111 Radar Search and Localize Receiver APECS II
- 2332 TV and Video distribution system
- 2411 Information Retransmission Installation

1.18.2.4.4. Guided Missile Vertical Launcher Group

There are eight Guided Missile Vertical Launcher Groups, also called Ship Mounting Interface Missile (SMI-M). One launcher (see Illustration 1-2221-13) consists of two canisters. They are fitted with an anti-icing heating system. The NATO Sea Sparrow Missile (NSSM) is contained in the canister. This is a semi-active missile propelled by a rocket motor using solid fuel. It can be used against air targets to a maximum height of 25,000 feet and against surface targets with maximum interception distance of about 18,000 yards.



illus. 1-2221-13 Canister

1.18.2.5. Cannon system 76 mm (BSMI22216)

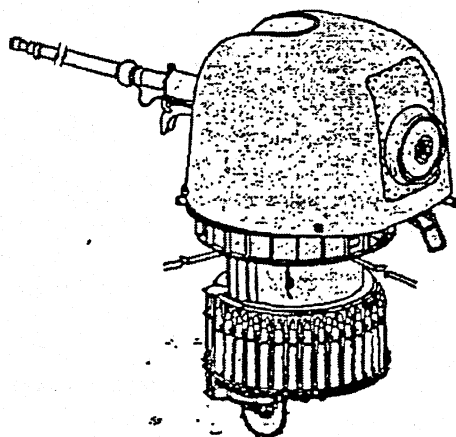
The cannon system 76 mm consists of the following parts:

- Cannon OTO MELARA (76 mm)
- Weapon Interface Cabinet Gun
- Operating console (COTC)

1.18.2.5.1. Cannon OTO MELARA (76mm)

The OTO MELARA (see Illustration 1-2221-14) is an automatic cannon that can be used against air and surface targets.

The cannon consists of an above deck (top turret) and a below decks (bottom turret) part, a COTC, Cooling Unit and a de-icing system.



illus. 1-2221-14 OTO MELARA

The top turret has the following parts:

- Barrel
- Loading arms
- breech block
- pallet
- cradle
- loading drum
- empty cartridge gulley
- cannon clearing system
- The bottom turret has the following parts:
 - rotating magazine
 - screw lift
 - ship stable ammunition lift
 - turret controller control panel

Shot range maximum is 17,000 yards. The effective shot range is:

- 5,500 yards (aircraft)
- 4,400 yards (missiles)
- 14,000 yards (sea targets).

The Royal Netherlands Navy uses three sorts of ammunition:

- a pre-fragmented grenade with proximity fuse for air targets and small rapidly moving sea targets
- a naturally splintering grenade with percussion fuse for large sea targets
- training ammunition with inert grenade.

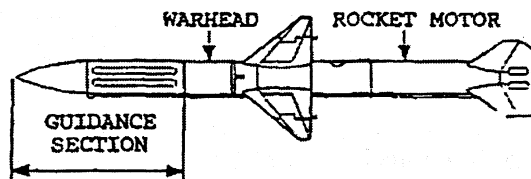
Two types of grenade can be used:

- high explosive (HE)
- target practice (TP)

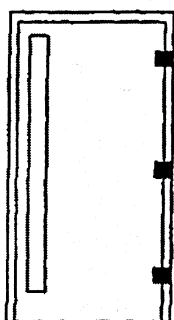
1.18.2.4. Vertical Launching System VLSMK48 (BSMI22215)

The Guided Missile Vertical Launching System (GMVLS) uses Sea Sparrow RIM 7 M/P missiles (see Illustration 1-2221-9), modified for vertical launching by means of JVC. A total of 16 canisters are set up vertically on the port side of the hangar. The Vertical Launching System is constructed from the following parts:

- Weapon Interface Cabinet NSSM
- Missile Launch Controller
- Electrical Interface Cabinet (4)
- Guided Missile Vertical Launcher Group (8)



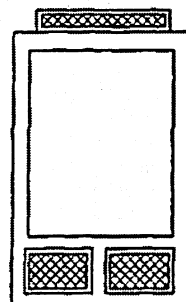
illus. 1-2221-9 Sea Sparrow missile



illus. 1-2221-10 WIC NSSM

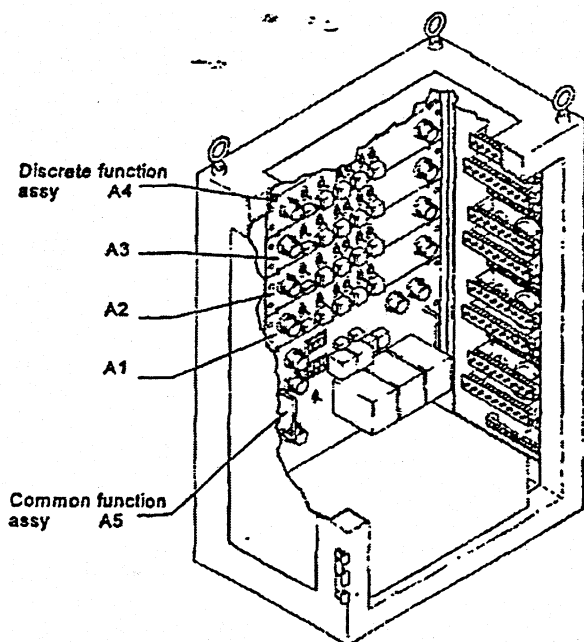
1.18.2.4.2. Missile Launch Controller

The Missile Launch Controller (MLC) (see Illustration 1-2221-11) provides the interface between the four Electrical Interface Cabinets and the Weapon Interface Cabinet (WIC). After receiving a launch order the launch controller regulates the launching order for a maximum of 16 projectiles. The Missile



illus. 1-2221-11 Missile Launch Controller

Launch Controller also supplies information concerning the status of the GMVLS and the readiness of the missiles.



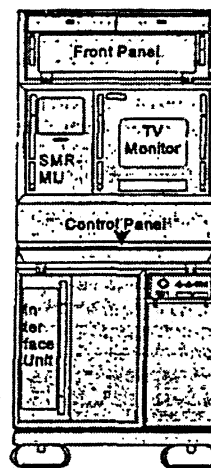
illus. 1-2221-12 Electrical Interface Cabinet

1.18.2.4.3. Electrical Interface Cabinet

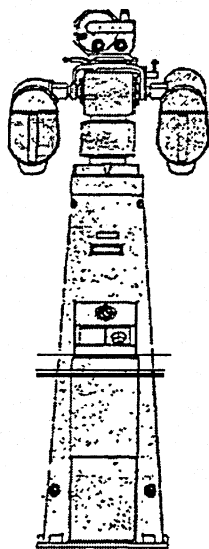
The Electrical Interface Cabinet (see Illustration 1-2221-12), also called Ship Mounting Interface Electrical (SMI-E), is an electrical interface between the Missile Launcher Cabinet and two Guided Missile Vertical Launch Groups. There are four Electrical Interface Cabinets.

Only the connection with the master SCC is active. The SCC has a:

- Front Panel; with the following sub-control panels:
 - SCC status; shows the status
 - Computer control; fault indication and loading of programmes
 - Technical control; fault indication and switching on functions
 - Weapon control; for technical operation of the weapons
- SMR μ ; MWCS system computer
- TV monitor; for A-scope video, alpha numerical info and TV video
- Control Panel; for operating the system
- Interface Unit; for connecting the system to internal and external parts.



illus. 1-2221-6 STIR Control Console (SCC)



illus. 1-2221-7 Target Designation Sight

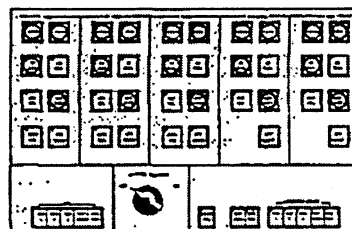
1.18.2.3.2. Target Designation Sight

The MWCS is equipped with two Target Designation Sights (TDS) (see Illustration 1-2221-7), one on the port bridge wing and one on the starboard bridge wing. The TDS is a synchronized optical system for measuring the bearing and elevation of the target. The information from the synchronized units is sent to Data Handling (system function DH1) via the Interface Unit.

1.18.2.3.3. Central Control Panel

The Central Control Panel (CCP) (see Illustration 1-2221-8) in the MWCS is used to:

- display fault indicators
- display the type of software loaded (OPE or SPP)
- show the status of the various sensors and weapons in the MWCS
- act as the authorization panel for firing and sensor functions.



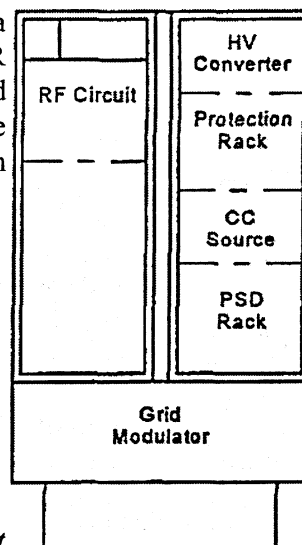
illus. 1-2221-8 Central Control Panel

1.18.2.1.4. Transmitter Cabinet

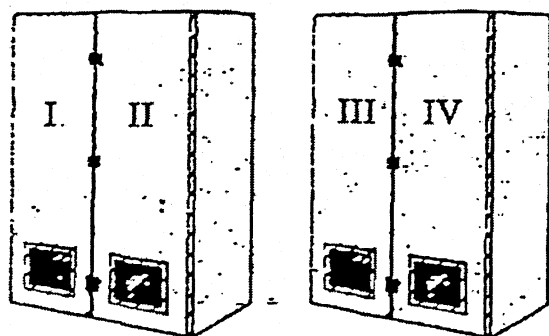
The Transmitter Cabinet (see Illustration 1-2221-4) contains a TWT which supplies the transmission signal for the STIR Director. The TWT transmitter is controlled by the FCU and the MTTU in the TCC. The maximum power is 125 kW, the frequency is between 8700 and 9600 MHz and the PRF between 3.2 and 6.6 kHz. The TWT transmitter has the following parts:

- Radio Frequency Circuit; supplies an RF signal at the correct frequency to the TWT transmitter
- Grid Modulator; supplies power for the filament and for the TWT grid
- Protection Rack; has the following tasks:
 - switching in the various units
 - carrying out commands from the various control panels
 - preventing damage to the transmitter

illus. 1-2221-4 Transmitter Cabinet



High Voltage Converter; supplies various voltages for the TWT transmitter
 Constant Current Source; supplies current for the TWT Power Supply
 Distribution Rack focussing coil; supplies various voltages.



illus. 1-2221-5 CWI Transmitter Group

1.18.2.1.5. CWI Transmitter Group

The illumination radar function is situated in the CWI Transmitter Group (see Illustration 1-2221-5). The transmission signal (10.000-10.250 MHz, 2 kW) illuminates the target. The NSSM is tuned to this frequency and can detect the reflected signal. The CWI Transmitter Group contains the following parts:

- I Control Monitor; determines the working of the transmitter
- II Amplifier & Oscillator; produces the transmission signal
- III Static Converter
- IV Cooling Unit.

1.18.2.2. Separate Tracking and Illumination Radar II (BSMI22212)

This is identical to BSMI 22211 Separate Tracking and Illumination Radar I.

1.18.2.3. Fire Control Distribution and Control System (WCS) (BSMI 22214)

The WCS has the following parts:

- STIR Control Console (2)
- Target Designation Sight (2)
- Central Control Panel

1.18.2.3.1. STIR Control Console

The STIR Control Console (SCC) (see Illustration 1-2221-5) contains the system computer and acts as the control unit for the MWCS. The MWCS has an SCC-GUN and an SCC-NSSM available. The cannon is controlled through the SCC-GUN control panels and the GMVLS through the SCC-NSSM control panels. The SCCs are identical apart from the different control panels. In the MWCS one SCC acts as master and the other as slave. Both SCCs are connected with Data Handling Computer 1 and 2.

the system computer in the STIR Control Console (SCC) and the Multi Task Tracking Unit (MTTU) in the Tracker Control Cabinet (TCC). The STIR Director has the following parts:

- Antenna with TV camera (visual information about the target to be tracked for the SCC and the closed TV circuit)
- Monopulse receiver
- Swivel angle and elevation parts
- Shock absorbing foundation

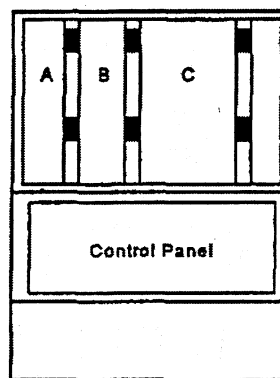
The functions of the STIR Director with TV camera are:

- tracking function; acquisition and tracking of the assigned targets
- illumination function; the tracked targets can be illuminated with CW radar waves for directing a Sea Sparrow rocket
- rear reference function; the Sea-Sparrow rockets launched are illuminated from behind by a broad bundle of CW rays coming from the rear reference antenna
- kill assessment; determination of the Kill or Missile engagement.

1.18.2.1.2. Tracker Control Cabinet

The Tracker Control Cabinet (TCC) (see Illustration 1-2221-2) is the central control unit of the Sensor sub-system. The TCC determines the transmission frequency and the Pulse Repetition Frequency (PRF) of the TWT transmitter. The target video from the STIR Director is processed here and used to direct the STIR Director. The most important units of the TCC are:

- Frequency Control Unit (FCU) and Timing Unit; these supply the following signals:
 - two high frequency signals for the TWT amplifier
 - local oscillator signals for the receiver in the STIR Director
 - phase reference signal for the receiver
 - clock signal for timing
- Multi Target Track Unit (MTTU); a digital pulse Doppler tracking video processing unit, for automatic target acquisition and tracking of bearing, elevation and distance.
- Sensor Computer and Interface Unit (SCIU); this receives target data from Data Handling via the

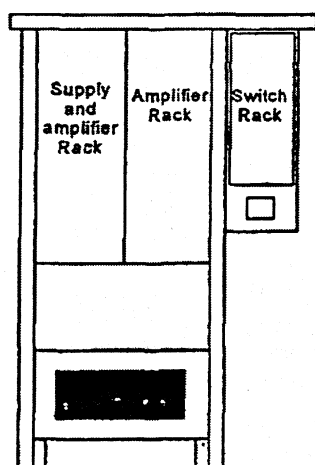


illus. 1-2221-2 Tracker Control Cabinet

A = Sensor Computer Interface Unit
B = Multi Target Track Unit
C = Frequency Control Unit/Timing Rack

afb. 1-2221-2 Tracker Control Cabinet

STIR Control Console. The Sensor Computer also receives information (swivel angle data, elevation data and distance gate) from the MTTU. The Sensor Computer uses this data to correct the distance gate and the position of the STIR Director (via the Supply and Amplifier Cabinet).



illus.

1.18.2.1.3. Supply and Amplifier Cabinet

The Supply and Amplifier Cabinet (SAC) (see Illustration 1-2221-3) supplies power to the STIR Director servo motors. The SAC consists of the following parts for this:

- Supply and Amplifier Rack
- Amplifier Rack
- Switch Rack

1-2221-3 Supply and Amplifier Cabinet

Illius 1-2221-3 Supply and amplifier Cabinet

1.18. 2221 Short and Medium range Air Defense system (MWCS)

1.18.1. General

The Multi Weapon Control System (MWCS) is an integrated Tracking radar and Fire Control system coupled to weapons providing defense against air and surface targets. The weapons coupled are:

- Cannon OTO MELARA (76 mm)
- Guided Missile Vertical Launching System (GMVLS) with 16 Nato Sea Sparrow Missiles (NSSM).

The MWCS carries out the following tasks:

- Primary functions; optimum use of weapons (and sensors) against air and surface targets plus Direct Operational Gun Assignment Surface (DOGAS); this is the use of the cannon outside of the scheduling function with assistance from the two FC windows in SMART
- Secondary functions; intercept calculation, investigation request and sector search.

The GMVLS or the cannon can be used against air targets under the control of MWCS. Sea targets are combatted using the cannon under control of DHI (SMART) while the MWCS can also use the GMVLS against these. The MWCS uses a scheduler governed by a set of prescriptions for the first and second weapon and sensor combinations (firing doctrine and waiting time).

The MWCS receives commands from Data Handling. These commands are:

- Engagement orders (6)
- DOGAS order (1)
- Investigation requests (3)
- Sector Search requests (3)

Track data obtained and status information (target info/status) are sent to DH.

An overview of the MWCS with the coupled weapons is given in Illustrations 1-2221-17 and 1-2221-18. The MWCS consists of the following sub-systems:

- Sensor sub-system, consisting of the following two identical parts:
 - Separate Tracking and Illumination Radar I (BSMI 22211)
 - Separate Tracking and Illumination Radar II (BSMI 22212)
- Operating system consisting of:
 - Firing distribution and Control sub-system (BSMI 22214)
- Weapons sub-system consisting of:
 - Vertical Launching system (BSMI 22215)
 - Cannon system 76mm (BSMI 22216)

1.18.2. Sub-systems

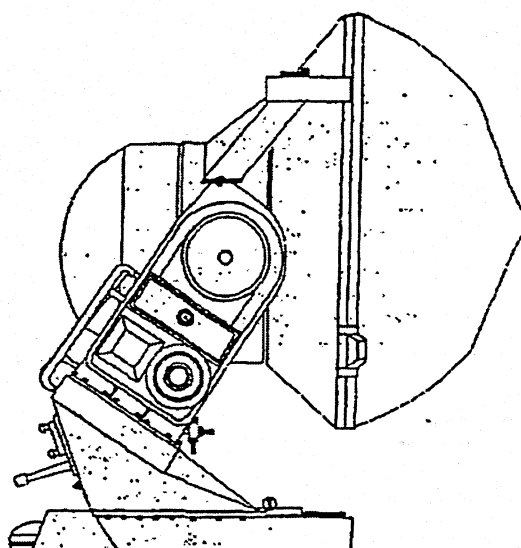
1.18.2.1. Separate Tracking and Illumination Radar I (BSMI 22211)

The Separate Tracking and Illumination Radar (STIR) I consists of the following parts:

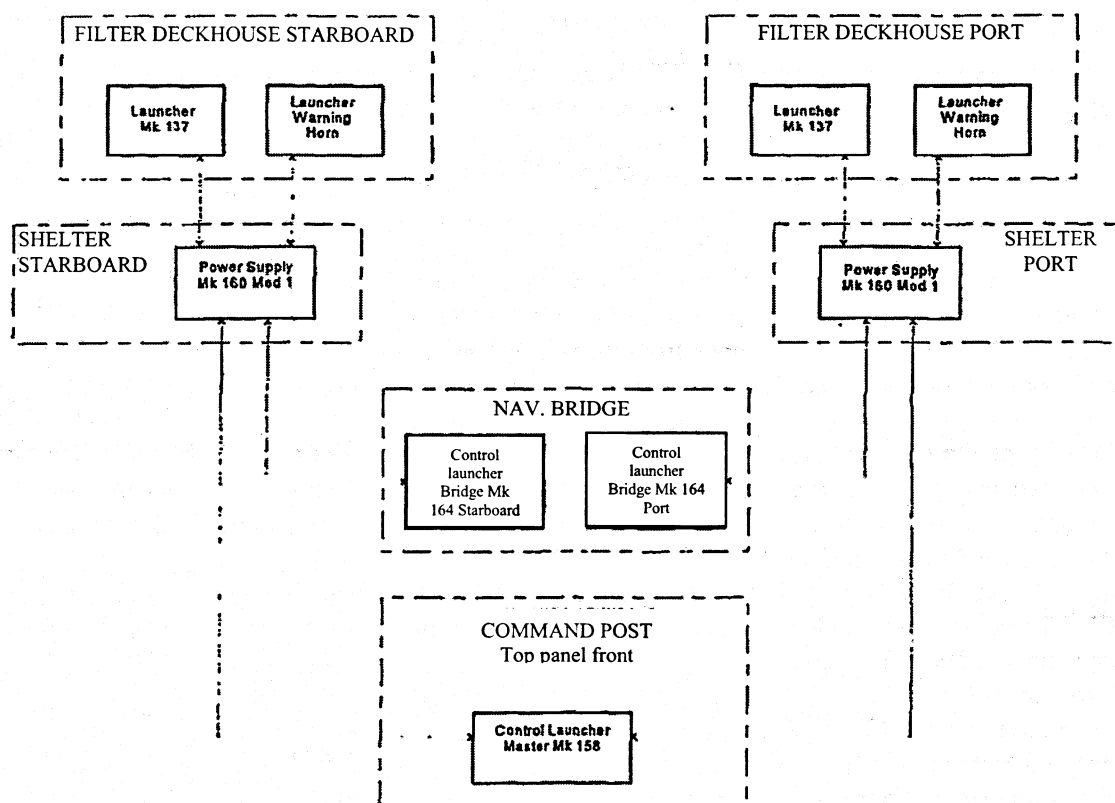
- STIR Director
- Tracker Control Cabinet
- Supply and Amplifier Cabinet
- Transmitter Cabinet
- CWI Transmitter Group

1.18.2.1.1. STIR Director

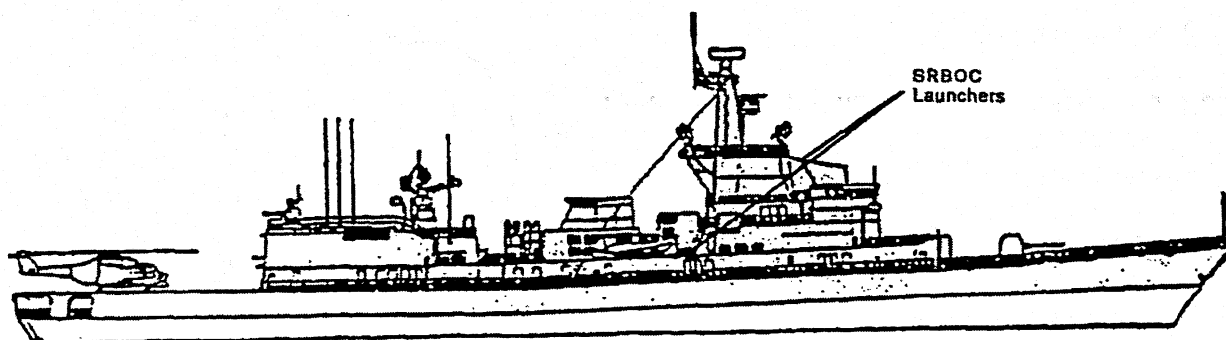
The STIR Director (see Illustration 1-2221-1) intercepts and tracks targets and guides missiles in combination with



illus. 1-2221-1 STIR Director

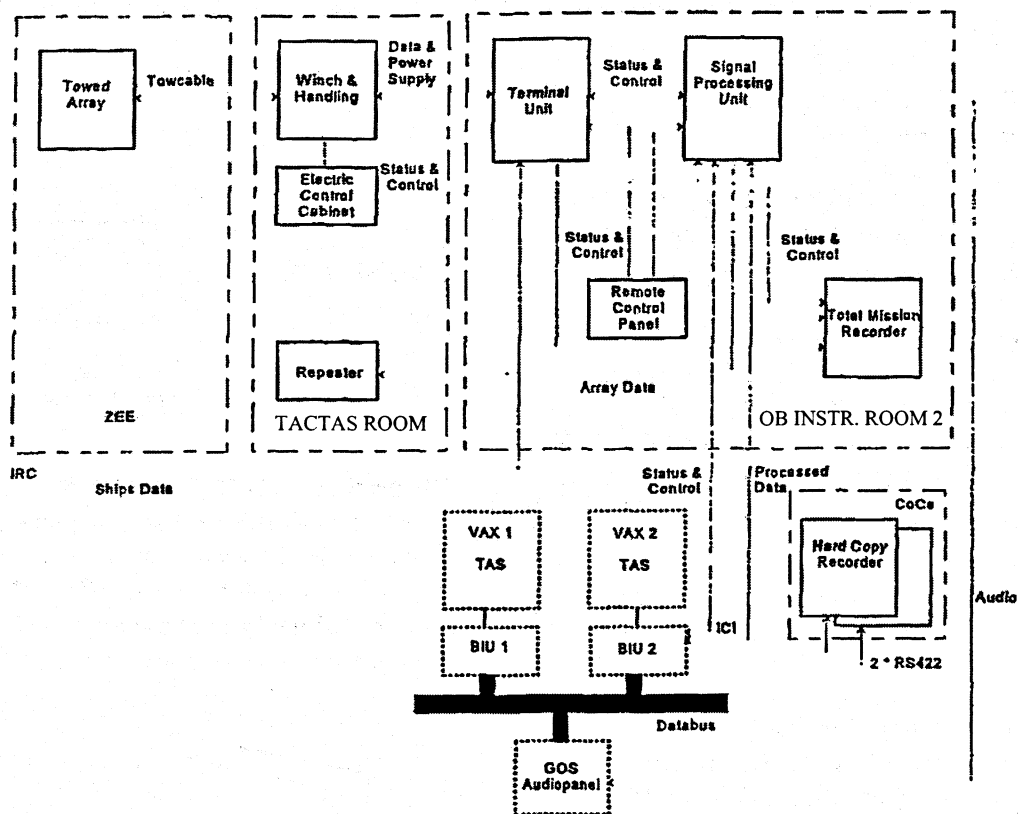


illus. 1-2212-5 Overview

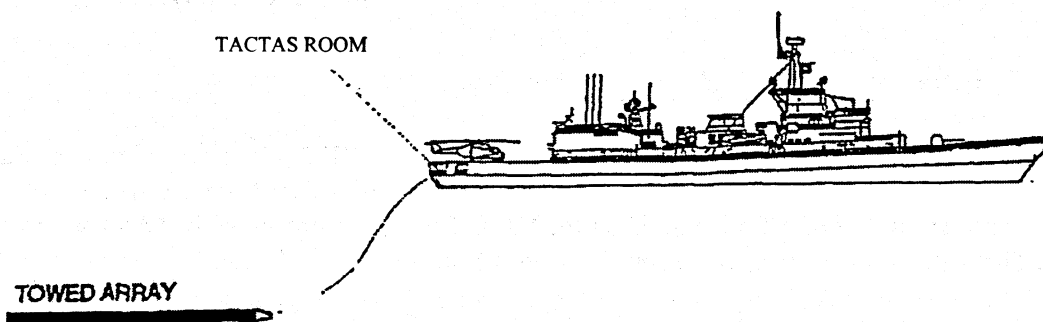


illus. 1-2212-5 Position of Launchers

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illus. 1-2156-10 Overview



illus. 1-2156-11 Sensor

the array, the Signal Processing Unit (SPU) and the Total Mission Recorder (TMR). The TU also provides the power for the array and contains an On Board Array Simulator. The data is synchronized and transport of the data through the 2500 m long tow cable is also carried out by the TU. The TU also shows the status of the Anaconda.

1.16.2.3.3. Total Mission Recorder

The recorded sonar information can be played back later using the record and playback function on the Total Mission Recorder (TMR). The TMR is situated in the OB instrument room 2.

1.16.2.3.4. Remote Control Panel

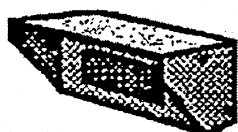
The Remote Control Panel (RCP) (see Illustration 1-2156-7) is situated in the OB instrument room 2 and is connected with the SPU, TU and the TMR and is used to control the power supply switching, authorization and power supply status monitoring.



illus. 1-2156-7 Remote Control Panel

1.16.2.3.5. Repeater

The Repeater (see Illustration 1-2156-8) is situated in the TACTAS room, is connected with the SPU and displays details about the array system. These details are the depth (DH= Depth Head module; DT = Depth Tail module), course (HH = Heading Head module; HT = Heading Tail module) of the array and details

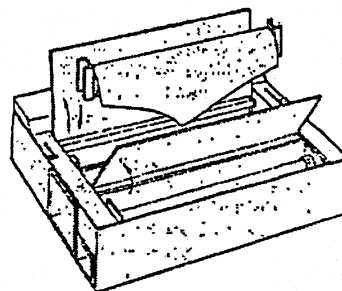


illus. 1-2156-8 Repeater

about the sea water temperature, the length of the array in use and the tension in the tow cable.

1.16.2.3.6. Hard Copy Recorder

Two Hard Copy Recorders (HCR) are situated in the Command Post (see Illustration 1-2156 -9). These HCRs are connected with BIU 2 and produce graphical recordings of the history of the LOFAR (Low Frequency Analysis and Recording) data from the Anaconda. The LOFAR data is printed on heat sensitive paper with time on the vertical axis and frequency on the horizontal axis. The amplitude is shown in gray.



illus. 1-2156-9 Hard Copy Recorder

1.16.3. Integration

1.16.3.1. Integration in the central system

The Anaconda (see Illustration 1-2156-10) is connected with BIU 2 of the central system via the Terminal Unit and the Signal Processing Unit. The SPU supplies data from the Anaconda, via BIU 2, to the application function TAS running in the VAX. The data is processed in TAS and displayed on a GOS. The installation is operated by remote control from a GOS via the application function TAS.

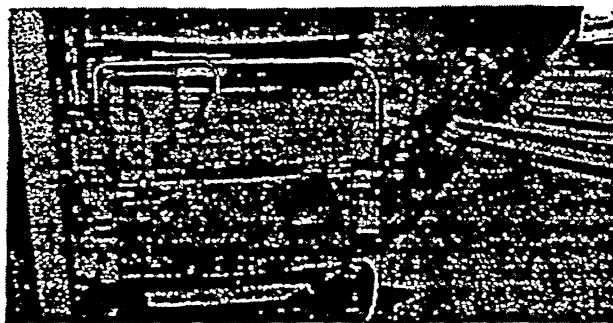
1.16.3.2. Integration at BSMI level

As well as integration in the central system the Towed Array Sonar installation is also integrated with the following BSMIs:

- 2325 Integrated Radio Intercom & Telephone sub-system
- 2411 Information Retransmission Installation

The audio signal from the Anaconda is sent from the Signal Processing Unit via an audio cable to the audio panels on the GOSs. The operator can listen to the sonar sound from the Anaconda via the audio panel on the GOS. The Anaconda is connected with the Information Retransmission Cabinet (IRC) in order to receive ship's data (log, course, roll and pitch).

- Hydraulic Power Pack (HPP) (see Illustration 1-2156-4); is the only part of the system which is not situated in the Tactas room but instead in the Starboard Steering machine room. The HPP drives the Winch, Handling Drum and Cable Layer Device.

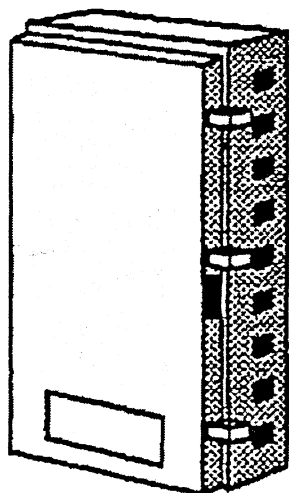


illus. 1-2156-4 Hydraulic Power Pack

1.16.2.3. Electronic Sub-system

The Electronic Sub-system has the following modes available:

- Normal mode; the Anaconda is fully operational
- Degraded mode; the Anaconda is partly operational
- Simulation mode; the Anaconda is used for simulation; simulated data only is sent to the SPU.
- Mixed Simulation mode; the Anaconda is used for simulation. Operational data is also sent through.
- Playback mode; recorded data is sent from the TMR to the SPU;
- Mixed play back mode; data from the TMR and from the Simulator is sent to the SPU.



illus. 1-2156-5 Signal Processing Unit

The Electronic Subsystem has the following parts:

- Signal Processing Unit Cabinet
- Terminal Unit
- Total Mission Recorder
- Remote Control Panel
- Repeater
- Hard Copy Recorder (two)

1.16.2.3.1. Signal Processing Unit

The Signal Processor Unit (SPU) (see Illustration 1-2156-5) processes the sonar signals step by step and also provides the interfacing with Data Handling. This unit is situated in OB instrument room 2 and has the following parts:

- Signal Processing (SPI), is the pre-processor for SP2 and provides Narrow Band (NB) and Broad-band (BB) Detection, DEMON analysis and Audio signal.

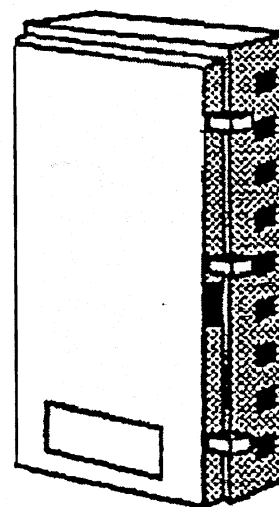
- Post Processing (SP2) handles automatic detection and tracking from NB and BB, processes the Ambient Noise and sends the data to the Hard Copy Recorder.
- Electromagnetic unit, controls on and off switching and various fault monitors.
- Sonar Master rack; controls the sonar status and management. This includes:
 - control and execution of the sonar modes
 - monitoring and localization of faults
 - interfacing with Data Handling

The SPU uses the following as interfaces:

- audio channel, directly to the audio panel on the GOS
- processed data, to the BIU for display purposes
- two hard copy channels

1.16.2.3.2. Terminal Unit

The Terminal Unit (TU) (see Illustration 1-2156-6) is situated in the OB instrument room 2 and is used for the interfacing between



illus. 1-2156-6 Terminal Unit

The array consists of the following parts:

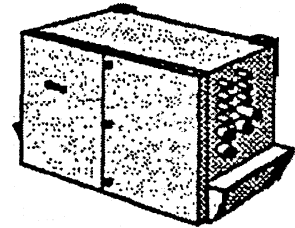
- Acoustic section consisting of:
 - 1 HF module (DD); this receives in the Narrow band 400-800 Hz and Broad band to 4000Hz. The HF module is about 27 m long and contains 46 hydrophones.
 - 2 MF modules (BC and CB); these receive in the Narrow band 100-400 Hz (together with the DD module). Each MF module is about 40 m long and contains 48 hydrophones, spread over 16 hydrophone groups.
 - 4 LF modules (AA); these receive in the Narrow band 10-100 Hz (together with the DD, BC and CB modules). Each LF module is about 27 m long and contains 32 hydrophones, spread over 4 hydrophone groups.
- Head Module (HM); this is about 20 m long and takes care of multiplexing all data so that it can be sent through the tow cable; it also contains a depth and course sensor and the power supply for the array goes through this module.
- Tail Module (TM); this is about 20 m long and contains a depth, course and temperature sensor. HM and TM together handle the synchronization and multiplexing of all data.
- Vibration Isolation Module (VIM); this is about 50 m long. The movement of the ship introduces low frequency mechanical vibrations in the tow cable. The VIM reduces the transfer of these vibrations of the tow cable to the array. This module stretches about 25 %.
- Anchoring Cable Fitting (ACF); this is for the electrical and mechanical connections between the array and the tow cable.

1.16.2.2. Winch and Handling Equipment

The Winch and Handling Equipment (WHE) operates the array sub-system and is situated in the Tactas room. The WHE is used to lower the wet-end and haul it back on board. This is possible at speeds up to a maximum of 16 knots and seas up to

sea state 5 (restrictions conform BWIS, MEDWD and MEDGES). The WHE has its own hydraulic power system and consists of the following parts:

- Electric Control Cabinet (see Illustration 1-2156-2); this supplies the electricity for the system and contains all controls which operate via a built-in Programmable Logic Computer.

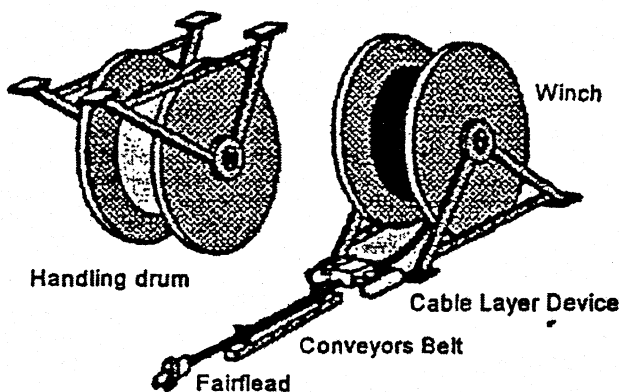


illus. 1-2156-2 Electric Control Cabinet



Remote control unit

- Winch: (see Illustration 1-2156-3); can accommodate 2500 m tow cable and an array of about 300 m. Handling drum; is used to store defect modules if there is a fault in the array and to replace the defective module by a reserve one, kept in bins along the walls of the Tactas room



- Remote Control Unit; a portable unit used to operate the winch and the Hydraulic Power Pack (HPP) at a distance. The unit also has an emergency stop control and various monitoring functions
- Cable Layer Device; placed on the deck and used to make sure that the array is wound on to the winch correctly
- Conveyors Belt; situated underneath the handling drum between the winch and the fairlead to move the array

Ill. 1-2156-3 Winch and handling Equipment

- Fairlead; is a guide to ensure that the array is dropped directly behind the ship and also wound back in in the same way. It also conducts the water that drops off the equipment away.

1.16. 2156 Towed Array Sonar installation (ANACONDA) SQR-02/00

1.16.1. General

The Towed Array Sonar installation (Anaconda) automatically detects acoustic signals with frequencies between 10 and 4000 Hz. The sensor of the Towed Array Sonar installation is a towed array that is set up for receiving underwater noise. The system can apply demodulation (Demon analysis) to the signals received. After processing the signals the information can be made available to the operator for classification in various forms. The underwater noise to be classified can come from all mechanically operated means of propulsion (such as: nuclear, diesel or electrical propulsion, auxiliary machinery and the brief use of rudders for example). Every object, in which there is interest, has its own acoustic signature (fingerprint) so that classification is possible. Display is made using an A-scan (amplitude/ bearing or amplitude/frequency) and a B-scan (time/ bearing or time/frequency).

The Towed Array Sonar installation carries out the following primary functions:

- Detection of sound sources in a wide band and narrow band spectrum and within a maximum of three frequency ranges to be set between 10 and 800 Hz (threat verniers)
 - Localization and tracking:
 - automatic via the ADT process;
 - broad band (max. 15 tracks)
 - narrow band (max. 750 tracks)
 - manual via verniers; max. 12 frequency ranges to be set between 10 and 800 Hz
 - classification of contacts:
 - via audio channel; between 50 and 4000 Hz
 - via so-called LOFAR analysis; five verniers on swivelling bundles in the frequency range between 10 and 800 Hz
 - DEMON analysis on four channels; each channel analyses in a frequency range from max. 400 to 4000 Hz via four bundles which can be swivelled either manually or automatically.
 - Support:
 - surroundings noise measurements
- Total Mission Recorder
- simulation
 - Built In Test Equipment (BITE)
 - array module tester.

The application function TAS is responsible for the operation and display of the Anaconda.

An overview of the Towed Array Sonar installation is given in Illustrations 1-2156-10 and 1-2156-11.

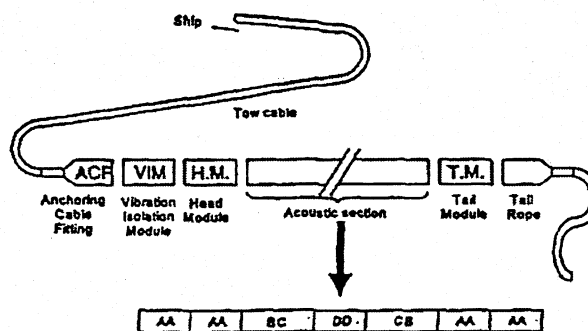
The system consists of the following parts

- Array Sub-system
- Winch and Handling Equipment
- Electronic Sub-system

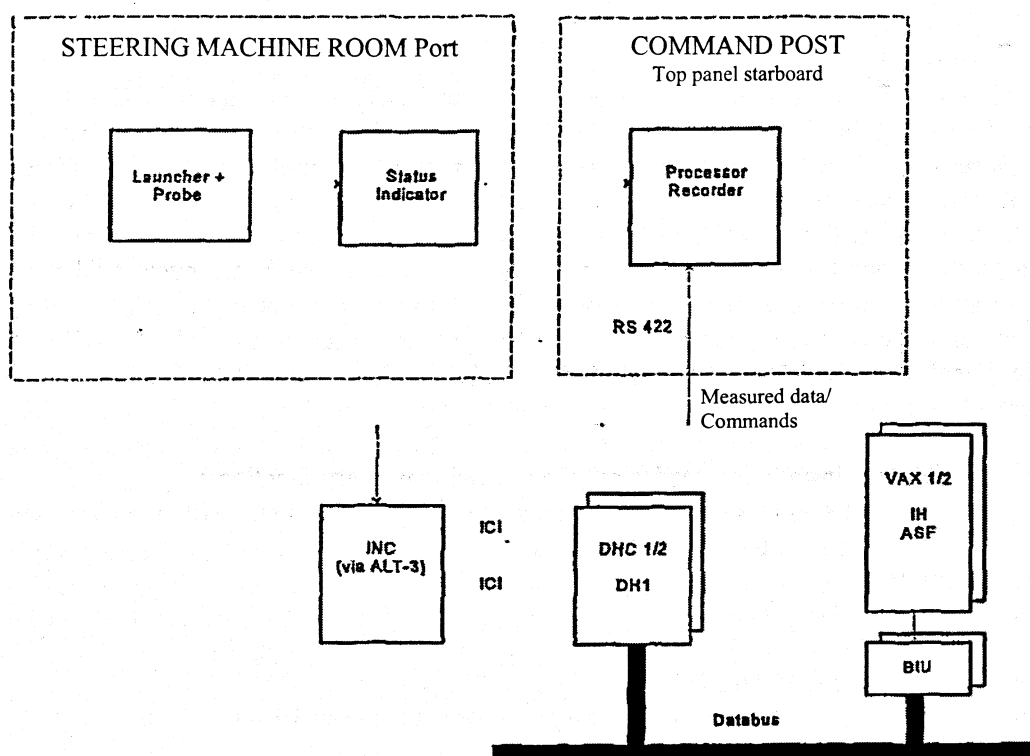
1.16.2. Equipment

1.16.2.1. Array Sub-system

The Array Sub-system (see Illustration 1-2156-1) consists of a tow cable and an array. The array is an opaque hose formed from ten modules and a tail rope. The tow cable is about 2500 m long and the array about 300 m



illus. 1-2156-1 Array sub-system



illus. 1-2154-4 Overview

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1.15. 2154 Expandable Bathythermograph System

5.1. General

The purpose of the Expandable Bathythermograph System (XBT) is to determine the profile for the speed of sound underwater. The XBT measures the speed of sound underwater as a function of the depth either directly or indirectly. The measurement is carried out using a probe which is lowered into the water and gradually sinks to the seabed. The speed of sound profile is necessary for the sonar systems on board the M frigate. Two different measurements can be made using the XBT:

- Direct measurement using an XSV probe which measures the profile of the underwater speed of sound directly
- Indirect measurement using an XBT probe which measures the temperature as a function of the depth. The system converts the temperature depth profile to an underwater speed of sound profile according to the salinity of the water.

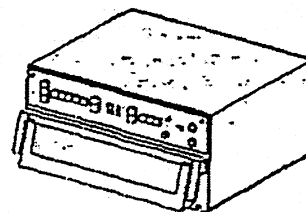
An overview of the XBT is given in Illustration 1-2154-4. The XBT consists of the following parts:

- Processor Recorder
- Status Indicator
- Launcher with probe

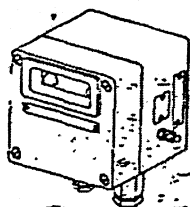
M5.2. Equipment

1.15.2.1. Processor Recorder

The Processor Recorder (see Illustration 1-2154-1) contains electronic circuits for system control, processing and recording. The Processor Recorder calculates the speed of sound profile from the temperature, salinity and the depth or measures this directly using the XSV probe. The Processor Recorder also plots the speed of sound profile on a paper roll.



illus. 1-2154-1 Processor Recorder



illus.

Indicator

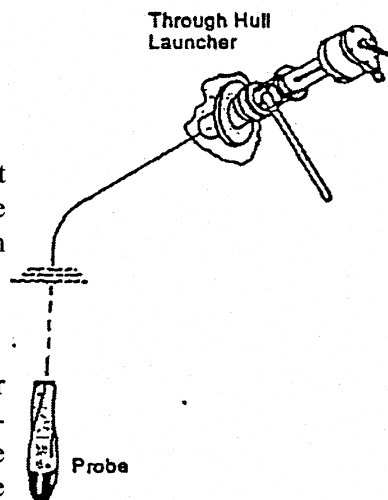
1.15.2.2. Status Indicator

The Status Indicator (see Illustration 1-2154-2) forms the interface between the Processor Recorder and the Launcher. Lights on the Status Indicator show whether the operator can launch a new probe or reload a probe.

1-2154-2 Status

1.15.2.3. Launcher with probe

The probe can be dropped out of the ship from Engine Room Port using the Launcher LM4A (see Illustration 1-2154-3). The probe sinks to the seabed and remains connected to the launcher by a thin cord until the measurement has been completed.



illus.. 1-2154-3 Launcher met probe

1.15.3. Integration in the central system

The Processor Recorder is connected with the Interface Computer (Data Handling Cabinet) of the central system (see Illustration 1-2154-4). Data Handling can access the measured data from the Processor Recorder and send this to IH/ASF. Interfacing takes place via a RS-422 balanced line full duplex.

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1.14. 2153 Sea surface Temperature Recorder (SONAR 2013)

1.14.1. General

The Sea Surface Temperature Recorder (Leeds & Northrup) is an autonomous system for measuring the surface temperature of the sea water. The results are plotted on a paper roll. If there is a sudden particular temperature change a code is printed on the roll showing the temperature, place, date and time of the measurement. An overview of the Sea Surface Temperature Recorder is given in Illustration 1-2153-4. The Sea Surface Temperature Recorder consists of the following parts:

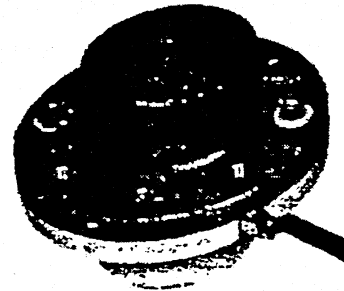
- Hull-mounted Sensor
- Temperature Recorder

1.14.2. Equipment

1.14.2.1. Hull-mounted Sensor

The Hull-mounted Sensor (see Illustration 1-2153-1) is situated in the forepeak 1.2 metres under the waterline (see Illustration 1-2153-3). Temperature measurement has sensitivity of 0.2 °C and the temperature range can be set between:

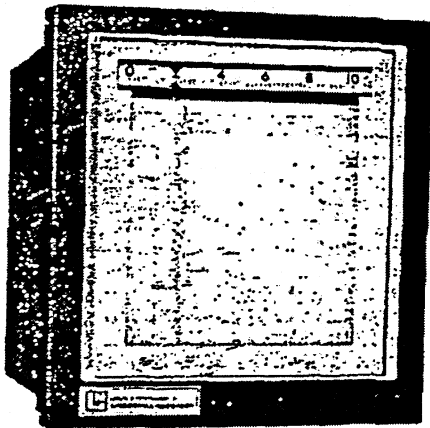
- -2 to 25 °C
- 13 to 40 °C



illus. 1-2153-1 Hull-mounted Sensor

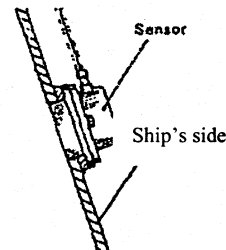
1.14.2.2. Temperature Recorder

The Temperature Recorder (see Illustration 1-2153-2) is situated in the Command Post in the top starboard panel. The temperature of the sea water is plotted by this recorder. The paper speed is 1 inch per hour

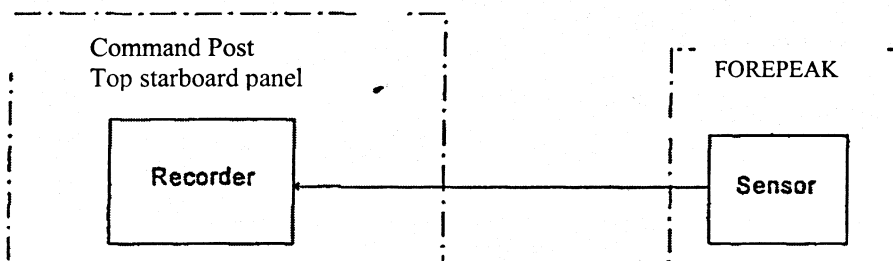


illus. 1-2153-2 Temperature Recorder

1.14.3. Integration The Sea surface Temperature Recorder is not integrated.



illus. 1-2153-3 Position of Sensor

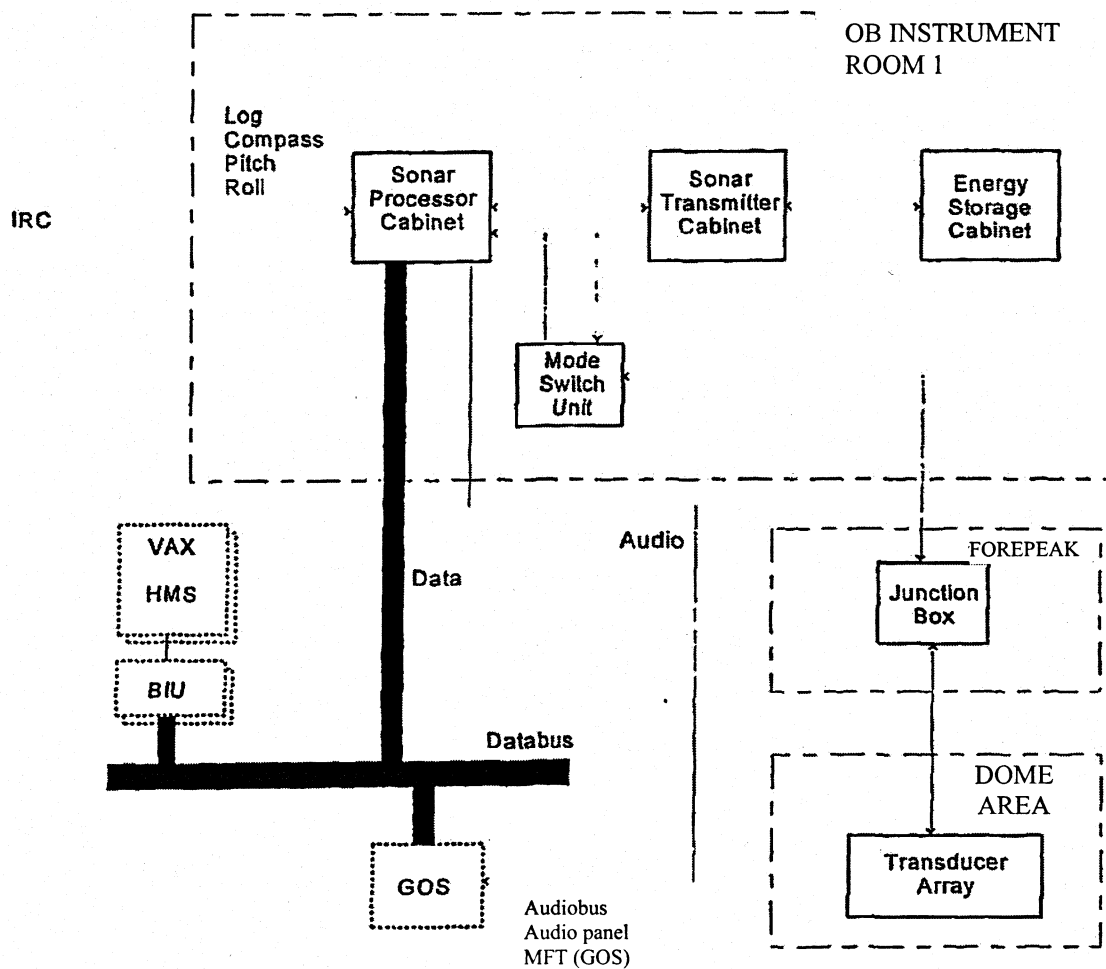


illus. 1-2153-4 Overview

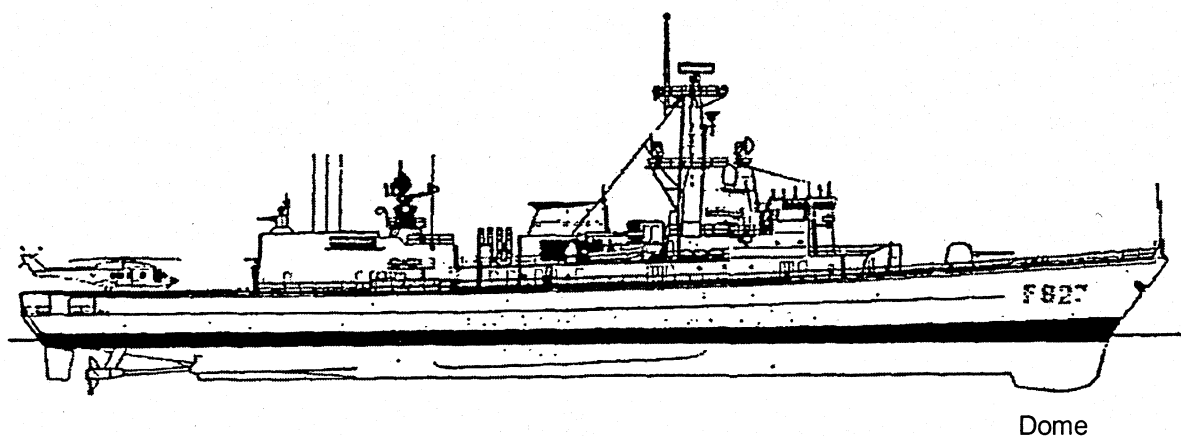
1.13.3.2. Integration at BSMI level

As well as integration in the central system the sonar installation is integrated with the following BSMIs:

- 2325 Integrated Radio Intercom and Telephone sub-system (GRIT)
- 2411 Information Retransmission Installation

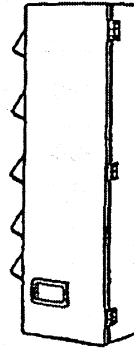


ilus. 1-2151-7 Overview

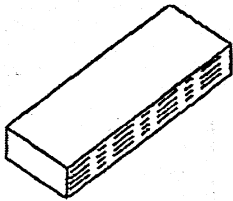


illus. 1-2151-8 Position of Dome

1.13.2.4. Mode Switch Unit (MSU) The front-end processing organizes the manner of matching and switching in the Mode Switch Unit (see Illustration 1-2151-4). The MSU consists of a Signal Conditioning Unit (SCU), the Dual Replay And Matching Unit (DRAMUs) and a Control Panel. The MSU makes it possible to use the transducer for transmitting/receiving with broad and narrow vertical bundles. The unit can be operated using the Control Panel and it is also possible to carry out maintenance and diagnosis.



illus. 1-2151-4 Mode Switch Unit



illus. 1-2151-5 Junction Box

1.13.2.5. Junction Box

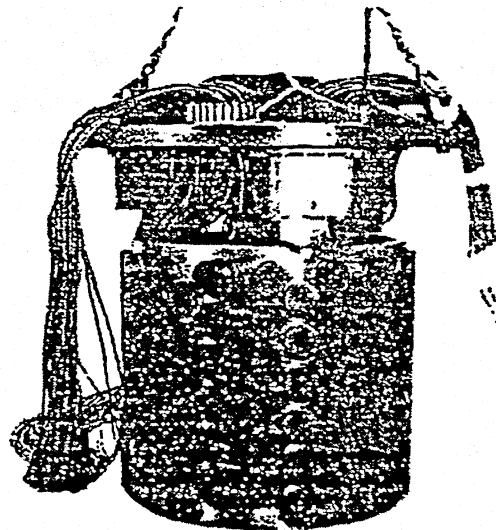
The Junction Box (see Illustration 1-2151-5) connects the Mode Switch Unit with the Transducer Array. The Junction Box reduces the number of cables needed between the Transducer Array and the Mode Switch Unit. The cables are connected in such a way that the vertical bundle width of the transducer array can be set by using 3 or 6 hydrophones.

1.13.2.6. Transducer Array

The Transducer Array (see Illustration 1-2151-6) converts the electrical energy into acoustic energy and visa versa. The Transducer Array can be operated in the following modes:

- Wide beam mode (full stave), for maximum distance
- Narrow stave mode, (half stave) voor echo monitoring, poor weather conditions and short range

The Transducer Array is a cylindrical array consisting of 32 staves each with 6 elements placed in the DOME space (see Illustration 1-2151-8). The DOME space is filled with filtered sea water under a pressure of two bar.



illus. 1-2151-6 Transducer Array

1.13.3. Integration

1.13.3.1. Integration in the central system

The PHS-36 is connected directly with the databus. The software running in the PHS-36 supplies the sonar data via the databus and the BIU to the Software Function HMS in the VAX where the data is processed and displayed.

The audio signal from the PHS-36 is also sent by audio cable to the audio panels of the GOSs. The operator can use the audio panel to listen to the sonar sound from the PHS-36.

The PHS-36 is also connected to the Information Retransmission Cabinet (IRC) in order to receive the ship's data (log, course, roll and pitch).

The PHS can be operated from a GOS or locally.

Versa Module Europa (VME) rack.

The SPPU carries out the sonar pre-processing functions, such as:

- FM, CW and passive pre-processing
- audio pre-processing
- processing of distance parameters

The AUX carries out the auxiliary processing functions, such as:

- alarm detection
- passive processing
- audio processing
- central timing
- generating and entering test signals

The VME carries out the other sonar processing functions, such as:

- system control
- recording and replay
- computer aided detection and tracking
- built-in testing
- interface with data handling
- interface with communication system
- interface with the IRC

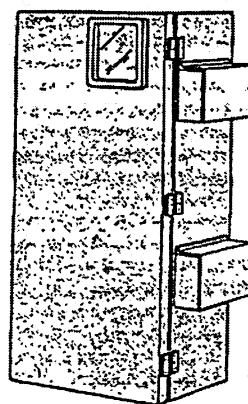
1.13.2.2. Sonar Transmitter Cabinet (STX)

The Sonar Transmitter Cabinet (see Illustration 1-2151-2) handles:

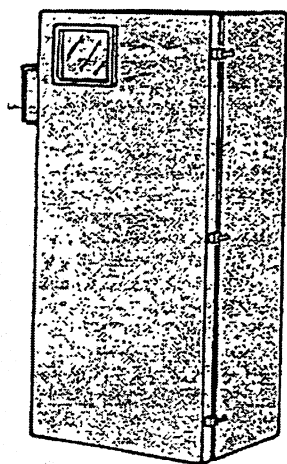
- generating the transmission pulse (CW, FM or CW/FM)
- formation of the bundle
- local power supply
- control of the transmitter

The Sonar Transmitter Cabinet contains the following parts:

- Print rack
- Dual Output Modules (DOM)
- Constant Power Converter (CPC)



illus. 1-2151-2 Sonar Transmitter Cabinet



Illus. 1-2151-3 Energy Storage Cabinet

1.13.2.3. Energy Storage Cabinet (ESC)

The Energy Storage Cabinet (see Illustration 1-2151-3) is a power buffer which supplies the power needed for transmitting the long FM/CW-pulses, so that the ship's power network does not become overloaded. The ESC consists of seven identical Sonar Energy Storage Units (SESU).

1.13. 2151 Sonar installation PHS-36

1.13.1. General

The Panoramic Hull-mounted Sonar (PHS-36) automatically detects underwater contacts using active transmissions. The PHS-36 also has the possibility of receiving noise in passive mode and applying modulation to this. Underwater contacts are detected and displayed on a GOS automatically. The main functions of the PHS-36 are:

- Active detection of contacts (details of bearing, location, distance, Doppler and target strength)
- Passive analysis of sounds for classification purposes (details of bearing location and frequency)
- Passive noise analysis
- Automatic tracking of selected contacts

In active mode the:

- transmission frequency is 6.5 or 7.5 kHz
- transmission mode is CW, FM or FM/CW
- transmission type is omni-directional (OMNI) or directional (DIR) or variable OMNI/DIR

The following bands are available in the passive mode:

- band I (1.5-3.5 kHz)
- band II (4.5-10.5 kHz)
- DEMON (DA)

The PHS-36 has two identical processors which can work in either active or passive mode independently of each other. If only one processor is being used it is termed single mode and if both are in use the term is multi mode. The FM, CW and passive modes can all be carried out in single mode while FM/CW, FM/passive, CW/passive and passive/passive modes can be carried out in multi mode.

The PHS-36 supplies active sonar data (alarms, traces, tracks and passive data) to the application function HMS running in the VAX. Alarms are single echoes and traces, which are echoes from a target which can be correlated using ping to ping. The PHS-36 can generate and maintain a max. of 50 CW and 50 FM traces and track a max. of 12 targets (HMS-AT-tracks). The application function HMS processes the contact data from the PHS-36. An HMS track which is updated once per transmission cycle can be coupled to a trace. When a target is assigned to a PHS-36 track channel the update frequency is 1 Hz.

Noise received by the PHS-36 is displayed by HMS on a GOS, as an increased intensity level. The noise can be modulated for classification purposes.

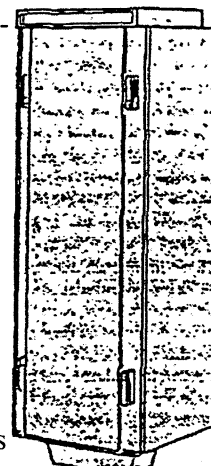
An overview of the PHS-36 is given in Illustrations 1-2151-7 and 1-2151-8. The PHS-36 consists of the following parts:

- Sonar Processing Cabinet
- Sonar Transmitter Cabinet
- Energy Storage Cabinet
- Mode Switch Unit
- Junction Box
- Transducer Array

1.13.2. Equipment

1.13.2.1. Sonar Processing Cabinet (SPC)

The Sonar Processing Cabinet (see Illustration 1-2151-1) contains two Standard Signal Processing Units (SPPU), an Auxiliary Processing Unit (AUX) and a



illus. 1-2151-1 Sonar Processing Cabinet

1.12.2.4.1. Detecting Unit MK28NH

There are two Detecting Units of this type on board (see Illustration 1-2141-3). These Detecting Units are connected with two warning channels and provide low-level warning. They measure the amount of radioactivity around the ship. One measures the radioactivity level in the air (top deck rib 111-121) and the other measures the amount of radioactivity in the water (pump room drinking water).

1.12.2.4.2. Detecting Unit MK 29NH

There are five Detecting Units of this type on board (see Illustration 1-2141-3). These Detecting Units are connected with five control channels and provide high-level warning. They measure the amount of radioactivity in the atmosphere in and around the ship in the following places:

- Command Post
- Gantry (shelter 3)
- Technical Area
- NTB (shelter 1)
- Top deck (rib 111-121)

1.12.3. Integration

The Radiac installation is connected with the IVS system via seven current loop interfaces (one interface per Detecting Unit), so that the measured doses can be displayed in the TC and on the CDT IVS screen.

1.12. 2141 Radiac installation Mk 22 NRS

1.12.1. General

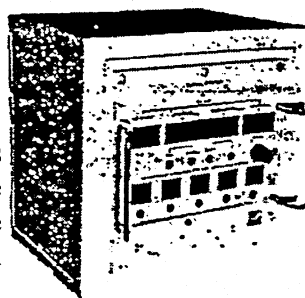
The Radiac installation is used to detect radiation from radioactivity in and around the ship. A High-level warning (0-99 rad/h) applies in the ship and a Low-level and High-level warning (0-999 mrad/h) around the ship. An overview of the Radiac installation is given in Illustration 1-2141-4. The Radiac installation consists of the following parts:

- Indication Unit
- Power Unit
- Simulator
- Detecting Units

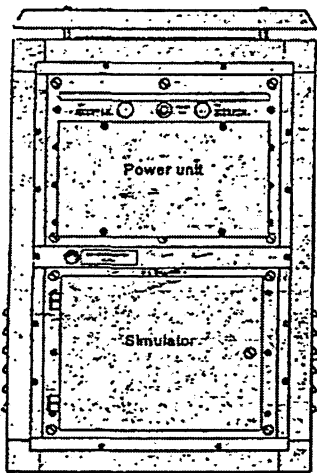
1.12.2. Equipment

1.12.2.1. Indication Unit

The Indication Unit (see Illustration 1-2141-1) receives pulses from the Detecting Units via warning and control channels. The pulses received are processed and counted per time period. The radiation dose per time period is converted to mrad/h and shown on a display unit. The time period for a warning channel is 6.67 s and for a control channel 4.76 s. If the levels are exceeded a warning is sounded in the Command Post.



illus. 1-2141-1 Indication Unit



illus. 1-2141-2 Power and Simulator Unit

1.12.2.2.

Power Unit

The Power Unit (see Illustration 1-2141-2) supplies +17 and +5V for the Radiac installation.

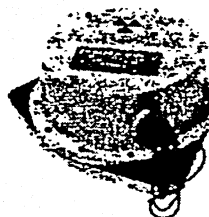
1.12.2.3. Simulator

The Simulator (see Illustration 1-2141-2) generates test signals to simulate fallout conditions. The Simulator is used for training and exercises. Various pulse patterns can be generated via software programmes.

1.12.2.4. Detecting Units

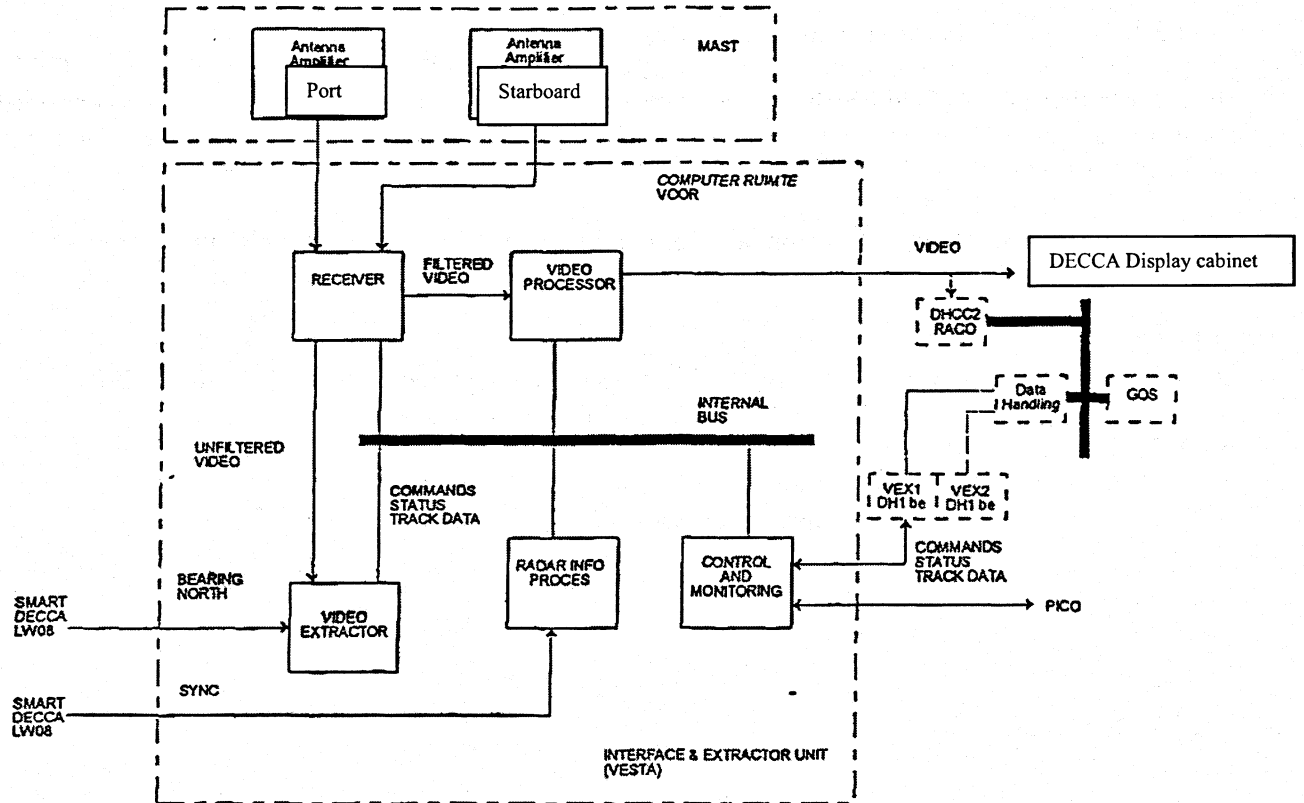
There are two types of Detecting Unit in a Radiac installation - a high-level warning and a low-level warning Detecting Unit. The sensitivity of a low-level unit is a thousand times greater than that of a high-level unit. The two types of Detecting Units are:

- Detecting Unit MK 28NH (low-level)
- Detecting Unit MK 29NH (high-level)



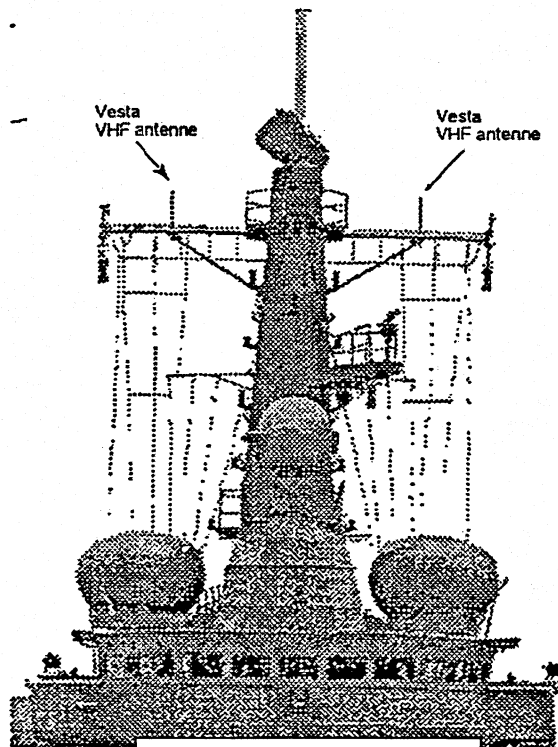
qfb. 1-2141-3 Detecting Unit

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illus. 1-2127-3 Overview

afg. 1-2127-3 Overzicht



illus. 1-2127-4 Sensors

1.11.3. Integration

1.11.3.1. Integration in the central system

The Video Processor is connected by means of a coax cable to the Data Handling Computer Cabinet 2 (RACO) (see Illustration 1-2127-3) in which the video signals are processed. Control and Monitoring is connected to the Sensor Management Cabinet (SMC) by an ICI connection. The information received and calculated (position, speed and code) is sent to Data Handling Function DH1, via the SMC (VEX1), for plot display.

The VESTA is remote controlled from a GOS, via the same ICI interface. It is also possible to select VESTA video by means of a switch above the DECCA display cabinet.

1.11.3.2. Integration at BSMI level.

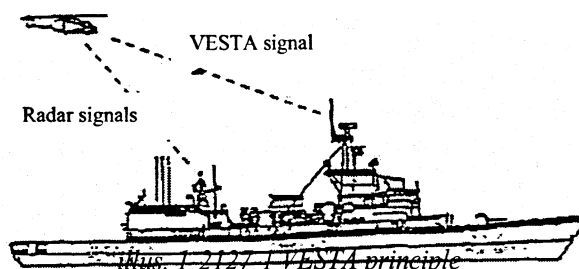
As well as integration in the central system the VESTA is integrated with the following BSMIs:

- 2111 Radar Search and Localize Receiver APECS II
- 2122 Sea warning radar installation DECCA
- 2123 Air warning radar installation LW-08/02
- 2124 Target acquisition radar installation SMART

1.11. 2127 Helicopter control installation (VESTA) SRQ-11/00

1.11.1. General

The Helicopter control installation (VESTA) is a semi-active position determining and identification system for helicopters designed for use by the ships. When directed by radar from the ship, problems occur caused by the small radar reflecting surface and the present. The VESTA (VERSatile helicopter TrAns-system), which makes better observation and the helicopter on the radar system possible, has to solve this problem. The VESTA has two parts helicopter



helicopters are which are sea clutter ponder direction of been designed a

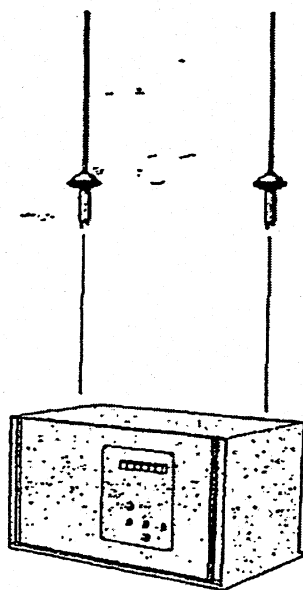
and a ship's part. The helicopter part consists of a

transponder which is activated by every radar pulse received and responds to this by producing a VHF answer signal with recognition code (see Illustration 1-2127-1). This VHF signal is detected by the ship's part on board and displayed on a screen to show the position of the helicopter. A maximum of 5 codes are available for recognising helicopters and it is also possible to work without using a code. The VESTA video and the plot codes can be displayed on the GOSs (secondary RACO video) and on the DECCA cabinet in the Command Post. Display is only possible in combination with the video from the LW-08, SMART or DECCA radar. The VESTA system can be remote controlled using the Software Remote Control Panel on the GOS. The range of the VESTA system depends to a large extent on the flying height of the helicopter but is generally not more than 40 NM (VHF range).

An overview of the VESTA (ship's part) is given in Illustrations 1-2127-3 and 1-2127-4. The VESTA on board consists of the following parts:

- VHF Antenna and Amplifier
- Interface and Extractor Unit

1.11.2. Equipment



illus. 1-2127-2 VESTA system Receiver

1.11.2.1. VHF Antenna and Amplifier

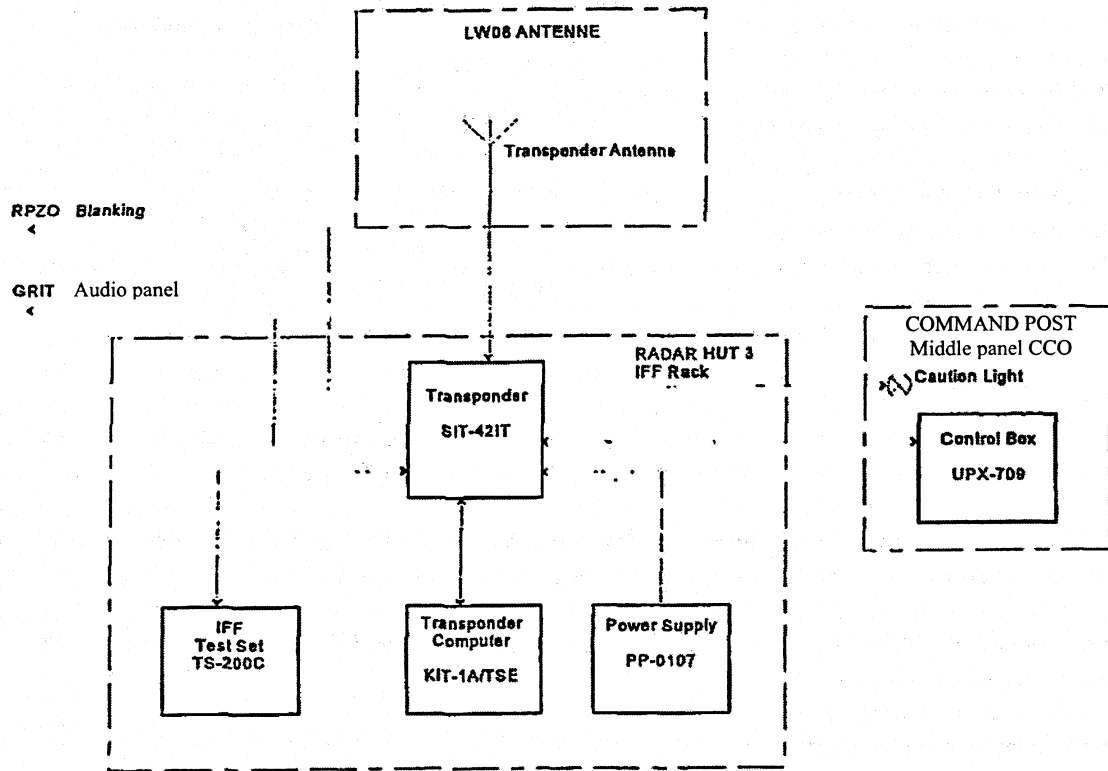
These are two omni-directional VHF antennas (see Illustrations 1-2127-2 and 1-2127-4) with built in amplifier, mounted on the port and starboard yard, for receiving the transponder signal.

1.11.2.2. Interface and Extractor Unit

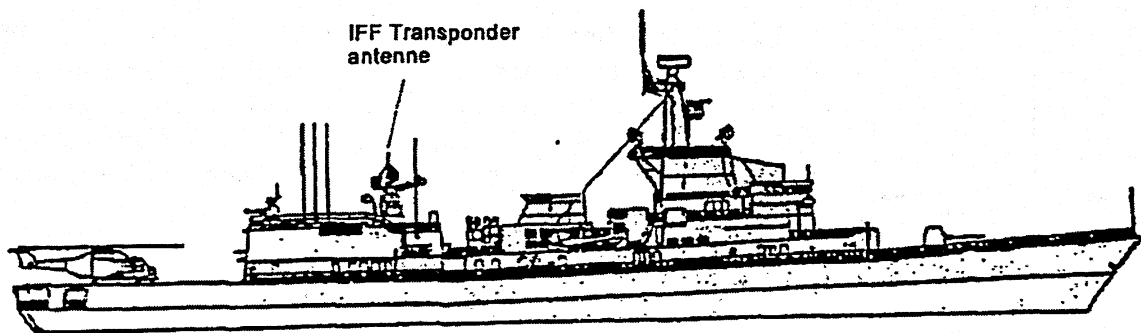
This unit (see Illustration 1-2127-2) is situated in the Computer room SEWACO Fore. The Interface and Extractor Unit contains a

- Basic VESTA part; this identifies and decodes the transponder signal and converts this to a video and code signal for display purposes. This part consists of a:
 - Video processor
 - Radar info processor
 - Control and Monitoring

- Video Extractor part; this establishes the position and speed of up to 5 helicopters by means of an unfiltered video signal and the timing signals from the Basic VESTA part and the bearing and north reset pulses from the primary radar selected at that moment

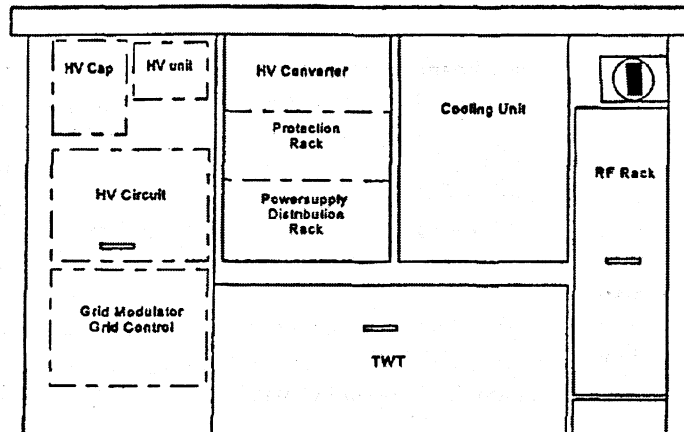


illus. 1-2126-4 Overview



illus. 1-2126-5 Sensor

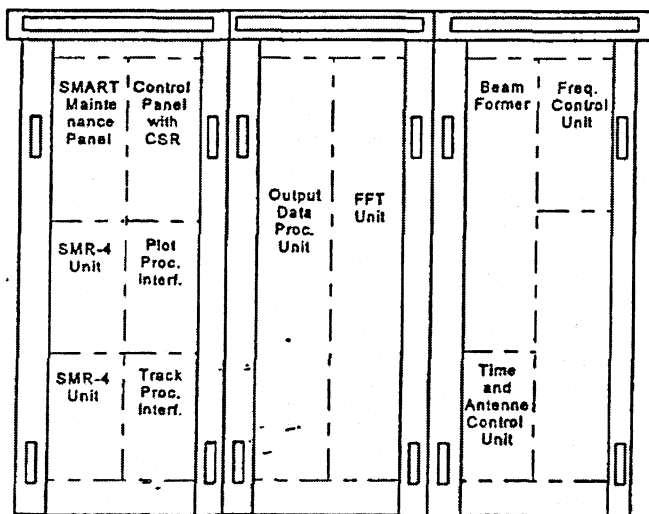
- RF Rack, containing RF components such as a circulator, waveguides and a waveguide switch
- Protection Rack, monitors all parts for safe working
- Power Supply and Distribution Rack, provides power to all parts in the Transmitter Cabinet
- Cooling Unit (cooling system with demineralized water) for cooling the high power components



Illus. 1-2124-2 Transmitter Cabinet

1.8.2.3. Processing Cabinet

The Processing Cabinet (see Illustration 1-2124-3) analyses the data received from the receiver in the antenna and converts this data to video and track reports for Data Handling. The Processing Cabinet also carries out the interfacing between the SMART and the external systems for control and monitoring purposes. The Processing Cabinet contains the following functions (see Illustration 1-2124-5):



Illus. 1-2124-3 Processing Cabinet

- Timing frequency and antenna control function, achieved by: Frequency Control Unit; this generates the RF transmission signal, control pulses for the transmitter, reference and clock signals and test and calibration signals.
- Timing and Antenna Control Unit; control of the RF transmission signal, supply of the timing signals for SMART, control of the antenna platform stabilization and control of the bearing drive
- Beam former function; achieved by a 16 points Fast Fourier Transformation (FFT) Beam former. This generates elevation oriented data by analysing the phase difference between the 16 receiver channels coming from the receivers in the antenna.

FFT processor function; achieved by a (Doppler) FFT Unit, consisting of two Doppler modules. Each module processes six elevation bundles. The unit establishes the phase shift caused by the speed of the target.

Output data processor function; this is a multi processor system achieved with the Output Data Processor Unit and has the following functions:

- video detection (hits)
- sub-clustering of the hits per burst and clustering of the sub-clustering
- separate video for the FC window
- establishing the target parameters
- control of the data speed to the Plot and Track Processor

1.8. 2124 Target Acquisition radar installation (SMART) DA-08/6LS

1.8.1. General

The Signal Multi-beam Acquisition Radar for Targeting (SMART) is a 3D radar. The SMART operates in the F-band and is used for building up the air and sea image for acquisition of targets. The SMART is equipped with a fully stabilized lightweight antenna, a very good suppression of the antenna side lobes, an accurate and completely 3D information output, a Doppler FFT (Fast Fourier Transformation) and an integrated and fully automatic detection, initiation and tracking system. The SMART can be operated locally and by remote control using the Software Remote Control Panel on the GOS display. SMART's tasks are:

- air warning with automatic detection, initiation and 3D-tracking of air targets
- sea warning with automatic detection, manual or automatic surface target initiation and automatic tracking
- support for cannon fire through FC window control (FC surface window & FC splash window)

The general details of SMART are:

- maximum range for air targets 120 km
- maximum range for sea targets 40 km
- track capacity is 160 air tracks and 40 surface tracks
- transmission modes: Fixed frequency and frequency agility in the F band (3100-3500 MHz)

1.8.2. Equipment

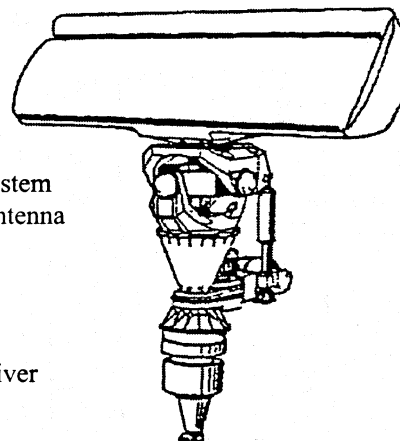
An overview of the SMART is given in Illustrations 1-2124-5 and 1-2124-6. The SMART consists of the following parts:

- Antenna
- Transmitter Cabinet
- Processor Cabinet
- Hydraulic Power Unit

1.8.2.1. Antenna

The antenna (see Illustration 1-2124-1) consists of an antenna system with hydraulically stabilized platform and a bearing drive. The antenna system consists of a radome containing:

- Transmit Antenna; an array of horns
- Receiver Antenna consisting of an array with 16 antenna-elements on the top of the transmission antenna
- Receiver with 16 receiver channels, placed behind the Receiver Antenna



Illus. 1-2124-1 Antenna

1.8.2.2. Transmitter Cabinet

The Transmitter Cabinet (see Illustration 1-2124-2) amplifies the incoming RF signal (coming from the timing, frequency and antenna control function in the Processing Cabinet) to a high power RF signal suitable for transmission via the transmission antenna. The nominal peak power is 145 kW. The Transmitter Cabinet contains the following parts:

- TWT, amplifies the RF input signal to a 100 kW transmission signal
- High Voltage Supply, required for the TWT consisting of a:
 - HV Converter
 - HV Unit
 - HV Capacitor
 - HV Circuit
- Grid (pulse) Modulator, generates grid pulses for activating and blocking the RF pulse output signal

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Priority for	interrogation method determined by	
	within the sector	outside the sector
Data Handling	Data Handling	no interrogation
none	Data Handling	IFF Decoder Panel
IFF Decoder Panel	IFFDecoder Panel	IFF Decoder Panel

Table 1-2125-1 Priorities

1.9.3.2. Integration at BSMI level

As well as integration in the central system, the IFF Interrogator installation is integrated with the following BSMIs:

- 2111 Radar Search and Localize Receiver APECS II
- 2123 Air warning installation LW-08/02

Two coax cables run between the IFF rack and the intermediate panel AC in the Command Post for test purposes.

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- Plot and track processor function; the two units work together closely forming the Plot and Track Processor with the principle task of the acquisition and tracking of air and sea targets and interfacing with Data Handling.

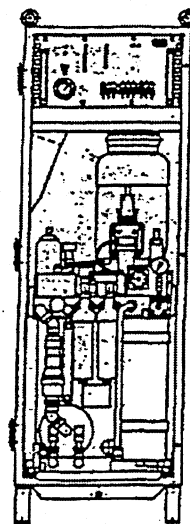
The Processor Cabinet also contains a:

- SMART Maintenance Panel (SMP); provides local control, monitoring and test facilities
- Control Panel with cassette recorder; this is used for loading test software in the Track and Plot Processor

1.8.2.4. Hydraulic Power Unit

The Hydraulic Power Unit (HPU) (see Illustration 1-2124-4) supports the hydraulic platform stabilization. The HPU also contains interface functions between the Time and Control Unit and the bearing drive and the hydraulic system. The HPU consists of 3 units:

- Control Panel; switches and indicators for operational functions and indication of faults
- Control Relays Unit; for switching on, for protection and the interface function of the Time and Control Unit
- Pump Unit; for the hydraulic system



III. 1-2124-4 HPU

1.8.3. Integration

1.8.3.1. Integration in the central system

The SMART is connected via the databus via the Trackprocessor (SMR4) and the accompanying BICL (see illustration 1-2124-5). SMART supplies tracks and status requests to DH through this interface and the SMART can be operated from a GOS. The ODP also supplies separate video (log video and signal from one antenna bundle (stripline)) to the RACO.

1.8.3.2. Integration at BSMI level

As well as integration in the central system, the target acquisition radar installation SMART is also integrated with the following BSMIs:

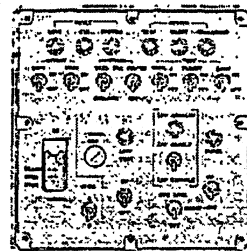
- 2111 Radar Search and Localize Receiver APECSII
- 2127 Helicopter control Installation VESTA
- 2411 Information Retransmission Installation

1.9.2.2. Interrogator Computer KIR-IA/TSEC

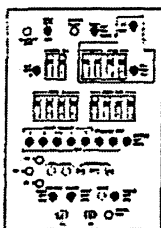
The Encoding Computer KIR-IA/TSEC allows the use of mode 4. The Encoding Computer is situated in the IFF rack (see Illustration 1-2125-2). The KIR is provided with an encoding code by a KIK 18 which is a key with which the code for the day can be set for mode 4.

1.9.2.3. Interrogator Set Control C-5441/TPX-54 (V)

The Interrogator Set Control (see Illustration 1-2125-3) is fitted with a number of monitoring lights and switches for checking and operating different parts of the interrogator. The monitoring lights and switches have the following functions: Fault indicators, Status indicators, Bypass, Video and Test functions.



Illus. 1-2125-3 Interrogator Set Control



1.9.2.4. Decoder with alarm monitor

The decoder (see Illustration 1-2125-4), which is situated in the Command Post, provides a video signal for display on a GOS. The decoder also operates the interrogation (in the different modes) and the display, decoding and selecting of IFF answer signals. The video signal is digitalized in the RACO. The alarm monitor reacts to the following special IFF codes:

- code 7500 for aircraft hijacking
- code 7600 for communication fault
- code 7700 for general emergency signal
- four times the bracket pulses for military emergency signal.

Illus. 1-2125-4 Decoder with Alarm Monitor

1.9.2.5. Test antenna

The Test antenna is situated on the front of the funnel and is connected with the Interrogator via the IFF rack. This antenna is used for test purposes.

1.9.3. Integration

1.9.3.1. Integration in the central system

The IFF video is sent to the RACO (secondary video) and the IFF reply video to the SMC (see Illustration 1-2125-5). The IFF Interrogator radar installation supplies video signals which are processed by:

- the IFF Video Extractor in the SMC and then converted to IFF plots, which can be displayed if desired on GOSs as secondary plot alongside a primary LW plot being displayed. The IFF info is further processed in DH for code reading on tote.
- the RACO and then converted to radar video, which can be displayed if desired on GOSs as IFF data above the primary plot being displayed.

The IFF Interrogator can receive Mode Challenge signals from DH via the Video Extractor which show in which mode interrogation is to take place. Setting the Mode Challenge takes place from Data Processing or via the IFF Decoder Panel with the priorities as shown in Table 1-2125-1.

1.9. 2125 IFF Interrogator radar installation SPX-01/00

1.9.1. General

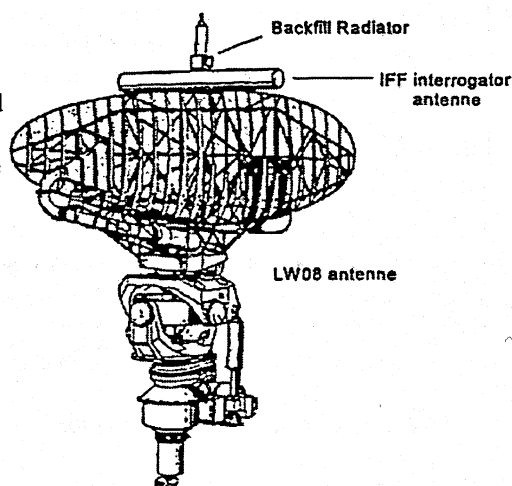
The IFF Interrogator forms part of the Identification Friend or Foe (IFF) system. The IFF system can be used for establishing the identity of ships and aircraft and the height of aircraft. The two most important parts of the IFF system are the interrogator and a transponder (BSMI 2126). The interrogator sends out interrogation signals (pulse coded) to the target (ship or aircraft) that in turn sends back an answer via an own transponder (pulse coded). The code for the answer signal is not known to the enemy. In order to prevent the transponder in the aircraft being activated or triggered by any other signal than the IFF interrogation signals, the IFF interrogation signal has a particular coded format which is termed the "mode of interrogation". The IFF system has the following modes which can be distinguished by the length of the pulse:

- Mode 1 (military), for identification. For example, an air defense mission
- Mode 2 (military), for identification. For example, type of aircraft and/or base
- Mode 3/A (military/civil), for air traffic control organization. For example, an air base
- Mode C (military/civil), identification with height information
- Mode 4 (military), code protected identification.

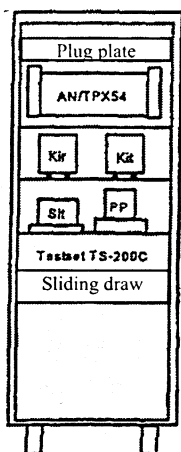
The Interrogator radar installation sends out the pulse coded interrogation signal via the IFF interrogator antenna which turns with the LW-08 antenna (see Illustration 1-2125-1). A Backfill Radiator is placed on the LW-08 antenna for omni-transmissions of P2. The transponder responses received are sent to the RACO and the SMC. The IFF video image can only be displayed in combination with the radar image from the LW-08. The Interrogator radar installation consists of a transmission and a receiver part. An overview of the Interrogator radar installation is given in Illustrations 1-2125-5 and 1-2125-6.

The Interrogator radar installation consists of the following parts:

- Interrogator AN/TPX-54
- Interrogator Computer KIR-1A/TSEC
- Interrogator Set Control C-5441/TPX-54 (V)
- Decoder group with alarm monitor
- Test antenna



Illus. 1-2125-1 IFF Interrogator Antenna

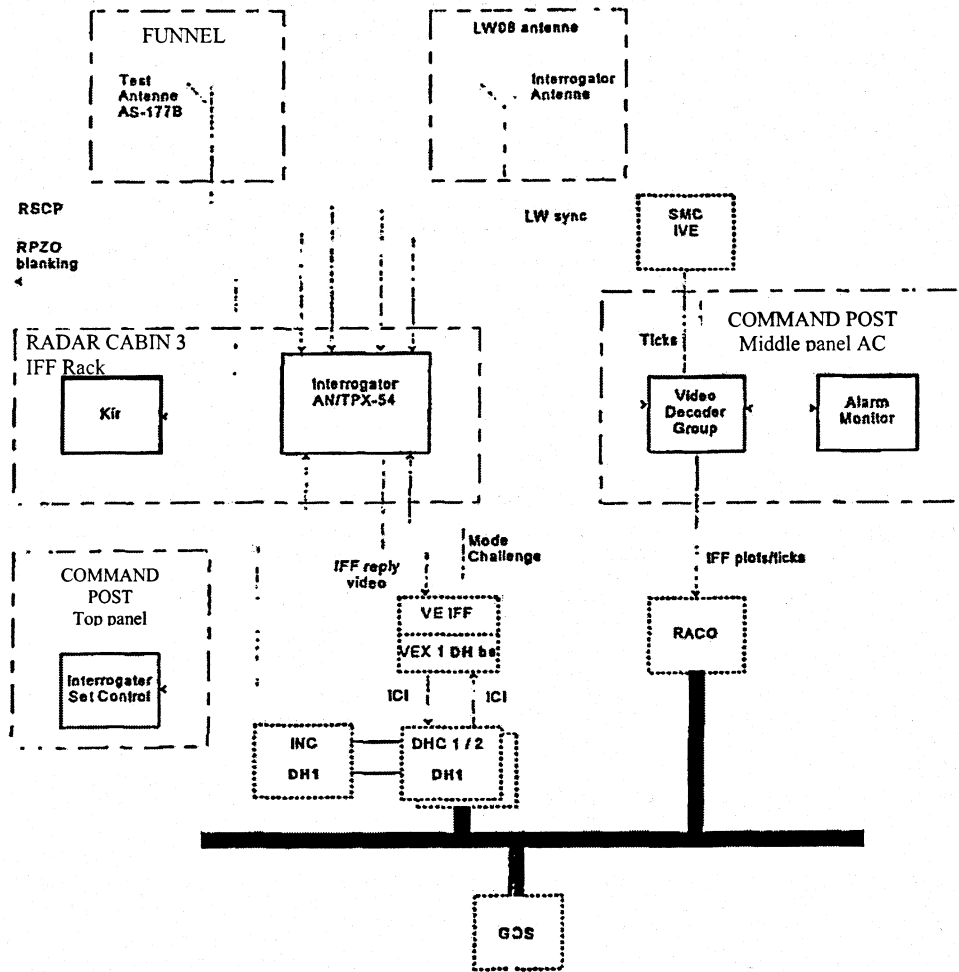


Illus. 1-2125-2 IFF Rack

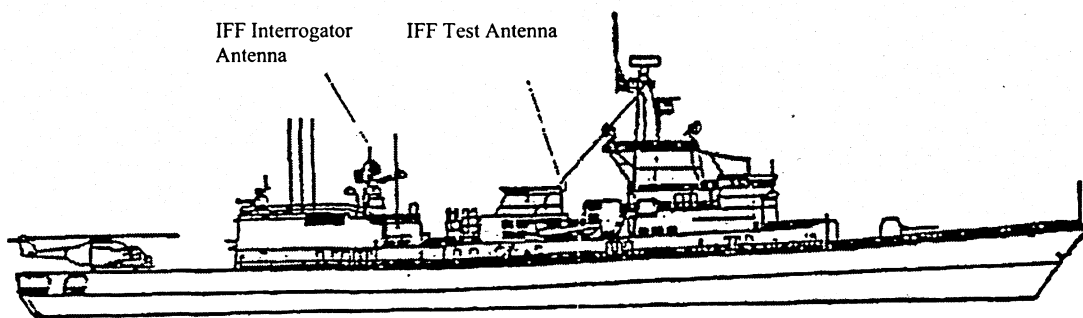
1.9.2. Equipment

1.9.2.1. Interrogator AN/TPX-54

The AN/TPX-54 Receiver/Transmitter is situated in the IFF rack (see Illustration 1-2125-2) and is a general purpose IFF Interrogator which can interface with a great many types of radar and IFF systems in the modes described. The Receiver/Transmitter transmits the interrogator signals and receives the answers to these. Transmission frequency is 1030 MHz and receiver frequency is 1090 MHz. The signals received can be displayed on a GOS, as track via the SMC (Video Extractor I) and as video via the Video Decoder and the RACO.



illus. 1-2125-5 Overview IFF Interrogator



illus. 1-2125-6 Sensors

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1.10.2.3. Power supply

The Power supply PP-0107 for the Transponder system is situated in the IFF rack (see Illustration 1-2126-3).

1.10.2.4. Transponder set

The Transponder Set SIT-421T is situated in the IFF-rack (see Illustration 1-2126-3) and consists of a receiver and a transmitter. The receiver amplifies and decodes the interrogation signal after which the transmitter generates an answer signal which is transmitted via the antenna.

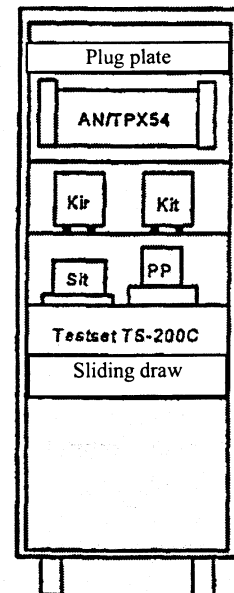
1.10.2.5. IFF Test set

Various functions of the Transponder system can be tested using the IFF Test set TS-200C (see Illustration 1-2126-3). The Test set is capable of interrogating the Transponder system and checking the answers given to the interrogation. The IFF Test set can also partly test the Interrogator by connecting it to the Interrogator.

1.10.3. Integration at BSMI level

The IFF Transponder radar installation is integrated with the following BSMIs:

- 2111 Radar Search and Localize Receiver APECS II
- 2325 Integrated Radio, Intercom and Telephone sub-system.



illus. 1-2126-3 IFF Rack

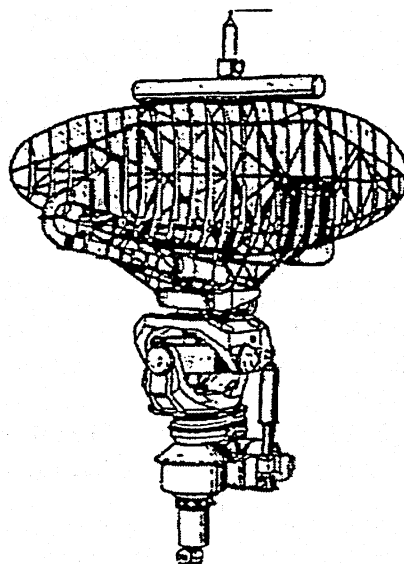
1.10. 2126 IFF Transponder radar installation SPX-02/00

1.10.1. General

The IFF Transponder radar installation receives and decodes an interrogation signal from an interrogator and responds by creating and transmitting an answer signal. The answer signal is sent out using the code set for the interrogation mode used. The transmitted signal consists of a frame of pulses with a pulse train containing the code of mode 1, 2, 3/A or C in between a start and stop pulse. A mode 4 computer (KIT) decodes a mode 4 interrogation signal from an interrogator and supplies a mode 4 answer to this. The IFF system is treated under BSMI 2125 IFF Interrogator radar installation. The transponder transmits using the transponder antenna which is placed on top of the LW-08 antenna (see Illustration 1-2126-1). The user hears a buzzing tone via the audio panel (GOS) if a valid mode 4 interrogation is not answered by the transponder. This is termed the "AUDIO ALARM". An overview of the IFF Transponder system is given in illustrations 1-2126-4 and 1-2126-5. The IFF Transponder radar installation consists of the following parts:

- Control Box
- Transponder Computer
- Power Supply
- Transponder Set
- IFF Test set

IFF transponder antenna

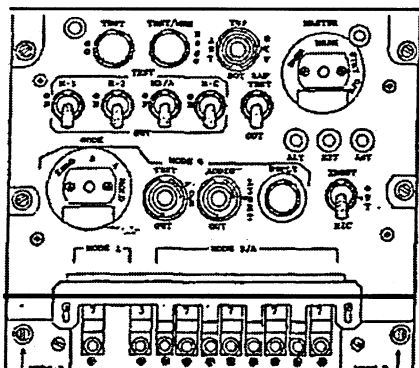


illus. 1-2126-1 LW-08 Antenna

1.10.2. Equipment

1.10.2.1. Control Box

The Control Box IFF UPX-709 (see illustration 1-2126-2) is the remote control for the Transponder and is situated in the Command Post. The Control Box can be used to select the mode in which the transponder should answer and to start various tests. Code settings for modes 1 and 2 can also be entered and a choice made from various signals for mode 4.



illus. 1-2126-2 Control Box

1.10.2.2. Transponder Computer

The Transponder computer KIT-1A/TSEC is an encoding (mode 4) computer which is situated in the IFF rack (see Illustration 1-2126-3). The computer decodes a mode 4 interrogation signal and provides a mode 4 answer signal to this. The answer consists of three modulated and time-coded pulses. The time-coded answer pulses are sent to the oscillator in the transponder installation.

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1.17. 2212 Launching System (SRBOC) Mk36 Modi

1.17.1. General

The Super Rapid Bloom Offboard Chaff (SRBOC) Launching system Mk36 Modi is used to mislead threats from guided missiles and guided weapons systems etc. Misleading is caused by launching a grenade containing radar reflecting material (strips of metal with fiber or an infrared composite).

There are two launchers on board (one on the port side and one on the starboard side). Each of the launchers has six barrels. The SRBOC can be operated in the following ways:

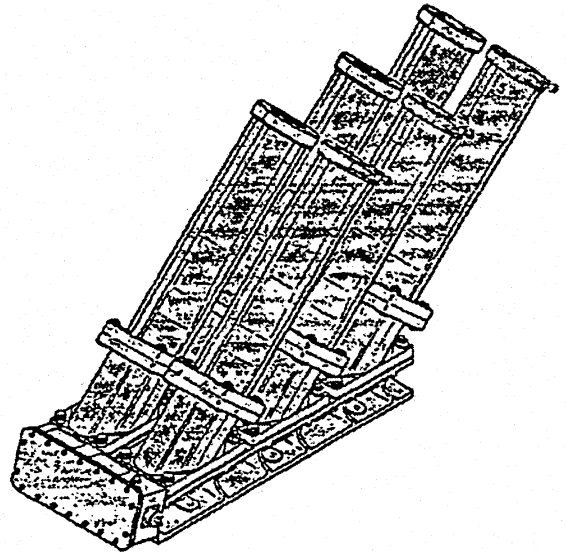
- from the Commando Post using the Control Launcher Master Mk 158
- from the bridge using the Control Launcher Bridge (starboard and port) Mk 164

The SRBOC can be used in the following modes:

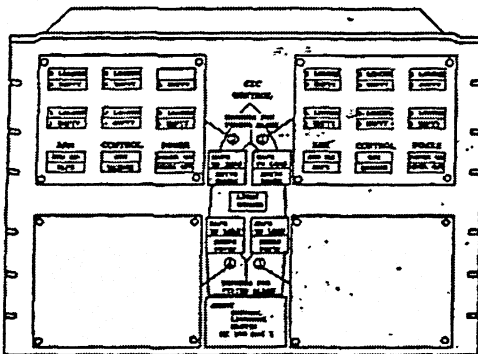
- Confusion = False ships group (not on board the M frigates)
- Distraction = False target (before lock-on)
- Seduction = Close to the ship by moving main target (after lock-on)

The function SRBOC in the system function DH supplies assistance when using the SRBOC in the form of launching advice. The launching advice consists of:

- an advice
- an alternative advice
- which launcher to use SB (starboard) or BB (port)
- recommended course and speed
- when the next launching should take place
- (refreshment tijd)



illus. 1-2212-1 Launcher



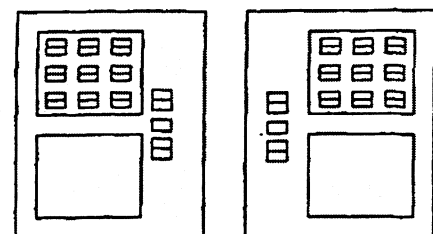
illus. 1-2212-2 Control Launcher Master

1.17.2. Equipment

An overview of the SRBOC is given in Illustrations 1-2212-4 and 1-2212-5. The SRBOC has the following parts:

- Launcher 5.125 inch Mk 137 Mod 1 (2) see illustration 1-2212-1
- Control Launcher Master Mk 158 Mod 1, see Illustration 1-2212-2

- Control Launcher Bridge Mk 164 Mod 1 (2), see Illustration 1-2212-3
- Power Supply Mk 160 Mod 1 (2)
- Horn Firing Alarm (2)



Starboard

Port

illus. 1-2212-3 Control Launcher Bridge

1.17.3. Integration

The SRBOC is not integrated but provision has been made on the INC for integration in the future.

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1.28. 2321 UHF Transmit/Receive sub-system SRC-38/00

1.28.1. General

The UHF transmit/receive sub-system forms part of the External Communication System of the SINCOS system and is intended for short range communication (Line Of Sight). An overview of the complete Transmit/receive system is given in BSMI 2323 (Illustration 1-2323-10).

Information in the External Communication system is transported through the fiber optical network FOCON (see Illustration 1-2325-8 of BSMI 2325). The users can operate the various transceivers by remote control by using FOCON.

The UHF Transmit/receive sub-system comprises eight Transceivers including two Guard Receivers coupled to five antennas. The Guard Receivers (VHF and UHF) are intended for receiving emergency signals. An overview of the UHF transmit/receive sub-system is given in Illustrations 1-2321-7 and 1-2321-8. The UHF transmit/receive sub-system has the following parts:

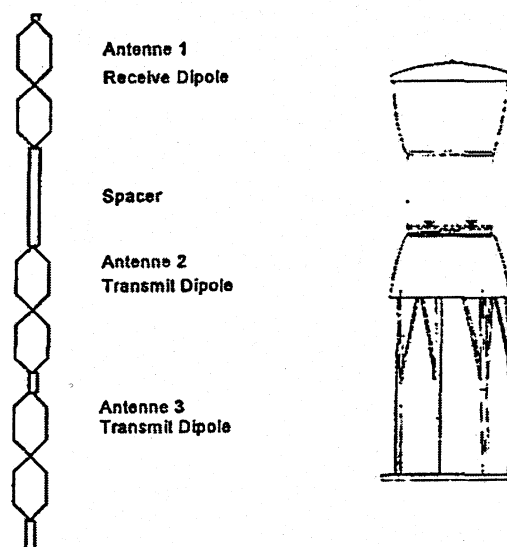
- Antennas (5)
- Antenna Patching Panel
- Multicouplers (4)
- Transceivers ERM 9000 (8)

1.28.2. Equipment

1.28.2.1. Antennas

Two types of antenna are used for the UHF and VHF bands:

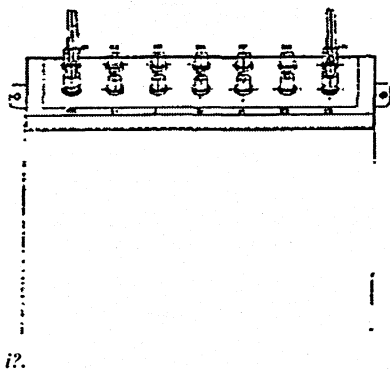
- one Rohde & Schwarz HK 253A1 antenna (see Illustration 1-2321-1). This is an omni-directional (vertical polarization) UHF antenna for frequencies between 225 to 400 MHz. This antenna consists of three independent dipoles. The top dipole (antenna number 1) is used for receiving and the two lower dipoles (antenna number 2 and 3) are used for transmitting.
- four Rohde & Schwarz HK014 antennas (see Illustration 1-2321-2). These are omni-directional (vertical polarization) UHF/VHF antennas for frequencies between 100 to 1300 MHz.



illus. 1-2321-1 HK253A1

illus. 1-2321-2 HK-014

The position of the antennas on board are shown separately in Illustration 1-2321-8.



illus. 1-2321-3 Antenna Patching Panel (UHF/VHF)

1.28.2.2. Antenna Patching Panel

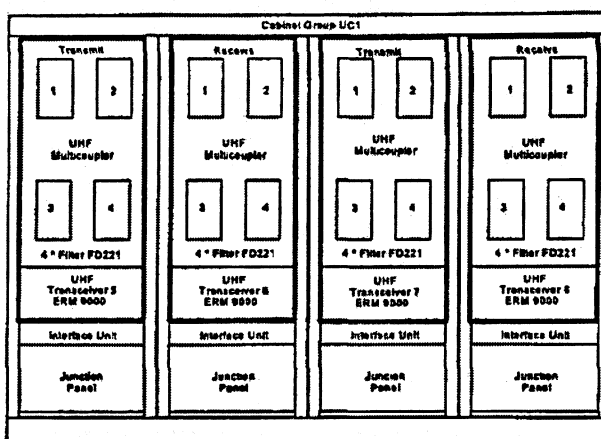
The Antenna Patching Panel (see Illustration 1-2321-3) connects the seven UHF/VHF antennas with the transmitters/receivers.

There are two splitters and two diplexer filters in the Patching Panel. The diplexer filters separate the UHF and VHF signals.

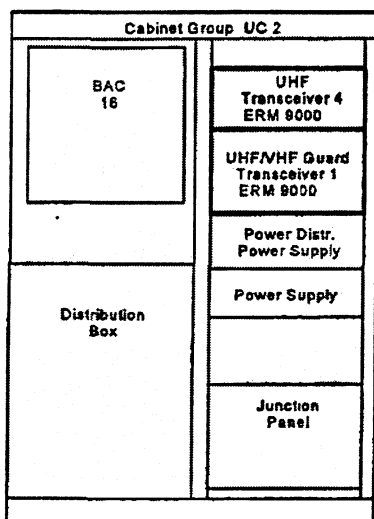
1.28.2.3. Multicouplers

Four Multicoupler systems are placed in Cabinet Group UC1 (see Illustration 1-2321-4). The Multicoupler (TX or RX filters) makes it possible to connect more than one transmitter to the same aerial simultaneously so reducing the number of antennas needed. A maximum of eight transceivers can be connected to the four Multicoupler systems.

A Multicoupler consists of four Filter Units FD 221. The filters are controlled by the UHF transceivers via the Interface Unit. The filters are used either as transmitter or receiver filter. It is not possible to use a filter for combined transmission and receiving in the same multicoupler.



illus. 1-2321-4 Cabinet Group UC1



illus. 1-2321-5 Cabinet Group UC 2

The Helicopter Direction Officer (HDO) (normal/bypass) switch can be used to bypass the FOCON system which is normally used for operating the system via the Remote Control Panel. The extra functions of Transceiver no. 2 are:

- UHF Guard Receiver
- prepared for frequency hopping (ECCM)

Transceivers no. 1 to 6 can transmit and receive in secure voice mode. A Wide Band Secure Voice encoding unit (KY58) is fitted in the circuit for this purpose.

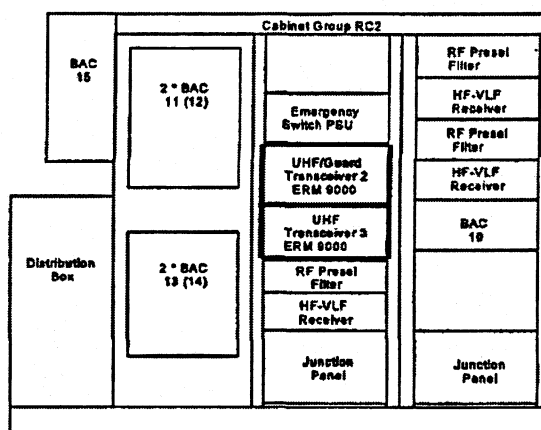
1.28.3. Integration in the central system

The UHF transmit/receive sub-system is connected with the FOCON system via BACs (see Illustration 1-2321-7). The XCVRs are set from a GOS. They are operated from a MFT (or SFT).

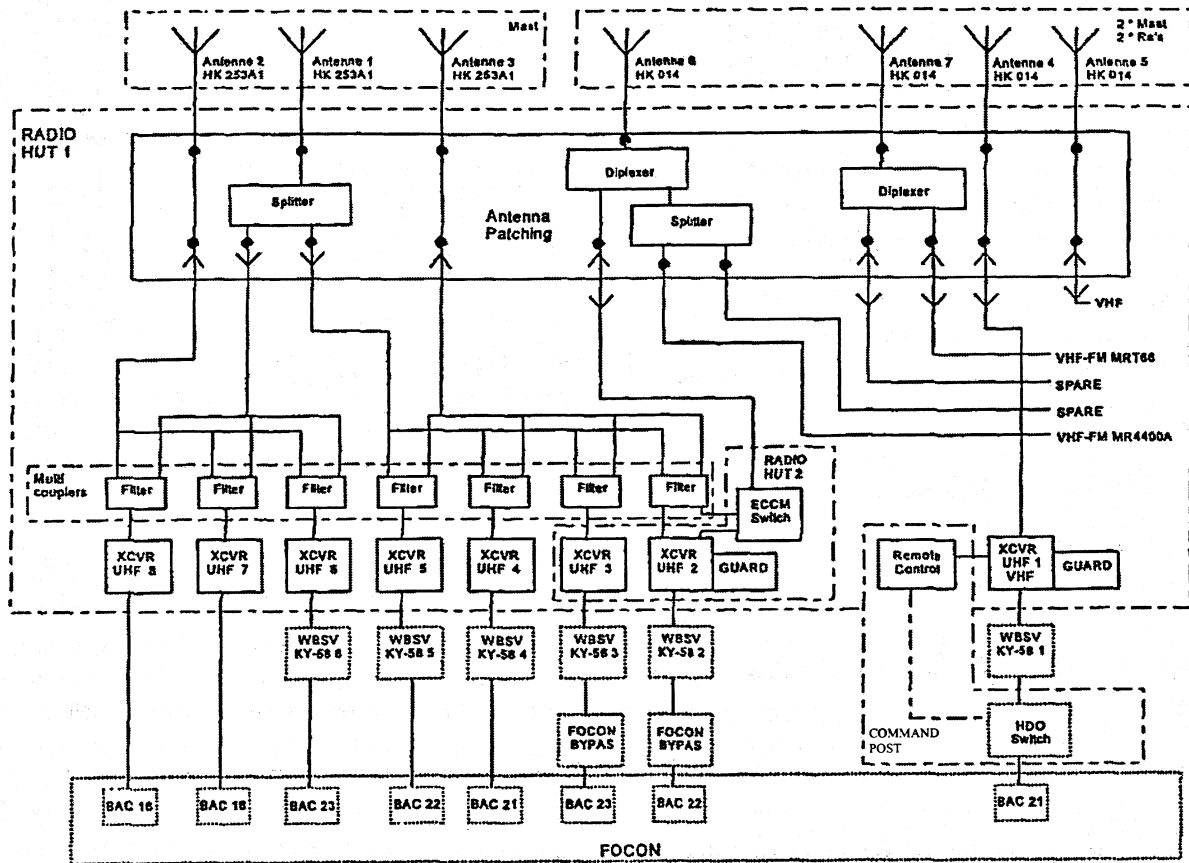
1.28.2.4. UHF Transceivers ERM 9000

The ERM 9000 is a multi mode UHF Transceiver which can be operated by remote control or by means of the front panel. Channel selection (99) can be via a preset channel or by direct selection. Automatic scanning of up to 99 channels is possible. The frequency range is: 225 MHz to 399.975 MHz in steps of 25 kHz. XCVR 1 also works in the frequency range 100 MHz to 155.975 MHz. Output power is 25 W (AM) and 40 W (FM). Eight UHF Transceivers are placed in cabinet groups UC1, UC2 and RC2 (see Illustrations 1-2321-4, 1-2321-5 and 1-2321-6). Transceiver no. 1 and no. 2 have a number of extra functions. Those of Transceiver no.1 are:

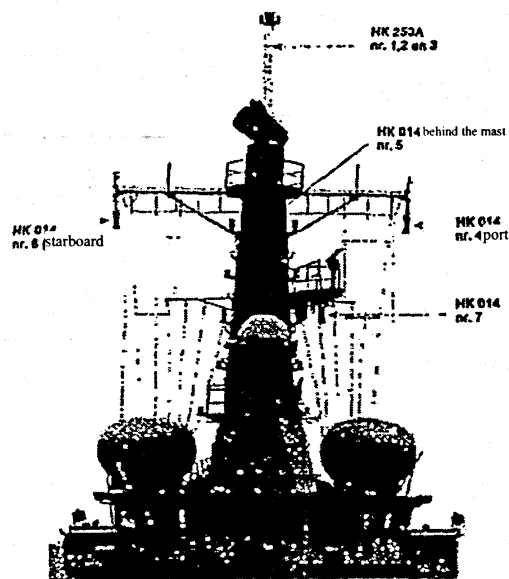
- UHF/VHF Guard Receiver
- operational function for helicopter control.



illus. 1-2321-6 Cabinet Group RC
2



illus. 1-2321-7 Overview



illus. 1-2321-8 UHF/VHF antennas 1 to 7

1.29. 2322 VHF Transmit/receive sub-system SRC-39/00

1.29.1. General

The VHF Transmit/receive sub-system forms part of the External Communication System of the SINCOS system and is intended for short range communication. An overview of the complete Transmit/receive system is given in BSMI 2323 (Illustration 1-2323-10).

The VHF band can only be used over short distances but these are still further than using the UHF band. An overview of the VHF Transmit/Receive sub-system is given in Illustrations 1-2322-5 and 1-2322-6. The VHF Transmit/receive sub-system has the following parts:

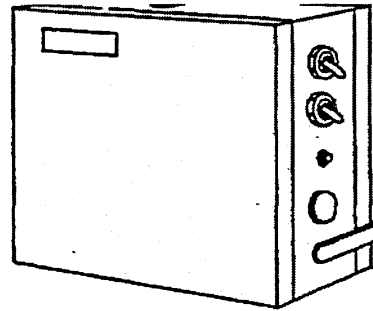
- Transceiver Mariphone MRT 66 including two Control Panels and a Distribution Box.
- VHF Receiver MR4400

1.29.2. Equipment

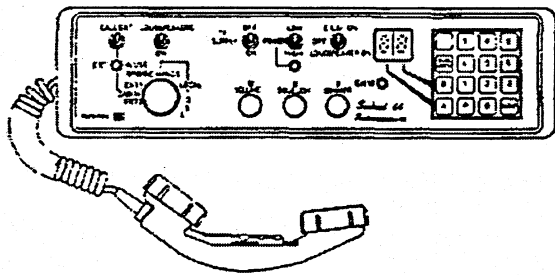
1.29.2.1. Transceiver Mariphone MRT 66

The VHF Transceiver Mariphone MRT 66 (see Illustration 1-2322-1) is placed in Radio cabin 1 and can be operated via the following sets of controls:

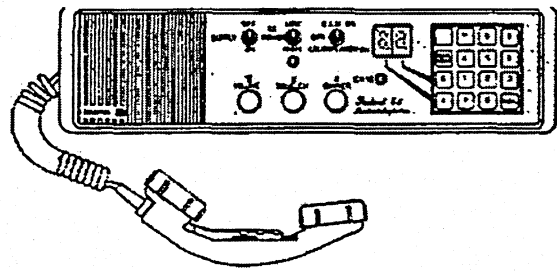
- Master Remote Control 66 (see Illustration 1-2322-2), situated in the Radio room
- Slave Remote Control 66 (see Illustration 1-2322-3), situated on the Navigation bridge
- from an operator position using an MFT, via the FOCON system



illus. 1-2322-1 Transceiver MRT 66

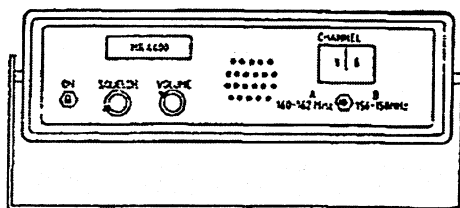


illus. 1-2322-2 Master Remote Control 66



illus. 1-2322-3 Slave Remote Control 66

The Mariphone MRT 66 is connected with HK014 antenna number 7 (see Illustration 1-2321-7) of the UHF Transmit/receive sub-system (BSMI 2321) via the antenna patching panel. The transceiver receives in the frequency band 156.025-158.500 MHz and transmits in the frequency band 156.300-158.500 MHz (simplex frequency channels) and 160.625-163.000 MHz (duplex frequency channels). The Mariphone MRT66 is connected with the FOCON system by means of a Distribution Box, which sends through digital and analogue signals.



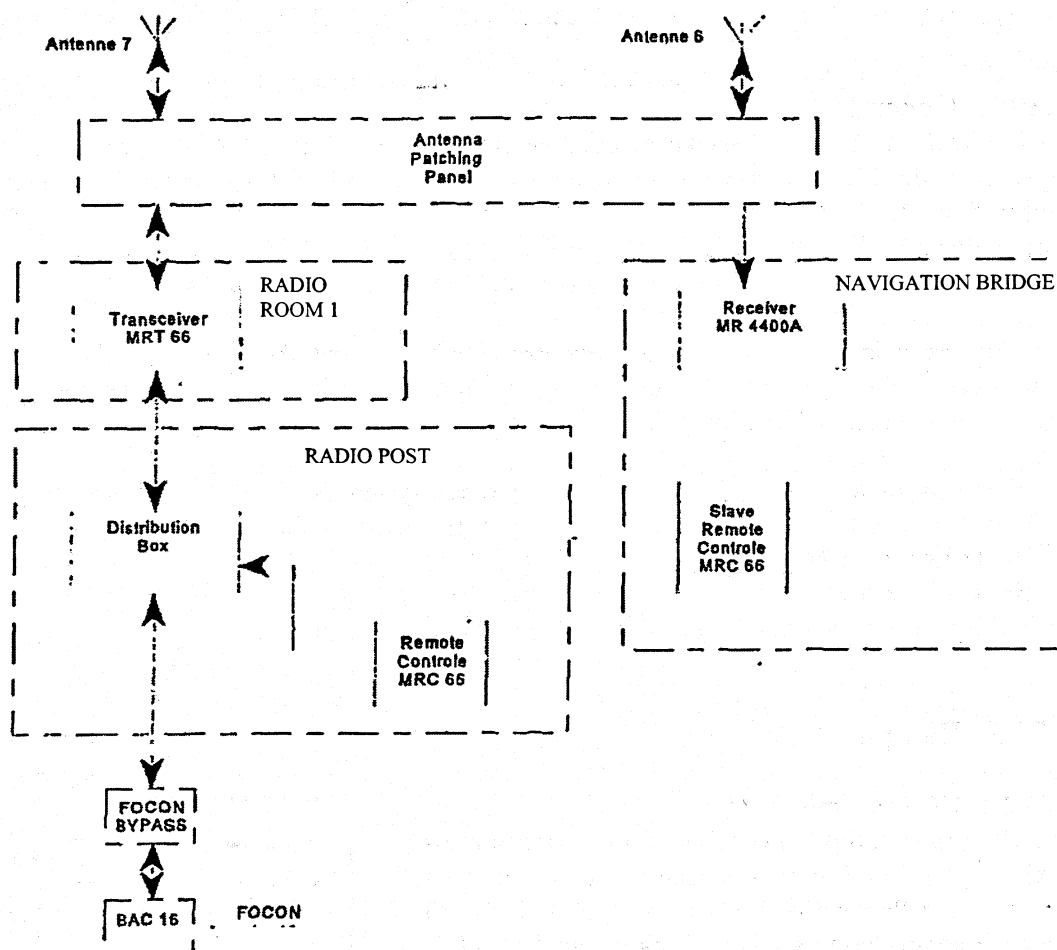
illus. 1-2322-4 VHF Receiver MR 4400

1.29.2.2. VHF Receiver MR4400A

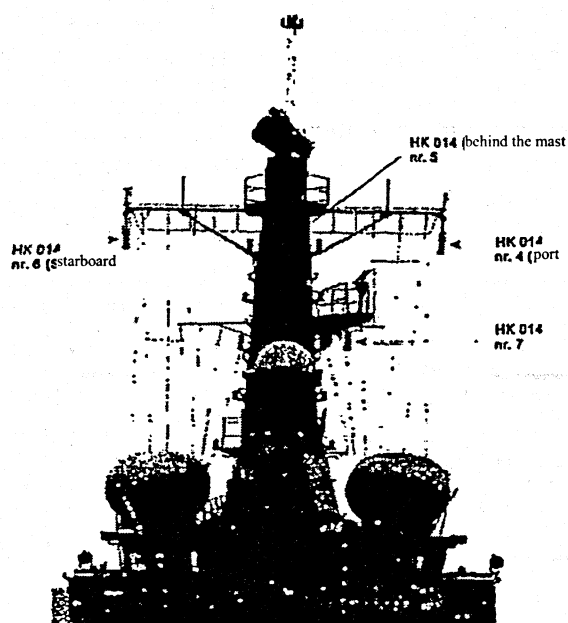
The VHF Receiver MR4400A (see Illustration 1-2322-4) is situated on the navigation bridge and is used to monitor the international maritime band channels (156.025 to 163.550 MHz, channels 1 to 99). The receiver is completely autonomous but does make use of antenna number 6 (see Illustrations 1-2322-5 and 1-2322-6) of the UHF Transmit/receive sub-system.

1.29.3. Integration in the central system

The Transceiver Mariphone MRT 66 is connected to FOCON (see Illustration 1-2322-5) via BAC 16. The installation can be operated from a MFT (or SFT) but it is not possible to set the installation from FOCON. This must be done using the Master RC or a Slave RC. The VHF receiver MR 4400A is not integrated.



illus. 1-2322-5 Overview



illus. 1-2322-6 VHF antennas 6 and 7

1.30. 2323 HF/MF/LF Transmit/receive sub-system SRC-40/00

1.30.1. General

The HF/MF/LF Transmit/receive sub-system is the HF to VLF part of the External Communication System in the SINCOs system. An overview of the complete Transmit/receive system is given in illustration 1-2323-10. The HF/MF/LF Transmit/receive sub-system provides the following possibilities:

- transmission in the HF band by means of Wide and Narrow Band sections
- reception in the HF, MF, LF and VLF bands

The HF band is suitable for long range communication but the quality of the HF connection is dependent on the weather and propagating conditions. The MF, LF, VLF bands are suitable for long range communication but with an inferior quality compared with the HF band.

An overview of the HF/MF/LF Transmit/receive sub-system is given in illustrations 1-2323-8 and 1-2323-9. The HF/MF/LF Transmit/receive sub-system consists of the following parts:

- HF Transmit System
- HF to VLF Receive System
- MF Emergency System
- Other Transceivers

1.30.2. Equipment

1.30.2.1. HF Transmit System

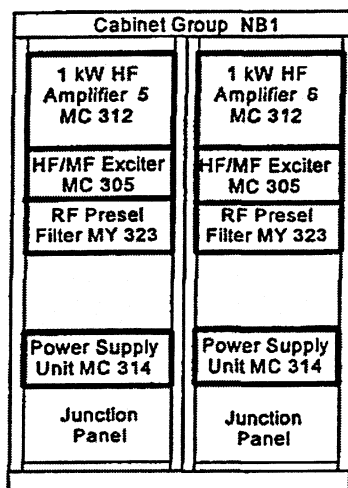
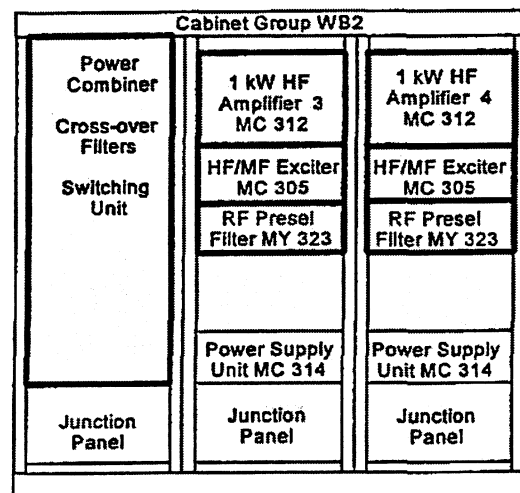
The HF Transmit System consists of 6 HF Transmitters (Tx1 to Tx6). Tx1-Tx4 are connected to a WB antenna system via a Power Combiner (2-30 MHz). Tx5-Tx6 are each connected to a NB antenna via an ATU (1.5-30 MHz).

1.30.2.1.1. Transmitters

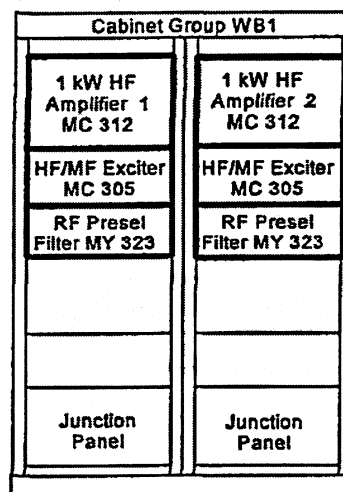
A Transmitter (MZ311) is built up from the following parts:

- Exiter (MC 305)
- Noise/suppression Filter (MY 323)
- Linear Power Amplifier (MC 312)

Four of these Transmitters are situated in Cabinet Groups WB1 and WB2 (see illustration 1-2323-1) and two in Cabinet Group NB1 (see illustration 1-2323-2).



illus. 1-2323-2 Cabinet Group NB1



illus. 1-2323-1 Cabinet Groups WB1 and WB2

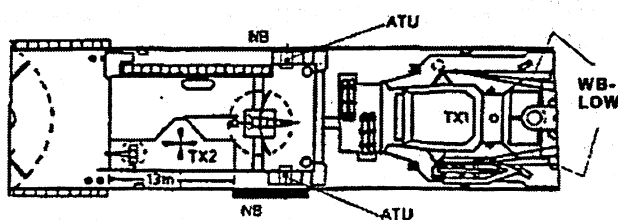
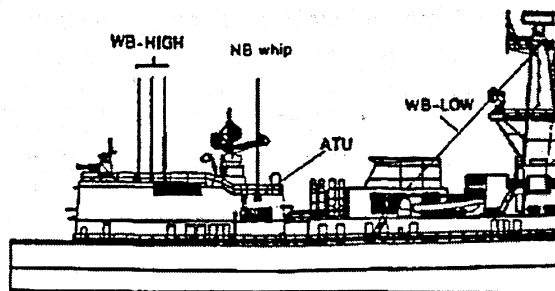
The Transmitters MZ311 have variable power to max. 1 kW. The WB transmitters may only be set to 500 W (2-30 MHz) and are connected to FOCON via the BACs. Transmitter 1 can also be used in the FOCON bypass.

Tx 5-6 are connected with BACs via the Distribution Frame in Cabinet Group RC2 (see illustration 1-2323-5). Transmitter 5 can be used in the FOCON bypass.

1.30.2.1.2. Wide Band Antenna system

The Wide Band Antenna system is for the HF band and is formed by:

- Wide Band Low Antenna (see illustration 1-2323-3), consisting of two 2-8 MHz wire antennas
- Wide Band High Antenna (see illustration 1-2323-3), consisting of four 6-30 MHz whip antennas STA 100 PM
- Power Combiner/crossover Filter; this is situated in Cabinet Group WB 2 (see illustration 1-2323-1) and combines the power outputs of the four Transmitters (Tx1 t/m Tx4). The power is divided between the two HF-WB antenna systems (Wide Band Low and Wide Band High) at the transition frequency of 7.2 MHz.



illus. 1-2323-3 Wide Band Low, High and Narrow Band Antennas

1.30.2.1.3. Narrow Band Antenna System

The Narrow Band Antenna (see illustration 1-2323-3) is formed by two STA 105PM HF Whip Antennas. Both antennas are connected with a corresponding Antenna Tuning Unit (ATU).

1.30.2.2. HF to VLF Receive System

The HF to VLF Receive System consists of the following parts:

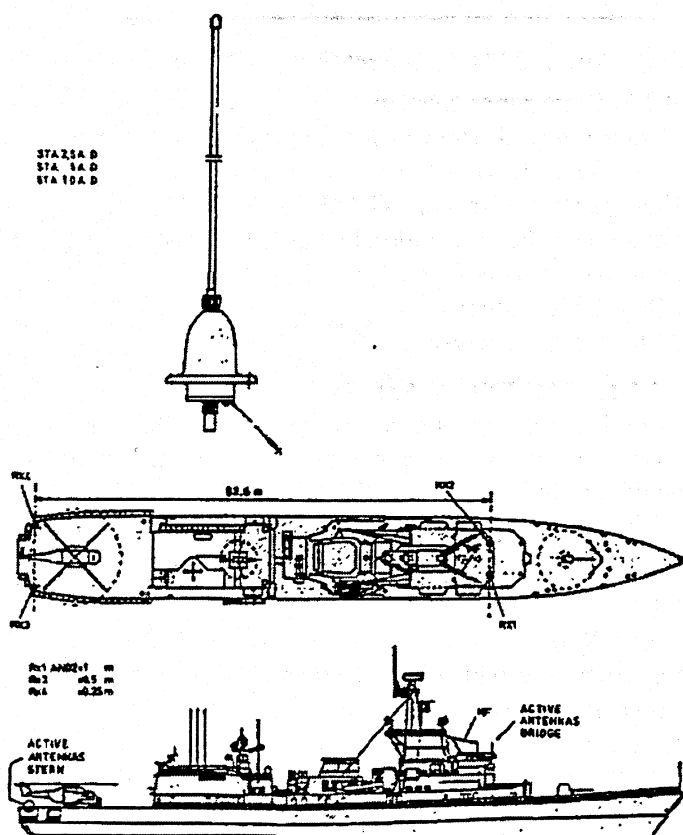
- Active Receive Antennas (4)
- Multicoupler Units (3)
- Preselector Units (12)
- Receivers (12)

1.30.2.2.1. Active Receive Antennas

The antenna system for the HF to VLF reception (see illustration 1-2323-4) is formed by four active antennas. These are:

- STA-10A (2); situated on the bridge deck (length 1 m).
- STA-5A (1); situated aft on the railing of the helideck (length 0.5 m).
- STA-2.5A (1); situated aft on the railing of the helideck (length 0.25 m).

The antenna with the best reception can be selected using a multicoupler. The frequency range can be varied from 10kHz to 30MHz by using filters.



illus. 1-2323-4 HF-VLF Receive antennas

1.30.2.2.2. Multicoupler Units AAD10/4

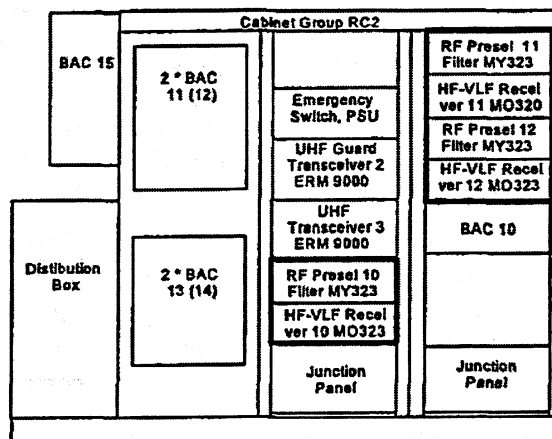
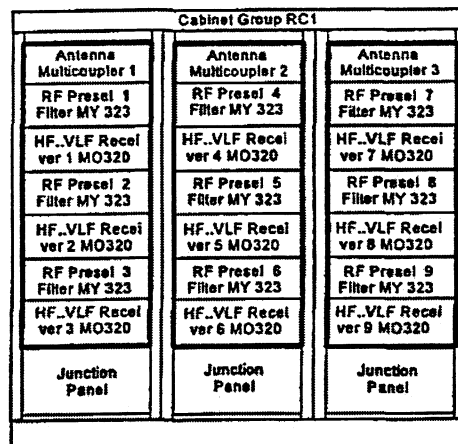
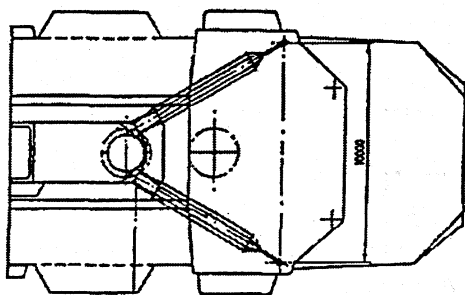
The RF signals from the four active antennas are connected with three multicouplers, situated in Cabinet Group RC1 (see illustration 1-2323-5). These multicouplers are connected with each other to form one large multicoupler. Each multicoupler has four antenna inputs and ten receiver outputs.

1.30.2.2.3. Preselector Units

There are twelve Preselectors Units situated in Cabinet Groups RC1 and RC2 (see illustration 1-2323-5). The preselector is a band filter working from 10 kHz to 30 MHz. The preselectors are identical to the Noise Suppression Filters used in the HF-WB transmission system.

1.30.2.2.4. Receivers

12 Receivers MO320 10 kHz-30 MHz, situated in Cabinet Groups RC1 and RC2 (see illustration 1-2323-5), are available for the reception of the HF to VLF band.



illus. 1-2323-5 Cabinet Groups RC1 and RC2

1.30.2.3. Emergency System

The Emergency System is for emergency situations and has the following parts:

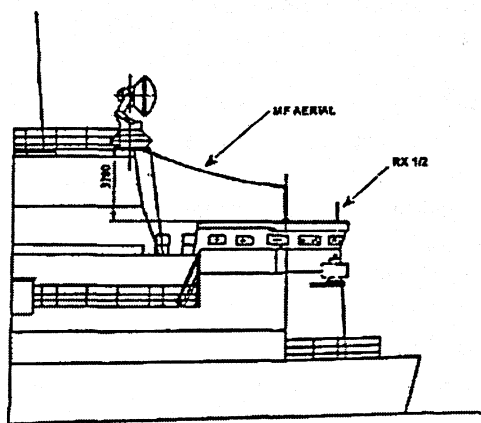
- Emergency transceiver ST 68E/M (MF/HF), situated on the Navigation bridge. The Remote control for this is in the Radio Post.
- MF TX/RX Antenna
- Auto Alarm Receiver

1.30.2.3.1. MF TX/RX Antenna

The MF TX/RX Antenna (see illustration 1-2323-6) is a wire antenna for emergency communication. The transmission frequencies are: 410 to 512 kHz and 2182 kHz. The reception frequency is between 10 kHz and 30 MHz.

1.30.2.3.2. Auto Alarm Receiver AAI

The AAI Receiver (Redifon) is a combination of an auto alarm and watchkeeping receiver. The Auto Alarm Receiver is situated in Cabinet Group MSI (Radio Post) (see illustration 1-2323-7) and monitors the MF distress frequency (500 kHz). The international alarm signal consists of a series of twelve successive tones each 4 seconds long with an interval of 1 second, transmitted within 1 minute.

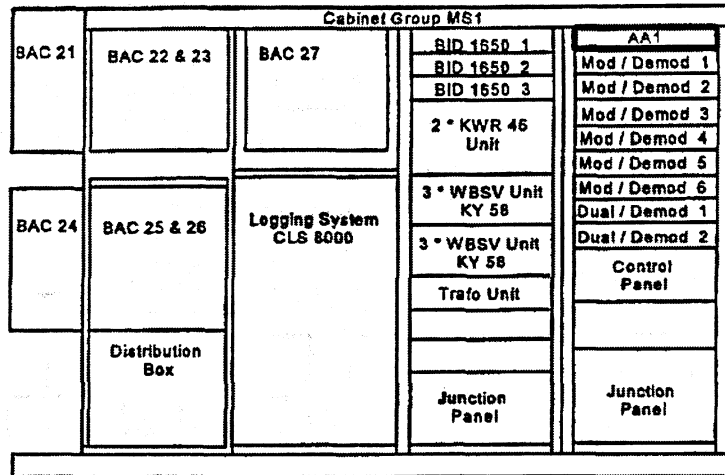


illus. 1-2323-6 MF Emergency Antenna

1.30.3. Other Transceivers

The other Transceivers on board the ship are:

- Watch Keeping Receiver 2182 kHz and a Navtex Receiver/recorder situated on the Navigation bridge. The Navtex receives information about the general sailing conditions (defective buoys, wrecks, storm warnings etc.)
- five Transceiver Portophones X1000 UHF.



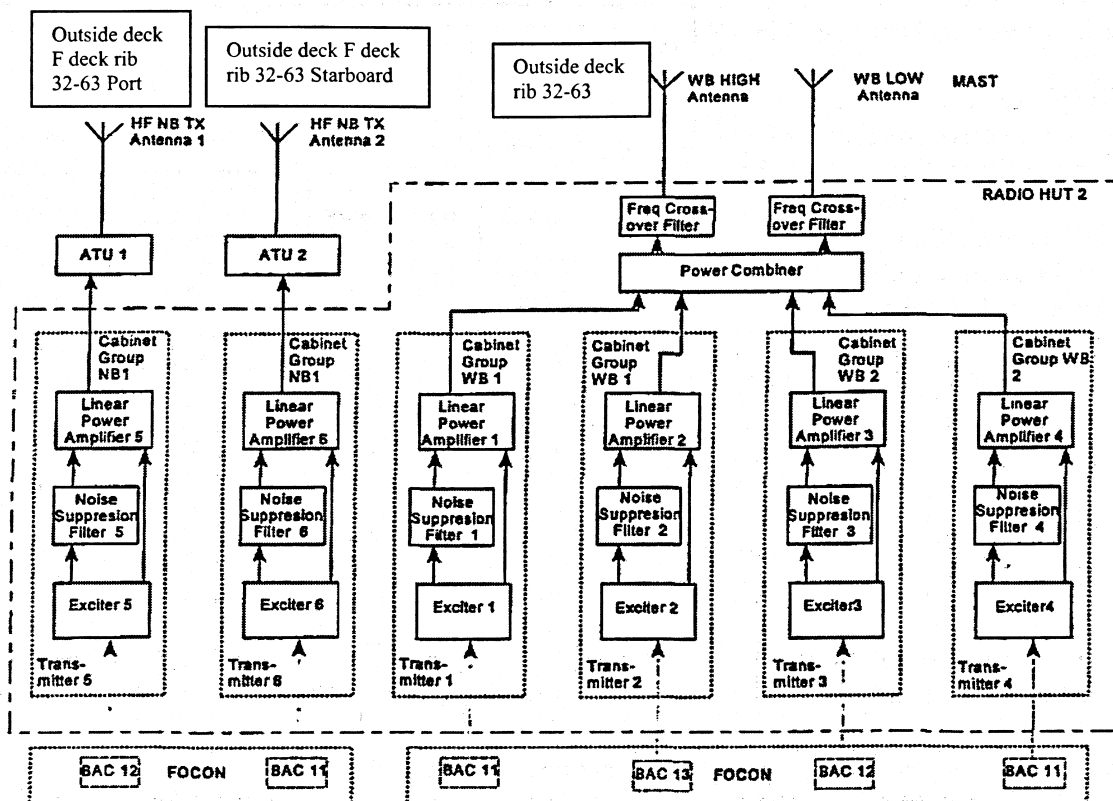
illus. 1-2323-7 Cabinet Group MS 1

1.30.4. Integration in the central system

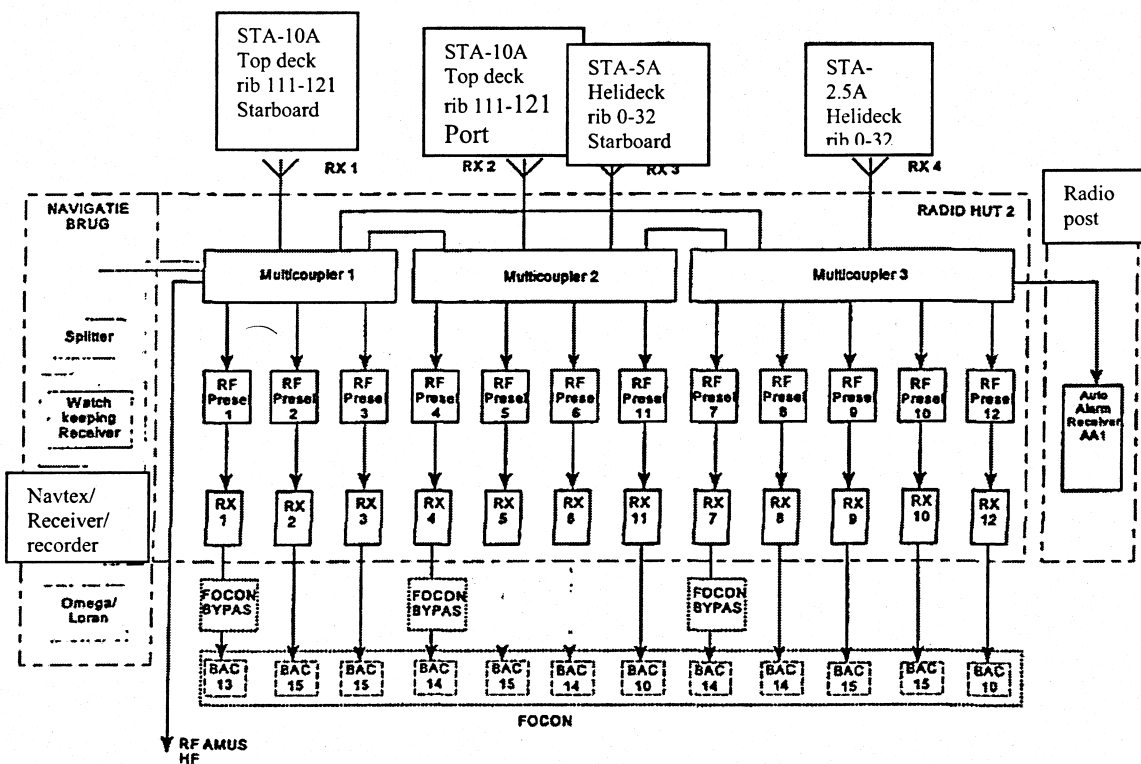
The following systems in the HF/MF/LF Transmit/receive sub-system are connected with the FOCON system via BACs:

- HF Wide Band Transmit System
- HF Narrow Band Transmit System
- HF to VLF Receive System

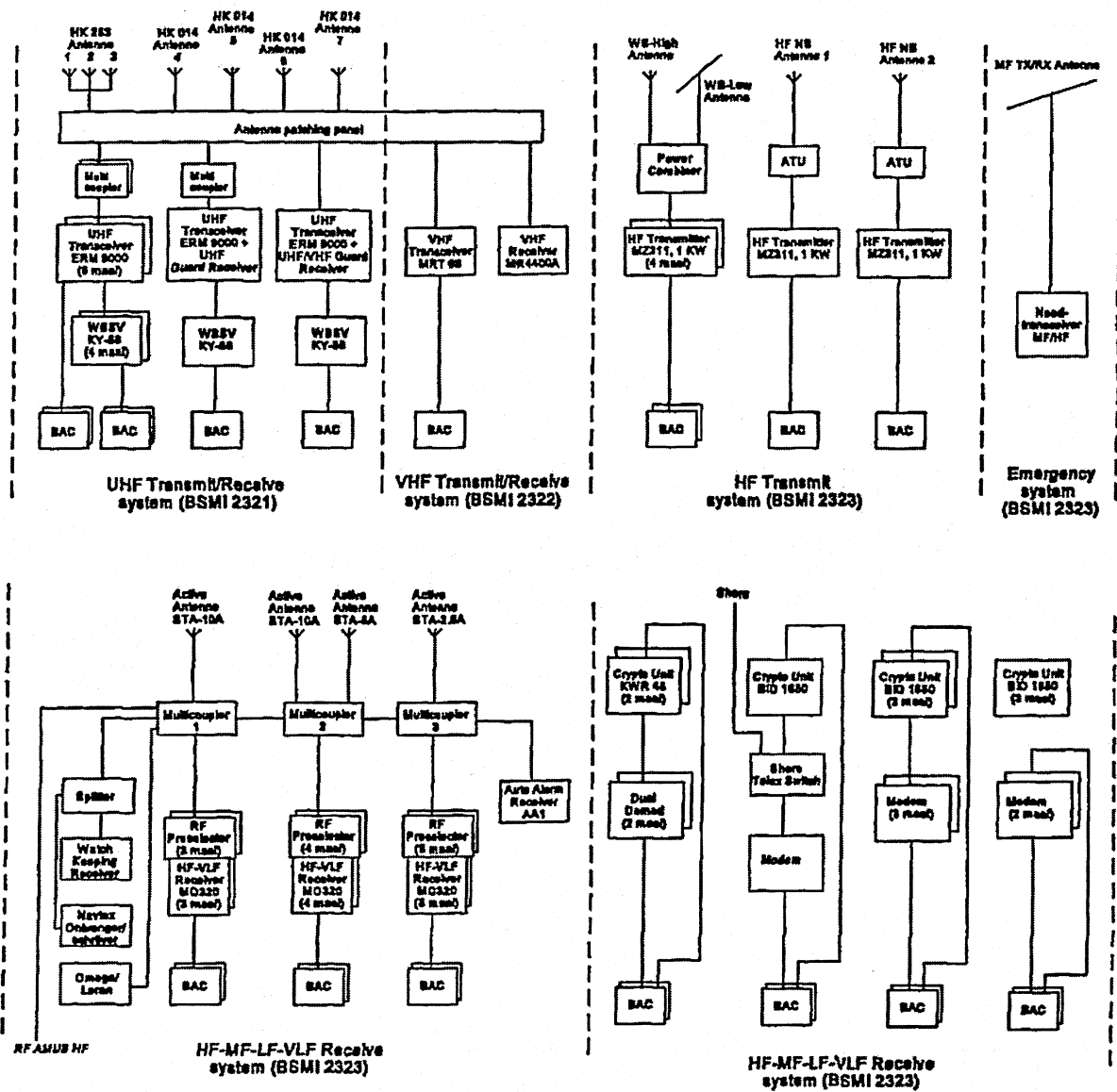
The Transmitters/receivers can be set from a GOS and are operated from an MFT/SFT.



illus. 1-2323-8 HF Transmit system



illus. 1-2323-9 HF-VLF Receive system



illus. 102323010 Transmit/receive system M Frigate

1.31. 2325 Integrated Radio, Intercom and Telephone sub-system (FOCON-A) SIC-15/00

1.31.1. General

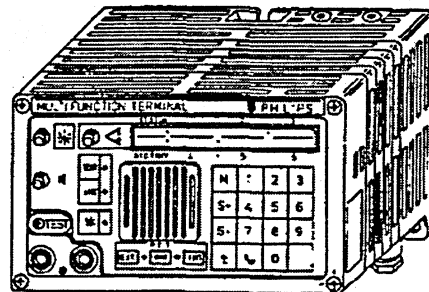
The integrated Radio, Intercom and Telephone sub-system (GRIT) is the Internal Communication System (ICS) of the SIN COS 1200. The ICS takes care of the internal communication, the transport and distribution of external communication signals as well as controlling the HF and UHF transmitters/receivers. The ICS is concentrated around an optical glass fiber network FOCON-A comprising four different network units (total of 66) and a double glass fiber ring. The total transport capacity is 8.192 Mbits/s. The data is sent at 32 kbit/s per user's channel. An overview of the GRIT is given in illustrations 1-2325-7, 1-2325-8 and 1-2325-9. The GRIT has the following parts:

- Network unit: Multi Function Terminal (MFT), (30)
- Network unit: Data Channel Concentrator (DCC), (2)
- Network unit: Automatic Coupling Unit (ACU), (6)
- Network unit: Bus Access Concentrator (BAC), (28)
- LV Supply and Distribution

1.31.2. Equipment

1.31.2.1. Multi Function Terminals (MFT)

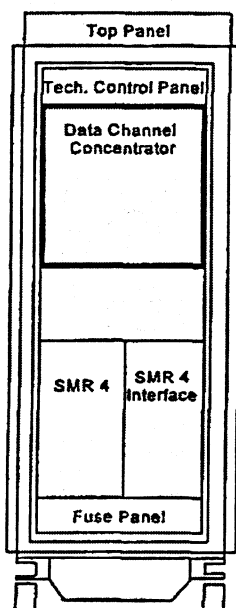
A user can use and control communication facilities for both internal and external communication from a MFT (see illustration 1-2325-1). Each MFT is programmed for the specific user. The MFT has a keyboard, an alpha numeric display and a built-in speaker. An external headset and/or a signal key can be connected to the MFT. The FOCON-A network has 30 MFTs. 16 MFTs are situated in the GOS consoles and 14 are stand alone.



illus. 1-2325-1 Multi Function Terminal

1.31.2.2. Data Channel Concentrator (DCC)

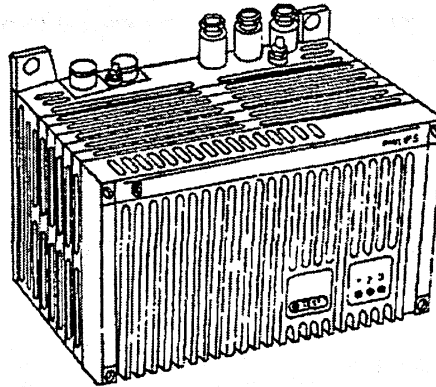
The DCC (see illustration 1-2325-2) is the interface between the Communication Control Computer (CCC) and the FOCON-A network. The GRIT has two DCCs which are connected with the two CCCs. One is situated in the CCC in Computer room SEWACO Fore and one in the CCC in Computer room SEWACO Aft.



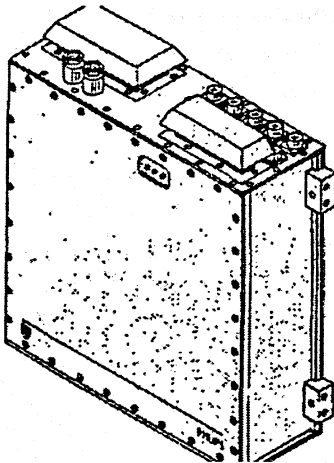
illus. 1-2325-2 Communication Control Cabinet

1.31.2.3. Automatic Coupling Unit (ACU)

The FOCON-A network is functionally self-repairing when the ring is interrupted because of a break in the glass fiber or a defective unit. Another network connection is created via the ACUs (see illustration 1-2325-3) as soon as a break occurs if more than one break occurs. This repair can be made within 1 second. The FOCON-A network has six ACUs.



illus. 1-2325-3 Automatic Coupling Unit



illus. 1-2325-4 Bus Access

1.31.2.4. Bus Access Concentrator (BAC)

A BAC (see illustration 1-2325-4) is an interface between the optical glass fiber network and the users. Different types of interface can be placed in a BAC. A maximum of 8 users can be connected to one BAC. Each user has his own interface card. BACs are used as the interface between the FOCON-A network and the ECS for the following functions:

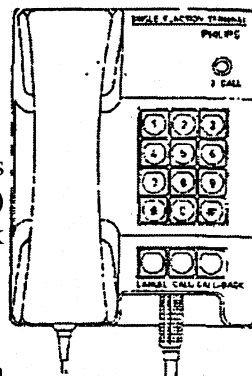
- Data interfaces for RATT and Encoding
- Speech interfaces for audio signals

The FOCON-A network will eventually have 28 BACs¹ with the following applications (see illustration 1-2325-7 and Table 1-2325-1):

- UHF-VHF and HF-VLF communication, both operating and setting
- RATT, Encoding and Secure Voice
- Link 11
- As interface between the FOCON-A network and the following systems/installations:
 - Single Function Terminals (SFT), (44)
 - Public Address System
 - Conference Extension Lines (CEL), (10)
 - Talk-Back Loudspeakers (TBL), (5)
 - Loudspeaker Blastproof, (3)
 - Communication Logging System
 - Private Automatic Branch eXchange (PABX)
 - Radio-Telebrief Installation
 - Underwater telephone

1.31.2.4.1. Single Function Terminal

The GRIT has 44 SFTs (see illustration 1-2325-5) which function as normal telephones for internal and external (shore connection) communication. The SFTs are connected with the FOCON-A network via BACs.



illus. 1-2325-5 Single Function Terminal

1.31.2.4.2. Public Address System

The Public Address System is connected with the FOCON-A via a BAC. Alarm signals can be given via the PA from MFTs and SFTs and via special

¹At present there are 26; after the SATCOM integration there will be 28

push buttons on the bridge and locally on the public address cabinet. Four Signal Adaption Units (SAU) are connected to the public address cabinet. The SAUs come under this BSMI and are used to make the call from a SFT clearer by means of an optical signal and/or a louder acoustic signal. There are three SAUs in three FM loop systems and one on the open H deck which is connected to a hooter or bell. The PA System and the SAUs are described in BSMI 2327.

1.31.2.4.3. Conference Extension Lines (CEL)

A Conference Extension Line consists of a number of interconnected headset connections (CEL sockets) all connected to a BAC. Everyone who is connected to the CEL by a headset can communicate full-duplex with all other participants. Because CEL is connected to a BAC, SFTs and MFTs can also communicate with a CEL. The M frigates have the following CELs:

- CEL Damage Control, via BAC 01
- CEL Submarine Combatting via BAC 02
- CEL TELEBRIEF, via BAC 03
- CEL MEER BOZ, (supplying at sea) via BAC 03
- CEL VUURL. B, (firing control B) via BAC 04
- CEL OLIE LAAD, (load oil) via BAC 05
- CEL Electrotechnical service, via BAC 06
- CEL NOOD MANOEUVREER, (emergency manoeuvre) via BAC 08
- CEL NBC, via BAC 19
- CEL VUURL. A, (firing control A) via BAC 18

1.31.2.4.4. Talk-back loudspeakers

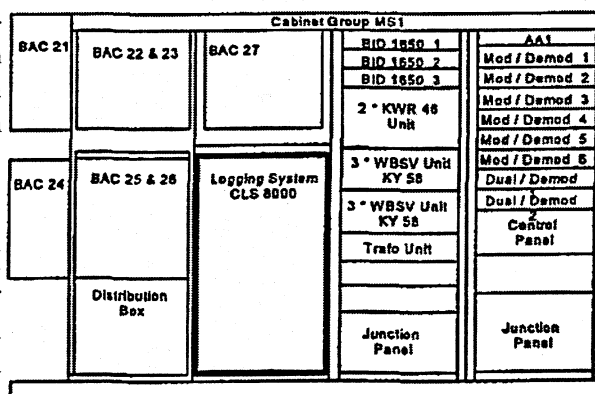
The Talk-back loudspeakers are loudspeakers which can also be used as a microphone. The Talk-back loudspeakers are connected with the FOCON-A network via BACs and form a point to point connection with MFTs or SFTs. 5 talk-back loudspeakers are available within GRIT, 4 of which have a public address button in a separate cabinet (2 near the Filter Deckhouse and 2 on E deck near the 20 mm machine gun). The fifth, in the HANGAR, does not have a public address button.

1.31.2.4.5. Loudspeaker Blastproof

The Loudspeaker Blastproof (Calling button explosion proof and amplifier) is a Talk-back loudspeaker in blast proof (spark proof) model with an external amplifier. There are three of these within GRIT, situated near the Goalkeeper, the Cannon and the Ammunition workshop.

1.31.2.4.6. Communication Logging system

The CLS 8000 is situated in Cabinet Group MSI and is used for recording internal and external communication. A maximum of 8 channels can be logged simultaneously on one of the two recorders. The CLS is connected to BAC 27.



illus. 1-2325-6 Position of the Logging System

1.31.2.4.7. Private Automatic Branch Exchange (PABX)

A separate telephone exchange of the type ASB501/04 (PABX) is also installed as well as FOCON-A. 90 standard telephone sets can be connected to this exchange. The PABX has four shore connections. Telephone connections between users, between FOCON users and between a PABX user and a FOCON user are all possible. The PABX is connected to FOCON-A via BAC 09. See Chapter 4.5 for a description of this system.

1.31.2.4.8. Radio Telebrief Installation

The telebrief is intended for use on the Helideck for briefing the Heli crew. Using a Press To Talk (PTT) switch and a throat microphone (doubled) the Flight Deck Officer (VDO) and an assistant have access to the Conference Line Telebrief in FOCON-A via a cable and a Distribution Box,

1.31.2.4.9. Underwater telephone

Communication with another underwater telephone on board a ship/submarine is possible with the underwater telephone (see BSMI 2334), which uses water as the propagating medium. The underwater telephone is connected to BAC 21.

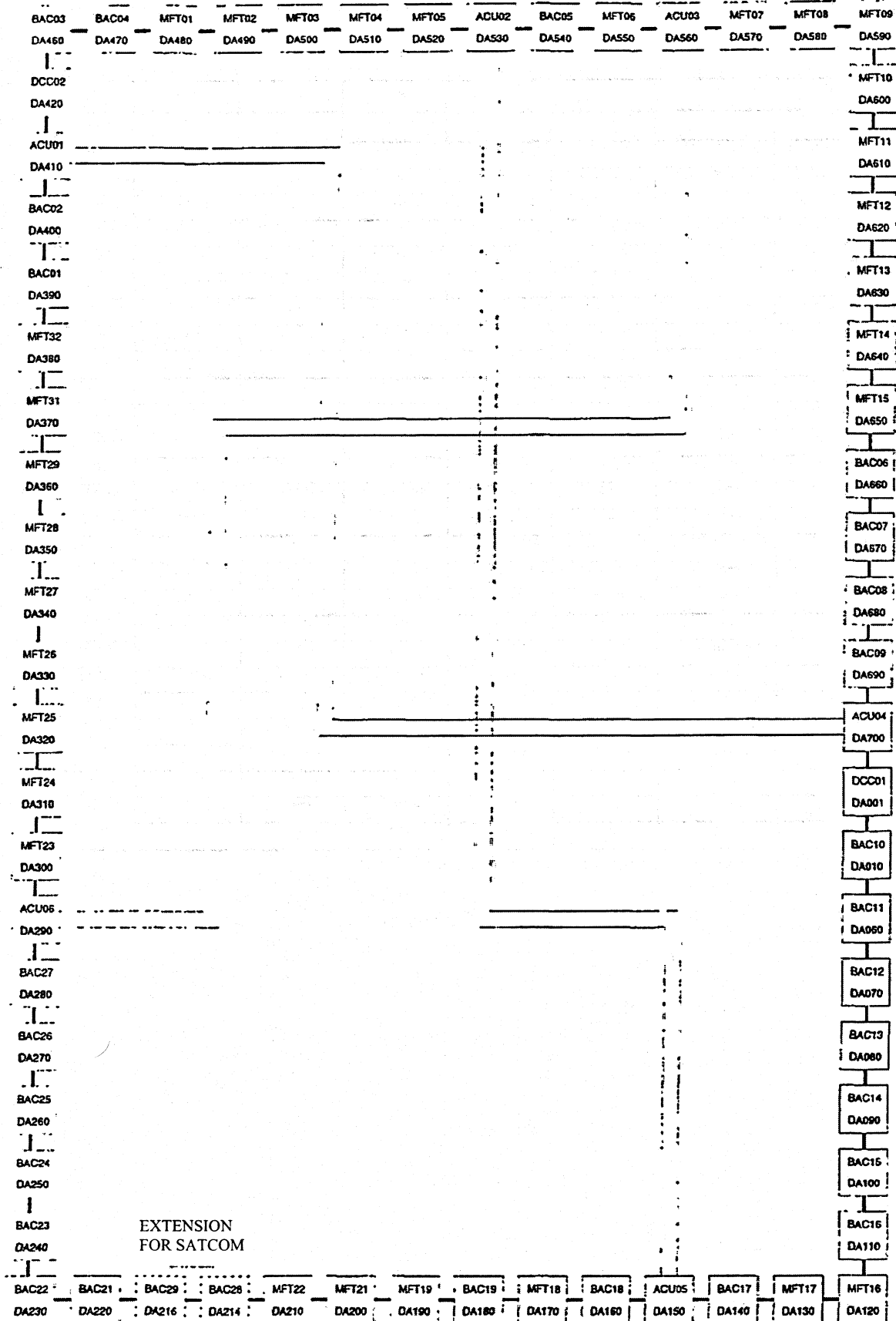
1.31.2.4.10. LV Supply and Distribution

The Power Supply Units (PSUs) for FOCON-A consist of two independent parts. Each part can provide power for eight FOCON-A units (MFT, BAC, ACU, DCC). Each FOCON unit is connected to two PSUs. Should a PSU experience loss of power an Emergency Power Unit (EPU) will take over.

1.31.3. Integration in the central system

The FOCON-A network with the accessories (GRIT) has a double connection with the central system. The FOCON-A network is connected with two Communication Control Cabinets (CCC-1 and CCC-2, one active and one passive) via two DCCs (see illustration 1-2325-9).

Most of the transmission and receive equipment can be operated and various encoding and connecting equipment can be switched in or out of the connection channels from a GOS using the software system function CM1. MHS users can send and receive messages from a VAX terminal via CCC/CM1 and FOCON.

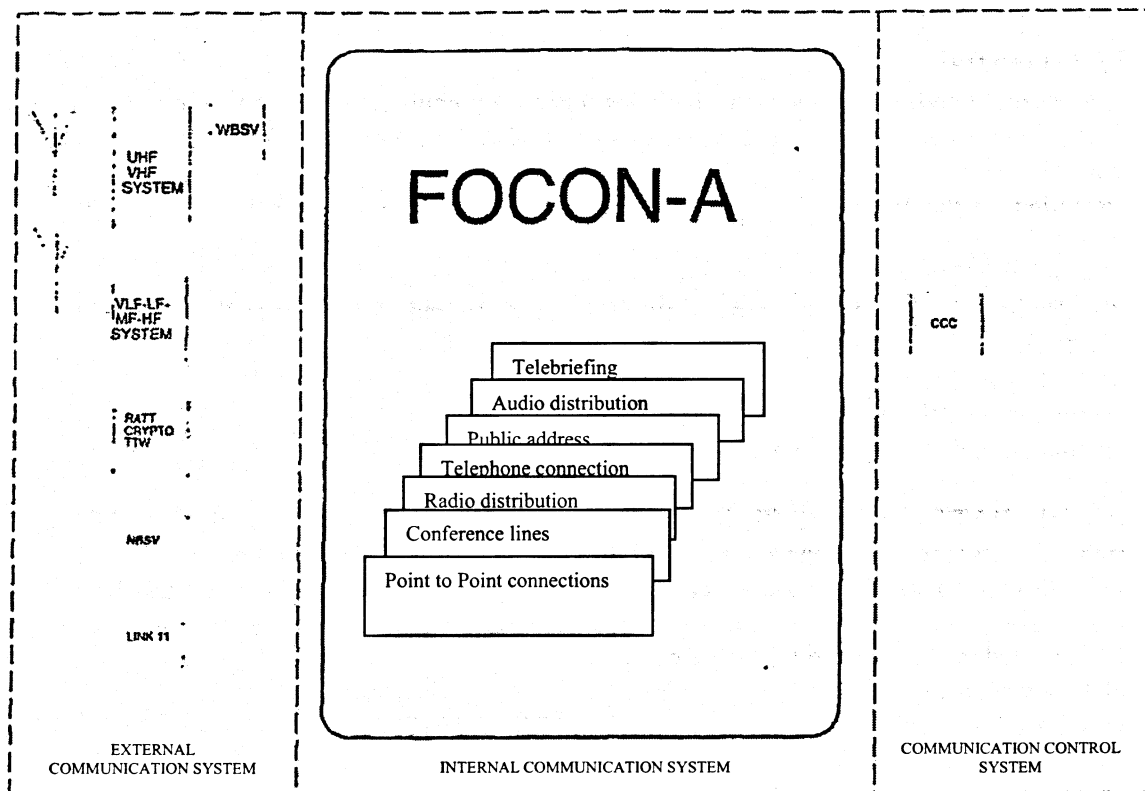


illus. 1-2325-7 FOCON-A Loop network

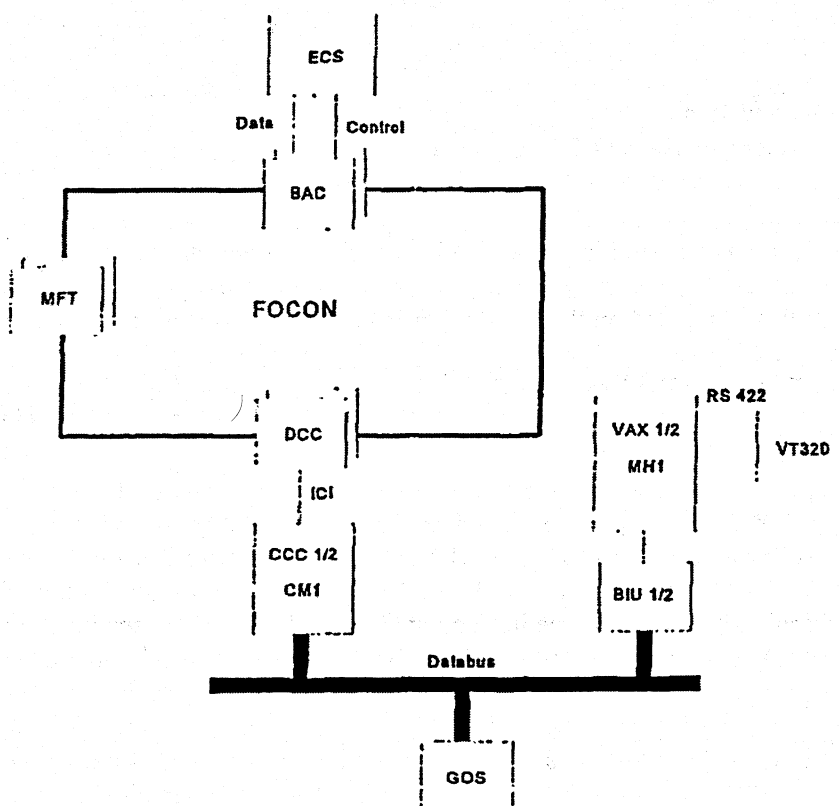
	Interface number							
	0	i	2	3	4	5	6	7
BAC01	SFT1 VDO-RMT	spare	SFT3 KMK-AR	SFT4 DGK	SFT5 HSB-AR	leeg	CEL DC	CEL DC
BAC02	SFT6 KOMP-AR	SFT7/10NIX1E	SFT8 h-dek	SFT9 CP-NST	SFT11 SMK-BB	SFT12 SMK-SB	CEL OB	CEL OB
BAC03	SFT13 COMP-AR	SFT14 SFT-GK	CEL meerboz	CEL meerboz	leeg	Radiotelebrief	CEL telebrief	CEL telebrief
BAC04	SFT15 hangar	SFT16/17BP-TORP	SFT18SP-AR	SFT19WPL-E	leeg	leeg	CEL vuurl.B	CEL vuurl B
BAC05	SFT21 ASSNBC	SFT22 WPL-W	SFT23 NZBKPL	SFT24 GOSMAN	SFT25 BUR-TD	SFT20 SFT-WD	CEL olielaad	CEL olielaad
BAC06	SFT26 plot	SFT27 KOMP-VR	SFT28 VMK	SFT29 KMK-VR	LSP plottafel	leeg	CELED	CELED
BAC07	SFT31 COMP-VR	SFT32 SP-VR	SFT33 TLFC	omroep off	omroep schep	omroep dck	omroep allen	leeg
BAC08	omroep mko	omroep mano	omroep alarm	om.rood sluiten	SFT30 GOSOOF	leeg	CELnoodmano	CELnoodmano
BAC09	PABX lijn 1	PABX lijn 2	PABX lijn 3	PABX lijn 4	PABX lijn 5	PABX lijn 6	leeg	leeg
BAC10	Rx11-USB	(64kB F)	Rx12-USB	(64kB F)	leeg	leeg	spare	spare
BAC11	Tx1-USB	(64kB F)	RBUS1	KeyL11-HF/UHF	TX4-USB	(64kB F)	Tx6-USB	(MkB F)
BAC12	Tx1-LSB	Tx4-LSB	RBUS3	Tx6-LSB	TX3-USB	(64kB F)	TxS-USB	(64 kB V)
BAC13	Rx1-USB	(MkB F)	RBUS4	KeyL11Rx	Rx4-USB	(64kB F)	Tx2-USB	(64kB F)
BAC14	Rx1-LSB	Rx7-USB	RBUS2	RxS-USB	Rx4-LSB	Rxo-USB	(64kB F)	(64kB V)
BAC15	Rx2-USB	(MkB F)	Rx3-USB	(64kB F)	RxS-USB	Rx9-USB	Rx10-USB	(64kB V)
BAC16	RBUS5	RBUS-6B	UHF7	KeyL11 UHF	VHF	UHF8	ESM500	(64kB V)
BAC17	SFT34 NAVCDT	SFT35 EOVHUT	SFT36/37 SRBOC	TTWBRUG	TBS2/3	leeg	leeg	LSP kaanen.
BAC18	SFT38 NAVALG	SFT39OOvdW	SFT41ZB/OZK	SFT42 HUTHTD	TBS4	TBS7	CEL vuurl.A	CEL vuurl.A
BAC19	SFT43 OTA	spare	SFT45 AMK	SFT46 HCB-VR	SFT47BUR-OD	leeg	CEL NBC	CEL NBC
BAC21	spare	UWT	L11-USBmod	(64kB F)	KY58-1	KeyL11 mod	KY58-4	(64kB V)
BAC22	modem 1	L11-LSBmod	BID1	TTWJ	KY58-2	RContr1	KY58-5	(64kB V)
BAC23	modem2	modem6	BID2	TTW2	KY58-3	RContr2	KY58-6	(64kB V)
BAC24	modem3	modem6	BID3	TTW3	NBSV1	RBUS-6A	NBSV1	(64kB F)
BAC25	modem4	BRASS-1	BID4	KVVR1	NBSV2	RC-BRASS-1	NBSV2	(64kB F)
BAC26	modem5	BRASS-2	modem5	KWR2	NBSV3	RC-BRASS-2	NBSV3	(64kB F)
BAC27	REC1	REC2	REC3	REC4	RECS	REC6	REC7	REC8
BAC28	KWR-3	KWR-4	BID5	BID6	BID7	spare	EOW	RContr
BAC29	spare	spare	spare	REKEY	NBSV4	TTW4	NBSV4	(64kB F)

*) BAC 28 and 29 are for the extension for SATCOM

Table 1-2325-1 Overview



illus. 1-2325-8 Overview



illus. 1-2325-9 Integration with databus

1.32. 2326 Message handling sub-system SGC-16/00

1.32.1. General

The Message handling sub-system includes encoding equipment for encoding and deciphering messages to be sent or those received (RATT) and also the encoding equipment for encoding speech (Secure Voice).

An overview of the Message Handling sub-system is given in illustrations 1-2326-3, 1-2326-4 and 1-2326-5.

RATT (Radio teletype) can be carried out in code if desired. RATT Encoding can be used in the following frequency bands:

- transmitting and receiving in the UHF and HF bands
- receiving in the MF, LF and VLF bands
- transmitting and receiving via a shore connection

In principle, RATT message traffic is carried out from the Message Handling System (MH1), whereby all messages are prepared, sent and distributed from a Video Display Unit (VDU). If the MHS is not available messages can be sent and received via a TTW (in FOCON-BYPASS).

RATT Encoded traffic uses the following equipment:

- Teletype writers (3)
- Telex Encoding Devices for sending and receiving BID 1650 (7)
- Telex Encoding Devices for sending and receiving BID 1750 (3)
- Shore Telex Switch
- Modem unit 1280A (8)
- Telex encoding Devices for receiving KWR 46 (4)

1.32.2. Equipment

1.32.2.1. Teletype writer

There are three Teletypewriters (TTW) on board:

- TTW 1; this is situated in the Radio Post and can function in normal and FOCON BYPASS mode
- TTW 2; this is situated in the Radio Post and can function in normal and FOCON BYPASS mode
- TTW 3; this is situated on the Navigation Bridge and functions only in normal mode

1.32.2.2. Telex Encoding Devices

The following Telex Encoding devices are available for encoding and deciphering messages:

- BID 1650/1V2 (7); Telex Encoding Devices are used for encoding and deciphering RATT messages (numbers 1, 2, 3 and 4) which are sent or received on a VDU or TTW.
When using FOCON-bypass Telex Encoding Devices 1 and 2 are set by Remote Control Units 1 and 2 respectively. Telex Encoding Devices BID 1650/1V2, numbers 5, 6 and 7 are used for messages to be sent via the SATCOM installation. Three BIDs 1650/1V2 are situated in Cabinet Group MSI (see illustration 1-2326-1) and three in Cabinet Group LA-CY-0291 (see illustration 1-2326-2)
- BID 1750/19 (2); these are intended for use with new telex equipment and are not yet integrated in the system; these two BIDs are situated on a table opposite Cabinet Group LA-CY-0291 in the Radio Post.
- BID 1750/18; this is intended for use with new telex equipment and is not yet integrated in the system. BID 1750/18 is situated in Cabinet Group LA-CY-0291 (see illustration 1-2326-2).

1.32.2.3. Shore Telex Switch

The Shore Telex Switch enables RATT traffic to communicate with telex networks on shore via a shore connection. This RATT traffic can be encoded or deciphered by telex encoding device I (BID 1650/1V2). The Shore Telex Switch has the following two positions:

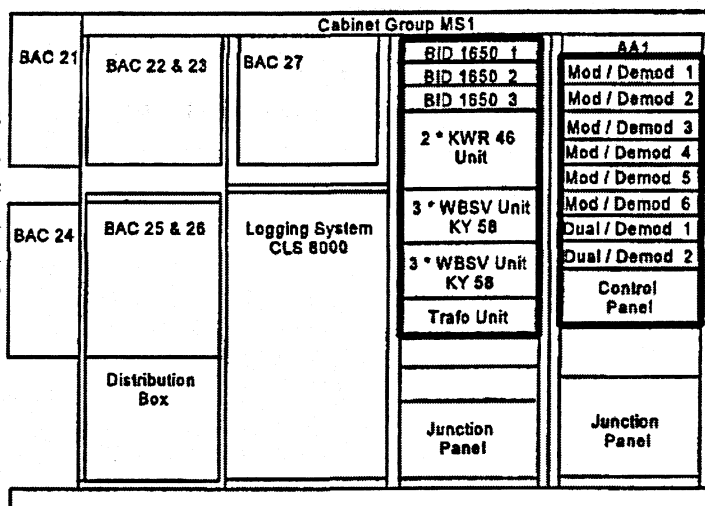
- RADIO; connection between encoding unit 1 and modem 1. The signal is transmitted/received via the transmit/receivers (RADIO).
- SHORE; connection between encoding unit 1 and the shore (via a line interface unit).

1.32.2.4. Modem Unit 1280A

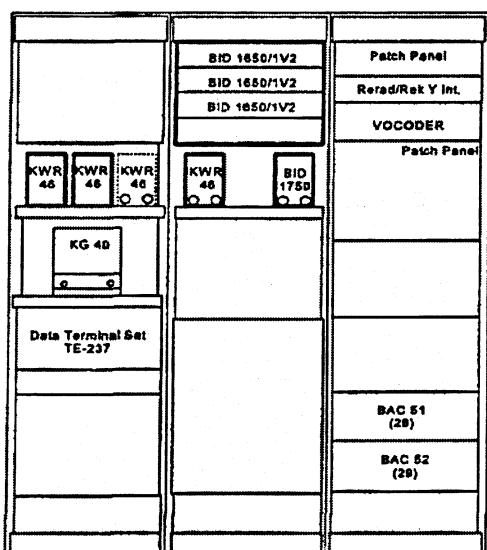
Six Modem Units of type 1280A are situated in Cabinet Group MSI (see illustration 1-2326-1).

1). The six Modem Units are configured as follows: *illus. 1-2326-1 Cabinet Group MSI*

- Four modulator/demodulator configurations (modems 1-4) each combined with a BID 1650 for sending and receiving. The uncoded signal to be transmitted is sent to BID 1650 via FOCON-A, modulated and sent via FOCON-A to the transmitter. An encoded/demodulated signal received is sent to the modem and then sent deciphered via FOCON-A to Message Handling.
- Two separate modulator/demodulators (modems 5 and 6).
- There are also two so-called BRASS modems present for reception present, each combined with KWR 46. The encoded/modulated signal is sent to these modems via FOCON-A. The deciphered/demodulated signal goes via FOCON-A to Message Handling.



The Modem Units 1280A and BRASS are operated by remote control via the Remote Control Bus from a GOS when in operational mode. When in FOCON BYPASS mode they have to be operated locally.



1.32.2.5. Telex Encoding Devices KWR46

Five Telex Encoding Devices KWR46 are available for deciphering the RATT encoded messages:

- KWR46 numbers 1 and 2 are situated in Cabinet Group MSI (see illustration 1-2326-1). These devices receive RATT encoded traffic from the Dual Demodulators. The encoded data from encoding device 1 is routed via a FOCON BYPASS switch.
- KWR46 numbers 3, 4 and 5 are situated in Cabinet Group LA-CY-0291 (see illustration 1-2326-2). These devices are used to decipher messages coming from SATCOM.

1.32.3. Secure Voice

Secure Voice is used for online coding and deciphering of speech. Secure Voice can be divided into:

- Wide Band Secure Voice (WBSV) for the UHF band
- Narrow Band Secure Voice (NBSV) for the HF band.

illus. 1-2326-2 Cabinet Group LA-CY-0291

1.32.3.1. Wide Band Secure Voice

Six KY58 devices are situated in Cabinet Group MSI (see illustration 1-2326-1) for coding and deciphering UHF channels. The six devices are coupled between FOCON-A and six UHF-XCVRs. Transformer units are used in order to electrically separate coded and uncoded information. The Transformer Units are also situated in Cabinet Group MSI.

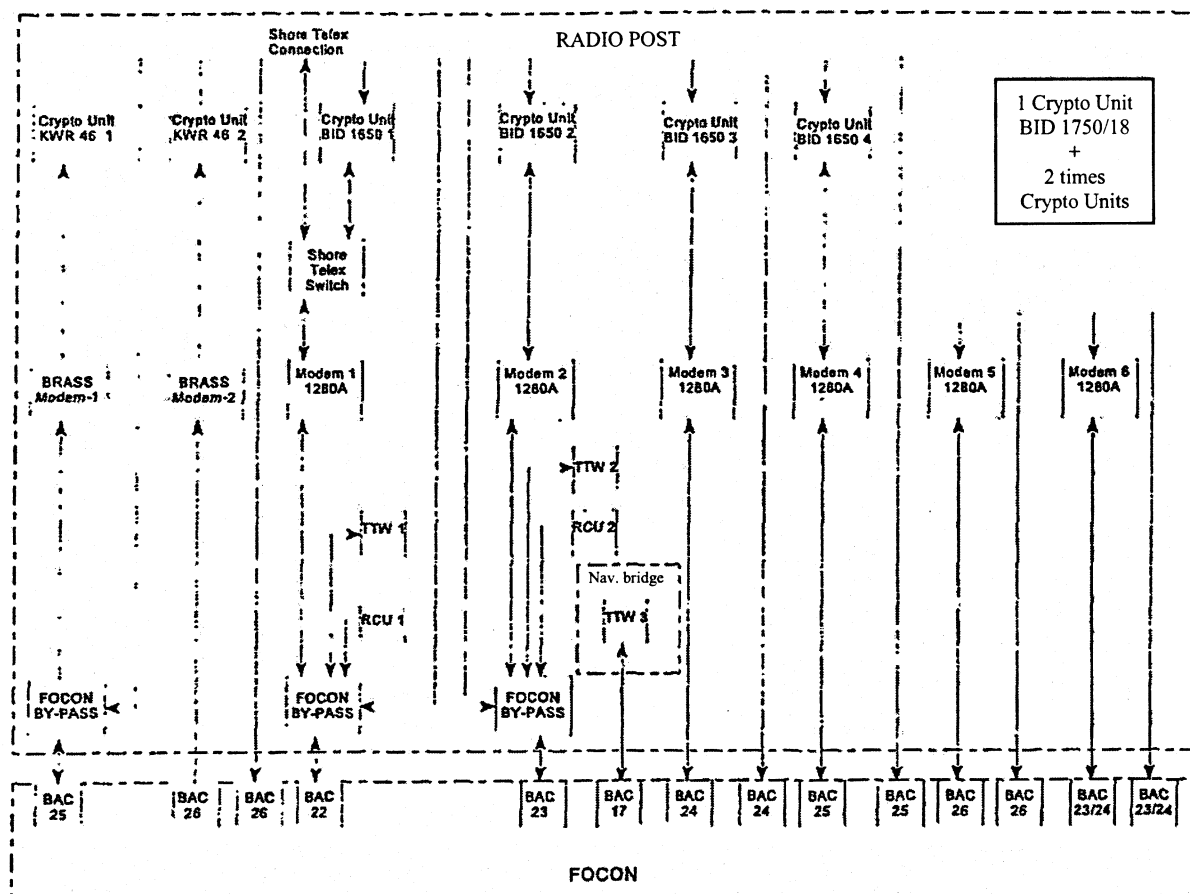
1.32.3.2. Narrow Band Secure Voice

Three NSBV units can be coupled to the SINCOB 1200 system for coding and deciphering HF voice channels. The coded and uncoded speech channels are routed to the HF channels in FOCON-A. NBSV is not possible in FOCON BYPASS mode.

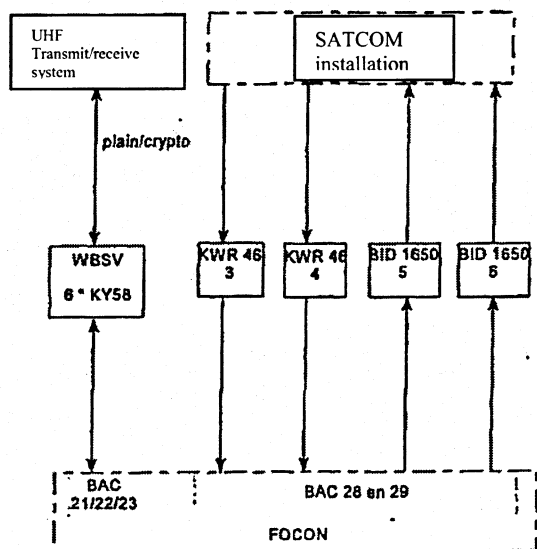
1.32.4. Integration in the central system

The Message handling sub-system is integrated in FOCON-A with the exception of three BID 1750s. Construction of chains and setting the modules via FOCON-A is carried out from a GOS.

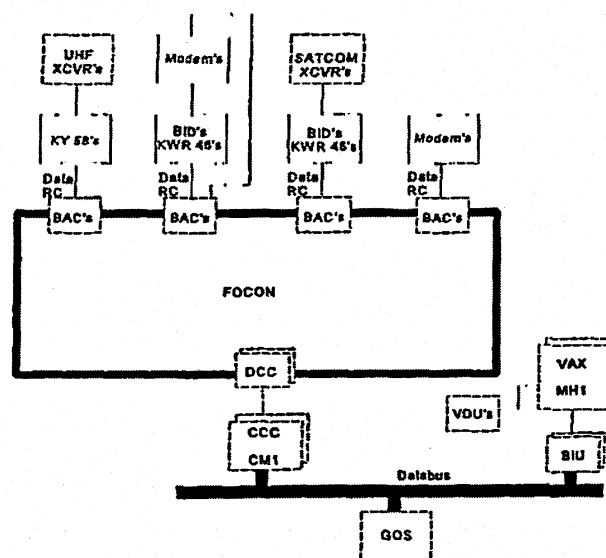
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illus. 1-2326-3 Overview RATT



illus. 1-2326-4 Overview Secure Voice



illus. 1-2326-5 Integration with Databus

1.33. 2327 Public Address System SIQ-03/00

1.33.1. General

The following signals can be selected, amplified and broadcast over the whole ship using the Public Address System:

- Alarm signals:
 - ALARM
 - ROOD SLUITEN (RED CLOSE)
- Public Address signals are divided into six groups:
 - OFF (officers)
 - SCHEP (crew)
 - DEK (Decks)
 - ALLEN (ALL, general broadcast)
 - MKO (engine room call)
 - MANO (manoeuvre)
- Amusement signals:
 - AMO I (amusement broadcast I)
 - AMO II (amusement broadcast II)

An overview of the Public Address System is given in illustration 1-2327-2. The Public Address system has the following parts:

- Public Address Cabinet
- Distribution network of loudspeakers and microphones

1.33.2. Equipment

1.33.2.1. Public Address Cabinet

The Ship's Public Address Cabinet (see illustration 1-2327-2) contains the following units:

- 200 Watt Amplifier (11)
- Control Panel
- Radio/cassette Player Panel
- Alarm and Relay Panel.

1.33.2.1.1. 200 Watt Amplifier

The eleven 200 Watt Amplifiers provide the power for the sound level of the Public Address system.

1.33.2.1.2. Control Panel

This panel provides the user with the following facilities:

- listening to audio signals via a built-in speaker
- amplifier level test
- amusement selection (AMO 1 or AMO 2)
- volume control
- initiate alarm and public address broadcast

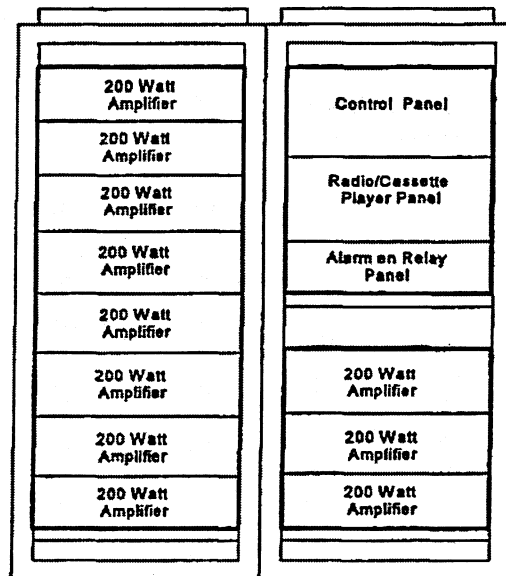
1.33.2.1.3. Radio/cassette Player Panel

The following equipment is situated in this panel:

- Cassette/car Radio RACING 664 Philips (2)
- Short Wave Receiver MARINER D2999 Philips

The panel also provides the following choices:

- Radio choice
- monitoring (select source for built-in loudspeaker) and volume.



illus. 1-2327-1 Public Address Cabinet

1.33.2.1.4. Alarm and relay panel

These are twelve cassettes for the alarm signals and switching functions.

1.33.2.2. Distribution network of loudspeakers and microphones

The Distribution network of loudspeakers and microphones has the following parts:

- Loudspeakers
- Loudspeakers Blastproof
- Muting Relay Cabinet (MRK)
- Receptacle Units with Amplifier
- Microphones

Loudspeakers are placed in almost all rooms in the ship. Receptacle Units with amplifier for microphone or headset connection are fitted in certain rooms. In rooms where there are both a microphone and a loudspeaker there is also an MRK to prevent feedback. Copper wire is used for the distribution of the signals.

Three FM loop systems with three Signal Adapter Units (SAU) are incorporated in the Distribution network. The signal from the distribution network can be received on a suitable headset with receiving equipment via the FM loop system. The three FM loop systems are situated in rooms with a high background noise level. These are:

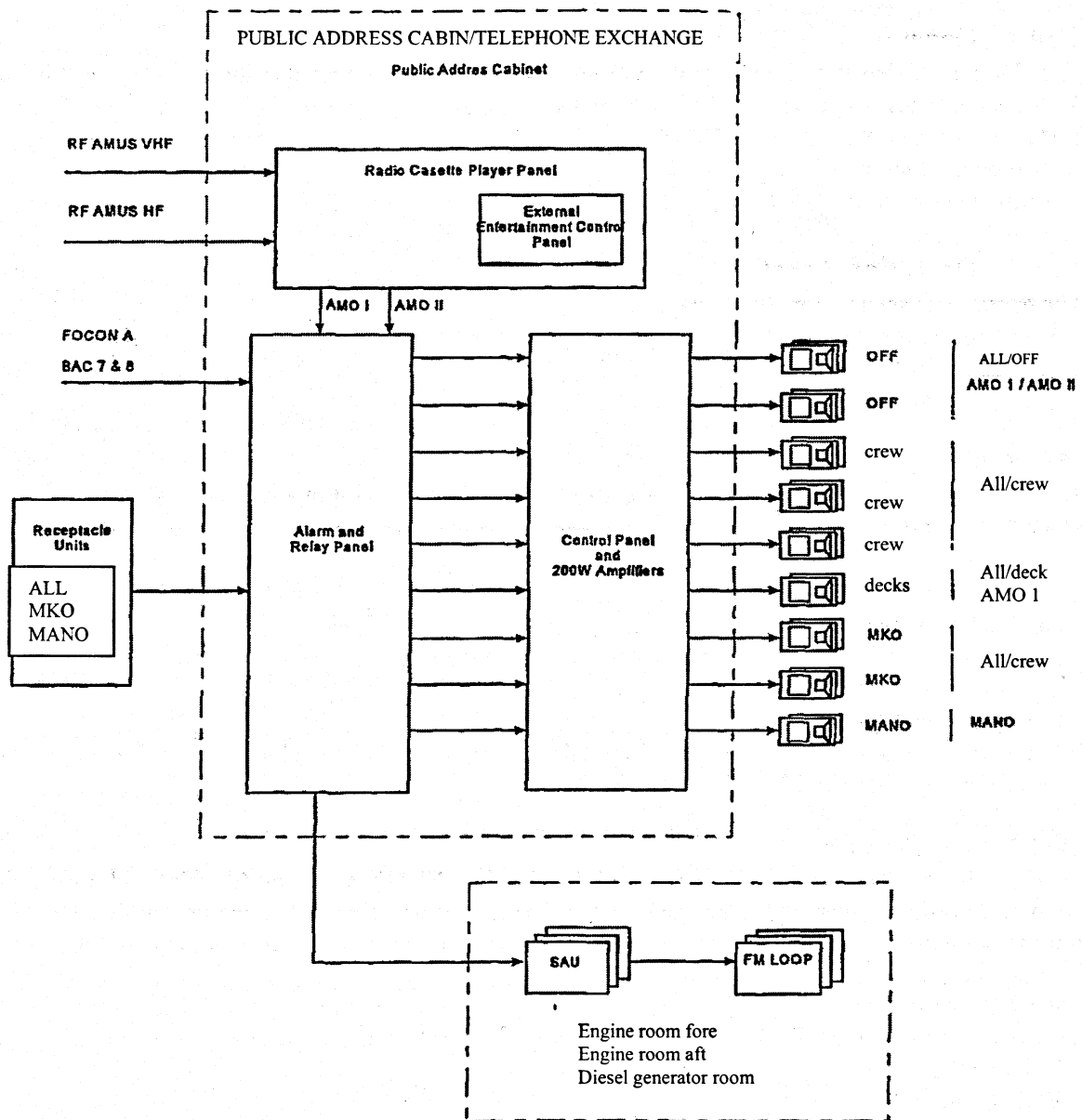
- Diesel Generator Room (DGK)
- Engine Room Aft (AMK)
- Engine Room Fore (VMK)

The SAUs (which form part of BSMI 2325 GRIT) clarify the public address signal by providing an optical signal and/or loud acoustic signal.

1.33.3. Integration in the central system

The Public Address system is connected with the FOCON-A system via BAC 7 and BAC 8. Alarm and Public Address signals can be sent to the Public Address system via the FOCON-A system. Public Address Alarm signals can come from an MFT or SFT. The Public Address system is connected by coax cables with the following outputs in order to receive antenna signals :

- HF AMUS output of the HF-MF-VLF receive sub-system
- VHF AMUS output of the UHF Transmit/receive sub-system



illus. 1-2327-2 Overview

1.34. 2332 TV and Video distribution system SRQ-08/00

1.34.1. General

The TV and Video distribution system (RadioTelevisionVideo bus) distributes radio, television and Video signals via a coaxial network to various users. An overview of the TV and Video distribution system is given in illustration 1-2332-1. It can be split into the two following sections:

- Operational section
- Amusement section

1.34.2. Operational section

The operational section consists of the following parts:

- Signal sources
- Coax Network
- Display Units

1.34.2.1. Signal sources

The signal sources consist of six cameras, two video recorders, including two TV modulators, and the MWCS (SCC GUN and SCC NSS). The cameras are situated in the following places:

- camera Helideck
- camera Goalkeeper (TV picture taken by the Goalkeeper camera with synthetic target information)
- camera "in the barrel" of the Otomelara
- camera STIR I
- camera STIR II
- camera Classroom

The two video recorders with the two TV modulators are situated in the plotting table. The plotting table is situated in the Command Post.

1.34.2.2. Coax Network

The Coax Network is built up from an amplifier (cabinet EI 11), a routing (double) and a ring circuit (double). In order to guarantee the signal for the Goalkeeper and Helideck cameras double input circuits (routings) are used. Two ring circuits are also used to guarantee the continuity of the network.

1.34.2.3. Display Units

The video pictures can be displayed on the following Display Units:

- VDU on the bridge
- VDU in the saloon
- all VDUs in de GOSs.

1.34.3. Amusement section

The Amusement section distributes radio, television and video programmes to eight broadcasting points in the crew quarters. Amplifiers which can be set per band are used to compensate for losses in the cables and branches. The amusement amplifier cabinet has the following antenna connections:

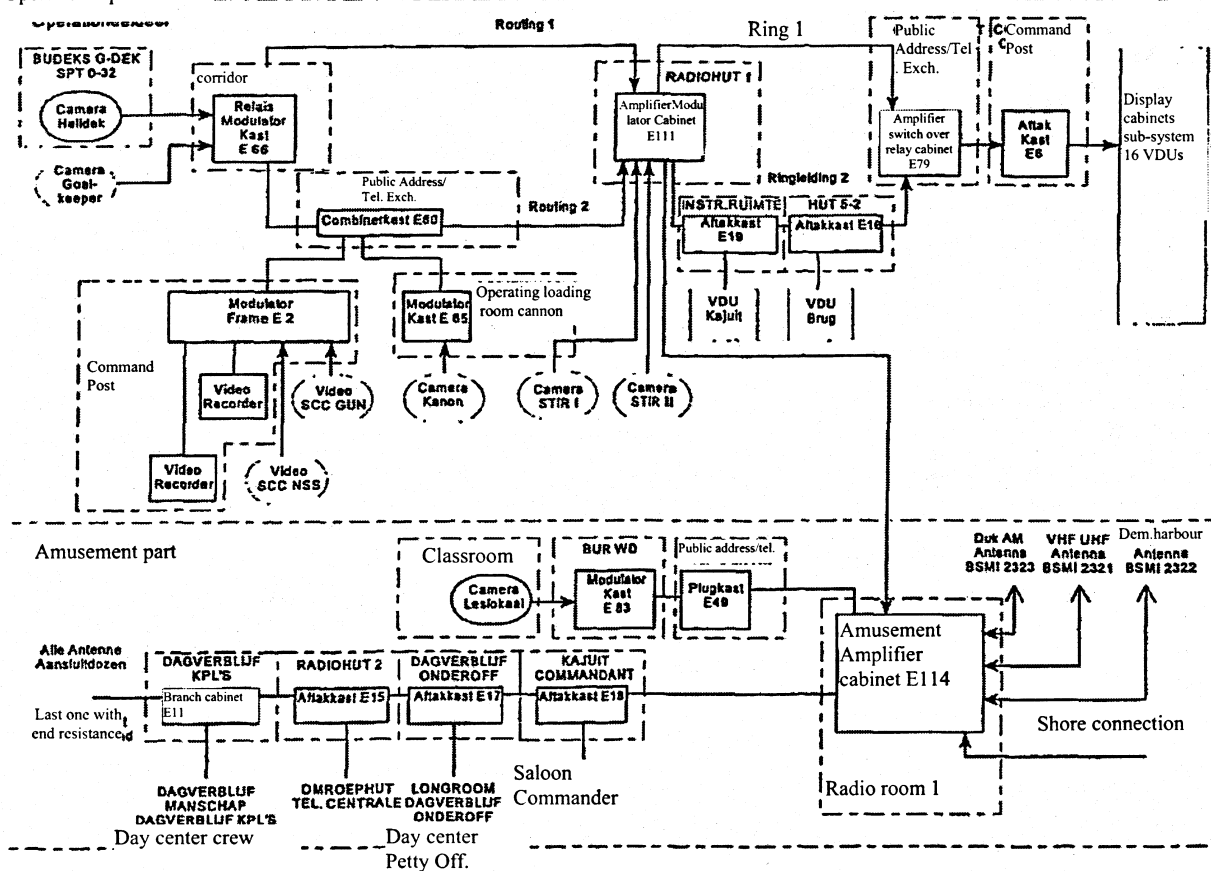
- ship's antenna, all-round sensitive UHF reception for use during sailing (via Antenne 6 in BSMI2321)
- harbour connection, direction sensitive reception while in harbour (via BSMI 2333)
- shore connection, plug cabinet room 986 WAK
- AM signal, from the HF-VLF receive system in BSMI 2323
- video programmes, from the public address cabin

It is possible to send signals from the operational section to the amusement section. When this happens the normal radio/TV reception is interrupted.

1.34.4. Integration

The TV and Video distribution system is stand-alone but other BSMIs are used as the source of the signals and the Display Cabinet sub-system for control.

Operational part



illus. 1-2332-1 Overview

1.35. 2333 Radio and TV Amusement system SRR-29/00

1.35.1. General

The Radio and TV Amusement system is used for relaxation and teaching purposes. It has the following parts:

- Audio and Video Installations
- Reception system

1.35.2. Equipment

1.35.2.1. Audio and Video Installations

A colour TV receiver and a video recorder are situated in the broadcasting cabin (telephone exchange). Audio and Video installations are fitted in the following crew areas:

- crew day recreation area/cafetaria
- KPL day recreation area
- long room
- OOFF day recreation area
- CDT saloon

The audio/video installations differ per ship but in general consist of:

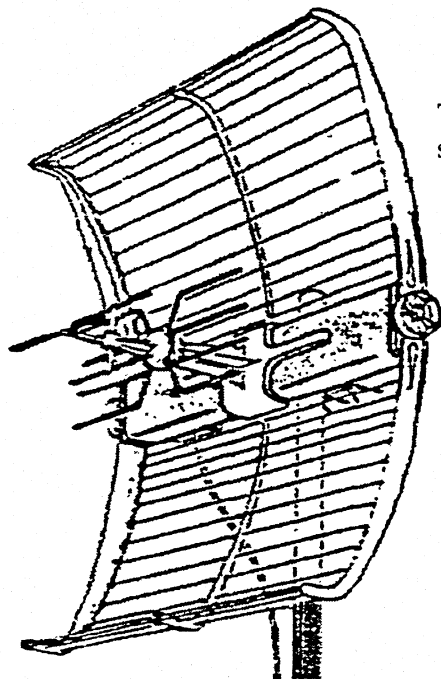
- two 2-way 6 ohm speakers
- tuner FM/AM/LG
- Audio amplifier 2 x 48W
- Cassette deck
- CD player
- Colour TV receiver
- Video recorder

1.35.2.2. Receiver system

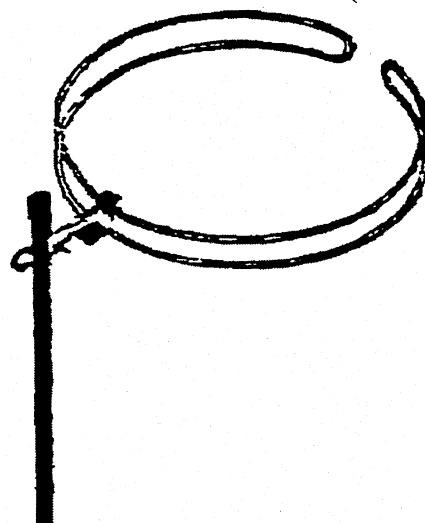
The Radio and TV Amusement Installation has a receiver system consisting of:

- Grid TV antenna (channel 21-60) (see illustration 1-2333-1)
- FM Ring dipole antenna (see illustration 1-2333-2)
- Mast couple filter.

The Radio and TV Amusement system antenna also receives a signal from the TV and Video Distribution Installation (BSMI 2332).



illus. 1-2333-1 Grid antenna



illus. 1-2333-2 Ring dipole antenna

1.35.3. Integration

The Radio and TV Amusement system is not integrated.

1.36. 2334 Underwater telephone installation UT 2000

1.36.1. General

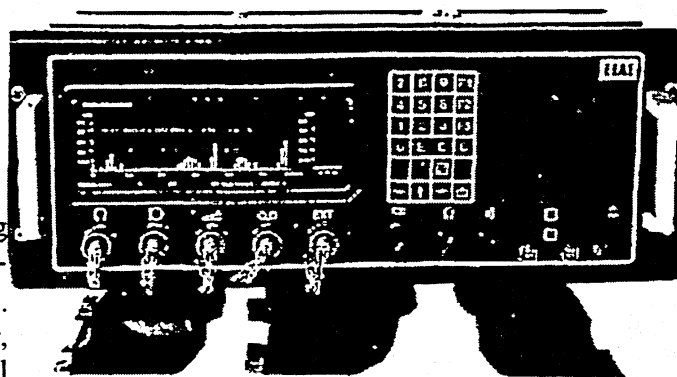
The purpose of the Underwater telephone installation UT 2000 is to be able to communicate with submarines underwater using a wireless system for speech and telegraphy. The system also makes it possible to measure the distance to a submarine. The system is operated locally from the Command Post but it is also possible to telephone underwater from an MFT (via FOCON-A). An overview of the Underwater telephone installation is given in illustration 1-2334-4. The system has the following parts:

- Transmitter Receiver Unit
- Transducer
- Operating equipment

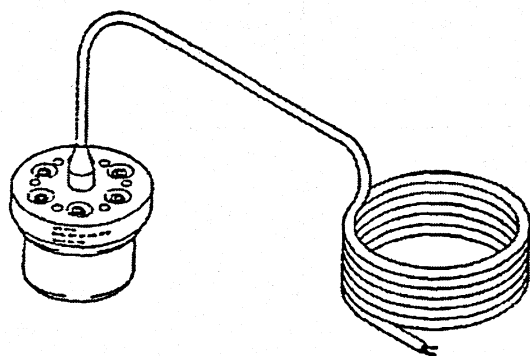
1.36.2. Equipment

1.36.2.1. Transmitter Receiver Unit

The Transmitter Receiver Unit (see illustration 1-2334-1) transmits and receives amplitude modulated signals in the Single Side Band (SSB). The unit has nine different modes. These are: telephony, telegraphy, pinger, transponder, distance measurement, external data, cavitation measurement, key programming and a test mode.



illus. 1-2334-1 Transmitter Receiver Unit



illus. 1-2334-2 Transducer

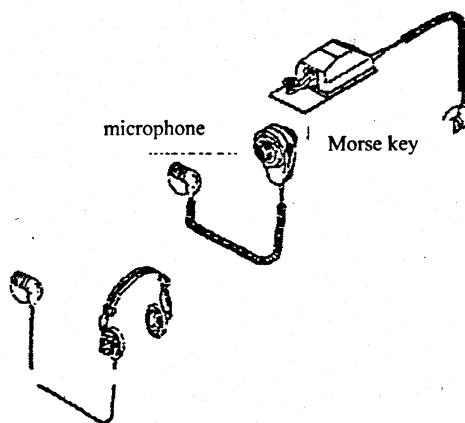
1.36.2.2. Transducer

The Transducer TSE 5-1 (see illustration 1-2334-2) converts the signal to be transmitted/received from acoustic to electrical and vice versa. The transducer is placed in the sonar dome.

1.36.2.3. Operating equipment

The Transmitter Receiver Unit is fitted with the following operating equipment for local operation (see illustration 1-2334-3):

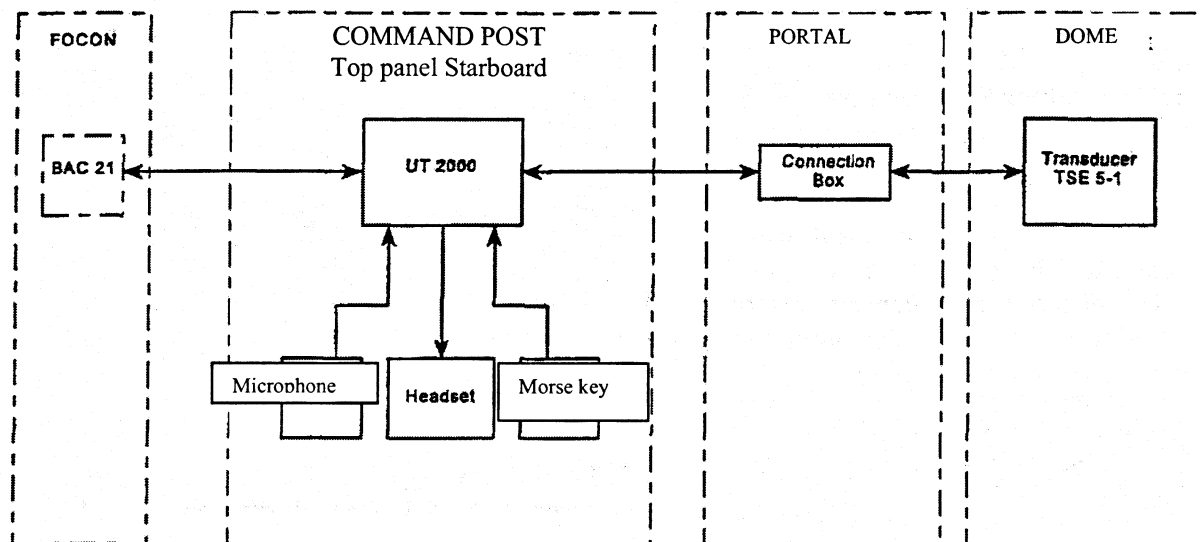
- microphone
- headset
- morse key



1.36.3. Integration in the central system

The installation is integrated in FOCON-A via BAC 21. It is possible to build up a channel which includes the underwater telephone from a GOS so that this installation can then be activated.

illus. 1-2334-3 Operating equipment



illus. 1-2334-4 Overview

1.37. 2335 SHF Satellite Communication Installation SRC-49/00

1.37.1. General

The SHF Satellite Communication Installation (ElectroSpace Industries) provides Super High Frequency (SHF) radio communication via geostationary communication satellites. The system transmits in the 7.9-8.4 GHz frequency range and receives in the 7.25-7.75 GHz frequency range. Full duplex data/voice (plain/secure) communication with another SHF SATCOM station is possible with this installation via a selected satellite as intermediate station. The system also allows position determination to be carried out.

The system has two dish antennas which automatically focus on the beacon signal from the satellite. A tracking circuit maintains the antennas in the right direction and one antenna (primary) is used for the communication. The system automatically switches to the other antenna if the primary antenna loses track or if the quality of the reception is too poor. If both antennas lose the signal they remain focussed on the last contact point. If contact is not restored within five minutes the system switches to search mode in order to localize the satellite again. An overview of the Satellite Communication Installation is given in illustrations 1-2335-7 and 1-2335-8. The Satellite Communication Installation has the following parts:

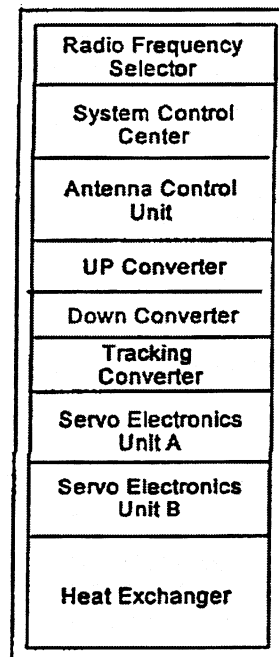
- Electronics Cabinet
- Interface Cabinet
- Power Amplifier Cabinet
- Prime Power Distribution Cabinet
- Antenne (2)
- Test horn

1.37.2. Equipment

1.37.2.1. Electronics Cabinet

The Electronics Cabinet (see illustration 1-2335-1) consists of the following units:

- Radio Frequency Selector; controls the progress of the signal received by the antennas to the Down Converter and Tracking Converter.
- System Control Center; central operation and status monitoring of the entire system.
- Antenna Control Unit; controls the transmission and receiving of information and orders via the SEU, including the ship's position, the satellite position and the course of the ship, so that the antenna system is able to locate and to continue to track a satellite.
- Up Converter; converts a 70 or 700 MHz signal from the Baseband Interface (Interface Cabinet) into a SHF transmission signal for the Power Amplifier Radio Frequency Unit in the Power Amplifier Cabinet.
- Down Converter; converts the SHF signal received to 70 or 700 MHz for the Baseband Interface Unit (Interface cabinet).
- Tracking Converter; controls the tracking using the satellite beacon signal and continues to control and adjust this by means of a track error signal. This data is sent to the Antenna Control Unit.
- Servo Electronics Unit A; controls antenna A (BB)
- Servo Electronics Unit B; controls antenna B (SB)
- Heat Exchanger; provides cooling for the cabinet and is kept at a particular temperature by the ship's cooling water.

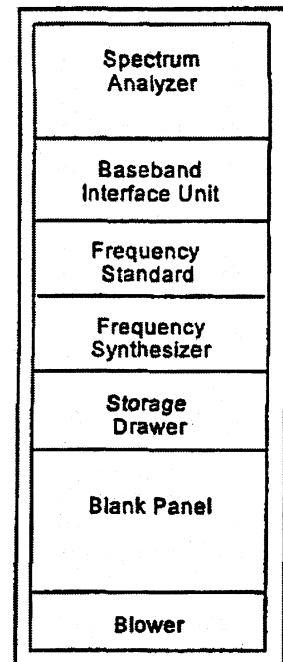


illus. 1-2335-1 Electronics Cabinet

1.37.2.2. Interface Cabinet

The Interface Cabinet (see illustration 1-2335-2) has the following units:

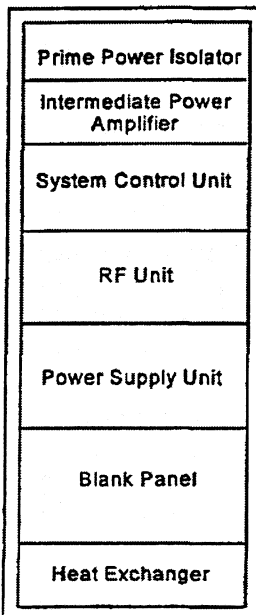
- Spectrum Analyzer; used for testing the RF and IF signals and reading the TCON signal.
- Baseband Interface Unit; the interface between the system and a maximum of three external 70 MHz and three external 700 MHz modems.
- Frequency Standard; generates a 4 MHz reference signal for various units
- Frequency Synthesizer; generates a 70 MHz signal variable between +3 and +13 dBm for test purposes.
- Storage Drawer; for storage.
- Blower; for cooling the Cabinet.



illus. 1-2335-2 Interface Cabinet

1.37.2.3. Power Amplifier Cabinet

The Power Amplifier Cabinet (see illustration 1-2335-3) contains the following units:

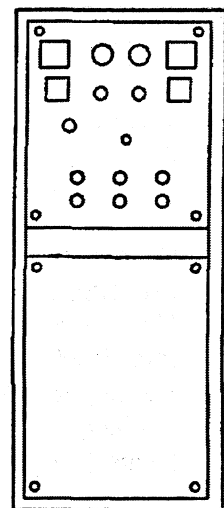


- Prime Power Isolator; contains a three phase circuit breaker to interrupt the power to all units and a safety circuit.
- Intermediate Power Amplifier; amplifies the SHF transmission signal from the Up-Converter to the required level for the TWT in the RF circuit.
- System Control Unit; control and monitoring of the Power Amplifier and the Interface with the System Control Center in the Electronics Cabinet.
- Radio Frequency Unit; contains a TWT with the accompanying circuits for generating the transmission signal (1600 W VSWR).
- Power Supply Unit: generates all power supplies for the RF Unit and the IPA Unit.
- Heat Exchanger: cools the cabinet; is kept at a particular temperature by the ship's cooling water.

illus. 1-2335-3 Power Amplifier Cabinet

1.37.2.4. Prime Power Distribution Cabinet

All the power supply required for the installation is supplied by the Prime Power Distribution Cabinet (see illustration 1-2335-4). This cabinet is connected to the ship's power supply. All the necessary operating units and signals are visible on the front panel.

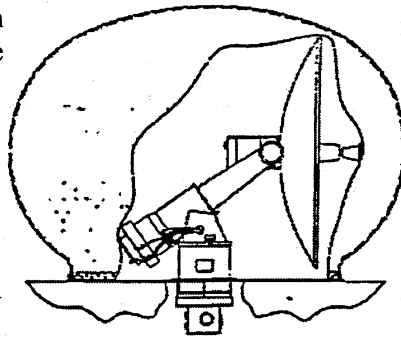


illus. 1-2335-4 Prime Distribution Cabinet

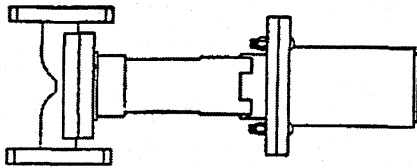
1.37.2.5. Antenna

The antenna (see illustrations 1-2335-5 and 1-2335-8) is situated in a ball-shaped dome 2.1 metres in height. The system has two antennas. Each antenna has the following parts:

- Antenne Assembly; a rotatable (in three directions) dish antenna
- Power Control Communications Unit; control and distribution of the power supply for the various parts
- Radome Access Hatch Interlock Switch; an access hatch with switch to be able to switch off the antenna
- Radome Heaters; to provide heating in the Radome
- Radome Light Assembly; to provide lighting in the Radome



illus. 1-2335-5 Antenna with dome



illus. 1-2335-6 Test horn

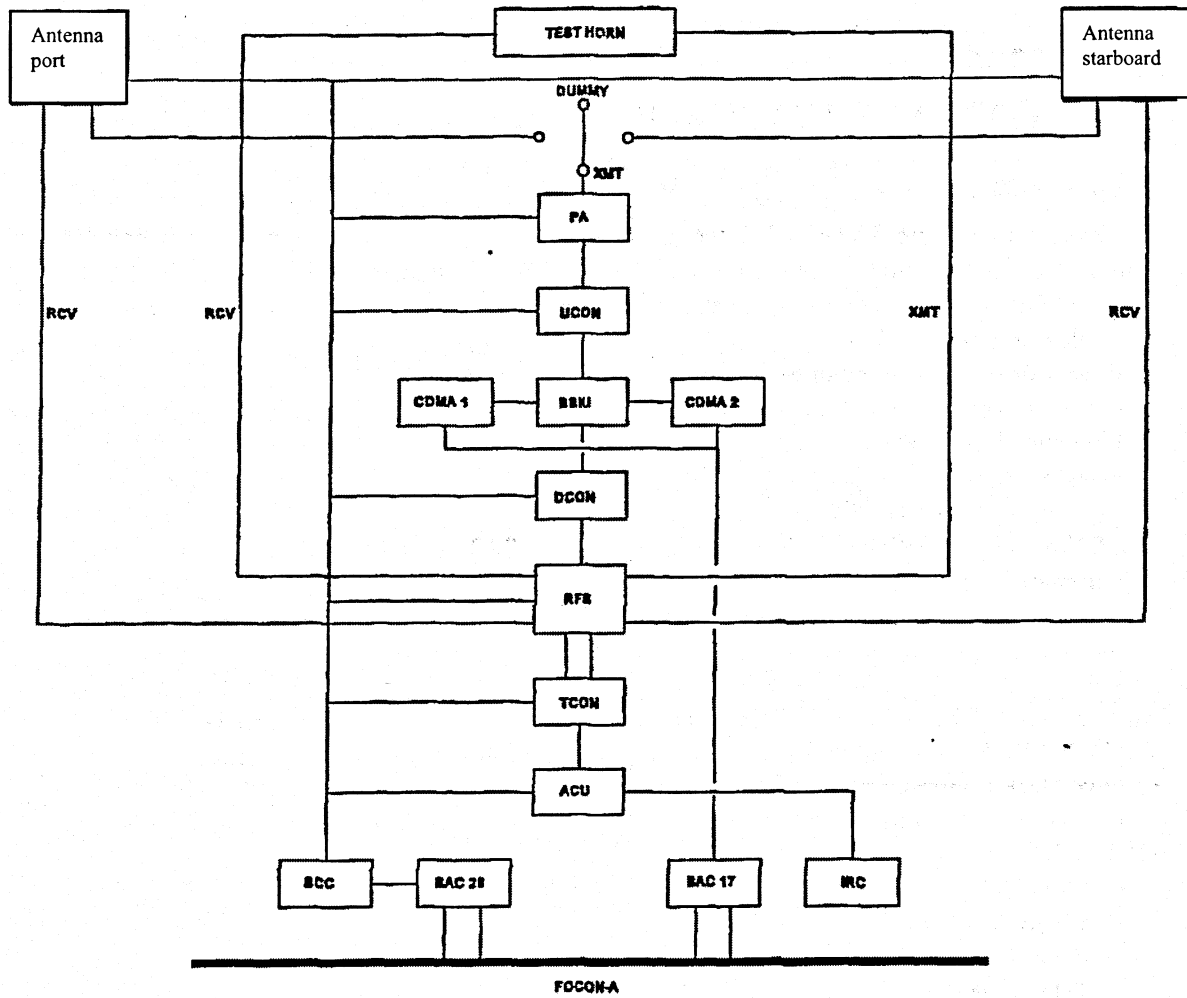
1.37.2.6. Test horn

The Test horn (see illustration 1-2335-6) is used to test the system using a dummy load by providing average transmission and reception characteristics. The test horn is a passive device situated on the Top deck (bridge deck).

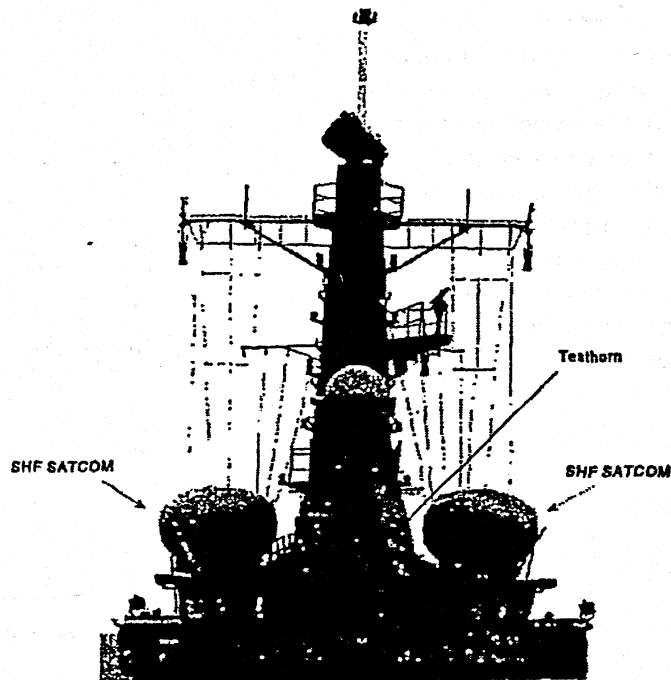
1.37.3. Integration in the central system

The Satellite Communication Installation is connected with BAC 17 and 28 of the FOCON-A system. Various modems can be connected Via FOCON-A. At present there are two CDMA modems present which work with 70 MHz. Full duplex data/voice (plain or secure) communication lines can be established with the help of interfaces and encoding equipment.

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illus. 1-2335-7 Overview



illus. 1-2335-8 SATCOM antennas

1.38.2336 Satellite Communication Installation (INMARSAT) JUE-45A/MK2

1.38.1. General

MARISAT (Maritime SATellite), later called INMARSAT, is the largest, worldwide commercial communication system to provide services for the offshore industry and shipping. INMARSAT has three satellites which together cover the whole world. INMARSAT offers the following services:

- duplex or simplex telex
- duplex or simplex telephone
- duplex or simplex telephone (data/fax)
- high speed data (option)
- priority

The following connections can be set up using INMARSAT services:

- automatic or semi-automatic telex connections
- telephone conversations
- data exchange

An overview of the INMARSAT installation on board is given in illustrations 1-2336-4 and 1-2336-5. The INMARSAT is an autonomous system and has the following parts:

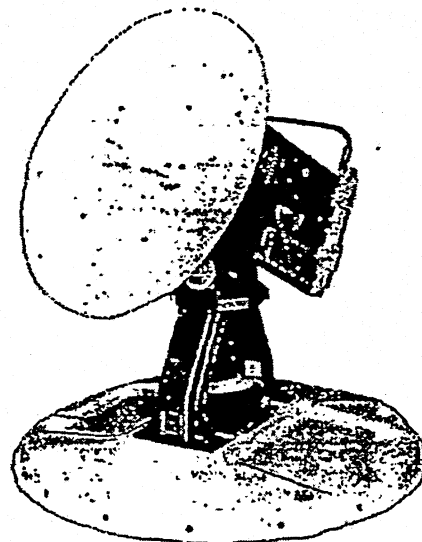
- Above Deck Equipment:
 - Satellite dish with control
- Below Deck Equipment:
 - Main Unit
 - Video Display Unit
 - Read-Out Printer
 - Telephone (2)

1.38.2. Equipment

1.38.2.1. Satellite dish with control

The antenna (see illustration 1-2336-1) automatically searches for the satellite to receive the Time Division Multiplex (TDM) signal. If the reception is blocked (mast, obstacle) the system will restore itself. If the satellite is received at an elevation angle of $< 6^\circ$ the system transfers to another satellite. The antenna moves independently of the ship's movement in order to track the satellite. The antenna elevation is from 6° to 90° and the azimuth runs from 270° anti-clockwise to 270° clockwise in relation to the bows. The antenna is situated in a radome and has the following parts:

- dish
- High Power Amplifier (RF output 30W)
- Low Noise Amplifier
- diplexer
- servo motors
- AntennaControl Unit
- Frequency Translate Unit

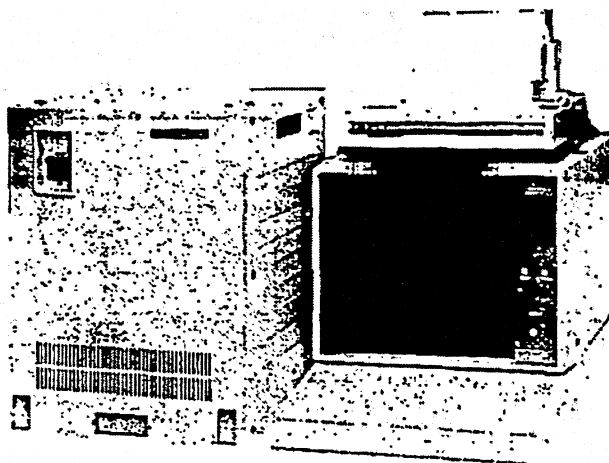


illus. 1-2336-1 Satellite dish

1.38.2.2. Main Unit

The Main Unit or terminal control unit regulates all the functions of the ground station and consists of a transmission and a receive section. The Main Unit (see illustration 1-2336-2) includes the following:

- amplifiers
- demodulators
- expander
- synthesizer
- frequency generator
- Central Processing Unit (CPU)
- modulators



1.38.2.3. Video Display Unit

The Video Display Unit (VDU) displays the messages sent and received. Messages can also be prepared using the keyboard and saved for use later on.

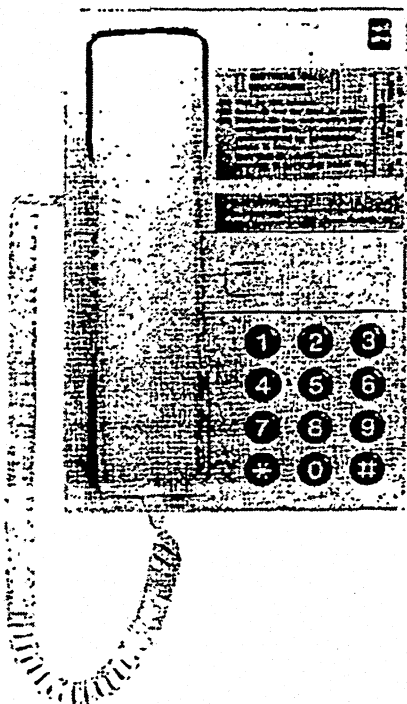
The VDU is connected to the Main unit which has 16 kB memory, equivalent to 40 minutes telex traffic. The VDU (see illustration 1-2336-2) consists of:

- monitor screen
- key board

illus. 1-2336-2 Main Unit with Video and Printer

1.38.2.4. Read Out Printer.

The Read Out Printer (see illustration 1-2336-2) can generate a hardcopy of all messages and also print out the status of the various units.



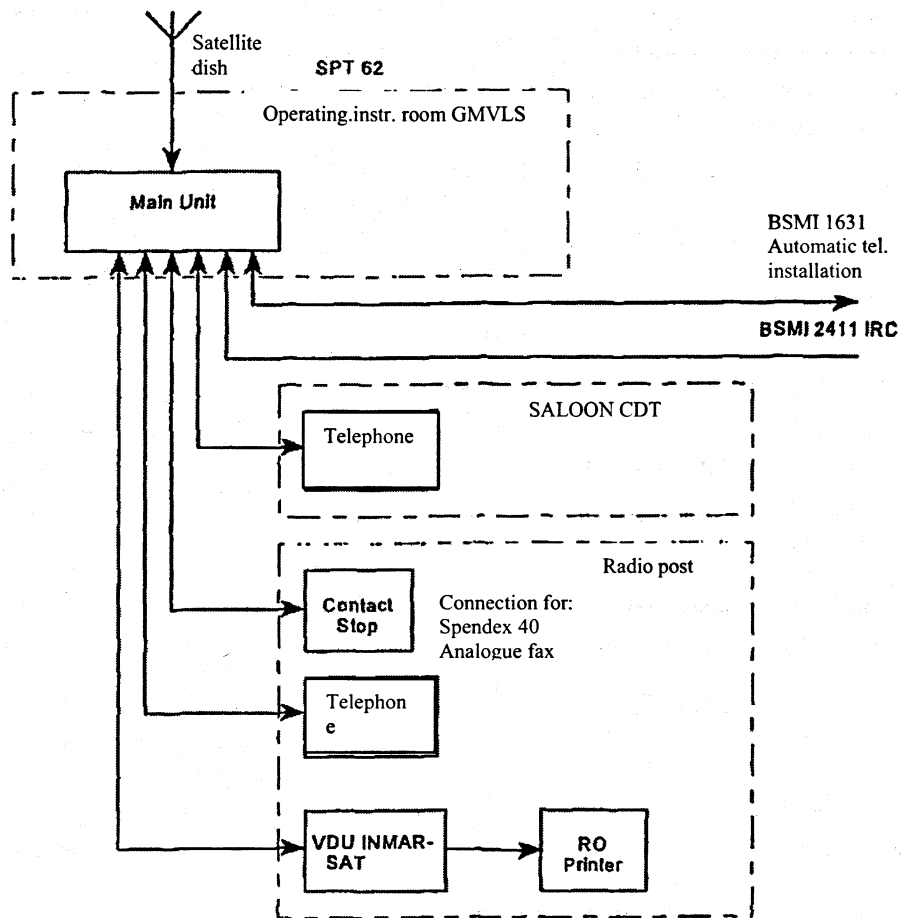
1.38.2.5. Telephone

The telephone (see illustration 1-2336-3) is used for sending and receiving spoken messages. A 2 and/or 4 wire telephone can be used.

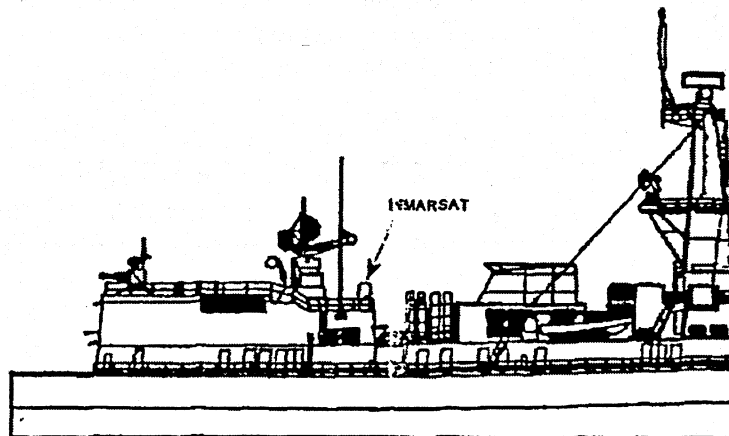
1.38.3. Integration at BSMI level

The INMARSAT is connected (see illustration 1-2336-4) with the Information Retransmission Cabinet (BSMI 2411). The IRC supplies the ship's heading to the Main Unit of the INMARSAT. The Main Unit is also connected with the Automatic Telephone Installation (BSMI 1631) so that telephone conversations can be held at various places on the ship.

illus. 1-2336-3 Telephone INMARSAT



illus. 1-2336-4 Overview



illus. 1-2336-5 Position on the ship

1.39. 2411 Information Retransmission Installation SEN-10/00

1.39.1. General

The Information Retransmission Installation (IRI) integrates and processes nautical data and supplies this integrated nautical data to Data Handling. The IRI also supplies data to various ship's systems, displays and light indicators in the various rooms. An overview of the IRI is given in illustration 1-2411-11. The IRI can be divided as follows:

- Information Retransmission Cabinet (Model 6520)
- Display Units and light indicators

1.39.2. Equipment

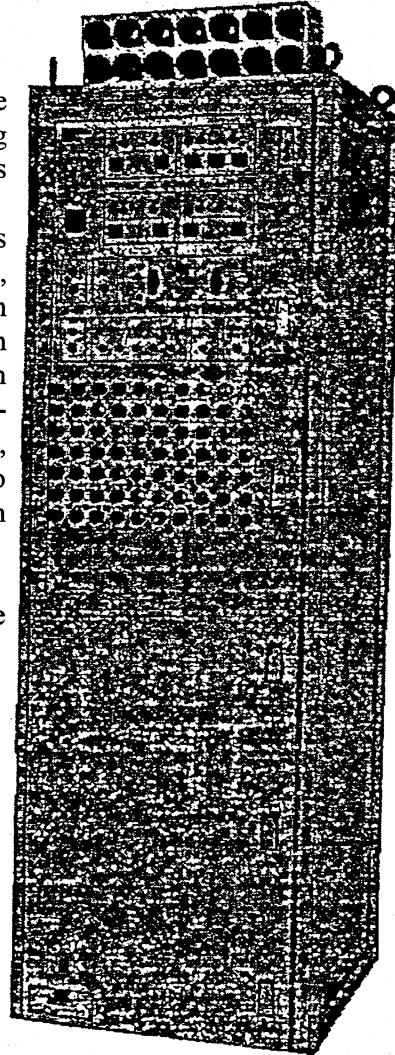
1.39.2.1. Information Retransmission Cabinet

The Information Retransmission Cabinet (IRC) (see illustration 1-2411-1) integrates and processes incoming nautical data and sends this data to display units, ship's installations and Data Handling and also gives light signals.

The IRC obtains information from the following installations (see illustration 1-2411-11): Log installation (BSMI 2413), Barometer installation (BSMI 2422), Wind speed and direction installation (BSMI 2421), Compass and inertial navigation installation SINS (BSMI 2412) and the Satellite navigation installation GPS (BSMI 2431). The data from the above-mentioned installations is converted to heading, roll, pitch, speed, position, wind and barometer pressure. The IRC also receives/sends data to the Information Processing System (IVS).

The IRC functions as back-end for DH1 and supplies the following data:

- status data; this is sent to the system function DH1, running in the SMRμ in Data Handling Computer Cabinets 1 & 2 (DHCC).
- IVS data to various installations (such as navigation, weather and automatic pilot systems); this has platform information such as the revolution speeds of propellers, diesels, pumps and compressors.
- system data from the IRC; this contains details about date, time (system time, local system time, tactical time and local time), geographical position, heading, sailing speed, wind speed, wind direction, barometer pressure, roll and pitch.



illus. 1-2411-1 Information Retransmission Cabinet

The interfaces between the IRC and the nautical equipment coupled to this which supply the data for data handling are (the inputs and outputs of the IRC are described in Chapter 4):

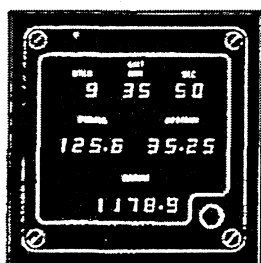
- STANAG no. 4156 interface; this is for the SINS and GPS. The SINS and GPS are connected with their interfaces via couplers
- RS422 interface; this is for the barometer, EM log, wind meters and the IVS.
- Synchro/Digital converters; these are used for converting the single (coarse) and 36 (fine) synchro signals from the Mk29 compass into data language.

1.39.2.2. Indicators and lights

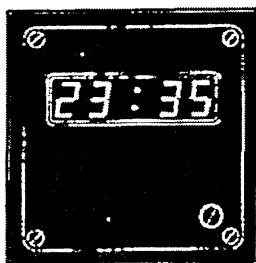
These are various indicators showing different nautical information. The light indicators show the status of the nautical installation such as: info loss, temperature too high, alarm, power, alert, etc. The indicators and lights are situated in the Command Post, on the Navigation Bridge, the VDO room, the WD office (only light indicators) and the Technical Center.

There is also a Clinometer on the Navigation Bridge. This is a stand-alone meter which measures the roll angle. The IRI controls the following indicators:

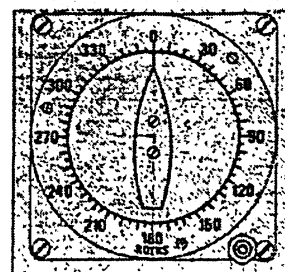
- numerical indicator (10), see illustration 1-2411-2; this indicator converts serial digital values into numerical values. The indicator shows the time, bearing, distance and barometric pressure or the time, bearing, wind direction and wind speed.
- numerical indicator time (20), see illustration 1-2411-3; this indicator only shows the time.
- course indicator (4), see illustration 1-2411-4; this is a synchro-servo indicator with a rotatable arrow position used to show the heading of the ship
- sailing speed indicator (1), see illustration 1-2411-5; this indicator shows the speed of the ship
- wind direction receiver (4), see illustration 1-2411-6; shows the relative wind direction.
- wind speed receiver (4), see illustration 1-2411-7 shows the relative wind speed.
- roll angle indicator (1), see illustration 1-2411-8; shows the positive or negative roll angle.
- pitch angle indicator (1), see illustration 1-2411-9; shows the positive or negative pitch angle.
- film daughter compass, (4), see illustration 1-2411-10; shows the compass angle, via a film indicator.



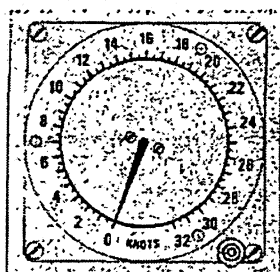
illus. 1-2411-2
Numerical indicator



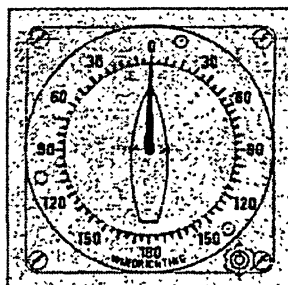
illus. 1-2411-3
Numerical indicator time



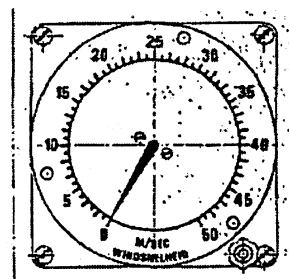
illus. 1-2411-4 Corrected
Heading indicator



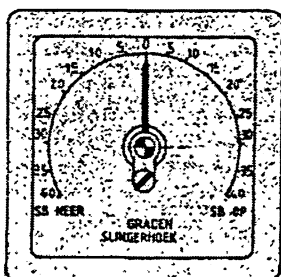
illus. 1-2411-5 Corrected
sailing speed indicator



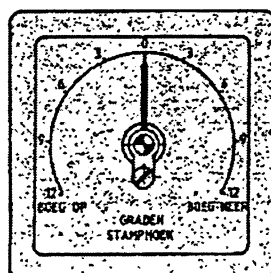
illus. 1-2411-6 Wind
direction receiver



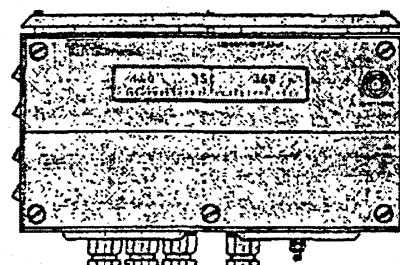
illus. 1-2411-7 Wind speed
receiver



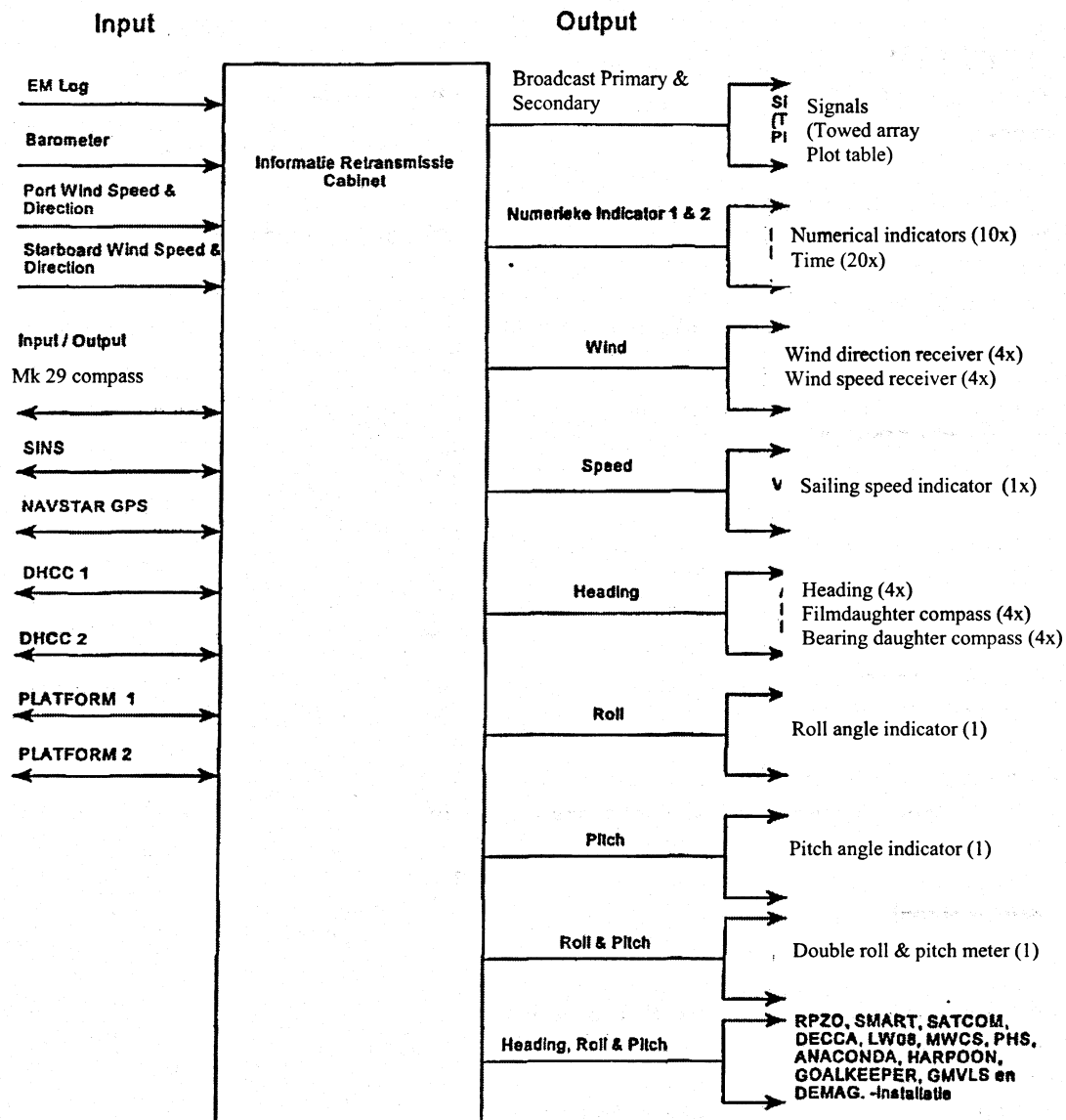
illus. 1-2411-8 Roll
angle indicator



illus. 1-2411-9 Pitch
angle indicator



illus. 1-2411-10 Film
daughter compass



illus. 1-2411-11 Overview

1.40. 2412 Compass and Inertial navigation installation SJN-17/00

1.40.1. General

The Compass and Inertial navigation installation supplies the following details to the IRC:

- compass details (roll, pitch and heading)
- position details

An overview of the Compass and Inertial navigation installation is given in illustration 1-2412-3. The Compass and Inertial navigation installation consists of the following compasses:

- NATO SINS COMPASS
- Gyrocompass MK 29 mod 0

1.40.2. Equipment

1.40.2.1. NATO SINS COMPASS

The NATO SINS Compass (see illustration 1-2412-1) is a ring laser compass which supplies the following details:

- position
- speeds
- heading, roll and pitch

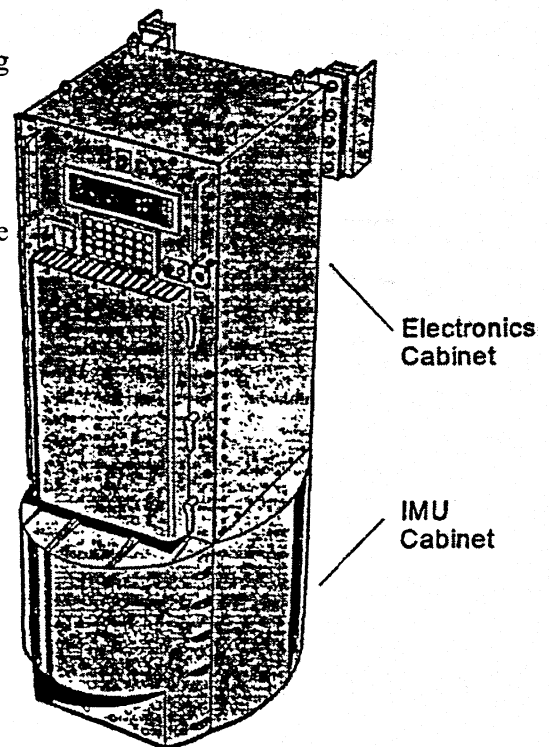
The SINS position is regularly realigned by the GPS. The NATO SINS Compass consists of an:

- Electronics Cabinet and an
- Inertial Measurement Unit (IMU) Cabinet.

The Electronics Cabinet contains:

- IMU Support Electronics; these control the sensors in the IMU Cabinet
- Navigation Processor Electronics; this processes the sensor signals
- I/O Processor Electronics; this processes the sensor signals
- Control and Display Electronics; this controls the operation of the SINS Compass

The Inertial Measurement Unit is carried out by a Ring Laser Gyro (RLG). There are two laser beams in the RLG which rotate with identical resonance frequencies in a triangular path but in opposing directions.



illus. 1-2412-1 Nato SINS Compass

When the RLG rotates a frequency difference is caused between the two laser beams because one beam has to travel further than the other.

The SINS continuously and automatically supplies the following details to the IRC via a STANAG 4156 Interface:

- the geographical position of the ship
- horizontal and vertical speed components
- heading, roll and pitch

In order to be able to work properly the SINS receives the following data:

- Ship's speed data from the GPS or LOG installation
- Regular position from the GPS or manually entered position

1.40.2.2. Gyrocompass MK29 mod 0

The Gyrocompass MK 29 mod 0 (see illustration 1-2412-2) is the second compass. It supplies heading, roll and pitch to the IRC and receives speed information from the IRC. The MK 29 consists of the following parts:

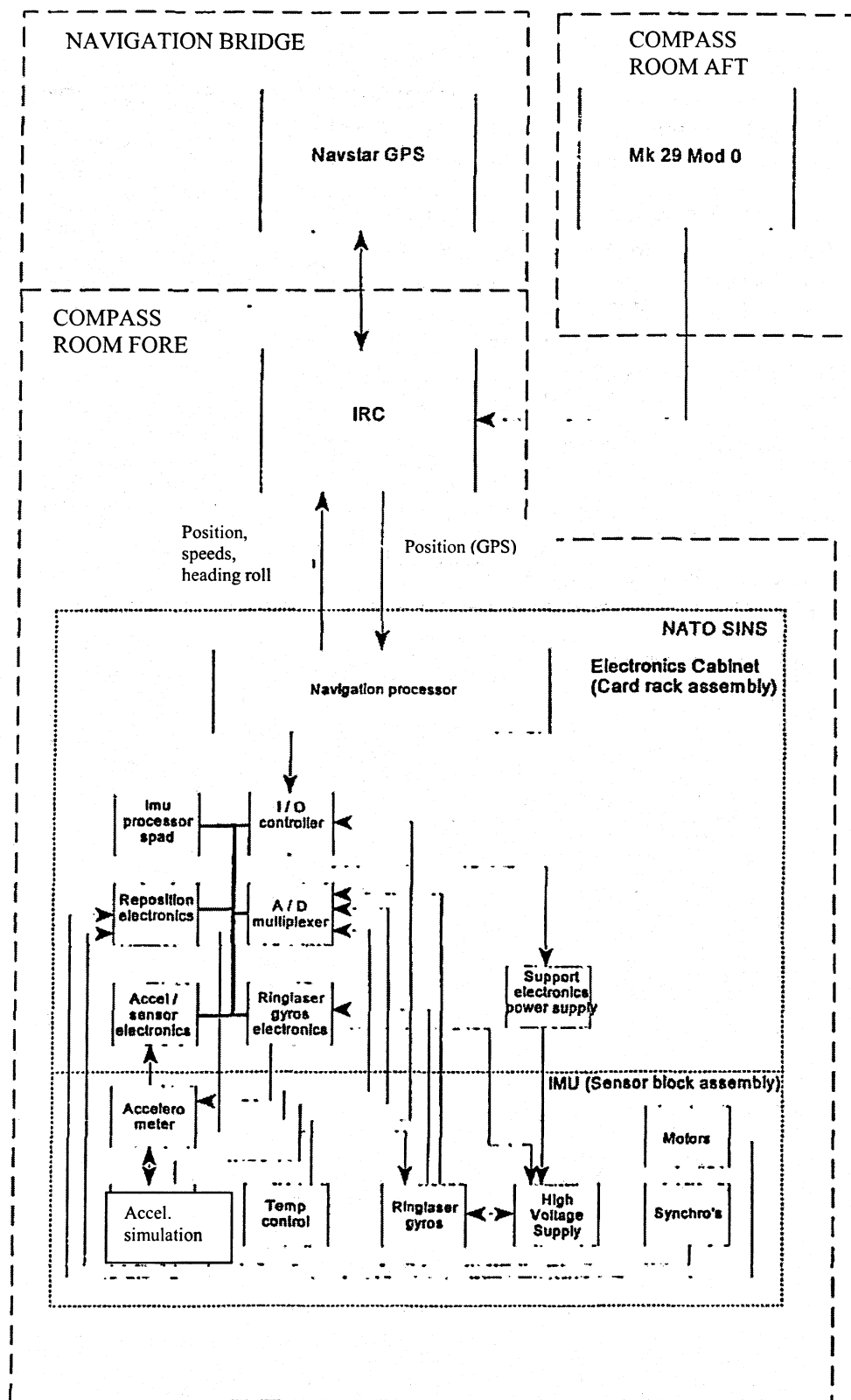
- independent stabilized platform (gimbal support) with a construction that reacts rapidly to ship's movements
This construction consists of:
 - Vertical Gyro and Directional Gyro
 - Acceleration meters, north/south and east/west
 - Gyro and Heater Preamplifiers
- electronic part to control the sensitive element. This has the following parts:
 - Clock Circuit
 - Gyrotol power supplies
 - Cardanus and Gyro Torquing Electronics
 - Analogue Computer
- electronic control system that automatically allows the compass to work in the right mode



illus. 1-2412-2 Gyrocompass
Mk 28 Mod 0

1.40.3. Integration in the central system

Both compasses are coupled to the IRC.



illus. 1-2412-3 Overview

1.41. 2413 Log installation SJL-04/00

1.41.1. General

The Log installation measures the sailing speed and calculates the distance sailed by the ship using two sensors, one of which is redundant. The information measured and calculated is sent to the:

- Information Retransmission Cabinet (IRC)
- Distance counter in the Command Post (only the distance)

An overview of the log installation is given in illustration 1-2413-4. The log installation has the following parts:

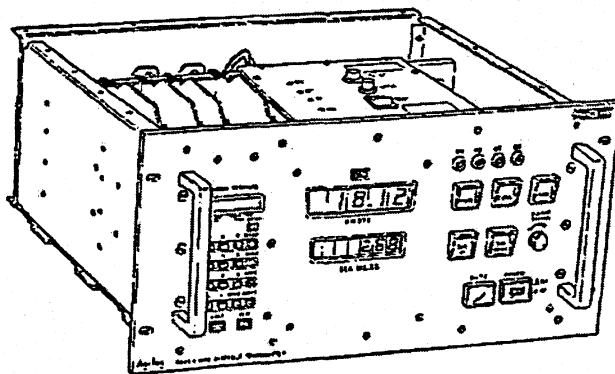
- Agilog Speed & Distance Transmitter Unit
- Probe Speed Sensor (2)
- Built in distance counter with total and day counter

1.41.2. Equipment

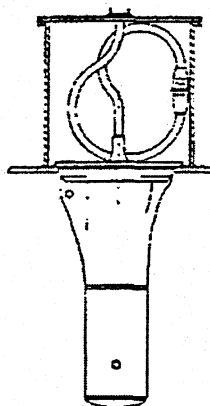
1.41.2.1. Agilog Speed & Distance Transmitter Unit

The Agilog Speed & Distance Transmitter Unit, which is placed in a 19 inch rack (see illustration 1-2413-1), processes the signals from the two sensors and calculates and displays the sailed distance and sailing speed. These values are also sent to the distance counter and the IRC. The unit has the following facilities:

- simulation mode selection
- underwater sensor selection
- calibrated curve selection
- self-test capability



*illus. 1-2413-1 Agilog Speed &
Distance
Transmitter Unit*



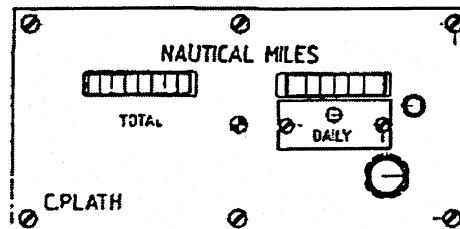
*illus. 1-2413-2
Probe Speed Sensor*

1.41.2.2. Probe Speed Sensor

The probe (see illustration 1-2413-2) is a very sensitive sensor which is mounted on the ship's skin underneath the waterline (one to port and one to starboard) and which gives a speed dependent signal. The position of the probe on the ship's skin is such that it is not affected by turbulence caused by the bows. The complete sensor is mounted outside the skin of the ship.

1.41.2.3. Built in distance counter with total and day counter

This counter (see illustration 1-2413-3) is built into the control panel above the table in the Command Post. The two numerical indicators show the total distance sailed by the ship and the distance sailed per day.

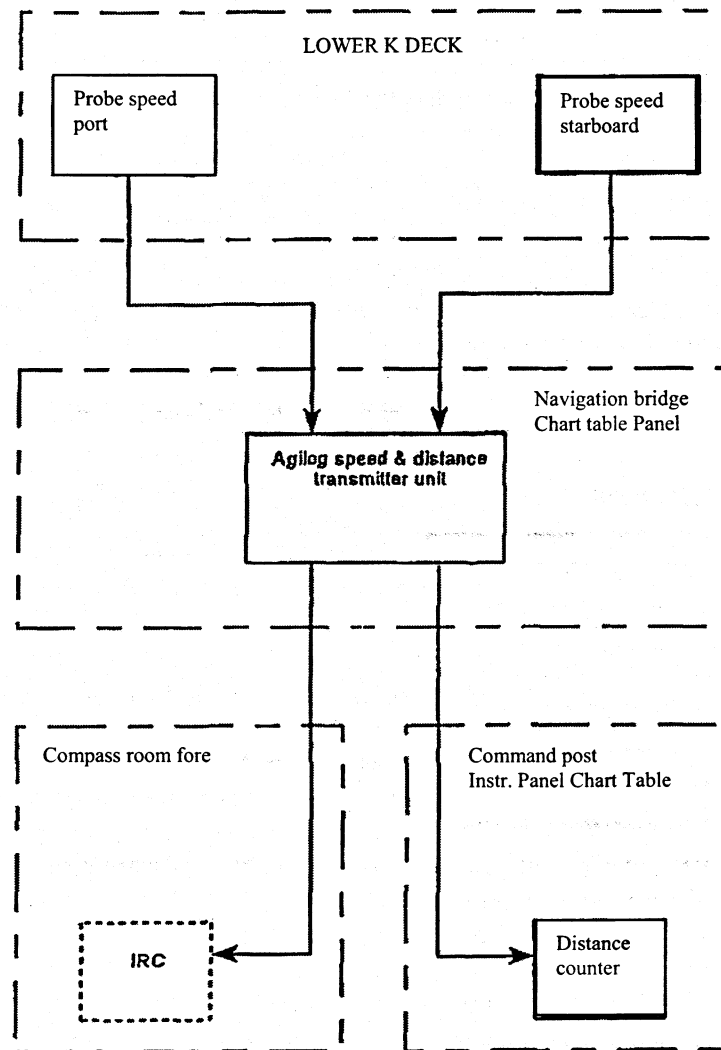


*illus. 1-2413-3 Distance
counter*

1.41.3. Integration

The log installation is connected with the IRC through a RS 422 interface and supplies the sailing speed, status and the distance sailed.

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illus. 1-2413-4 Overview

1.42. 2421 Wind measurement installation SML-10/00

1.42.1. General

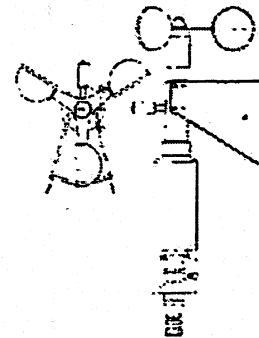
The Wind measurement installation measures the relative speed and direction of the wind and supplies these details to the IRC. An overview of the Wind measurement installation is given in illustration 1-2421-3. The Wind measurement installation has the following parts:

- Wind speed meter & direction indicator (2)
- Electronic unit

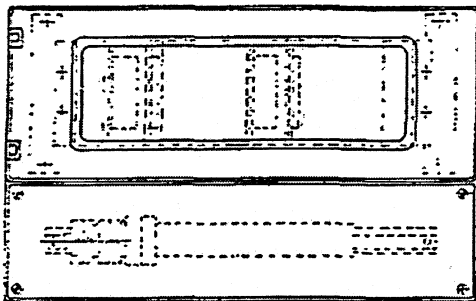
1.42.2. Equipment

1.42.2.1. Wind speed meter and direction indicator

The Wind speed meter & direction indicator (see illustration 1-2421-1) measures the wind speed using a rotor and the wind direction with a vane. One sensor is situated on the yard to port and one to starboard (see illustration 1-2421-4).



illus. 1-2421-2 Electronic Unit



illus. 1-2421-1 Wind speed meter and direction indicator

1.42.2.2. Electronic Unit

This unit (see illustration 1-2421-2) processes the signals from both wind speed and direction sensors. Both of the sensors are connected to the Electronic Unit.

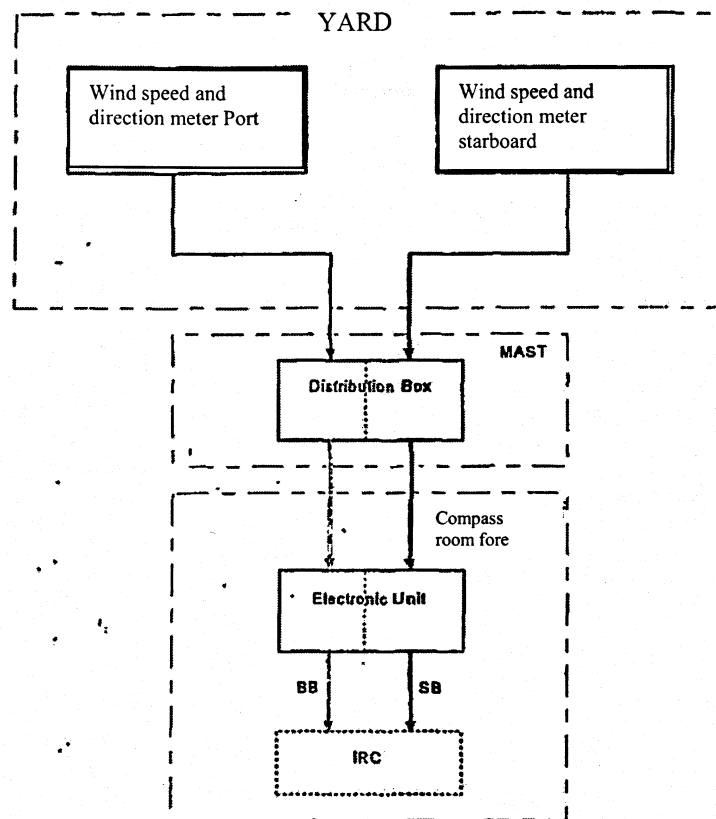
This unit has a:

- Power Supply Unit (2); CPU board (2) with software program to calculate the wind speed and direction.
- mother board; this connects the CPU boards and power supply units

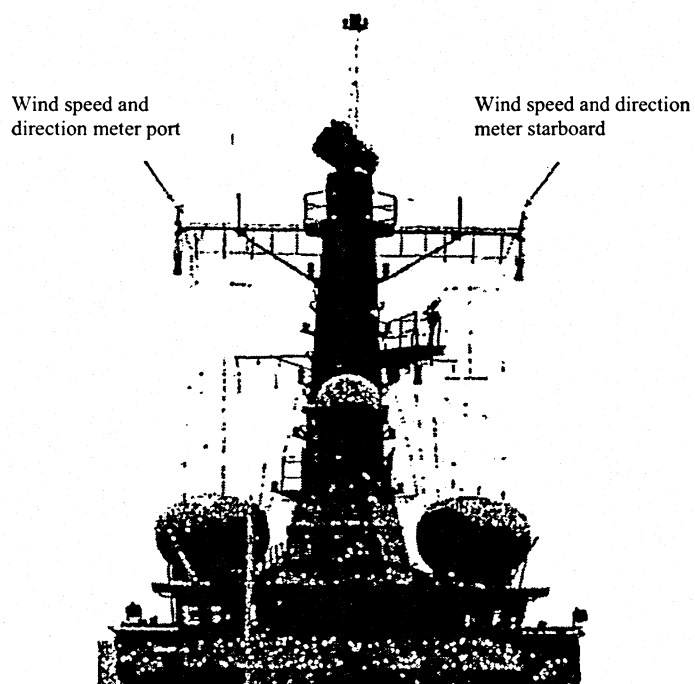
1.42.3. Integration in the central system

The Wind measurement installation is connected to the IRC via two RS 422 channels and supplies wind speed and wind direction data to the IRC.

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illus. 1-2421-3 Overview

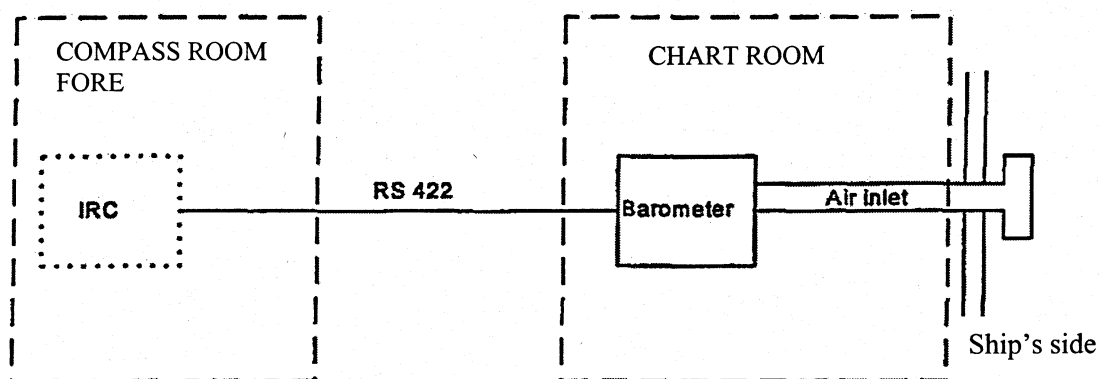


illus. 1-2421-4 Position on the ship

1.43. 2422 Barometer installation DB-1A

1.43.1. General

An overview of the Barometer installation is given in illustration 1-2422-1. The barometer installation consists of a Barometer which measures the outside air pressure. The Barometer is situated in the Chart room and supplies the air pressure data to the IRC through a RS 422 interface. The air pressure is measured by allowing air to the barometer via an air intake through the ship's side.



illus. 1-2422-1 Overview

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1.44. 2423 Weather chart printer installation (FURUNO) FAX-214

1.44.1. General

The Weather chart printer installation receives electronic weather charts sent out by the Meteorological Institutes and prints these on paper. An overview of the Weather chart printer installation is given in illustration 1-2423-2. The Weather chart printer installation has the following parts:

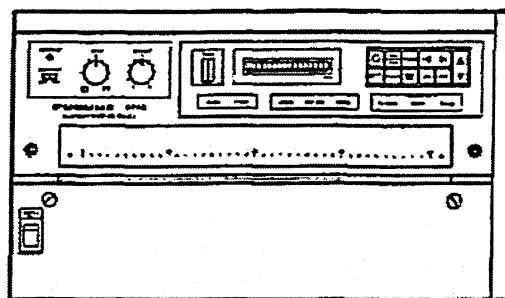
- Furuno FAX-214
- Power supply
- Loudspeaker with amplifier

1.44.2. Equipment

1.44.2.1. Furuno FAX-214

The weather chart receiver (see illustration 1-2423-1) has the following parts:

- Receiver
- Recorder (printer) part



illus. 1-2423-1 Furuno FAX-214

1.44.2.2. Power supply

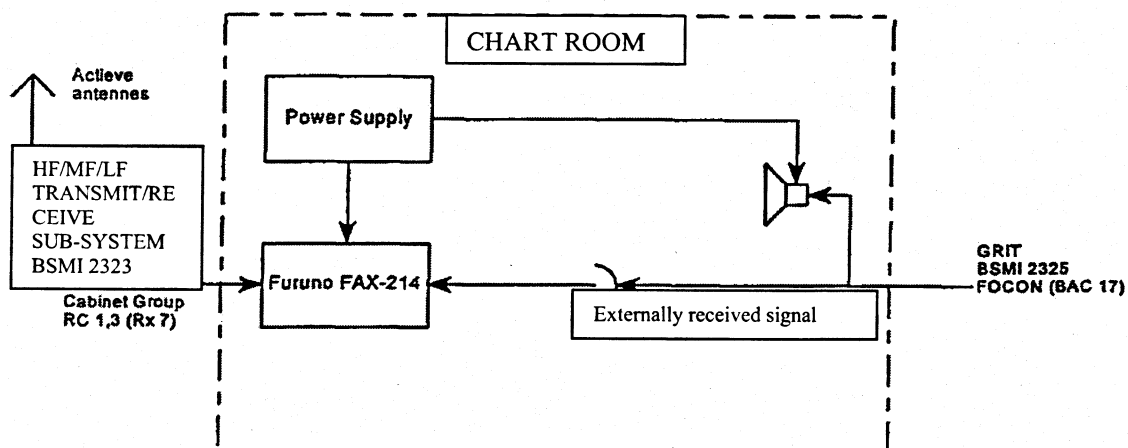
The Power supply provides power for the Furuno FAX-214 and the loudspeaker with amplifier.

1.44.2.3. Loudspeaker with amplifier

This is used to tune the weather chart receiver. A station can be recognized from its sound. The sound is connected with the FOCON system with or without the loudspeaker (with amplifier) being switched on.

1.44.3. Integration in the central system

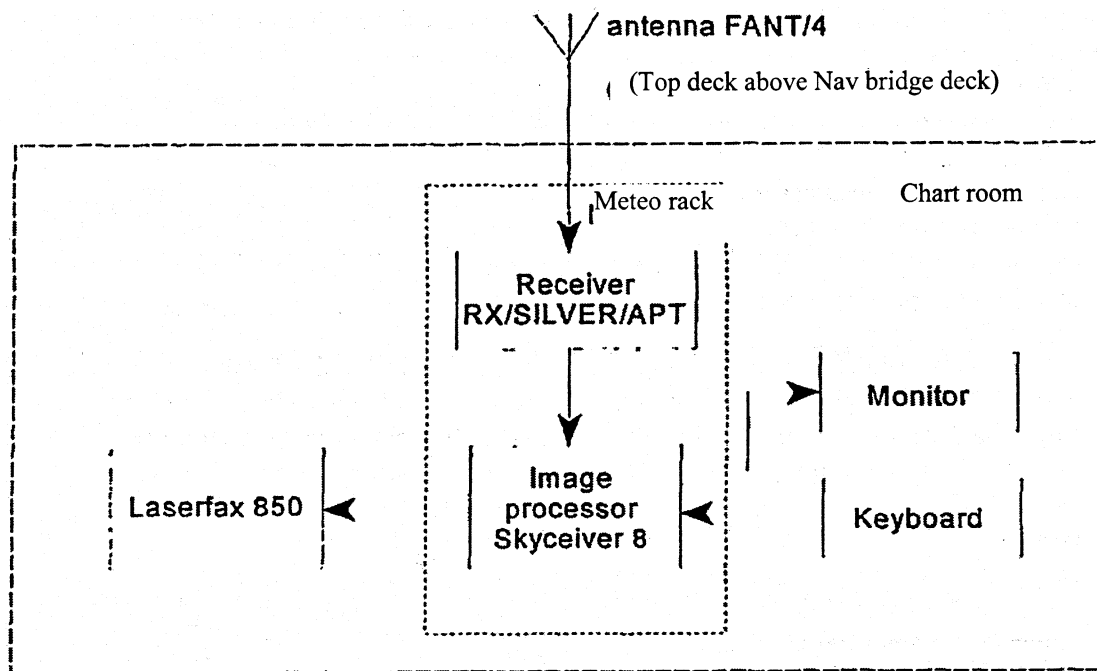
The Weather chart printer installation is connected with the FOCON system via BAC 17. If the Furuno receiver is overloaded by the ship's transmitters another receiver can be coupled to the Furuno recorder.



illus. 1-2423-2 Overview

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illus. 1-2424-5 Overview

1.46. 2431 Satellite Navigation Installation (NAVSTAR/GPS)

1.46.1. General

The purpose of the Satellite Navigation Installation NAVSTAR Global Positioning System (GPS) is to determine the geographical position, time and speed of the ship. The Global Positioning System is used worldwide and is formed by 24 satellites which circle the earth in 6 different orbits. There are four satellites in each orbit which circle the earth every 12 hours. At least four satellites are always visible from any position on the earth.

Each satellite has two link frequencies: L1 = 1575.42 MHz and L2 = 1226.6 MHz.

The NAVSTAR/GPS on board the ship receives the following two transmission codes from the satellite:

- Precision (P) code (accuracy ± 16 meter)
- Coarse/Acquisition (C/A) code (accuracy ± 100 meter)

The accuracy of the NAVSTAR/GPS depends on the number of errors received, clock error, reflection error and the atmospheric propagation error.

The receiver on board the ship and the satellite generate identical codes for the position determination. The time difference between the code from the receiver and the code received from the satellite determines the distance between the ship and the satellite (the clocks in the satellite and the receiver are set to exactly the same time). The position of the satellite is always known. The position + time and speed are calculated by the computer in the receiver with the help of four satellites.

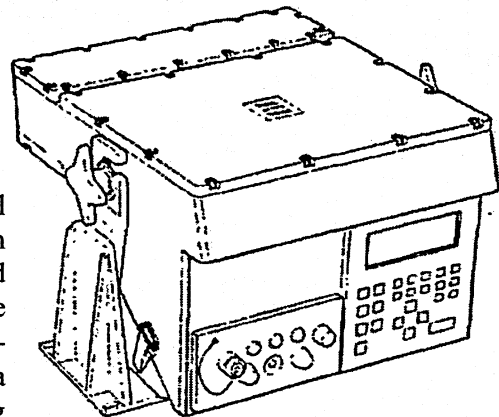
An overview of the NAVSTAR/GPS is given in illustration 1-2431-3. The NAVSTAR/GPS has the following parts:

- Receiver & Processor Unit
- Antenna & Pre-amplifier Unit

1.46.2. Equipment

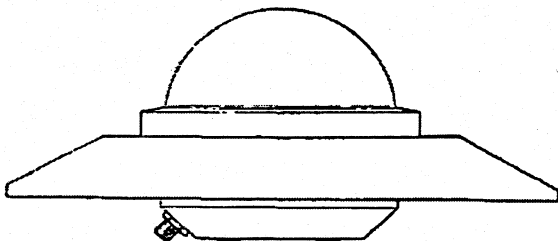
1.46.2.1. Receiver & Processor Unit

The Receiver & Processor Unit (RPU) is a five channel GPS maritime receiver (see illustration 1-2431-1) which receives the signals from the GPS satellites and determines the position, speed and time from these. The RPU can be controlled locally by an operator via a Control and Display Unit (CDU). The CDU consists of a display with function keys placed below this. Existing data can be modified or new data entered using these keys. There is also a status panel with fuses and indicator lamps on the RPU.



1.46.2.2. Antenna & Pre-amplifier Unit

This is a combined GPS antenna with a Pre-amplifier (see illustration 1-2431-2). The amplifier amplifies the GPS L1 and L2 signals received from the GPS satellites.

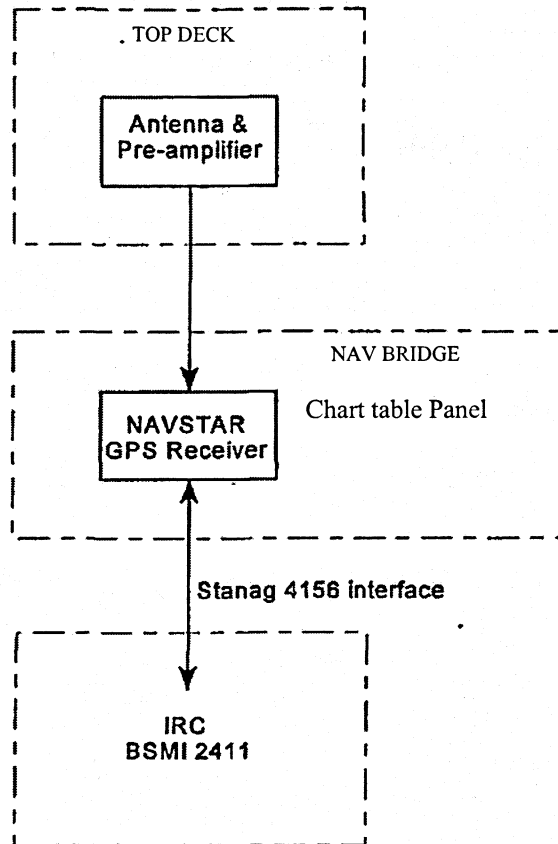


illus. 1-2431-2 Antenna & Pre-amplifier Unit

1.46.3. Integration at BSMI level

The NAVSTAR/GPS is integrated with the Information Retransmission Cabinet (BSMI 2411), via a Stanag 4156 interface (full duplex), (see illustration 1-2431-3). The NATO SINS (BSMI 2412) can be updated with the geographical position (longitude and latitude) from the NAVSTAR/GPS via the IRC. The nautical information (heading, speed etc.) are sent to the NAVSTAR/GPS from the IRC (BSMI 2411).

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illus. 1-2431-3 Overview

1.47. 2433 Omega Installation SRR-30/00

1.47.1. General

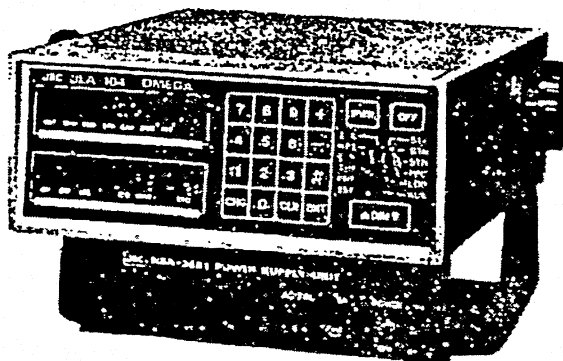
The Omega Installation determines the position of the ship. An overview of the Omega Installation is given in illustration 1-2433-3. The Active Antennas of the HF/MF/LF receive system are used as the antenna for the Omega Installation. The Omega Installation has the following two navigation systems:

- Omega Navigator
- Loran-C Navigator

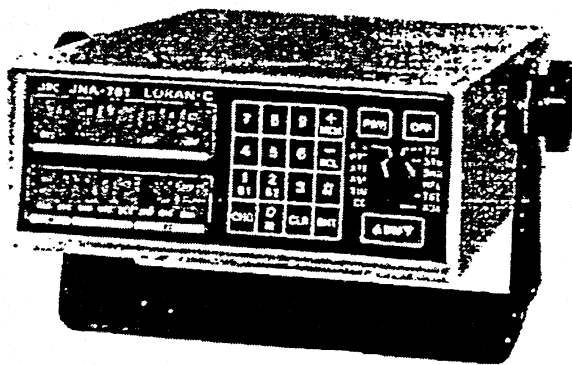
1.47.2. Equipment

1.47.2.1. Omega Navigator

The Omega Navigator (see illustration 1-2433-1), which is situated on the Navigation bridge, is an autonomous system operating in the Very Low Frequency (10-14 kHz) band. The Omega system consists of eight stations spread around the earth. The stations are situated in Norway, Liberia, Hawai, North Dakota, Reunion, Argentina, Australia and Japan. When all stations are working the position of the ship can be determined almost continuously all over the world. The position determination is carried out by receiving the hyperbolic LOP (Line Of Position) data. The position is then determined by two crossing hyperbolic lines. The resolution is 0.1 minutes (latitude, longitude).



illus. 1-2433-1 Omega Navigator



illus. 1-2433-2 Loran-C Navigator

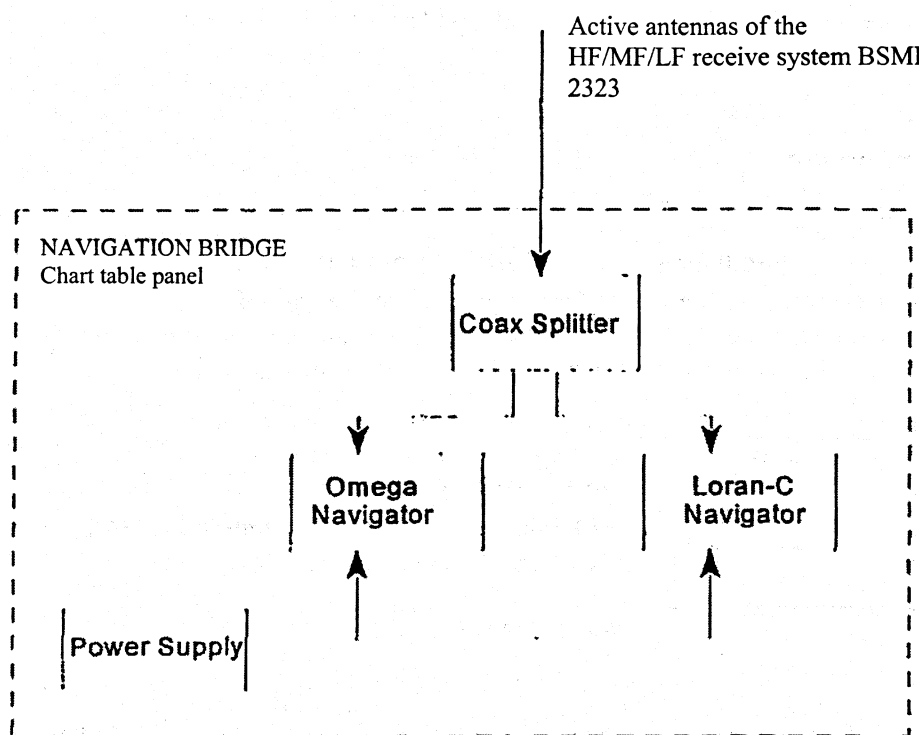
1.47.2.2. Loran-C Navigator

The Loran-C navigator (see illustration 1-2433-2), which is situated on the Navigation bridge, is an autonomous system operating in the Low Frequency (100 kHz) band. The navigator uses the Loran-C system which consists of more than ten Loran-C chains spread around the earth. Each chain consists of one master and several secondary stations. The users detect the time difference between the signal from the master and the signal from a secondary station. A hyperbolic line (Line Of Position) can be determined from the time difference between the two stations. The position is then determined by two crossing hyperbolic lines. The resolution is 0.01 minutes (latitude, longitude).

1.47.3. Integration

The Omega installation is stand-alone but uses the active antennas of the BSMI 2323 as signal source.

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illus. 1-2433-3 Overview

1.48. 2434 Echo sounding installation

1.48.1. General

The Echo sounding installation (KRUPP Atlas echograph 481) is an autonomous system for determining the depth of the sailing water. An overview of the Echo sounding installation is given in illustration 1-2434-4. The Echo sounding installation has the following parts:

- Transducer (2)
- Digital Indicator
- Recorder

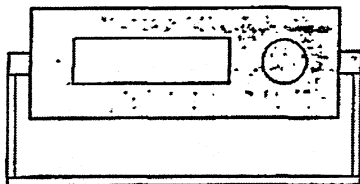
1.48.2. Equipment

1.48.2.1. Transducer

The Echo sounding installation (see illustration 1-2434-1) has two identical transducers for determining the depth. One is situated to the fore of the ship and one to aft. A transducer converts an electrical signal into an acoustic signal and converts the echo signals received from the seabed into an electrical signal.



illus. 1-2434-1 Transducer



Digital Indicator

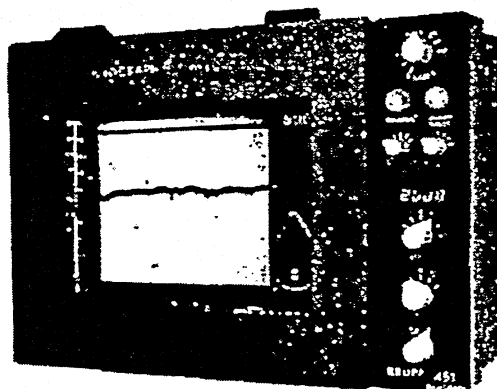
1.48.2.2. Digital Indicator

The Digital Indicator (see illustration 1-2434-2) displays the depth. It is situated in the Command Post.

illus. 1-2434-2

1.48.2.3. Recorder

The built-in Recorder (see illustration 1-2434-3) transmits signals via both transducers and the receiver receives the echoes from the seabed via these same transducers. The echoes are corrected for voltage level by the pre-amplifier in the Time Volume Control function (the voltage level of an echo is lower in deep water than in shallow water). The image of the echo is then printed out on a paper roll. The echo image depends on the range set, the amplification and the nature of the seabed. The built-in recorder also has an alarm function which sets off an alarm when the measured depth is the same as the alarm level set.



illus. 1-2434-3 Recorder AZ 6037

1.48.3. Integration

The Echo sounding installation is not integrated.