AD A055035

DEPARTMENT OF THE NAVY
NAVAL INTELLIGENCE SUPPORT CENTER
TRANSLATION DIVISION
4301 SUITLAND ROAD
WASHINGTON, D.C. 20390

(3)

CLASSIFICATION: UNCLASSIFIED

TITLE: (6) TROIKA, The West German Navy's New Mine Countermeasures System

(TROIKA, das neue Minenabwehrsystem der Marine)

AUTHOR(S): Feldes, Waldemar and Hausbeck, Volker (10) Waldemar / Feldes Volker / Hausbeck

PAGES: 11 (21) Trans. of

SOURCE: Soldat und Technik No. 11, 1977 ~~pp. 600-606~~ (West Germany) n11 p600-606 1977.

DDC JUN 14 1978

ORIGINAL LANGUAGE: German

TRANSLATOR: C

NISC TRANSLATION NO. 4017

APPROVED P. T. K.

DATE (11) 13 April 1978

(14) NISC-TRANS-4017 (12) 12p.

407 682 LB

TROIKA, THE WEST GERMAN NAVY'S NEW MINE COUNTERMEASURES SYSTEM; THE DEVELOPMENT OF MINE WARFARE

[Commander Waldemar Feldes and Commander Volker Hausbeck, Soldat und Technik, No. 11, 1977, pp. 600-606; German]

With the acceptance of the Troika project combining remote-controlled mine clearance craft (HFG) with the Type 351 remote control command vessels by the Defense Committee in May and the Budget Committee of the German Bundestag in June of 1977, the decision was made to build six TROIKA mine countermeasures systems for the Navy. The project includes the conversion of six coastal minesweeping boats of the Type 320 class to command vessels and the construction of 18 HFGs. These acquisitions have become necessary because the fast minesweeping boats of the Type 340/341 class will have to be put out of service in the early 1980s. The continued use of the converted coastal minesweeping boats of the Type 320 class and the West German development of the TROIKA mine countermeasures system over a period of years provide the necessary preliminary condition for a national standardization. The conversion of the boats, the building of the new HFGs, and getting them fitted out are taking place at West German shipyards. /600*

The invention of sea mines dates back to 1776. At that time, the American David Bushnell designed the first underwater explosive charge, which was intended to be delivered against an enemy through an immersion tube which was also developed by Bushnell. Although that attempt was unsuccessful, it marked the laying of the cornerstone for a development which has had a decisive influence on naval warfare throughout the world since that time. As a matter of fact, it was very quickly realized that own ports and coasts could be protected and enemy ships could be sunk with such an "invisible weapon". Thus, for example, the entrance to the port of Kiel was blocked successfully /601 during the German-Danish controversy (1848-1851), the Russians laid entire fields of mines off Kronshtadt, Petersburg and Sevastopol in the Crimean War (1845-1856), and finally, the southerners in America inflicted considerable losses on the northern fleet by mines (1861-1865).

The breakthrough to the modern employment of mines took place at the beginning of the present century in the Russo-Japanese War (1904-1905). Defensive barriers led to serious losses on both sides. Mass employment of mines, skillful mining of individual areas of the sea,

---

*Numbers in the right margin indicate pagination in the original text.

changing the geographic conditions of the sea in the operational area and the tieing down of enemy forces made the possibilities for the employment of this weapon, its danger and its effects on human beings and material clear. These factors were to determine the use of mines during World War I to a great extent. Offensive mining of enemy coasts and river mouths, defensive barriers for protection against enemy landings and transoceanic operations against trade routes developed increasingly into a systematic method of waging war.

During the four years of World War I, a total of 309,800 mines were laid, 45,000 of which were laid just by German ships, while England, America and Russia used a total of 238,000 mines.* The /602

---

*General Freiherr von Ledebur, Die Seemine, Verlag J.F. Lehmanns, Munich, 1977, p. 185.

---

technical ability to mass-produce mines and rapid delivery by means of aircraft opened up new possibilities for the use of mines between 1939 and 1945 and had a decisive influence on the waging of naval warfare during that period. Close to 700,000 mines were used by the warring countries, with approximately half of them being used by Great Britain, the United States and the Soviet Union and around 220,000 by Germany.*

---

*Ibid., p. 192.

The losses on both sides were also correspondingly high. Germany alone lost 38 submarines, 21 surface naval ships, 24 supply ships and 81 mine defense ships through the action of mines.* Up to the present,

---

*Erich Groener, Die deutschen Kriegsschiffe 1815-1945, Verlag J.F. Lehmanns, Munich, 1968, p. 350 ff.

---

the losses of the German merchant marine have not been accurately determined. However, one can take as a point of departure the assumption that, out of 3 million gross registered tons of hold space sunk, approximately one-third of that total fell victim to the action of mines. These losses would certainly have been much greater if effective mine defense measures had not been developed simultaneously.

Thought had been devoted to the problem of countering this insidious weapon and attempts had been made to counter it since the middle of the foregoing century. Ropes towed, sagging, through the

water were intended to explode the mines. With the expansion of mine warfare to the high seas and the improvement of the igniting systems, the minesweeping ships became larger and the development of methods of defense was pushed forward on an urgent basis. Thus, the mine defense ships that are operated still today in all navies of the world as high-seas, coastal and inalnd-waterways minesweepers finally came into being. For protection against anchored mines, these boats had a small draft at first. However, this in itself did not provide /603
sufficient protection against the newly-developed magnetic and acoustic ignition systems. For this, the answer was degaussing and soundproofing. Now the boats were built of plastic or wood, amagnetic metals were used extensively and additional residuary magnetisms were compensated for by a self-protection system (MES). Sound radiations were broken up by means of insulation.

These developments make it clear that mine technology and mine defense have been in competition with each other since the beginning and always lead to new ideas and the taking of new measures on both sides.

Modern Naval Warfare and the Use of Mines

Mine warfare has only changed slightly since 1945. This is in great contrast with naval warfare, whose nature has undergone sweeping changes in recent years under the influence of modern technologies. To a great extent, the fighting of ship against ship, submarine against ship and aircraft against ship, all within sight of each other, now largely is a thing of the past. Far-ranging missiles and torpedoes, air-supported locating systems, data-processing installations and, finally, electronic warfare make it possible to fight and destroy an adversary even when he is beyond the optical horizon.

However, the importance of the employment of mines and mine defense has scarcely been impaired by this. The powerful arsenals of mines in the possession of both the East and the West give eloquent testimony to this. Furthermore, ships, as well as aircraft and submarines, are available on both sides in great numbers as a means of delivery. By means of them, mines can be laid any place where it is desired to block certain portions of the sea, coastal waters or passages in order to delay the advance of enemy formations and inflict heavy losses on them. Furthermore, they are suitable for hampering the movements of an adversary even in areas where he can operate with superior forces.

Modern technologies have had a decisive influence on the employment of mines, as well as on all other types of naval warfare. Here it was not so much a matter of changing as of improving already-developed capabilities for effective action.

Thus, sea mines, as they always have, constitute a comparatively simple and inexpensive means of waging naval warfare, but nevertheless a very effective one. Contact, remote-control, ground, and anchored mines are still being laid today. However, their ignition systems are becoming more and more refined and tactical accessories are continually being expanded. As a result, programmed selection of targets, an improved probability of hitting, and more reliable mine defense have been developed.

Mine Countermeasures Today

Progress in mine technology necessarily also called for the development of effective means of defense. Thus, mine-hunting, in particular, was pushed after World War II. Sonar direction-finding, identification and destruction with precisely-launched explosive charges make this sytem suitable for use against all types of mines. However, minehunting is not applicable in all ocean areas to the same extent. The possibilities for the appli ation of minehunting techniques are especially limited in places wh re mud and sand can cover the mines or where a stony subsurf e can lead to a profusion of false contacts. Bottom conditions of precisely that type are particuarly frequent in the West German Navy's operational area--in the Baltic Sea, the Baltic Sea approaches and the North Sea. Therefore, additional defense systems are necessary which simulate ships' acoustic and magnetic fields and, thereby, cause mines to detonate.

The TROIKA Mine Countermeasure System

The TROIKA is that kind of a mine countermeasures system. It is a German development that was begun in the 1950s and has now been concluded. The Armed Forces and the technical services concerned with defense cooperated on this project in exemplary fashion and achieved a result which fully satisfied expectations--which ran high--and also is arousing great interest abroad.

The requirements laid down for this system resulted from experience during World War II and warlike hostilities of the recent past. The following is a catalog of those requirements:

A high degree of effectiveness against remote-control mines with acoustic, magnetic and combined ignition systems by means of effective mine countermeasures devices.

Low vulnerability to mine detonations when close to them because of a high level of shockproofing of ships and their equipment.

A reduction in personnel and material requirements by increasing the efficiency of the mine countermeasure units, thereby obtaining a favorable cost-effectiveness ratio.

Slight endangering of personnel through the use of unmanned, remote-controlled minesweeping devices and command vessels which do not need to run over mine fields.

Operational capability unhampered by bad weather conditions.

These requirements are satisfied by the TROIKA mine countermeasures system to a very large extent. The system consists of one remote-controlled command vessel and three remote-controlled mine clearance craft (HFGs) which, as a group, form a tactical and organizational unit. At present six such TROIKA groups are being prepared. They will be introduced into our Navy in the early 1980s.

In this connection, the corresponding number of coastal mine- /604
sweepers (KM-Boote) of the Lindau class are being converted to command vessels of the 351 class. These coastal minesweepers were built at German shipyards and put into service in 1958 and 1959. In past years, they have proved extraordinarily satisfactory from an operational point of view, and, in particular, they have shown themselves to be especially sturdy and seaworthy. Thus, according to assessments from personnel in the field of technology concerned with defense and from the shipbuilding industry, the naval architectural condition of these vessels even today is still so good that they can be kept in service for at least another 12 or 15 years after being converted and overhauled at a depot. Using them, it is possible to provide effective command vessels at a cost that is small by comparison with that of building new ones.

In substance, the conversion of the coastal minesweepers to command vessels involves two new components. The first of these consists of equipping them with control devices for remote-controlled employment of the HFGs. This installation works with a control radar which provides the positions and the possible deviations from the theoretical course. The data that are computed are translated into appropriate control commands through a steering-control installation and transmitted to the HFG through the remote-control installation by means of its radio communications gear. The remote-control installation is also the repeating means at the same time, and the execution of commands and the condition of the HFGs and their equipment are reported to the command vessel through that installation automatically. In conclusion, then, three HFGs can be controlled and serviced by a command vessel from up to a distance of several nautical miles without the command vessel itself having to stay in the mined area.

In the second place, a newly-developed mine-avoidance sonar is being installed to improve the safety of the command vessel and its crew in a mined area and, at the same time, the prospects of success of mine-countermeasure operations against anchored mines. With this underwater locating device, it is possible to detect anchored mines in time, before passing over them, and then to destroy them /605 by the skillful use of highly-accurate, towed minesweeping devices.

In their structure and behavior at sea, the remote-controlled HFGs can be compared with small ships. Their key part is a cylindrical tube made of shipbuilding steel which is 18 meters long and has especially thick walls. This hollow bar [sic] provided the [initial part of the] name for the HFG. It is subdivided into several watertight compartments by bulkheads to improve its strength. All the installations required for propulsion, minesweeping operations, and remote control are inside it. They have additional protection against shock effects by means of special installation, mounting, and suspension measures. The ends of the hollow bars are wound with coils of copper wire which, in combination with the steel hull and the power supply, generates a magnetic field with which the remote-control mines can be activated. A fore body and an after body are placed on the steel tube [i.e., hollow bar]. The noise generators, which supplement the magnetic field around the acoustic components, are located there. Finally, by means of wooden sheathing, superstructures such as a deckhouse, antennas, an anchor, a winch, etc., the hollow bar assumes the appearance of a small ship. In addition, all the equipment is installed in the deckhouse that is required to enable the HFG to navigate in port or on its way to the area where it is to be used, even without remote control.

Employment of the TROIKA

1. While En Route

Each HFG has a crew of three men when in port. The crews switch the equipment to manual operation and sail the HFGs into open water, There they stop, switch to remote control, leave the HFGs and transfer to the command vessel. There they take over the responsibility for remote control in the operations center. One HFG at a time is controlled and monitored by a steering-control device. The operations of all three HFGs are coordinated by means of a main control device.

2. Minesweeping

The area to be cleared is divided up into so-called minesweeping strips. The center lines of these strips are identical with the prescribed courses of the HFGs. The prescribed courses and the positions of the HFGs determined by the control radar are fed /?/ into the steering-control devices.

The control operators' task is to keep the positions of the HFGs matching the prescribed courses and to determine and deliver the steering orders necessary to accomplish that.

When the HFGs enter the minesweeping area, additional apparatus in them is switched on by remote control in order to generate magnetic and acoustic fields. These fields activate remote-control mines at distances that vary from one case to another and depend upon the depth of the water, the sensitivity setting of the mines' ignition devices, and a number of other factors.

When all the steps in a predetermined series of steps have been completed--for example, step no. 3 means that the mines are not ignited until the third time a ship passes over them--the mines are detonated.

While the command vessel stays outside the range of potential damage to it, the HFGs are immune to explosive effect because of the high level of their shockproofing.

If radio communications between the command vessel and the HFGs is interrupted by enemy action or technical defects, the HFGs anchor automatically.

Anchored mines are swept by the command vessel, using towed apparatus. When this is being done, the mine-avoidance sonar enhances the safety and effectiveness of the minesweeping operation.

The TROIKA mine countermeasures system has been tested by personnel in the field of technology concerned with defense, in close cooperation with the Navy, and brought to maturity from the technical point of view. It offers a number of important advantages by comparison with the traditional minesweeping ships.

In operation, a TROIKA is approximately two-and-one-half times as effective as a conventional minesweeper. Seen from that point of view, six TROIKA groups have a minesweeping capacity equal to that of 15 minesweepers.

This leads to a personnel requirement that is approximately 50% lower. /606
Furthermore, the craft and their crews are exposed to considerably less danger from mine detonations.

The cost of supplying TROIKA systems with the same minesweeping capacity is approximately 55% lower than for conventional minesweeping ships. Here the conversion of minesweepers on hand to command vessels was especially effective in holding down costs. It is obvious that operating costs are also low by comparison with conventional minesweepers. Hence the TROIKA mine countermeasures system is distinguished by the following characteristics:

High performance

A favorable cost-effectiveness ratio in procurement and in operation

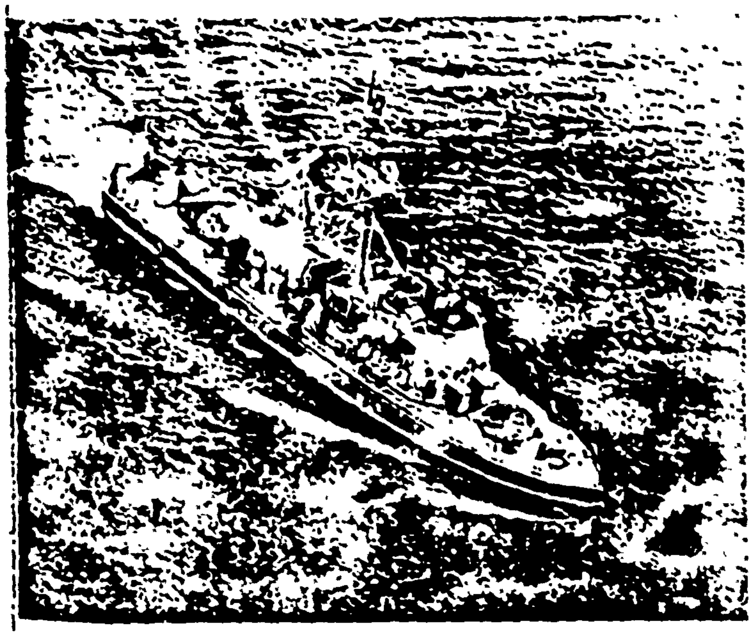
Low personnel requirements

Increased crew safety.

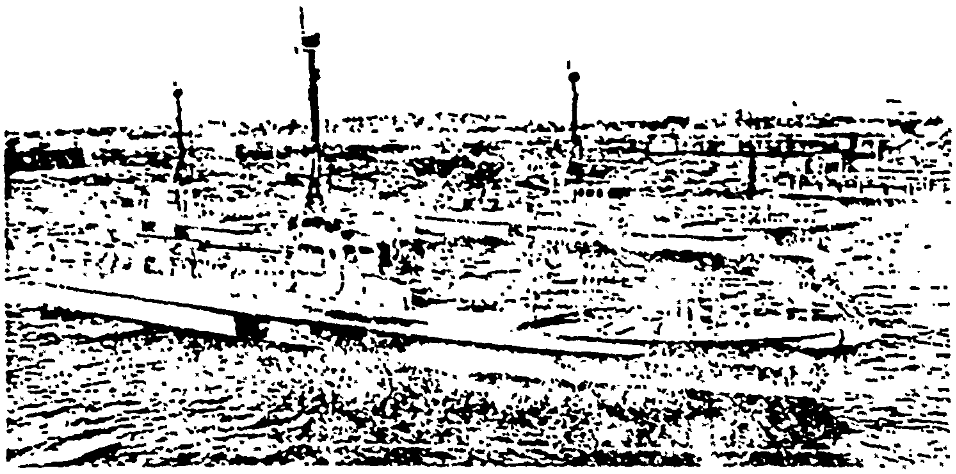
Time-consuming experiments, uncounted individual developments, and tests under operational conditions were necessary to achieve this result. This is apparent if, for example, one merely realizes that the HFG has to operate within the immediate effective range of one or more mines in order to explode them, but without being put out of action itself when it does so. These and other problems have now been solved, and, at the same time, the solutions demonstrate how a required capability, even with comparatively small use of personnel and financial expenditure, can be achieved by making use of modern technology.

Technical Data of the TROIKA Mine Countermeasures System /605

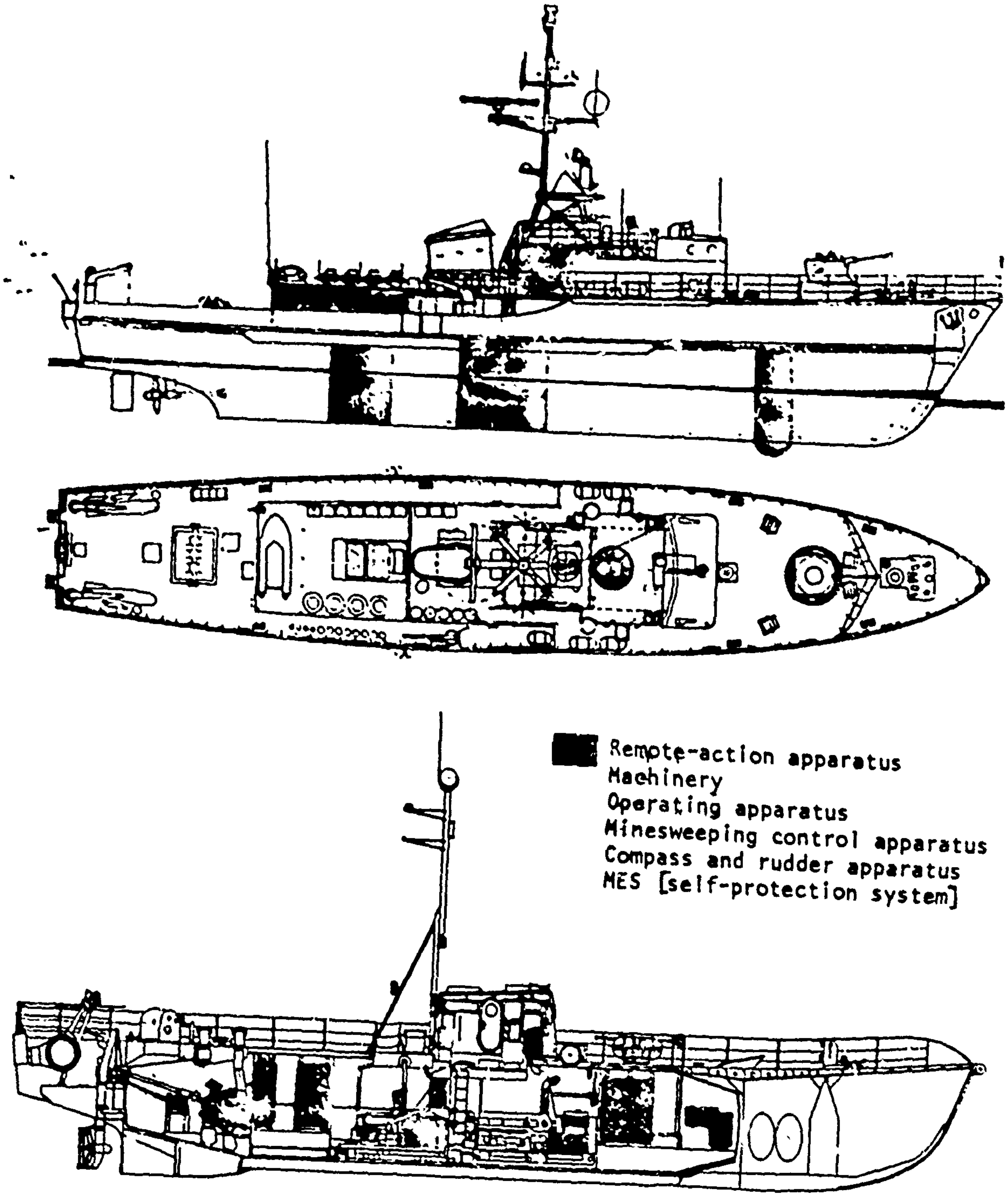
	Command Vessel	HFG
Operational displacement	430 tons	99 tons
Length overall	47 meters	27 meters
Beam overall	8.5 meters	4.6 meters
Draft	2.6 meters	2.3 meters
Main propulsion	Two 1,670-hp diesel engines	One 320-hp diesel-electric engine
Maximum speed	16 knots	9.4 knots
Radius of action	2,200 nautical miles at 16 knots	520 nautical miles at 8.8 knots
Armament	1 40-mm L/70 MEL mod. 71 Bofors	-
Crew	44 men	-



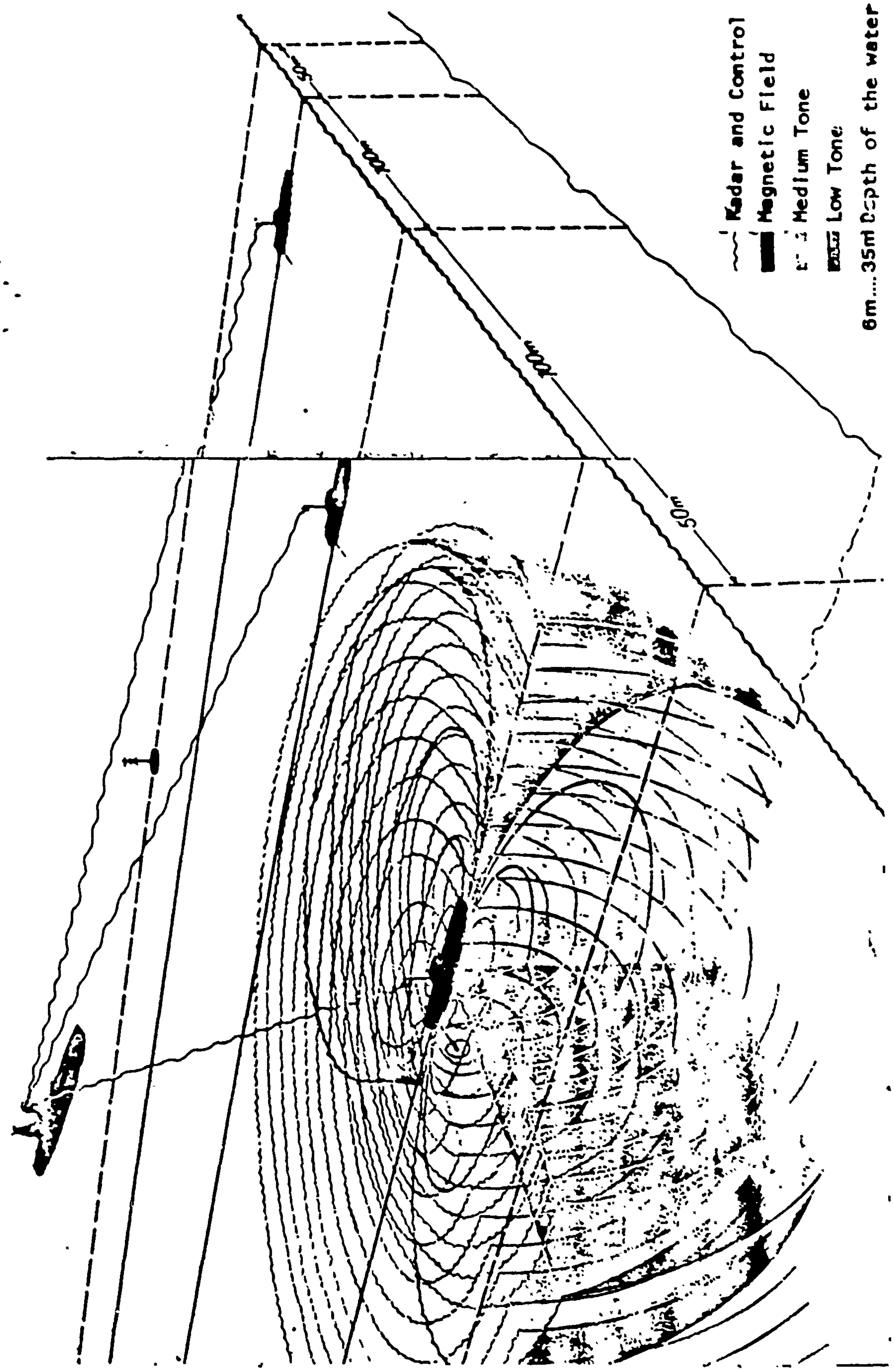
Type 351 HFG - Command Vessel



Remote-controlled Mine-clearance Craft (HFGs)



Type 351: Views of the HFG and Command Vessel


Radar and Control
Magnetic Field
Medium Tone
Low Tone
6m....35m Depth of the water
100m
50m