NAVEDCOM 143 - M

Change 0; June 1988


Nuclear Attack Submarine Combat Operations

# Red Storm Rising

# Nuclear Attack Submarine Combat Operations

**NAVEDCOM 143-M**
**Change 6 : Jun 1988**

# Preface

by Tom Clancy

# Contents

# A Quick Start

## What's Where

**The Manual:** [illegible]

[illegible]

**The Technical Supplement:** [illegible]

**The Keyboard Overlay:** [illegible]

**Which Scenario?** [illegible]

---

## Learning Games

[illegible]

**Year:** [illegible]

**Goal:** [illegible]

**Challenge:** [illegible]

**Scenario:** [illegible]

**Getting Started:** [illegible]

**Experiment with Displays:** [illegible]

**Find the Enemy:** [illegible]

**Get Started:** [illegible]

**Fire Weapons:** [illegible]

**Further Training:** [illegible]

## Rules & Campaigns

## The Universe, Ruling, Magic, and Peacekeeping

# Part 1
# The Operations Manual

# Starting Options

RED STORM RISING has many options. To make a selection, move the Controller or highlight your choice, then press the Selector. [illegible] in all situations. Typically, the Controller is your joystick, mouse, or cursor keys, while the Selector is the button or Return key. See the Technical Supplement for specific details.

## The Year

You can select one of four time periods.

**In 1984** Russian naval forces use "classic" western technology. However, your submarine is limited to weapons available at that time: the original [illegible] and the Harpoon missile.

**In 1988** the new Russian SIERRA and AKULA class submarines appear, as well as the first fruits of the stolen technology from the west. However, you have the new Tomahawk missile and the improved Mk 48 ADCAP torpedo. This scenario represents the situation at the time of the action of the novel Red Storm Rising.

**In 1993** a [illegible] the Russians [illegible] technological [illegible] some of their weapons. Meanwhile the Sea Lance ASW missile and [illegible] are available to NATO.

**In 1998** the Russian [illegible] continues [illegible] with a generation of submarines [illegible]. Fortunately for the West, the first boats of the new Seawolf class are in the fleet, carrying [illegible].

## Warship Identification Test

Examine the Submarine on the screen, then compare it with the illustrations in Part III (Reference Manual) of this book (pages [illegible]). You must correctly identify the vessel. If you fail, you're restricted to training scenarios.

If you make a correct identification, enter your name by typing it on the keyboard and pressing the Return (or Enter) key. Your records will be saved under this name.

## Boat Selection

You can select which type of nuclear attack submarine you wish to command. Classes are listed in order of completion, from the oldest (at the top) to the newest (at the bottom). As a general rule, the newer boats are quieter and have more weapons aboard. The Seawolf class is especially powerful, but not available until 1998.

Alternatively, you can allow the NMPC (Naval Military Personnel Command) computer to give you a boat. As in the real navy, if this is used, the type of boat you receive is partly chance, partly related to the number of submarines of that type currently in the Atlantic fleet.

## Level of Challenge

Introductory challenge is recommended for your first few games. Compared to Hard, there's more ammo in the world to kill, while your submarine is very resilient to damage and your powered suits absorb more.

Normal challenge is recommended for casual gaming. Compared to Hard, enemy ships are slightly weak in the world to kill, while your submarine is fairly resilient to damage.

Serious challenge is for players who want a challenge. Enemy submarines are smart, and they use their torpedoes and sensors well. The ocean is a complex and difficult place. Encounters with hostiles are usually fairly lengthy affairs and it is easier to get killed than to survive.

Ultimate challenge is not for the faint of heart. Enemy submarines are extremely aggressive and will hunt you relentlessly. A single hit is more likely to kill you, while Cyclops is very frail, and your torpedoes are very few. Your only ally is stealth. Remember that you can make a decisive combat advantage when you succeed by evading detection and make the destroyer yourself. Do not attempt this challenge unless you really want to die a lot.

## Scenarios

There are three groups of scenarios. Training scenarios provide an easy way to learn the basics of the game. Mission scenarios are your engagements against your world's military or enemy forces.

Free Dive Study is a campaign where you can explore the Tiny Grid where you take your boat to visit to explore Tom Clancy's Ghost Recon 2. Like all campaigns, it can be played without the points, at various levels of challenge and with the help of your choice.

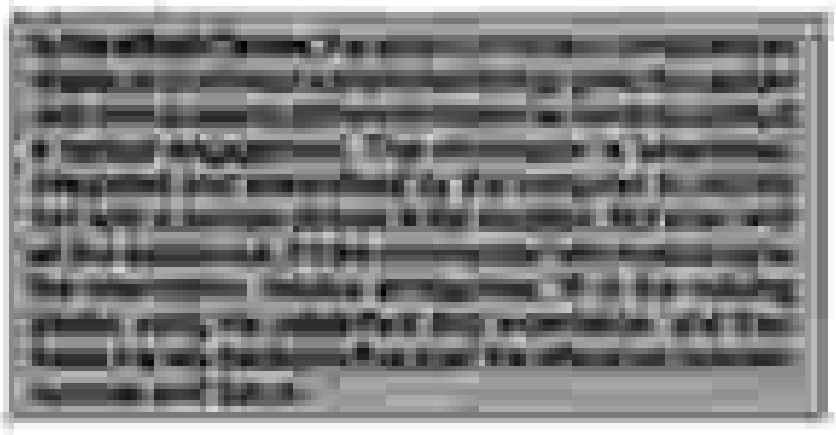
Training Missions are structured experiments, designed to make learning easier to learn a complex Russian weapons and to compare your skills. You can experiment with the ship and its controls, try various loadouts, and much more.

**"In a Mountain along Submarine"** This is a multiplayer underwater battle against Russian submarines. The goal of challenge is to destroy the enemy submarine. The level of challenge is determined by the position of the enemy submarine – in the open sea, Russian submarine (or Serious) doesn't pick up Ultimate in the distance.

**"Ice, a Kasatka-class Submarine"** This is a complex battle against a Russian submarine. The level of challenge is determined by the position of the enemy submarine – in the open sea, Serious – or Ultimate in the shallows.

**Battle Simulations** test your mettle in various tactical actions. Battle Simulations provide a mixture

**"Silent"** You get to play as one of a Russian crew's submarines. At higher levels of challenge, you will



# Battle: Engaging the Enemy

[illegible]

[illegible]

[illegible]

[illegible]

## Advice from Your Computer

[illegible]

## Useful Options

**Pause:** [illegible]

**Replay:** [illegible]

## Other Options (Advanced)

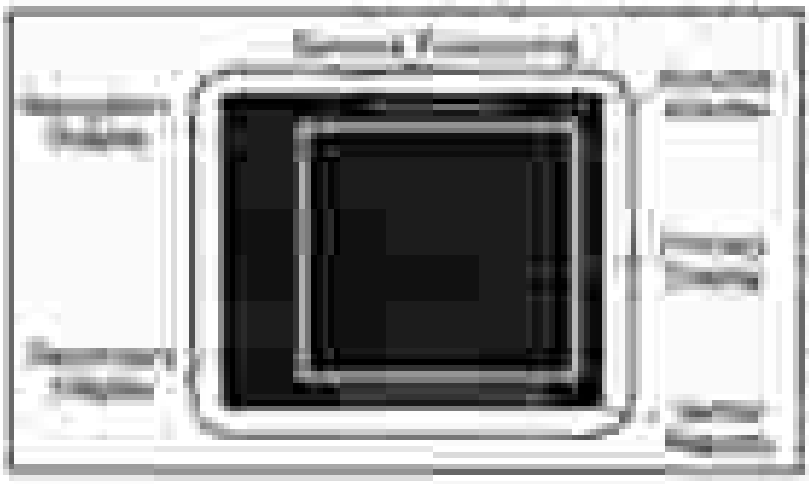
[illegible]

**Action Track Toggle:** [illegible]

**[illegible] Commands:** [illegible]

[illegible]

### Multi-Zoom Consoles



## Navigation

### Navigation Display

HEADING 236 DEG SPEED 12 KNTS DEPTH 375 FT. RUDDER LEFT 5 PLANES LEVEL

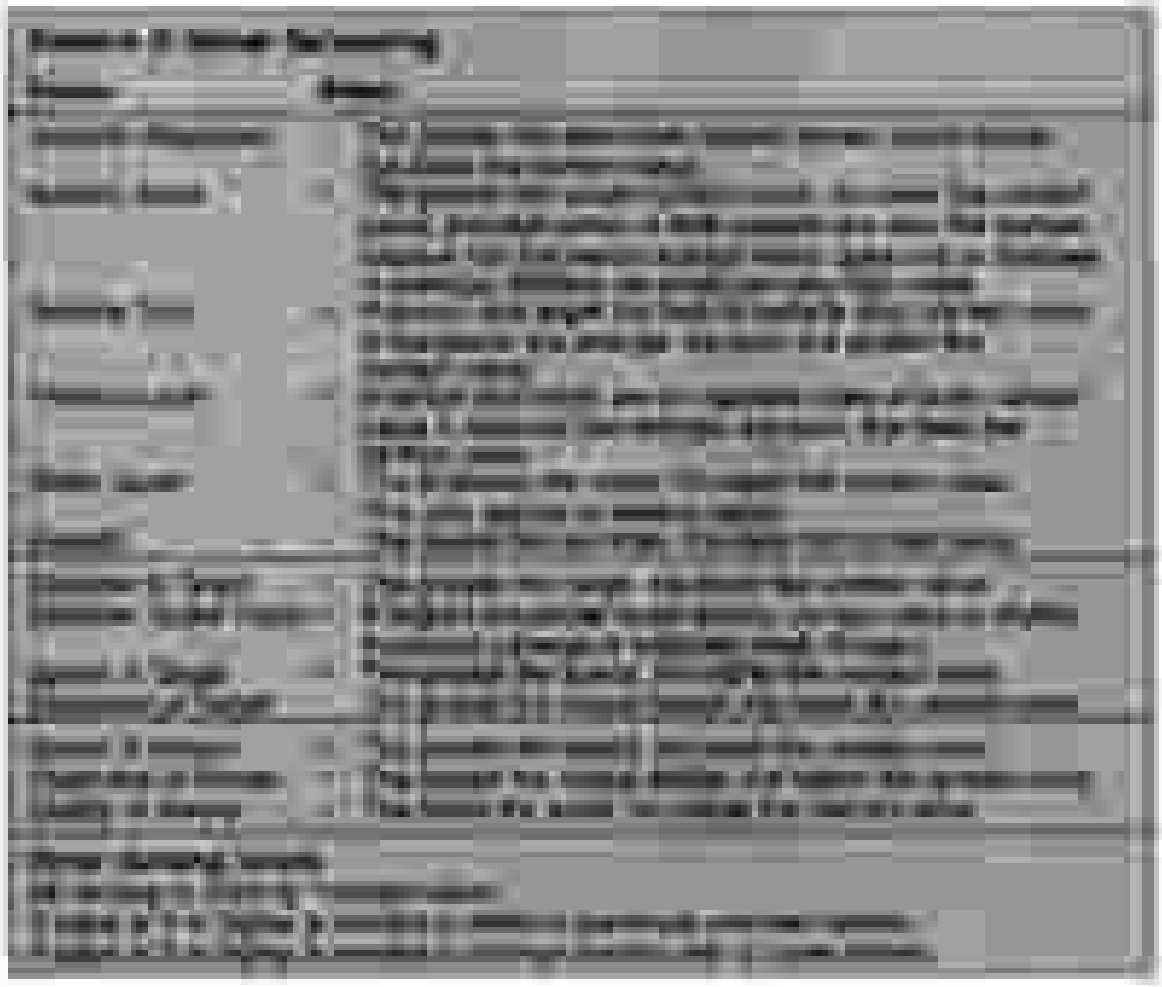
## The Tactical Display


The tactical display is the display shown when viewing in the 'C' missile view. This is the most important display in the game. The current phase of the attack sequence is shown in the top left corner. The current weapon selected is shown in the top right corner. Below this is shown the 'Time to Impact'.

## Sensors

## Contacts

CONTACT
UDALOY
BEAMHO
IGT DEG
SENSOR
OTP 114
SOL 87%
CRS 320
001 25
RANGE
34 KYDS



**(7) Towed Array:** [illegible]

[illegible]

[illegible]

**(8) Active Sonar:** [illegible]

[illegible]

**The Baffles:** [illegible]

[illegible]

## Sea Conditions

[illegible]

**Presentation:** [illegible]

**Transmission Loss:** [illegible]

**Ambient Noise:** [illegible]

**Surface Duct:** [illegible]

**Thermal Layer:** [illegible]


SUMAR DETECTION ANALYSIS
TRACKING
RADAR

## Acoustic Signature [Advanced]

## Surface Scanner [Advanced]

**The Early Exercises**

| | | |
|---|---|---|
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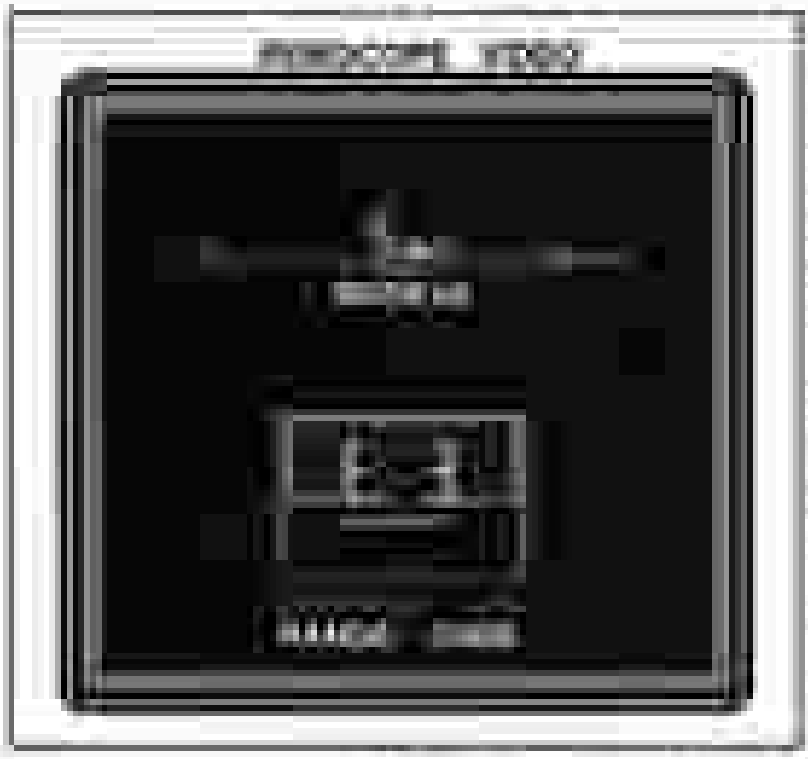



### Friendly & Enemy Contacts

### Ship Data Base

## Weapons

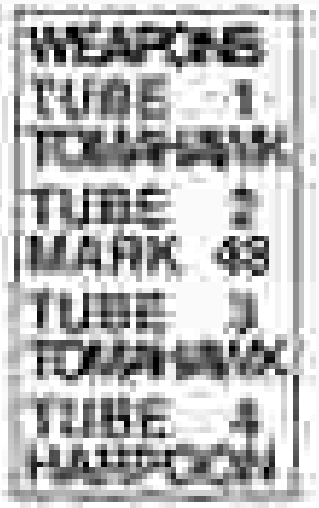
**Stopping Loading**

**Viewing Oxygen Status** When the Oxygen monitor is on, the oxygen saturation (%SpO2) and pulse (pulse) rate are displayed.

**Loading an Empty Tube** If a tube is empty, unloading is a two-step process:

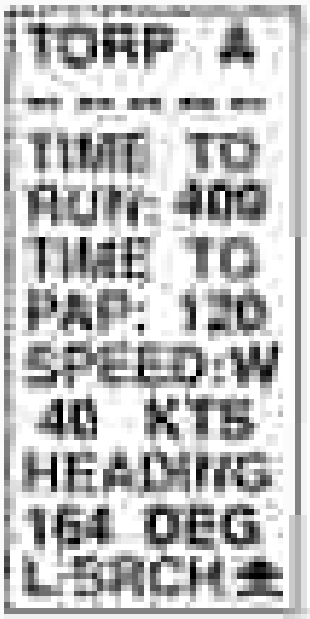
1. Press and hold the
2. Release the key when the machine has stopped and the

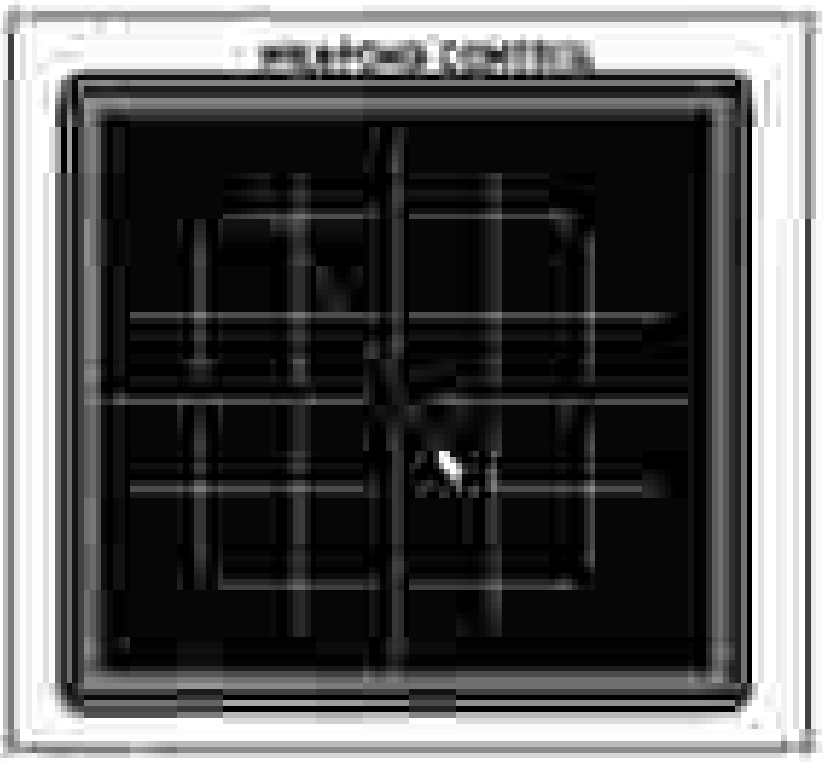
**Changing a Loaded Tube** If a tube is full, changing the sequence is the same as




The Mark 48 Wire-Guided Torpedo

## Controlling a Mark 48 Torpedo (Advanced)





**Genius Capabilities** Each is a language and 5 characters use in this sphere wisdom. Upon learning the Invoke ritual, a character may add the Ritual Knowledge (spell name) skill at rank 1. Each additional rank in this skill grants knowledge of one additional ritual.

**Hargrave Vault Capabilities** Upon reaching this level, a character gains the ability to open a Hargrave Vault. Vaults are described in detail in the Hargrave Vault section of this book.

**Sunnybrook Wanderers Capabilities** Upon reaching this level, a character gains the ability to open a Sunnybrook Wanderers Vault. Vaults are described in detail in the Sunnybrook Wanderers Vault section of this book.

**Wayfarer Vault Capabilities** Upon reaching this level, a character gains the ability to open a Wayfarer Vault. Vaults are described in detail in the Wayfarer Vault section of this book.

**Prestige Prestige** A character may choose to prestige at any time after reaching level 10. Prestiging resets a character's level back to 1, but grants a permanent +1 bonus to all attributes. A character may prestige a maximum of 10 times.

**(1) Press F to Pay Respects** Upon pressing F, the character will perform a unique animation. Players can use this to express themselves in various social situations.

**(2) Hold C to Crouch** Crouching reduces the character's profile, making them harder to detect. Crouching also reduces movement speed by 50%.

**(3) Press Shift to Sprint** Sprinting increases movement speed by 100% but drains stamina rapidly. Stamina regenerates when not sprinting.

**(4) Press Space to Jump** Jumping allows the character to clear obstacles and reach higher platforms. Jump height is affected by the character's Agility attribute.

**(5) Press E to Interact** Interacting with objects, NPCs, and doors is done by pressing E. Some interactions require specific items or skills.

**(6) Press Tab to Open Inventory** Opens the character's inventory screen, displaying all items currently carried.

**(7) Press M to Open Map** Opens the world map, showing explored areas, points of interest, and the character's current location.

**(8) Press Esc to Open Menu** Opens the game menu, allowing access to settings, save/load functions, and exit options.

**(9) Press F1 for Help** Displays a help screen with a list of all controls and their functions.

**(10) Press F5 to Quick Save** Saves the game to a quick save slot. Overwrites any previous quick save.

**(11) Press F9 to Quick Load** Loads the most recent quick save. Any unsaved progress will be lost.

**(12) Press F12 to Take Screenshot** Captures a screenshot of the current game view and saves it to the screenshots folder.

## Sea Lance Missiles

**Capabilities.** The missile is launched from a launch tube, is designed to attack a surface vessel above water. It cannot be launched from depths below 100'. Use rifle proficiency and attack bonuses are unchanged. Maximum range is about 4 hexes, maximum actual 10 hexes.

The missile is available from 1952 onward.

When the missile reaches its first waypoint it is released into the water. The warhead is the small black fin having torpedo characteristics and is targeted directly. Range and target are set at launch and cannot be changed. The missile has a 60' turning radius, cruising depth and speed of 30 knots, and a target acquisition range of 1 hex.

**Effects on Target.** If the missile hits a target, it changes to the depth of the target and does damage of 6, 8 or 10 hexes the target. It goes back to cruising.

**Tactics.** Launching a missile at a target that is not moving is more effective against a stationary than a moving target. Launching a missile at a target that has taken hull damage from the weapon before sinking.

**Firing Procedure.** Select the Fire Missile command. Click on the target. Pick a point on the first waypoint by clicking on the mission's guidance window. Then use the Controller to move the pre-planned waypoint (the first waypoint) to the desired location. Click on the Launch button.

**Controlling Missiles.** Once a missile is launched it cannot be recalled. You cannot make any changes to the missile's course or characteristics. You can only watch it and hope it hits the target.

## Single Missiles

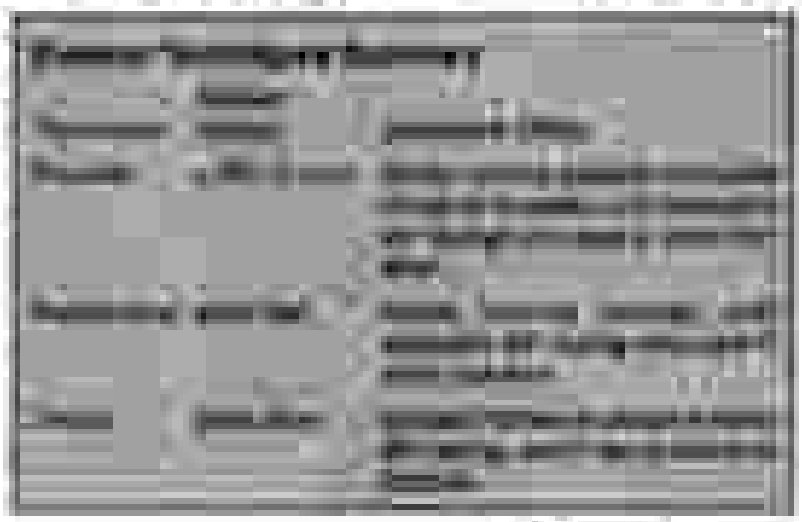
**Capabilities.** This missile is identical to the Sea Lance except it is fired from a submarine's torpedo tube. Maximum launching depth is 50. Limited but guided missiles are available with launching depths of 100'. Use use rifle proficiency and attack bonuses. The missile has a 60' turning circle, a 60' terminal run. The fire and reload sequence takes 1 minute. It takes 2 hexes of movement to launch the missile. It takes 1 hex of movement to bring another missile to the launch tube. It takes one hex of movement to bring another missile to the launch tube. It takes one hex of movement to bring another missile to the launch tube.

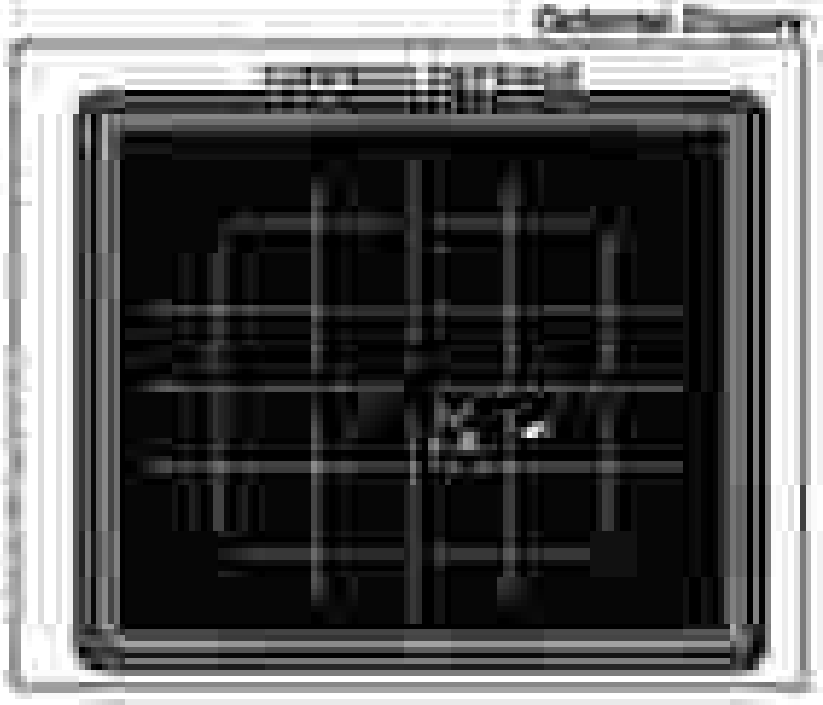
**Effects on Target.** The missile has a maximum range of about 8 hexes. It is effective only against surface vessels. Single hull hexes are available from 1951 onward.

**Firing Procedure.** Select the Fire Missile command. Click on the target. Pick a point on the first waypoint by clicking on the mission's guidance window. Then use the Controller to move the pre-planned waypoint (the first waypoint) to the desired location. Click on the Launch button.

**Controlling Missiles.** Once a missile is launched it cannot be recalled. You cannot make any changes to the missile's course or characteristics. You can only watch it and hope it hits the target.

## Evasion





## Hand Weapons

## Defensive Equipment

THREATS

DMG ± 3?2

RG 3050

DMG

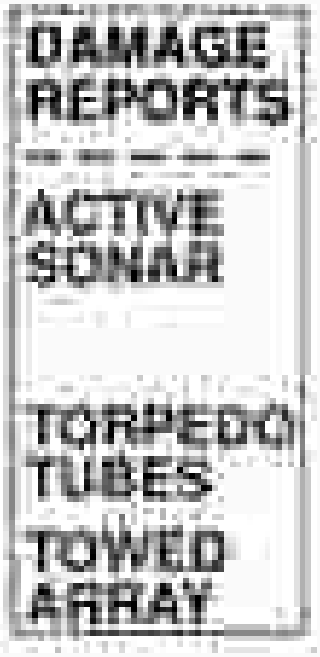
DMG

DMG

## Missile Tactics & Firefights

[illegible]

**Damage Report**



# Strategic Transit: the Norwegian Sea Theater

In "Strategic Transit" you represent one of dozens of ships of every description and your objective is to safely transit the Norwegian Sea.

You have a "Strategic Transit" card for each of your ships. Each card has a unique number (1 to 10) and a unique color. Each player chooses a card and places it in front of him. Each player then takes the ship counter that corresponds to the color of his card and places it on the map in the port of his choice.

The object of the game is to move your ship from your port to the opposite edge of the map. Each player moves his ship in turn, according to the sequence of play. The player with the lowest numbered card moves first, followed by the player with the next lowest numbered card, and so on. Each player moves his ship the number of hexes printed on his card.

## Home Port

You may choose any port on the map. Ports are located on the eastern edge of Scotland (northern England), the western edge of Norway, and the northern edge of Iceland. You will need to consider carefully the port you choose, as each port has its own advantages and disadvantages.

**Weapons Handling:** To arm or activate weapons from your Task Force, the Commander must roll a number on the appropriate weapon (each group of the Defense Data of submarine and weapon). Damaging the ground is not found.

Damaging weapons for your unit is an important decision. The SS Cruiser is an excellent all-around weapon especially useful against submarines, particularly those active subs. The Sea Lance is primarily useful against surface subs. Torpedoes (SUB) have a very effective use against surface ships (especially aircraft carriers), and are very effective against submarines. Depth Charges are the weapon of choice for attacking submarines. Remember that you can't shoot at your objective as a land target. Weapons are always worth planning if they're available.

**Evasion:** To make evasive maneuvers at your best, move the Commander to highlight the lower possibilities. Follow the Evasion Chart to make the roll.

**Returning to Base:** To return port, move the Commander to highlight the "Return Port" option and press the Execute.

**Warnings:** Your ships are most vulnerable if they do not have radar. Be very careful for warnings.

**Fuel:** As ships that escape to travelling at the speed of 5 hexes (Max. Speed) use up 1 unit. If a ship's fuel gets to zero, it will not be able to move. Ships can refuel at any friendly port.

## The Map

The map shows the northern waters between Greenland and Scandinavia (the "Norwegian Sea Theater"). For many reasons the high seas in the center of the map are

Enemies

Gestures

Pause, The Attack, Combo

**XO's Log: Game Report** | [illegible]

[illegible]

**Are Your Targets Tubed Loaded?** | [illegible]

**Finishing Your Mission** | [illegible]

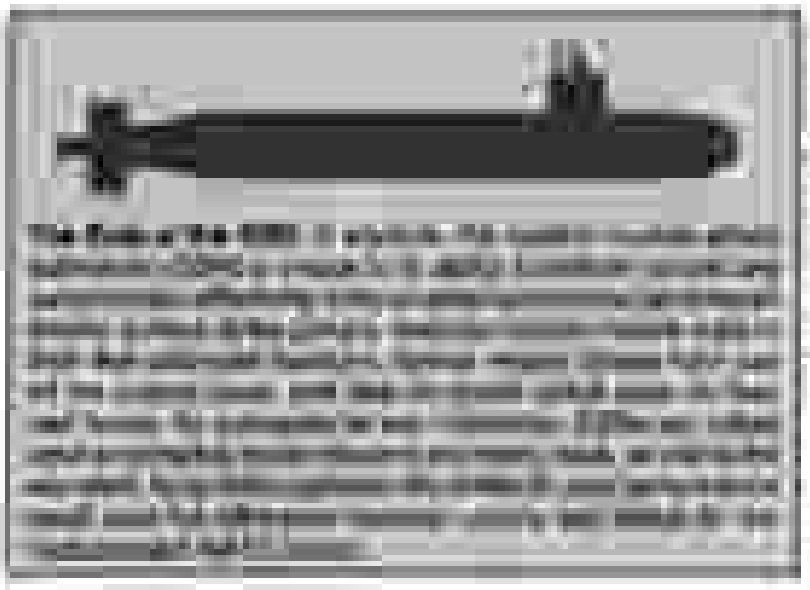
**Course of the War** | [illegible]

# Part 2
# The Captain's Manual

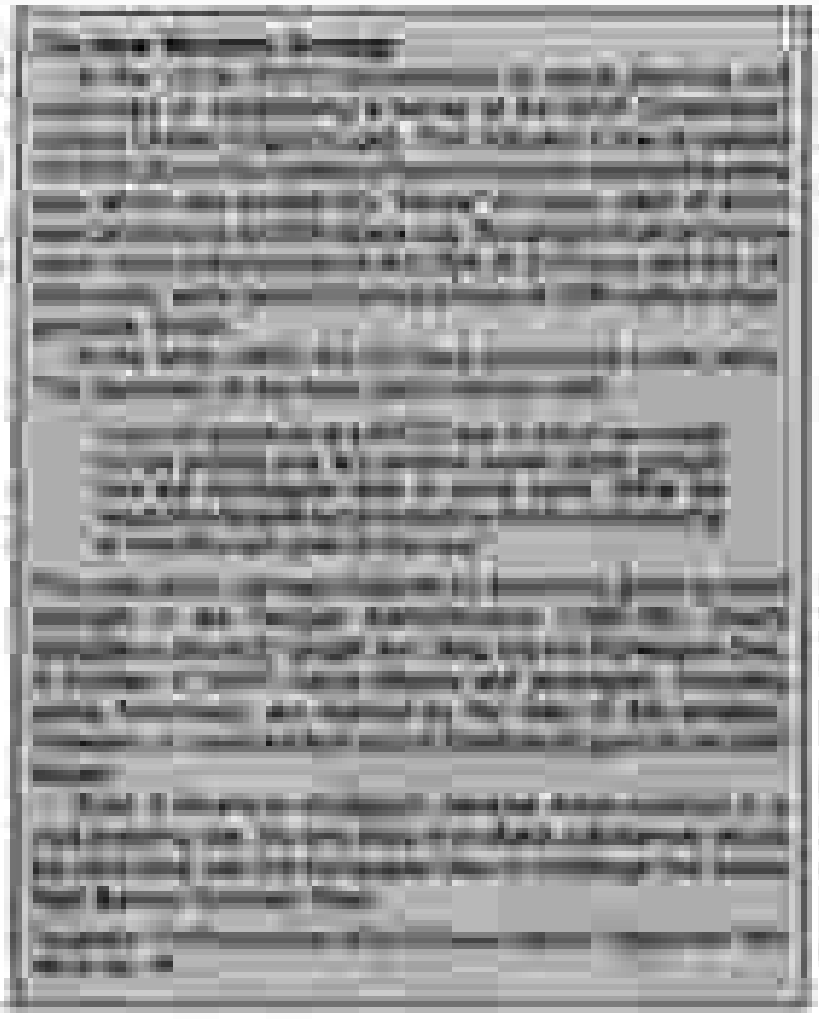
# Captain's Briefing:
## The Norwegian Sea Theater

### Introduction

### The NATO Perspective



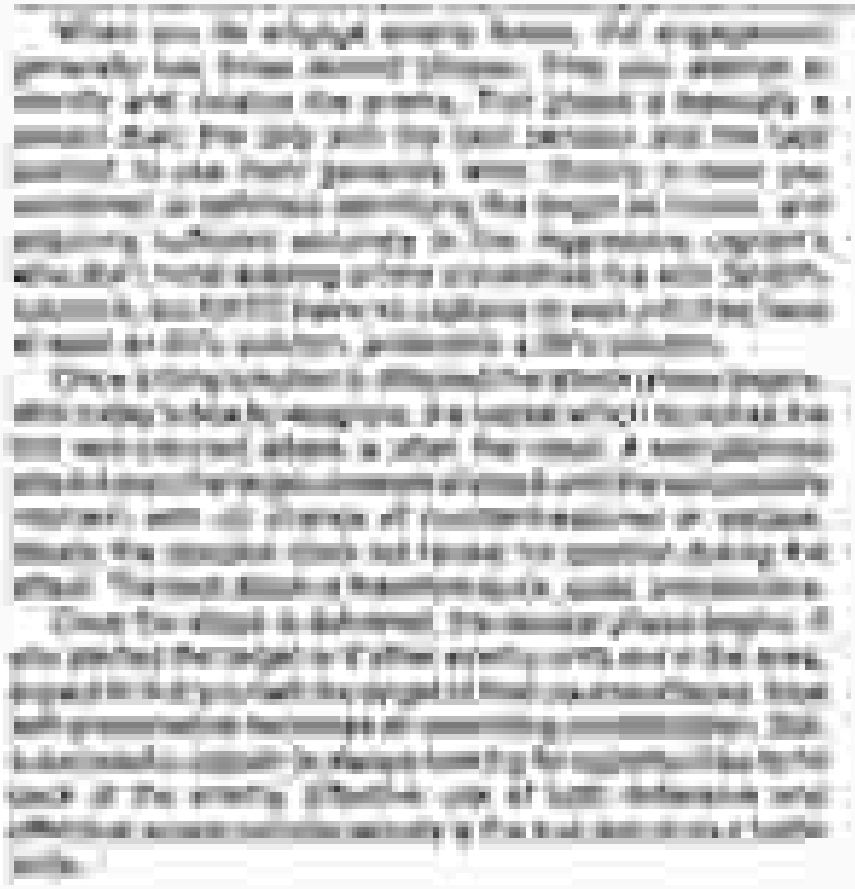
**The Role of the SSN:** A whole lot more than just a submarine



[illegible]

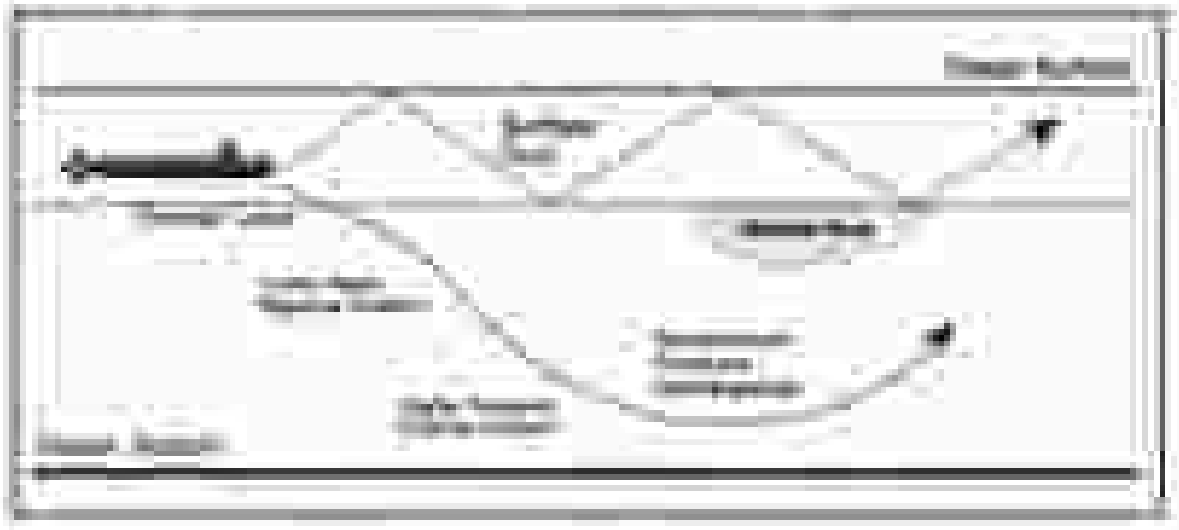
## Winning the War

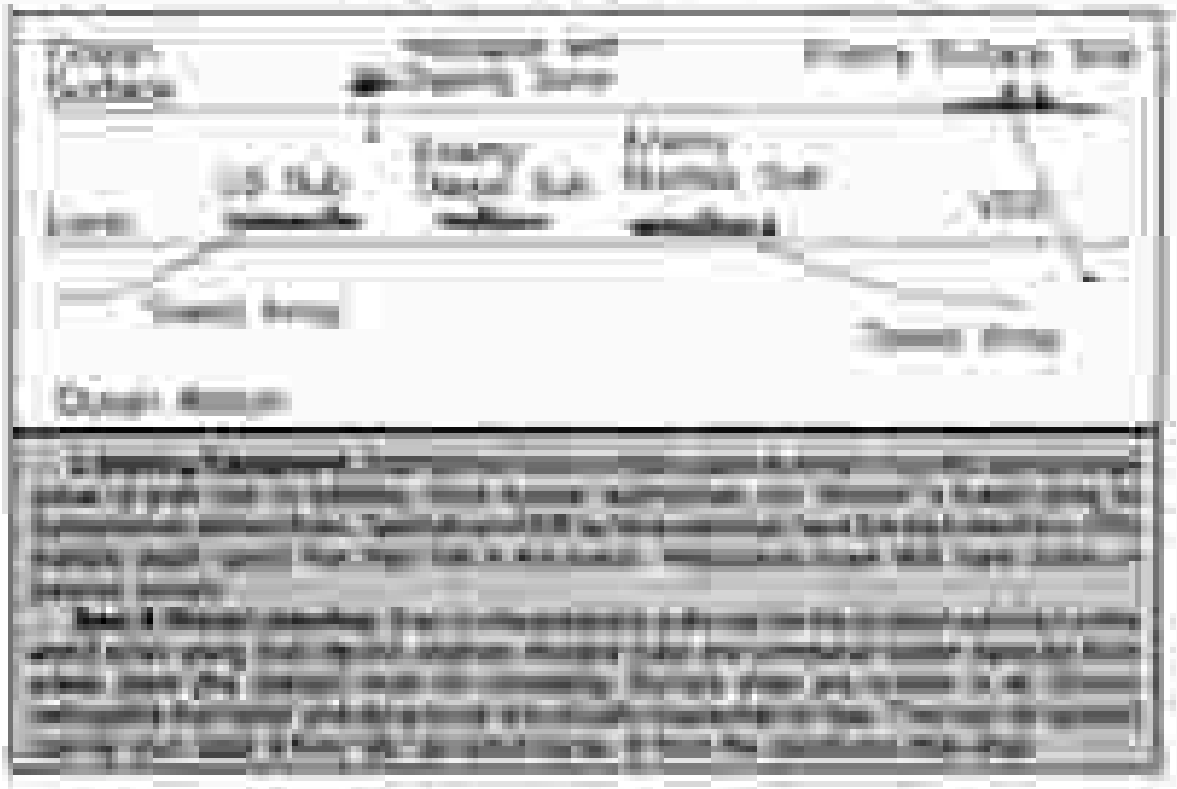
## Classic Stratagems



# Using Sonar and Other Sensors

## Sound and Sonar






US Sub
Enemy Sub "A"
Enemy Sub "B"

## Assembly Cross-Section

## Stone & Pyroscope

[illegible]

[illegible]

### Stay Quiet after Destroying a Contact

[illegible]

### Closing the Range

[illegible]

**The Battle**

**Sparring the Range**

[illegible]
[illegible]
[illegible]

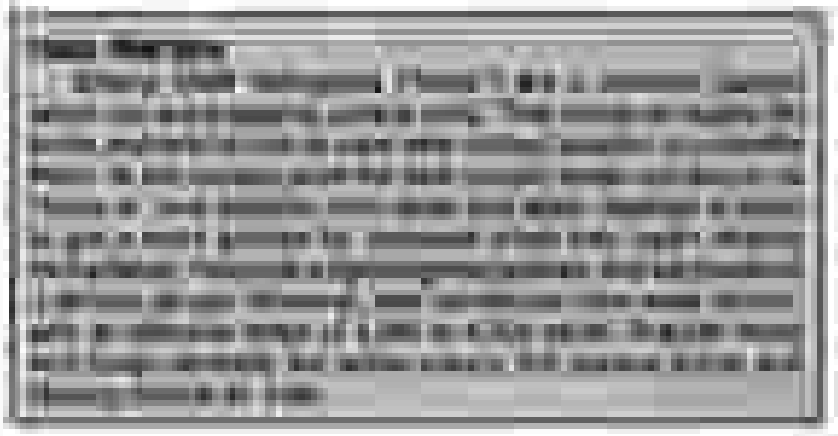
[illegible]
[illegible]

[illegible]

# The Norwegian Sea Theater

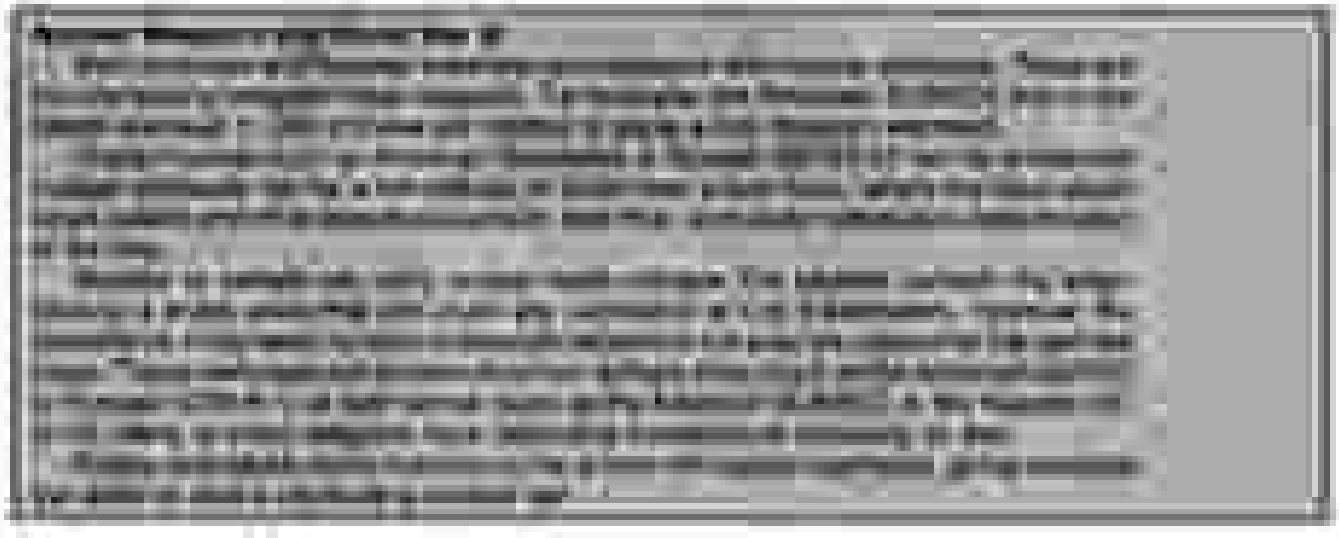
ARCTIC
ICE
PACK

## Occasionally Little Tennis



# Weapons & Attacks

## The Shooting Targets Attack



## Cruise Missiles

[illegible]

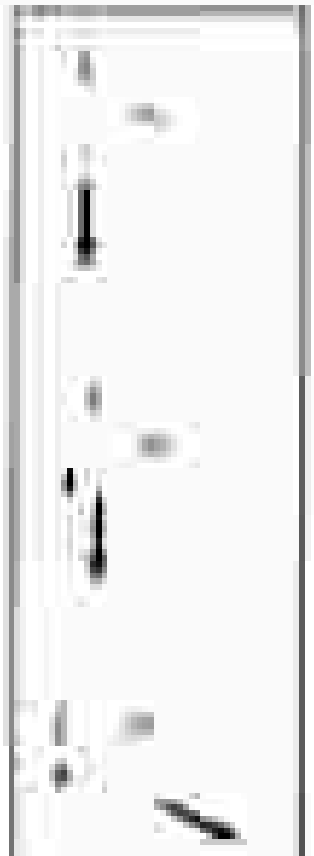
Chief Dalton

# Evasion & Escape

**Evading Tentacles.**

**Mind Thought.**

**Advanced Programming.**



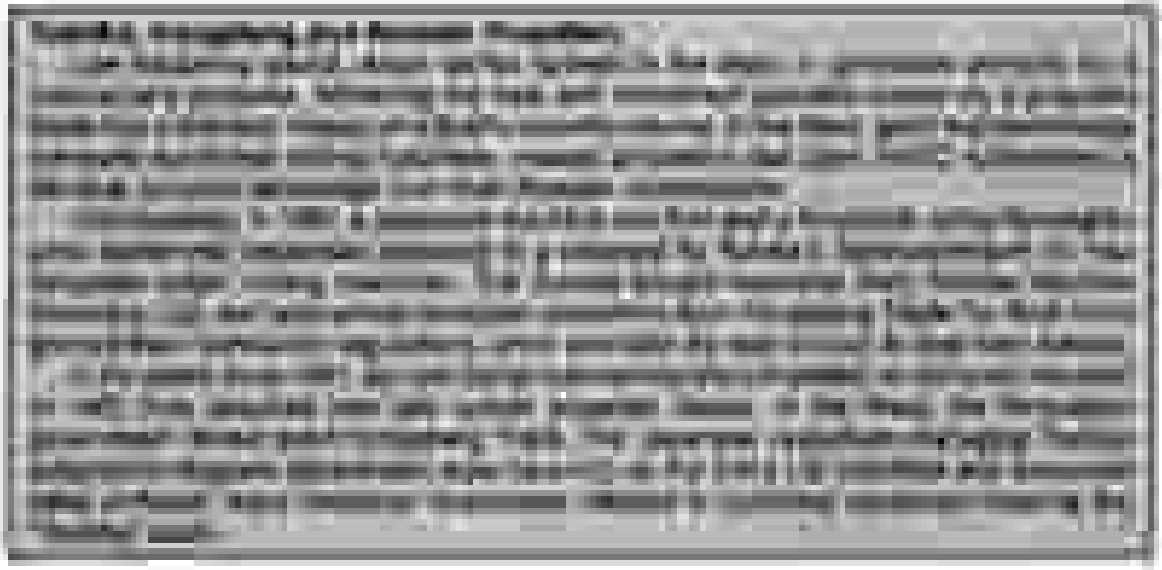
**The Danny Rule**

**Partial Structures**

# Russian ASW Tactics

## Tactical Philosophy

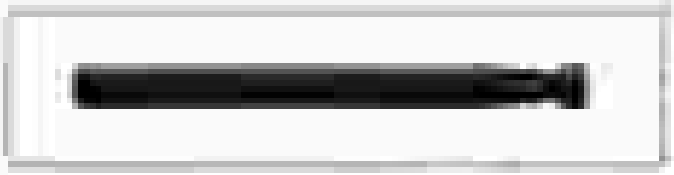
## Surface Warship Groups



# Part 3
# The Reference Manual

# US Submarine Weapons

## Mark 48 Torpedo



**Dimensions**

[illegible]

**Torpedo Performance**

[illegible]

**Range**

[illegible]

## [illegible]

**Weight Dimensions**

[illegible]

**Missile Performance**

[illegible]

**Range**

[illegible]

[illegible]

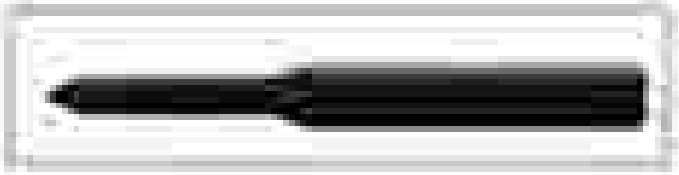
## [illegible]

[illegible]

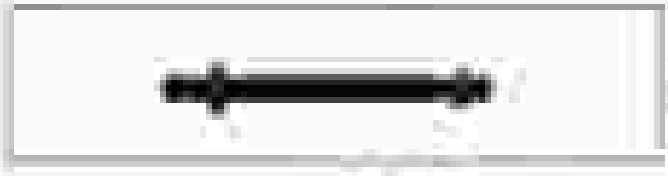
[illegible]

## [illegible]

[illegible]



[illegible]



**Dimensions:** [illegible]

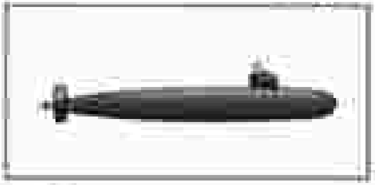
**Size** [illegible]

**Speeds** [illegible]

**Weapons:** [illegible]

**Sensors:** Low frequency sonars are the most effective, high frequency the least effective.

## USS Permit



**Dimensions:**

[illegible]

**Weapons:**

[illegible]

**Sensors:**

[illegible]

**Aircraft:**

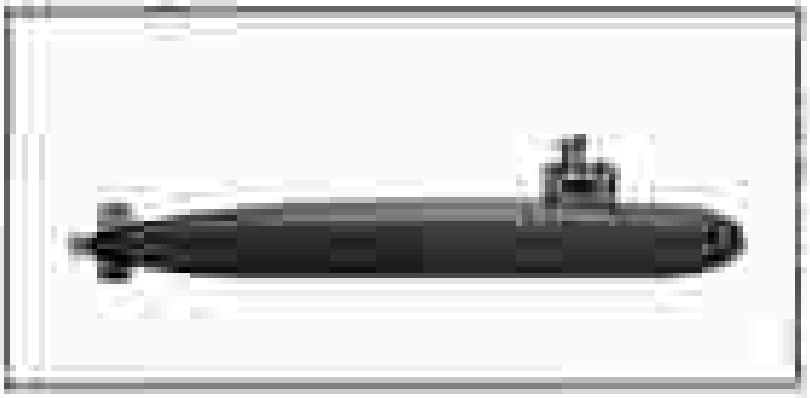
None

**Notes:**

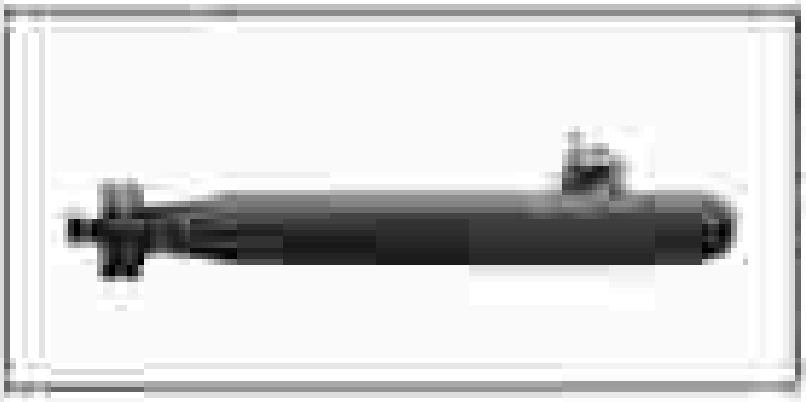
These submarines [illegible] the US Navy [illegible]. They [illegible] nuclear attack submarines. [illegible] Thresher [illegible] in 1963. [illegible]

[illegible]

## SSN Skipjack



## SSN Los Angeles



**Specifications**

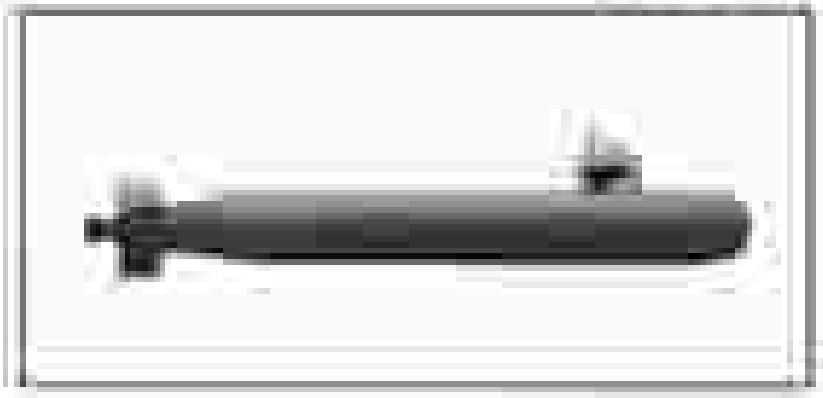
**Armament**

**Notes**

**Specifications**

**Armament**

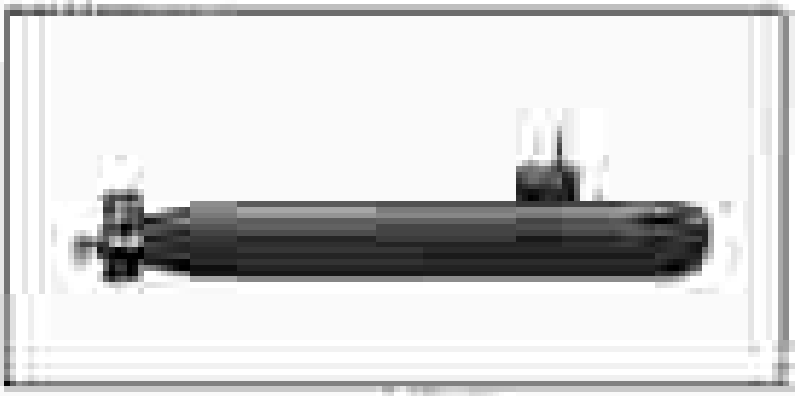
**Notes**



[illegible]

[illegible]

**[illegible] Seawolf**



**Dimensions:**
[illegible]

**Weapons:**
[illegible]

**Sensors:**
[illegible]

**Engines:**
[illegible]

**Service:**
[illegible]

[illegible]

# USSR Warships

## About Warship Data

**Type & Name:** [illegible]

**Dimensions:** [illegible]

[illegible]

**Speeds:** [illegible]

**Wpns:** [illegible]

**Sensors:** Low-frequency sonars are the most effective, high-frequency the least effective.

CVN Kremlin (ex Brezhnev)
[illegible]

**Dimensions:**
[illegible] tons
approx. [illegible] long
[illegible] kts
Nuclear reactors

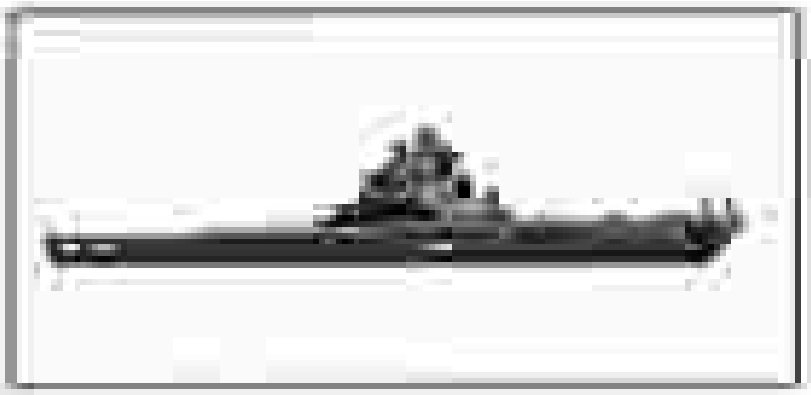
**Offensive Wpns:**
None

**Defensive Wpns:**
[illegible]

**Sensors:**
[illegible]

**[illegible] Aircraft:**
[illegible]

**Notes:**



## Oil Rigging

(Pride Army submarine [sunken])

**Dimensions**

[illegible]

**Offensive Specs**

[illegible]

**Defensive Specs**

[illegible]

**Sensors**

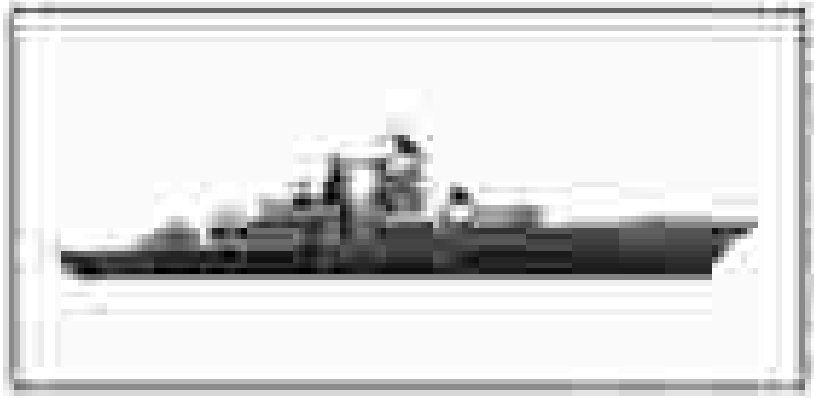
[illegible]

**Notes**

[illegible]

## [illegible] Class

(U.S. Mark Cruiser)



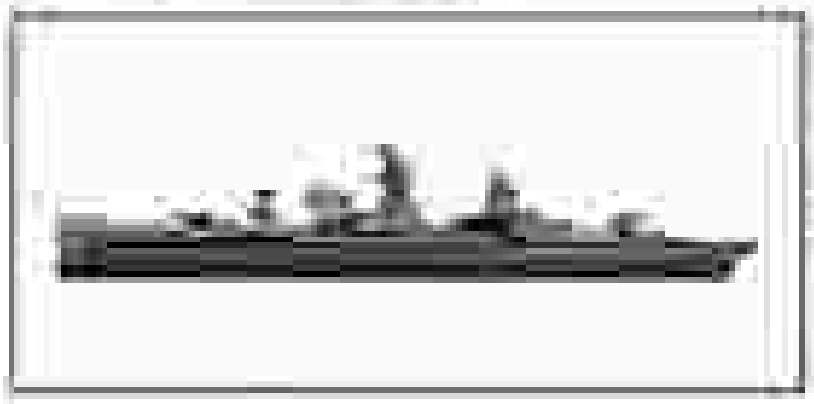
**Dimensions**

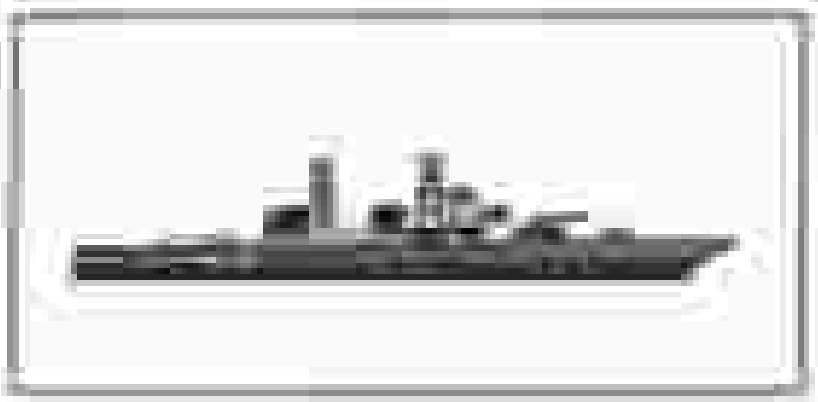
[illegible]

**Offensive Specs**

[illegible]

## CQ Vessels 0





## [illegible] Khalifeh Kaghbe

**Dimensions**
[illegible]

**Offensive Wpns**
[illegible]

**Defensive Wpns**
[illegible]

**Sensors**
[illegible]

**Aircraft**
[illegible]

**Notes**
[illegible]

## [illegible]

**Dimensions**
[illegible]

**Offensive Wpns**
[illegible]

**Defensive Wpns**
[illegible]

[illegible]

**Armament:**

[illegible]

**Sensors:**

[illegible]

## [illegible]

[illegible]

**Dimensions**

[illegible]

**Defensive Weapons**

[illegible]

**Sensors:**

[illegible]

**Aircraft:**

[illegible]

**Notes:**

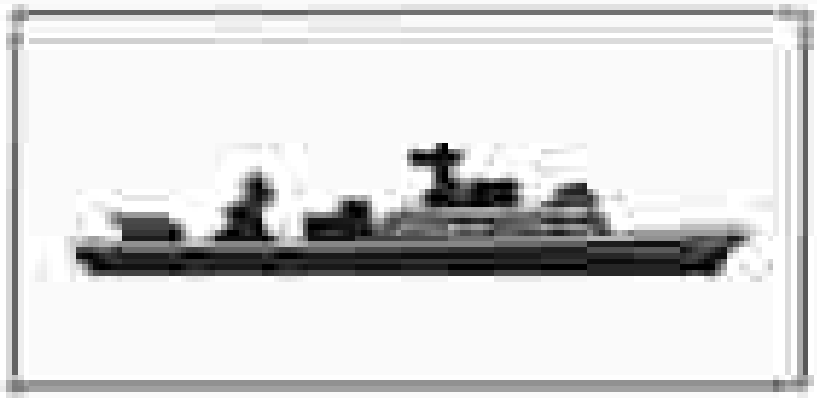
[illegible]

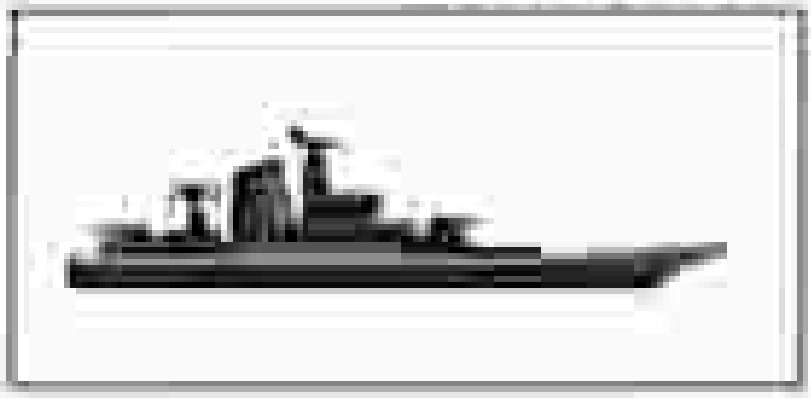
## [illegible]

[illegible]

**Dimensions**

[illegible]





**Aircraft**

None

**Notes:**

Numbers of these ships were completed between 1919 and 1922. Each one can carry about 20 armed officers and roughly 200 troops, depending on the climate and the type of patrol. The ships are fitted with a single 76mm gun and a machine gun. They are powered by two diesel engines, which can drive the ship at a maximum speed of 18 knots. The ships have a range of 3,000 miles at 12 knots. They are commanded by a Captain and have a crew of 100 officers and men.

## [illegible]
[illegible]

**Dimensions:**

[illegible]

**Offensive Systems:**

[illegible]

**Defensive Systems:**

[illegible]

**Sensors:**

[illegible]

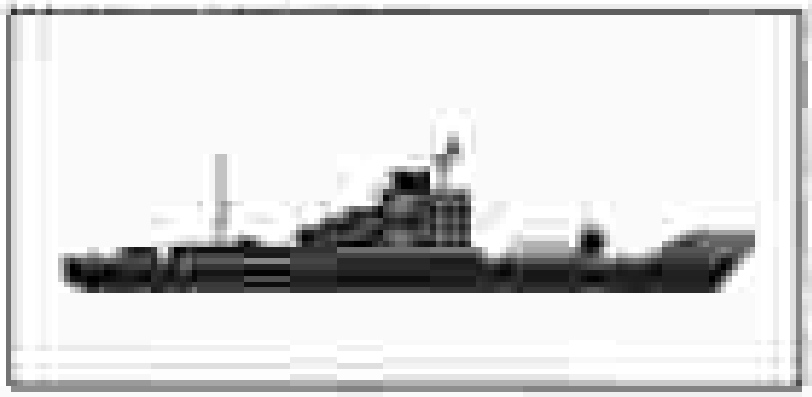
**Aircraft:**

[illegible]

**Notes:**

[illegible]

## [illegible]
[illegible]



**Dimensions:**

[illegible]

**Offensive Systems:**

[illegible]

**Defensive Systems:**

[illegible]

**Sensors:**

[illegible]

Aircraft:

Helicopter serving aboard ship

Notes:

Originally built as cargo ships in 1939-41. Many ships were converted to ship repair facilities by warships. Are essential their armaments. Number fully without missile-storage modifications, and in the Soviet Merchant Marine.

---

Dimensions:

6,300 tons;

111.3 m (x) (waterline)

130.10 m x 15.0m

15 kts; 40 km/h

Diesel propulsion

Offensive Weapons:

None

Defensive Weapons:

None

Sensors:

Warning radar

No sonars

Aircraft:

None

Notes:

Ships as a convoy ships were converted ship-repair ships. Six four in this class were completed between 1944 and 1945. The ship is outfitted for underway replenishment to keep ships and ship services, as well as having extra berths to replacement crews.

**ADR Sierra**
(ex-Navy Tender)

---

Dimensions:

8,750 tons;

16,000 tons loaded

132.9 m x 17.4m

15.5 kts; 287 km/h

Diesel propulsion

Offensive Weapons:

None

Defensive Weapons:

Removed

Sensors:

Warning radar

No sonars

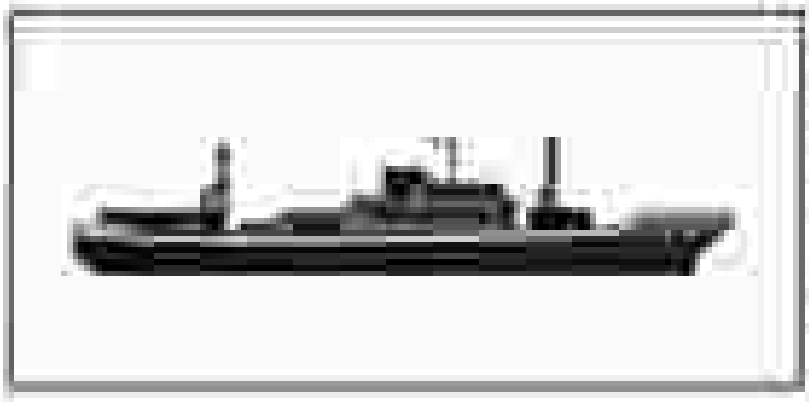
Aircraft:

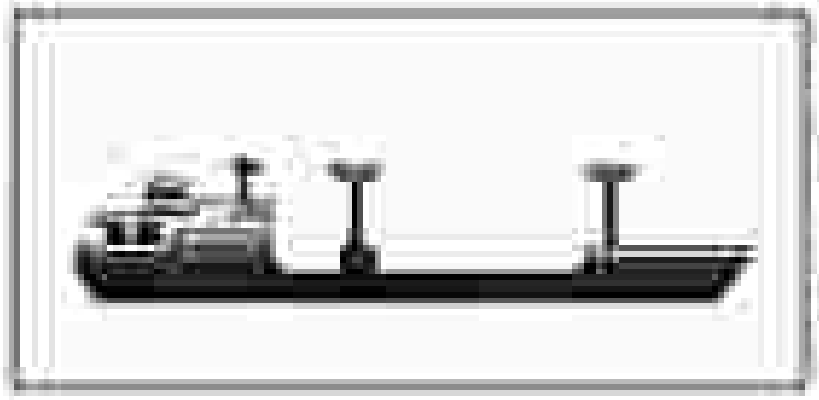
None

Notes:

Typical large merchant ships. Two were converted between 1967 and 1970. The ship is outfitted to replenish ship supplies. Originally fitted with 8 inch guns. These were later removed.

**ADR Sierra Class**
(ex-Navy Tender)





## [illegible]

**Dimensions**

[illegible]

**Weapons**

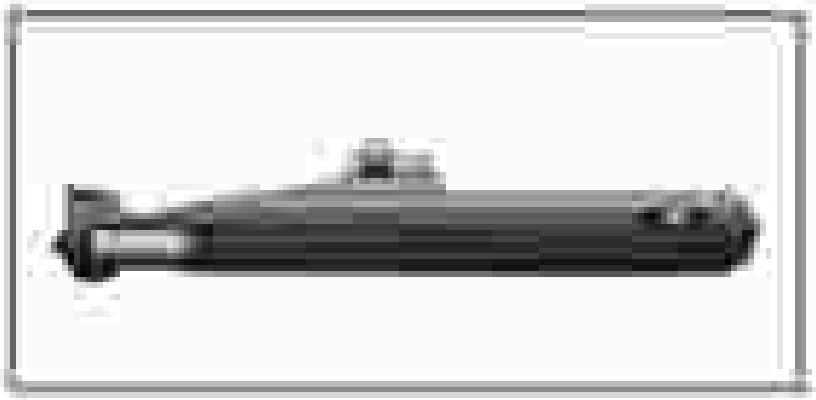
[illegible]

**Sensors**

[illegible]

**Notes**

[illegible]



## [illegible]

**Dimensions**

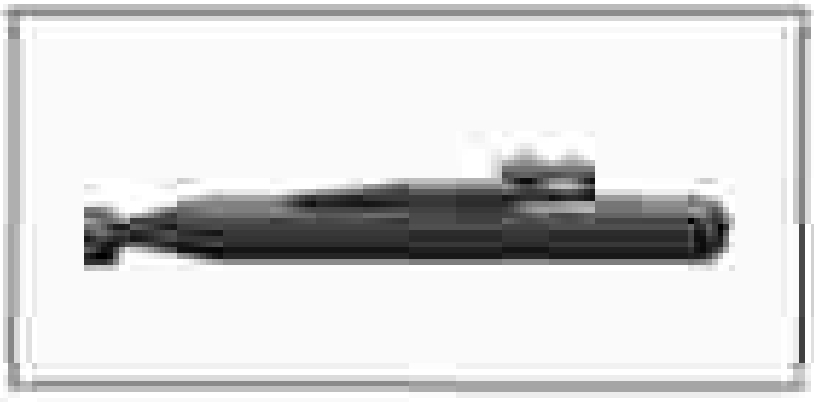
[illegible]

**Weapons**

[illegible]

**Sensors**

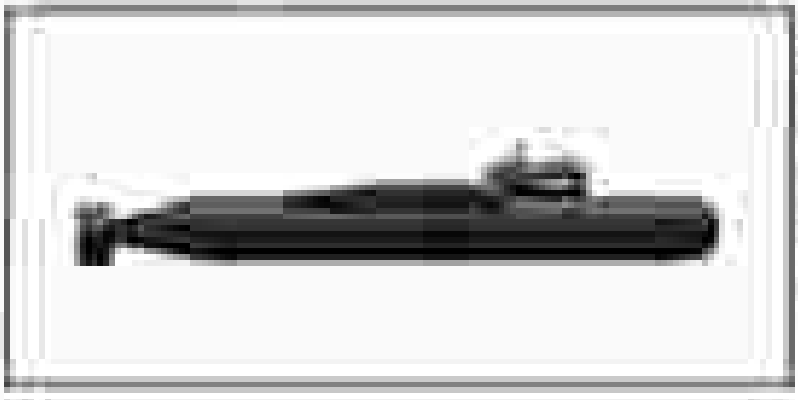
[illegible]



## Notes

[illegible]

## [illegible]



**Dimensions**

[illegible]

**Weapons**

[illegible]

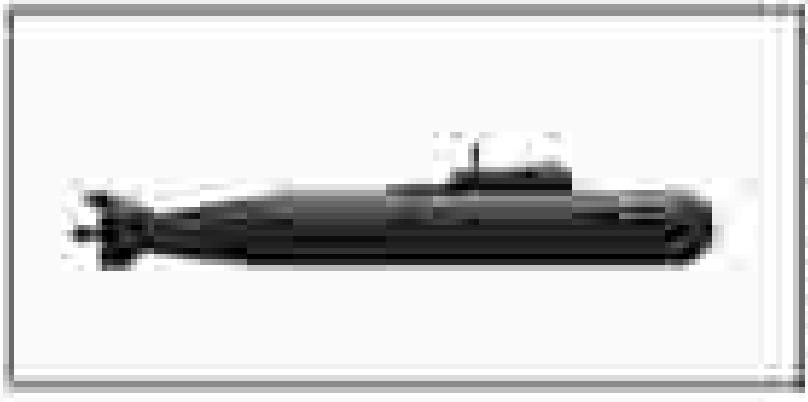
**Sensors**

[illegible]

**Notes**

[illegible]

## [illegible]

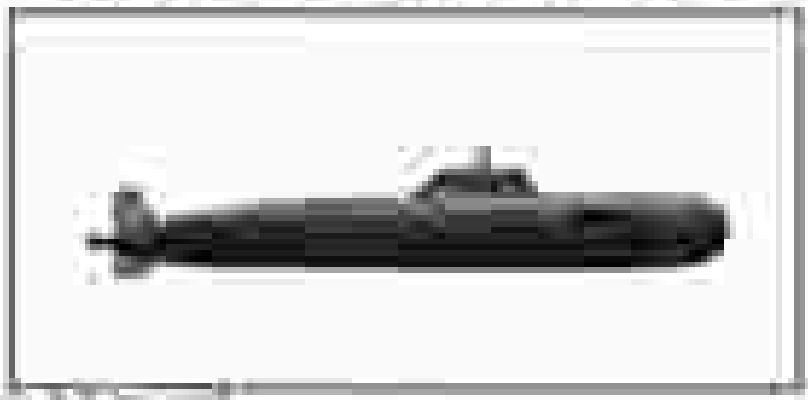


**Dimensions**

[illegible]

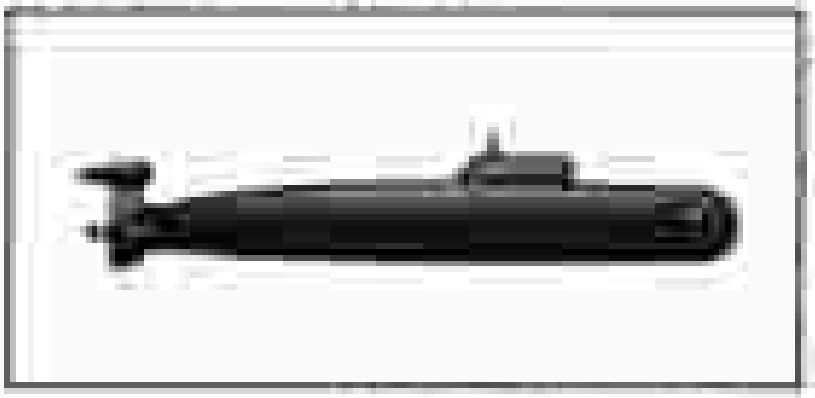
**Weapons**

[illegible]



## [illegible]

[illegible]



[illegible]

[illegible]

## [illegible]

[illegible]

[illegible]

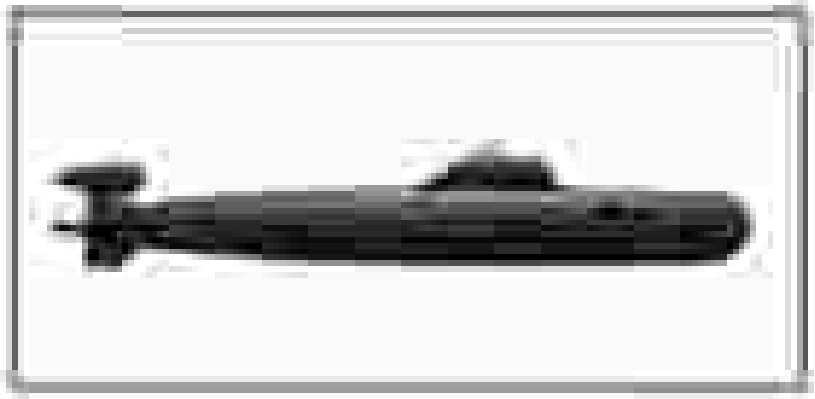
[illegible]

**Dimensions**

**Weapons**

**Sensors**

**Notes**

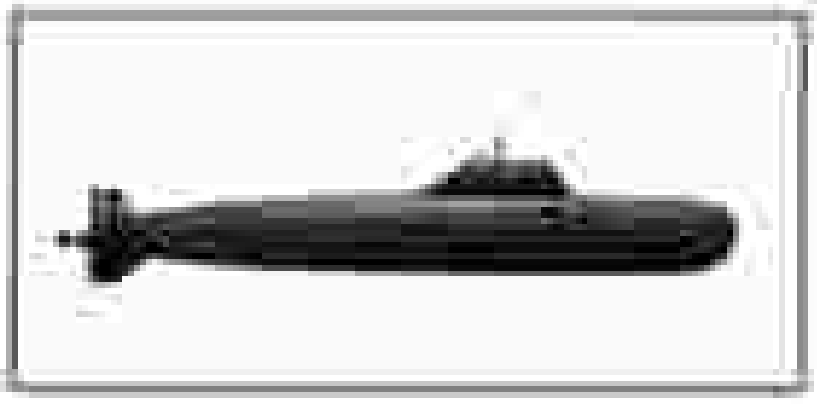


**Dimensions**

**Weapons**

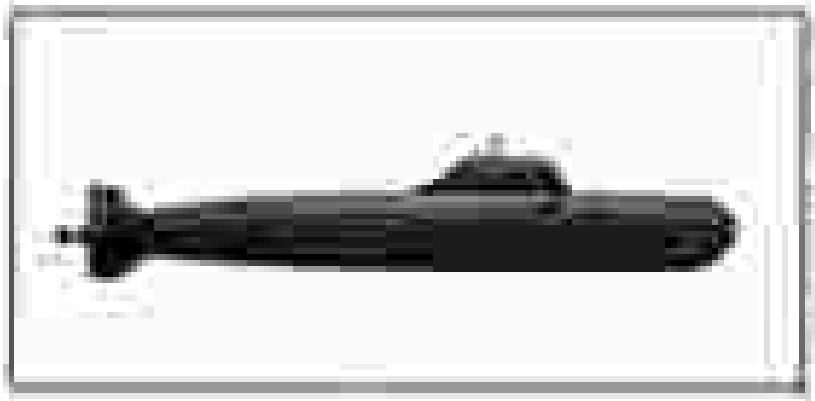
**Sensors**

**Notes**



## 939 Victor I

(N.A. Nuclear-powered Submarine)



Dimensions:

Displacement:

Propulsion:

Weapons:

Sensors:

Complement:

Programme:

Building time:

Cost:

Remarks:

## 939 Hunter/Killer

(N.A. Nuclear-powered Submarine)

Dimensions:

Displacement:

Propulsion:

Weapons:

Sensors:

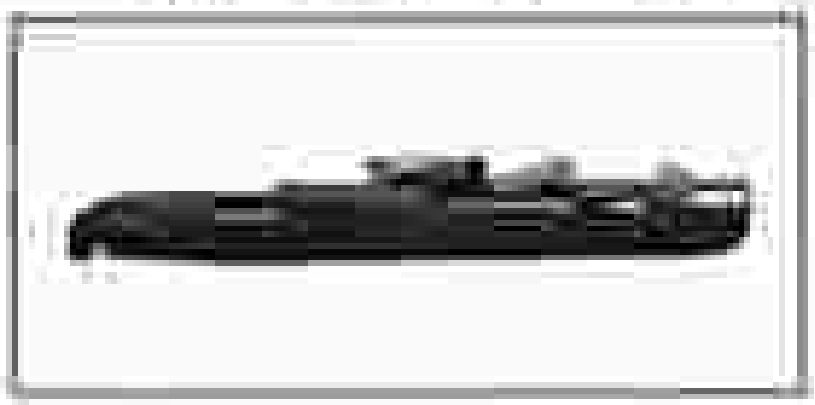
Complement:

Programme:

Building time:

Cost:

Remarks:



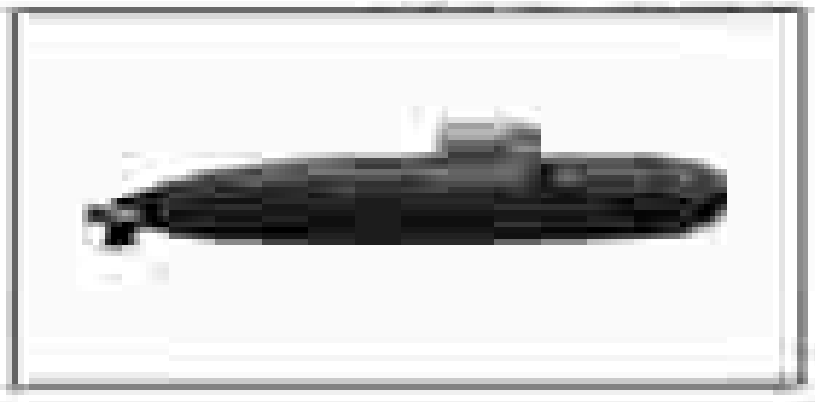
**Characteristics**
[illegible]

**Weapons**
[illegible]

**Sensors**
[illegible]

**Notes**
[illegible]





**Characteristics**
[illegible]

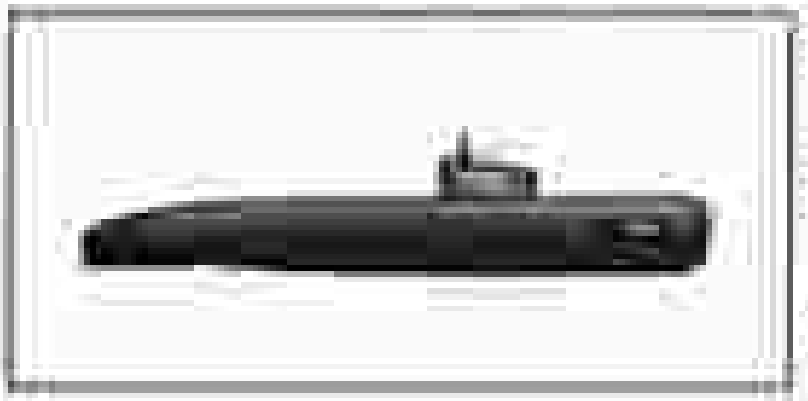
**Weapons**
[illegible]

**Sensors**
[illegible]

**Notes**
[illegible]

[illegible]

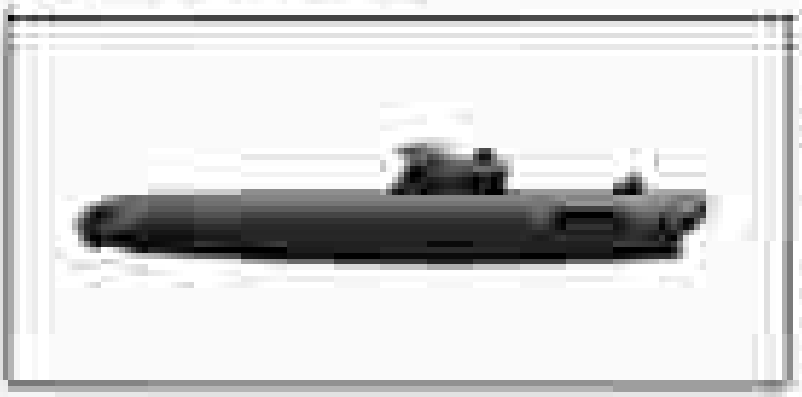
## [illegible]
[illegible]



**Displacement:**
[illegible]
**Weapons:**
[illegible]
**Sensors:**
[illegible]
**Propulsion:**
[illegible]

**Service:**
[illegible]

## [illegible]
[illegible]



**Displacement:**
[illegible]
**Weapons:**
[illegible]
**Sensors:**
[illegible]

# Glossary

**AA:** Anti-aircraft, a weapon capable of shooting down aircraft or [illegible] missiles.

**AAD:** Anti-Radiation Missile. The Russian MiG pursuit includes radars and warning systems covering the bottom of the rudder and speed brake defence system designed to protect [illegible]

**AEGIS:** Advanced Capability or improved version of the MiG [illegible]

**Archangel etc.:** [illegible] to the [illegible]

**Blue:** Current US Navy term for any submarine. Its hostile [illegible] submarine is known a 'ship'; that term is limited to surface vessels.

**Bravo:** Nickname for a human subtle missile submarine (SSBN).

**Clear:** Confirms the clearing command of a vessel.

**Cruise Missile:** Flying range sharply flying missile. Originally were unmanned have a rocket booster that accelerates the missile to cruising speed, after which a much more efficient air-breathing jet engine takes over. Depending on size and guidance equipment, such missiles can travel hundreds or more.

**Deterrence:** [illegible]

**DP (Dual Purpose) Gun:** A naval gun designed to fire either at surface targets (like an [illegible] targets (like [illegible] missiles from aircraft or missiles.

**ELF:** Extremely Low Frequency. A communications that use very low frequency waves transmitted through the earth itself. Used for coded messages from a station on the Kola [illegible] submerged at sea.

**EW:** Electronic Warfare. A [illegible] of [illegible] offensive.

**Fifties:** Electronic sensing measures [illegible] signals, especially radar signals.

**GIUK Gap:** Greenland – Iceland – United Kingdom Gap, the narrow straits that connect the Norwegian Sea to the North Atlantic Ocean.

**Hydrex:** Mnemonic [illegible]

**Hydro:** Common naval abbreviation for [illegible]

**HF:** High Frequency, a range that [illegible] long range communications. These are the least reliable of all radio [illegible]

**Kyrdic:** Thousands of yards. For example 6 Kyrdic is 6,000 yards.

**Lasers:** A beam of coherent light generally invisible to the human eye although certain [illegible] damage the eye.

**U.S. (Los Angeles Class)**

[illegible]

**Laurel Tennessee**

[illegible]

**[illegible]**

[illegible]

**[illegible]**

[illegible]

**[illegible]**

[illegible]

**Point Defense [illegible]**

[illegible]

**[illegible]**

[illegible]

**[illegible]**

[illegible]

**[illegible]**

[illegible]

**[illegible]**

[illegible]

**[illegible]**

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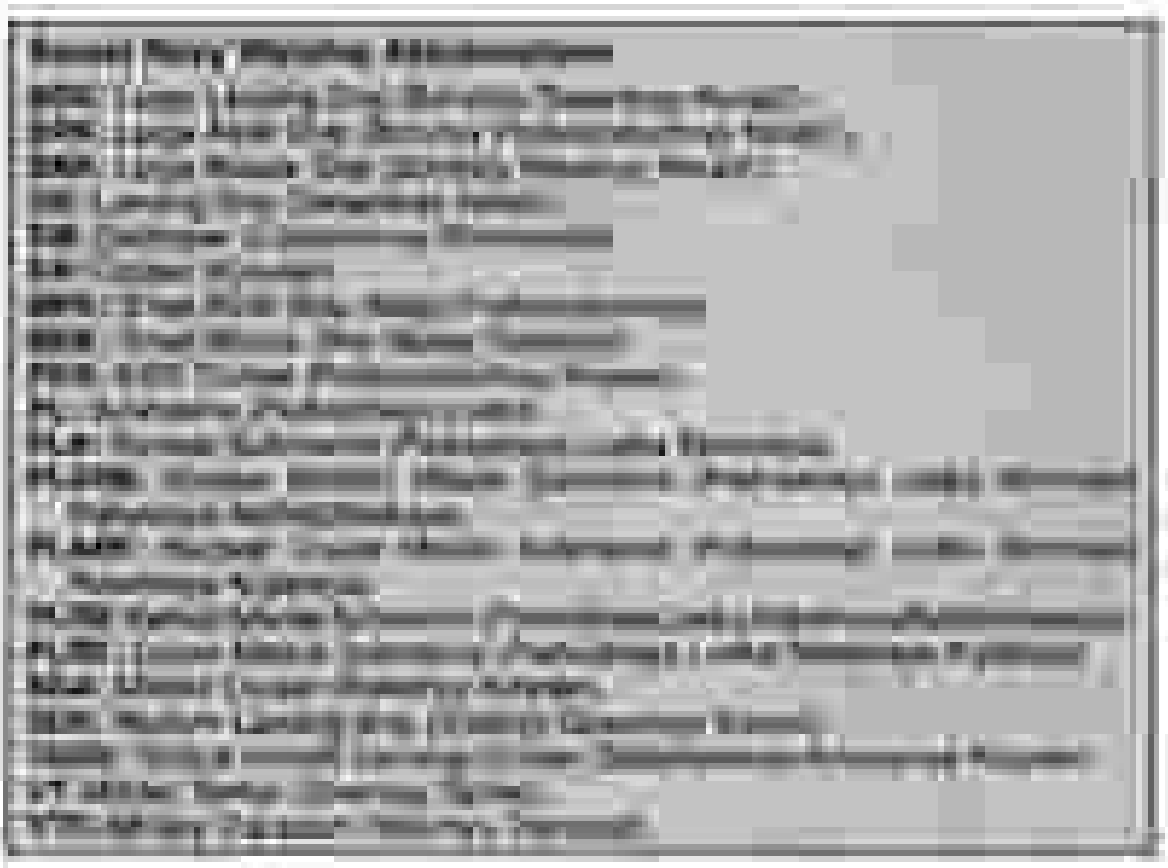
**[illegible]**

[illegible]



# Designers' Notes

# Credits

**Game Design**
Sid Meier
and Arnold Hendrick

**Original C-64 Programming**
Sid Meier and Richard Orban
with Andy Hollis

**Computer Graphics**
Murray Taylor
and Max Remington

**Music & Sound Effects**
Ken Lagace
with Jim McConkey

**Manual Text**
Arnold Hendrick

**Manual Graphics**
Murray Taylor with Barbara Bents
and Jackie Ross

**Technical Advice & Research**
Larry Bond and Tom Clancy

**Quality Assurance**
Chris Taormino

**Production**
[illegible]
[illegible]
[illegible]

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