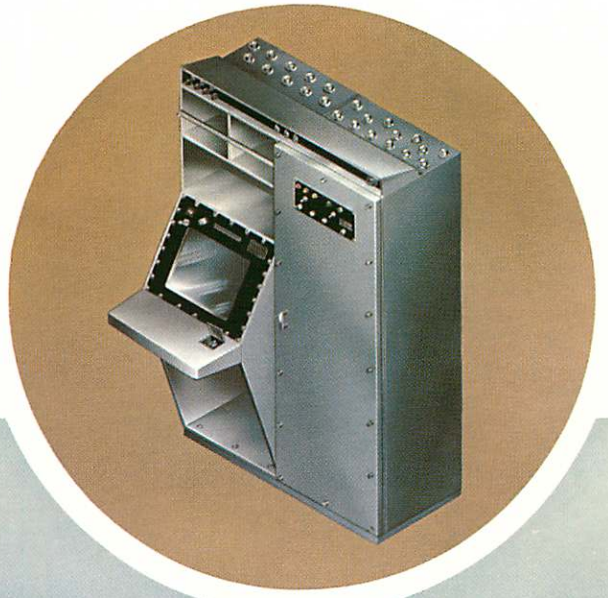
CAPABILITY IMPROVEMENT PROGRAM FOR FIRE CONTROL GROUP MK 111 AND FIRE CONTROL SYSTEM MK 114



Librascope

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IMPROVEMENT PROGRAM BACKGROUND AND RATIONALE

Operational in navies around the world today are fifty-three (53) Fire Control Group (FCG) Mk 111 systems and one hundred and eighty (180) Fire Control Systems (FCS) Mk 114. Using state-of-the-art technology for the time period 1956-1960, Librascope designed and built the Attack Console (AC) Mk 38 used in the Fire Control Group Mk 111 and the Attack Console (AC) Mk 53 used in the Fire Control System Mk 114 to provide a stand-off capability for the delivery of an advanced type of ASW torpedo (ASROC) that would provide effective defense against the underwater craft of that period as shown in Figure 1.

Figure 1. Librascope - Built FCG Mk 111/FCS Mk 114 controls launch of ASROC missile

The original Fire Control Group Mk 111 and Fire Control System Mk 114 have both reached the level of obsolescence where they are difficult and costly to maintain:

- spare parts are often unobtainable necessitating redesign to use currently available parts.
- mechanical gearing modules (rotating components) are reaching the limits of their useful life.

Today the reliability, speed, and memory density of computers are far superior to the early digital computer used in the Fire Control Group Mk 111. Because of these advanced design features, it is now possible to implement the ASROC weapon and Over-the-Side (OTS) torpedo computations in current, state-of-the-art, solid state technology with benefits from:

- reduced volume,
- reduced heat dissipation,
- reduced power requirements,
- increased reliability, and
- improved maintainability.

It is also possible to provide the capability for future expansion of the system to include:

- more advanced weapons,
- improved sensors, and
- more advanced Contact Motion Analyses (CMA) models.

IMPROVEMENT PROGRAM SYSTEM DESCRIPTION

Librascope has designed a digital fire control console that offers the following:

- A minimum cost modernization program.
- A replacement console that can be installed without ship modifications.
- Reliability and maintainability improvements to FCG Mk 111 and FCS Mk 114 which will also increase the operational availability of the ASROC weapon system.
- Compatibility with existing sensors and weapons without modification.
- Standard Electronic Module (SEM) circuit cards that are readily available in the U.S. inventory.
- A high reliability, low maintenance plasma panel for data display and operator interaction. A series of display pages will be selectable to assist the operator during target tracking and weapon firing.
- Future expansion capability for new sensors and weapons.

The new console will enhance the ASROC and OTS torpedo capability by providing more accurate computations which offer the following features:

- Automatic target tracking and CMA with operator override and edit
- Improved weathercocking and launcher stabilization
- Enhanced weapon selection and firing orders
- Higher resolution display
- Enhanced diagnostics and fault location procedures.

The new, high performance, digital fire control console will replace either the existing Attack Console Mk 38 for Fire Control Group Mk 111, or the Attack Console Mk 53 for Fire Control System Mk 114. This replacement console contains a current, state-of-the-art, digital fire control system with plasma display for operator interaction. Figures 2 and 3 show the new digital fire control console within the Fire Control Group Mk 111, and Fire Control System Mk 114, respectively.

The console interfaces with the same shipboard equipment (e.g., sonar, gyrocompass, wind equipment, torpedo tubes, ASROC launcher, etc.) as the aforementioned existing consoles. An adapter box is provided on the top of the console to facilitate use of existing ship's cabling without modification. The console occupies the same space as the existing console and is installed using the existing ship's deck mounting structure.

Librascope has conducted studies to define the digital console design and to identify critical areas in that design. The most critical element in the digital console design is providing stabilized launcher train and elevation signals which will permit smooth operation of the ASROC launcher, equivalent to that provided by the existing analog system. The smoothed launcher train and elevation signals are provided by a computer architecture using four dedicated militarized microprocessors, each performing one of the following:

- Formatting and merging of the input signals.
- Launcher stabilization and weathercocking calculations.
- Reformatting of the output signals.
- Master control which includes display management, Contact Motion Analysis (CMA), position-keeping, weapon selection, and rail/tube select - firing orders.

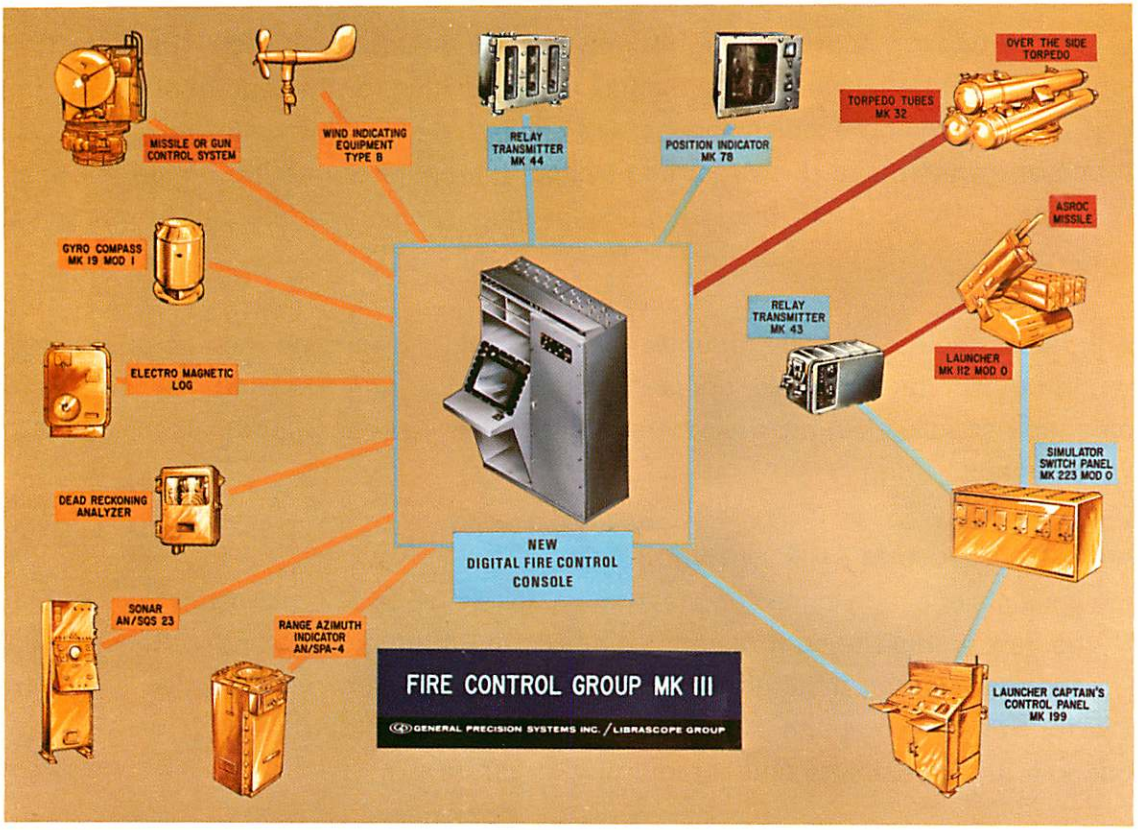

Figure 2. Fire Control Group Mk 111 with the New Digital Fire Control Console

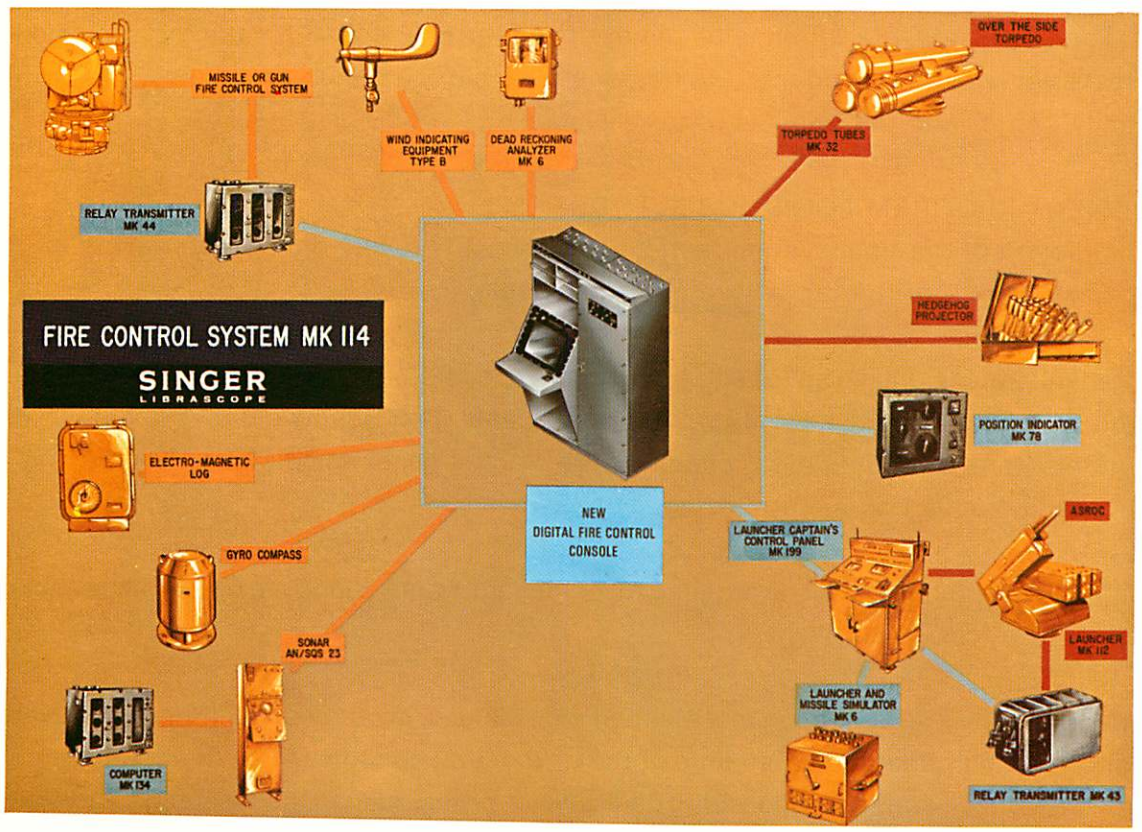

Figure 3. Fire Control System Mk 114 with the New Digital Fire Control Console

A plasma panel with a touch overlay control provides the interactive interface between the operator and the computer. An Initialization/Test display page provides for the input/modification of manual inputs (e.g., air density) and fixed values (e.g., parallax). A Geographic display page shows the position histories of ownship and the target and assists the operator in determining the best Contact Motion Analysis (CMA) solution. The Firing display page assists the operator in weapon selection, setting, and firing.

The new digital console materially reduces operator workload through the use of automatic target tracking and CMA with provisions for operator modification/editing. The digital console also provides a recommended weapon selection, with operator override, and sequentially leads the operator through the steps for weapon firing.

IMPROVEMENT PROGRAM SHIP INSTALLATION

Installation consists of simply removing the Attack Console Mk 38 or Attack Console Mk 53 and replacing it with the new digital fire control console shown in Figure 4. The existing fuse panel assembly is retained and mounted on the digital fire control console thereby retaining the same termination connectors for the ship's cabling. Adapters are provided to facilitate installation of the digital fire control console on the existing ship's mounting structure.

It is estimated that shipboard installation will take 21 days. This time frame is dependent upon the operational status of the existing attack console. Librascope will conduct system tests to verify the status of the interfaces and associated equipment and will provide assistance in resolving any deficiencies. The attack console will then be removed and the new digital fire control console installed. System tests will again be conducted to demonstrate that the new computer console will perform substantially better than the console it has replaced.

IMPROVEMENT PROGRAM LOGISTICS SUPPORT

At the completion of the final system test, Librascope will provide on-the-job training in the operation and maintenance of the digital fire control console.

Librascope will provide one (1) set of shipboard spares consisting of one of each type of circuit cards used in the computer system, except for the plasma panel. The plasma panel is designed as a depot only repairable item; due to its high reliability, the plasma panel has a Mean-Time-Between-Failure (MTBF) exceeding 2000 hours.

Only standard test equipment will be required for shipboard maintenance as repair can be accomplished by replacement of circuit cards.

Librascope will provide an Operation and Maintenance Manual, in commercial format, that will describe the operation and shipboard maintenance of the new digital console. A set of engineering drawings will be provided since schematic and wiring data will not be included in the Operation and Maintenance Manual.

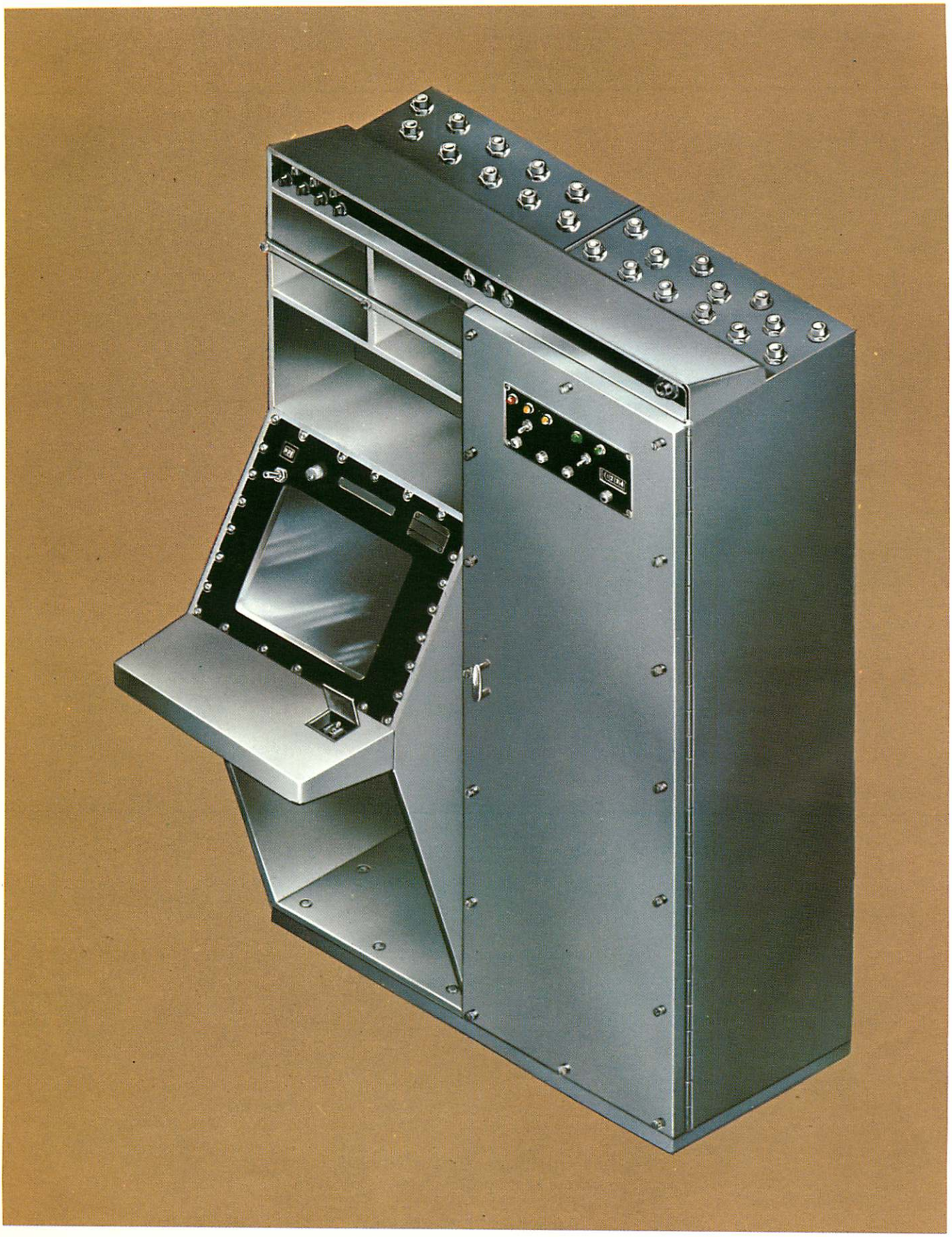

Figure 4. New Digital Fire Control Console

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