ANNIVERSARY ISSUE

AEGIS Excellence Newsletter Month 36

Vol. 2 No. 6 RCA Moorestown, N.J. December 1972

AEGIS: To Serve the Fleet

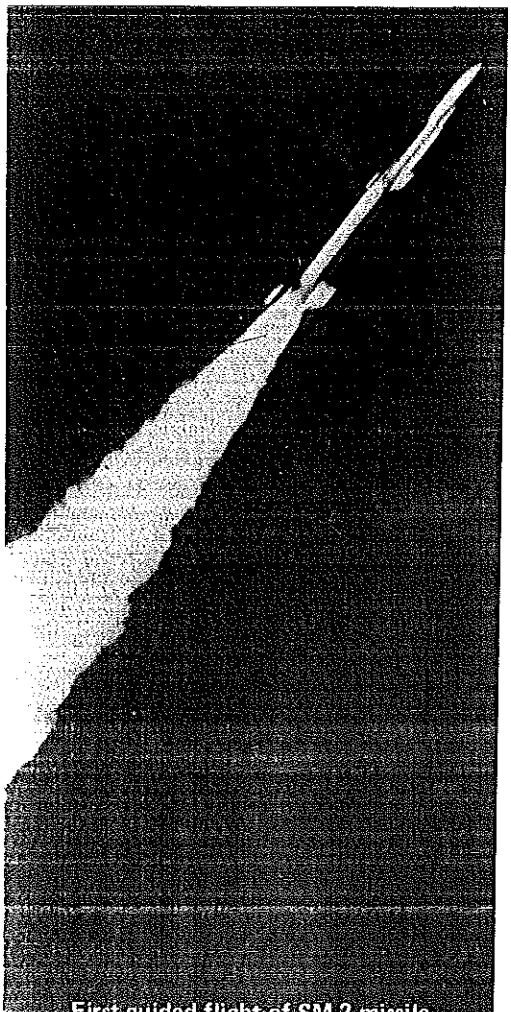
"Divine Wind" stormed through the U. S. Fleets in the Western Pacific in the final days of World War II. Before it abated, hundreds of American ships were sunk or damaged.

Kamikaze had struck!

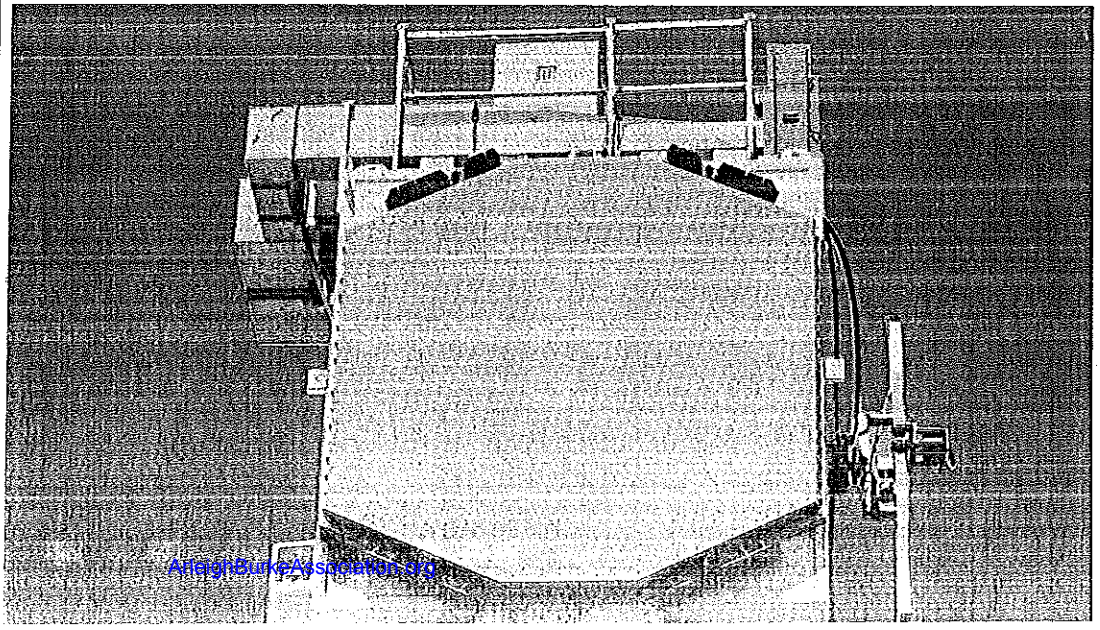
Determined no such future destructive force would be so effective against American ships, the U. S. Navy began the intensive search for an effective defense against air attack. That 25-year search has led to AEGIS.

AEGIS welds into a total system for shipboard use today's technical achievements of American science: digital electronics, fixed array radar and microcircuit technology. AEGIS integrates these advances into a weapon system that will provide our fleets superior defense through the coming decades.

Evolved from naval experiences gained from more than 20 years missile systems research; then studied as a fixed array radar based system; evaluated and refined over the past decade, AEGIS now, after three years in intensive engineering development, has emerged. AEGIS is the first, thoroughly system engineered, totally integrated anti-air warfare weapon system in Naval history. The product of dedicated Navy-Industry united team effort, AEGIS, now in test, stands ready to serve our Fleets in combat. It is to the AEGIS team that this Third Anniversary Issue is dedicated.



First guided flight of SM-2 missile continues White Sands Missile Range test program for the AEGIS missile. (See back cover.)



At right, AN/SPY-1 array radar antenna completes pattern test at RCA range, Moorestown, N. J.

Commemorating Three Years of AEGIS

"We are in a period in our history in which we face grave risks from circumstances over which we may have little control. Our Navy can be a decisive factor in such circumstances. As an island nation, we cannot rationally engage in commerce, honor treaties or deploy forces overseas without the protection of a strong Navy. Without adequate naval capability we cannot deter conventional war, let alone win it."

ADM Elmo R. Zumwalt, Jr.
Chief of Naval Operations
June 2, 1972

We who have studied Navy AAW needs are convinced that AEGIS with its quick reaction and nearly 100 percent availability is needed in operational ships to assure adequate naval capability.

AEGIS has met all technical performance and milestone goals in three years Engineering Development by a dedicated Navy-Industry team.

I congratulate each of you who are members of this team for your outstanding efforts. I look forward to your continued help as we move AEGIS through land and sea tests and into our fighting Navy.

RADM Merrill H. Sappington
Commander, Naval
Ordnance Systems Command

As we enter our fourth year of AEGIS Engineering Development, I am pleased to report that equipment and computer programs of AEGIS are being successfully assembled and tested at contractor plants and naval installations across the country.

RCA is proud to lead the industry members of the Navy-Industry team engaged in building this effective weapon system for our modern surface Navy.

We accord our commitment to AEGIS the highest priority. AEGIS will continue to receive our maximum attention.

Irving K. Kessler
Executive Vice President
RCA Government and Commercial Systems

AEGIS: Shield of the Fleet

THE AEGIS MISSION

AEGIS is a totally integrated weapon system designed to fulfill the mission of fleet air defense for the coming decades.

AEGIS is designed to provide exceptional system availability, fast reaction time, great firepower, immunity to electronic countermeasures, and extended intercept range.

AEGIS FULFILLS ITS MISSION

The AEGIS system combines computers, radars, and missiles to provide a defensive umbrella for our surface Navy. Installed in ships, the system will be capable of automatically detecting, tracking, and destroying airborne, seaborne, and land-launched weapons of the future that may be launched against our fleet.

The quick-reaction and high firepower of AEGIS stems from digital-computer managed operations coupled with a multi-function phased array radar capable of simultaneously performing all search, fire control-quality tracking and missile midcourse command guidance functions, in this sequence:

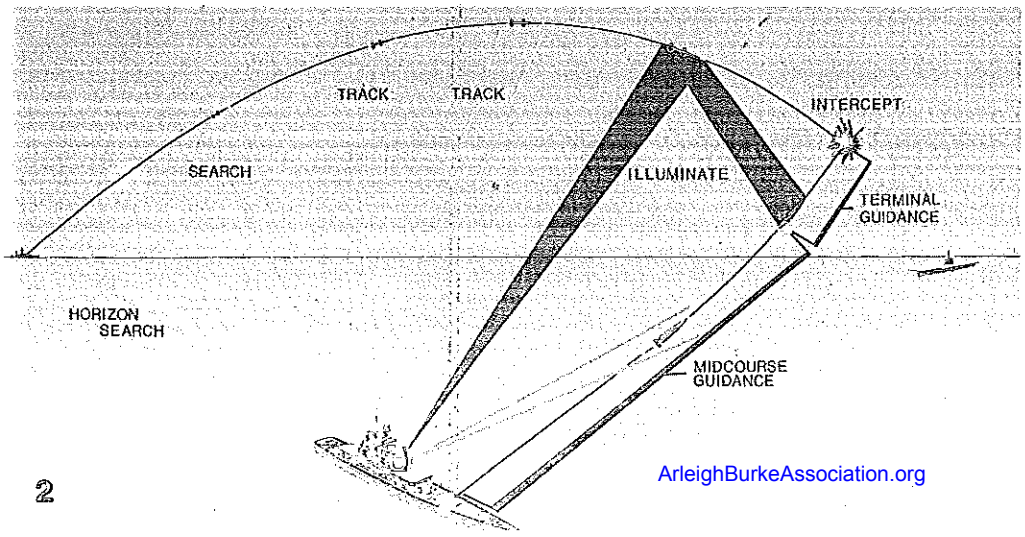
HORIZON SEARCH: A high-data-rate search under all conditions to cope with the low-altitude missile attack.

SEARCH: A highly adaptive normal mode search with an optimized burnthrough capability employing advanced ECM techniques; an almost immediate transition from search to track, minimizing reaction time.

TRACK: A track capacity capable of handling high numbers of friendly and hostile targets at adaptive data rates without interrupting search functions.

MIDCOURSE GUIDANCE: Simultaneously with search and track functions the phased array radar supplies midcourse guidance commands to several missiles. This permits easier launches, multiple engagements, longer intercept ranges and higher firepower. Rapid cycling, multiple purpose high firepower launchers sustain an unprecedented launching rate.

TERMINAL GUIDANCE AND ILLUMINATION: CW illuminators employ increased power density on target and rapid frequency selection for the semi-active terminal phase of missile flight to minimize mutual interference and counter spot jamming. Limiting illuminator use to the short terminal phase greatly increases firepower.



AEGIS Log:

by CAPT Wayne E. Meyer

This third anniversary of AEGIS Engineering Development is an excellent time to review our accomplishments even as we press forward to achieve our goal of modern air defense for our fleets.

Even two years ago, the spectacular progress we have made would have been difficult to predict. Much equipment existed only in artist's concepts and engineering drawings. What we were given to use from other programs was yet to be integrated into the AEGIS system. Program technical people were just beginning to function as a dedicated team. Technical problems loomed large as did problems of communications and motivation.

In retrospect, this is understandable. The weapon system prime contractor relationship was new to surface missile systems. Equipments to be integrated into AEGIS system design were separated by "orphan" areas such as switchboards, cooling air and water, which though vital to weapon system effectiveness, were the clear responsibility of no one particular Command.

CAPT.W. E. MEYER

Much of the equipment edicted for use in AEGIS was designed for other programs. We had to adapt and modify for AEGIS while not adversely affecting other programs.

But we persevered. Today, as the pages of this Newsletter show, we have our equipment and computer programs built and are assembling them into an integrated system. Much of this equipment has demonstrated its reliability and operability during long operating periods. We have over 80,000 hours on our digital computers. A crossed-field amplifier has operated two years without failure.

We innovated! We brought sailors into the manufacturing plants. We sent engineers to live aboard warships at sea. We initiated exciting new concepts in sparing and testing. We developed effective communication. We created a highly motivated technical team.

In these three years we developed valuable resources, human as well as equipment. These resources proved effective in developing AEGIS. We now want to use these resources to bring AEGIS to sea in fighting ships for defense of our Fleets.

Key Components of AEGIS

Key features are an electronically scanning radar, computerized command and control, guidance illuminator radars, missiles, and multi-purpose missile launchers.

Multi-Function Radar. Heart of AEGIS is its electronically scanning multi-function array radar, the AN/SPY–1, which automatically detects and tracks multiple targets. Operating under computer control, the AN/SPY–1 radar neutralizes jamming attempts and tracks and transmits guidance commands to the RIM-66C or SM-2 Standard Missile equipped with midcourse guidance capability.

Semi-Active Missile Homing. Targets automatically detected and tracked by the AN/SPY–1 radar are automatically evaluated as to threat and engageability. The most threatening targets are assigned to MK 90 Guidance Illumination Radars. The illuminators transmit radar energy which is reflected from airborne or surface targets, enabling AEGIS missiles to home in on the radar reflections.

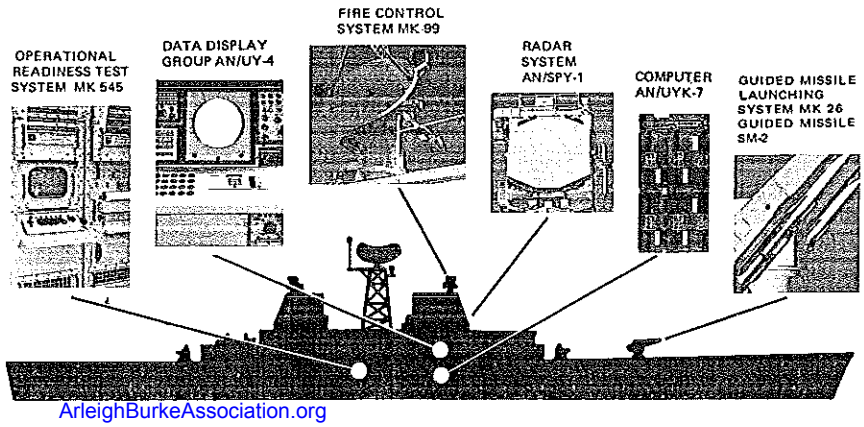
High Kill Probability. The AEGIS RIM-66C/SM-2 missile evolved from the already operational Standard Missile (SM-1). The weapon can effectively attack both airborne and surface targets. The missile's lethality combined with AEGIS' fast reaction and high availability provide the needed improvement in system effectiveness.

Maximum Availability. The MK 545 Operational Readiness Test System monitors the overall system, detecting, isolating and reporting malfunctions. This facilitates prompt repair or, when repair must be deferred, provides data for operational reconfiguration to bypass the failure.

Quick Reaction, Multi-Purpose Launcher. The MK 26 missile launcher employed by AEGIS is completely automated and digitally controlled. It launches both anti-air, anti-surface, and anti-submarine weapons interchangeably.

Computer Aided Control. AEGIS is integrated and controlled through three multi-purpose computer groups: Radar Control (MK 110), Weapon Direction System (MK 12), and Command Control (MK 130). Operations in these groups are facilitated by a complement of AN/UYK–7 computers, AN/UYA–4 displays, and associated peripheral equipment.

The officers and crew will be in control of AEGIS operations from detection to interception of targets. The system's computer-based operation eliminates unessential manual functions that hinder decision making. This reduces reaction time and promotes more effective supervision of the AEGIS defensive response.



They Are Building AEGIS

AEGIS development receives prime attention of the Surface Missile Systems Project of the Naval Ordnance Systems Command as the Naval Material Command agent.

CAPT Wayne E. Meyer is Project Manager of the Surface Missile Systems Project. He is responsible for all fleet surface missile systems including the 3-T family.

Top Naval management personnel directed by CAPT Meyer for AEGIS are shown in the chart. This team is the primary management interface with RCA, the systems contractor.

Offices of the Technical Representative (TECHREP), the Naval Training Unit (NTU) and Defense Contract Administration Services (DCASO) are located in the RCA plant at Moorestown, N. J. Other commands, particularly the Naval Ship Engineering Center and Naval Ship Weapons Systems Engineering Station contribute to the program. Currently the Navy directs major AEGIS effort at White Sands Missile Range, and at Long Beach Naval Shipyard.

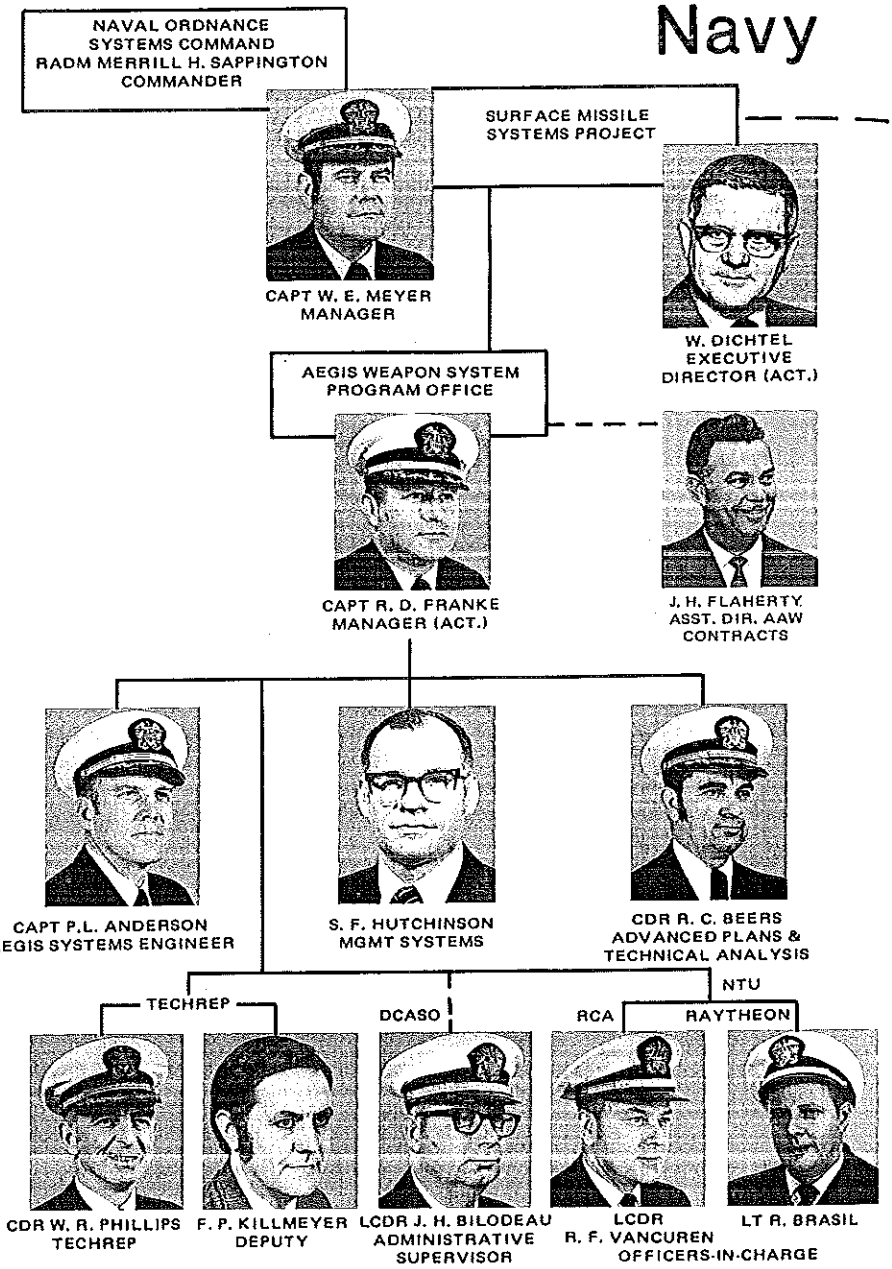
The Navy furnishes for incorporation into AEGIS: UNIVAC AN/UYK–7 digital computers; Northern Ordnance Division, FMC Corp.; Mark 26 Guided Missile Launching System with AEGIS digital interface; and the General Dynamics SM-2 Missile with AEGIS midcourse guidance. These equipments are used in other fleet systems.

JHU/APL

G. W. LUKE
HEAD, AEGIS
PROG. OFFICE

NAVY CONSULTANTS

The Johns Hopkins University Applied Physics Laboratory (JHU/APL) is technical advisor to the AEGIS Weapon System Manager. The Laboratory evaluates engineering models to ensure that AEGIS can be integrated with other shipboard systems for mutual support of combat missions. *Vitro Laboratories Division of Automation Industries, Inc.* assists the Navy AEGIS Program Office in areas of program management support. *Bird Engineering Research Associates, Inc.* provides engineering support in testing and measuring AEGIS design.



DASHED LINES (ABOVE) SHOW COMMUNICATION

"...the dramatic progress of modern technology pressures us to develop complex and highly sophisticated naval weapon systems and vehicles. Both the Navy itself and our industrial contractors must remember that naval weapon systems should not be designed to operate only under optimum conditions nor should they be designed so that only highly skilled technicians can operate and maintain them.

The problems inherent in developing and supporting a modern Navy are great indeed. Yet we can make considerable progress in meeting these challenges by increasing the mutual understanding of all those involved – naval personnel, government civilians, and civilians outside government – about what is really required to support a modern Navy."

Adm Isaac C. Kidd, Jr., Chief of Naval Material

Component Interrelationships and Functional Loops of AEGIS

OPERATIONAL STATUS: The Operational Readiness Test System continually determines the operational status. DETECTION AND DECISION: Targets enter the detection and decision loop from the AN/SPY–1 radar, other own ships sensors or other ship and aircraft data. Depending on the operating mode, targets are evaluated and when threat criteria are met, assigned to weapon control for engagement. In the auto-

RCA *System Contractor*

Prime contractor for AEGIS is RCA Government and Commercial Systems, Moorestown, N. J. RCA is responsible for total systems development and integration.

Managing AEGIS development for RCA is William V. Goodwin, Division Vice President, AEGIS Department.

Top AEGIS management support to Mr. Goodwin includes those indicated in the chart. Heads of AEGIS effort at major subcontractors are also shown.

Four major divisions of RCA produce equipments for AEGIS: *Missile and Surface Radar Division* produces the AN/SPY–1 electronically scanned planar phased array radar. *Aerospace Systems Division* produces the operational readiness test system (ORTS) equipment. *Communication System Division* produces the video formatter for AN/SPY–1. *Electromagnetic and Aviation Systems Division* produces equipment for the AN/SPY–1 radar signal processor being built at RCA M&SRD.

RCA has three major subcontractors on AEGIS:

Raytheon Company furnishes equipment of the weapon direction and fire control system, including the Mark 90 guidance illumination radar, and the high power transmitter for AN/SPY–1.

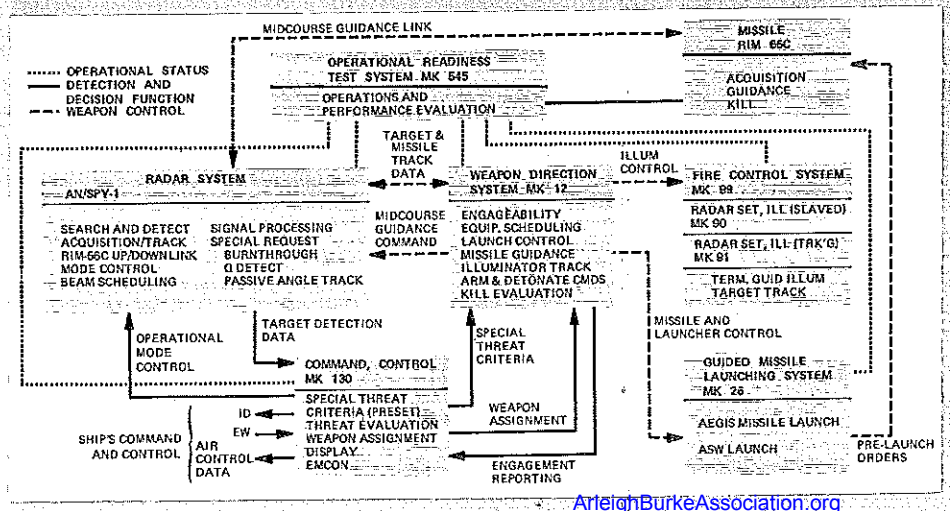
Computer Sciences Corporation furnishes computer programs for command and control functions and for operational integration of AEGIS.

John J. McMullen Associates, Inc. has supplied assistance to RCA in conceptual design of the AEGIS ship.

Gibbs and Cox, Inc. has also furnished design support for integration of AEGIS in USS Norton Sound.

In addition to these major contractors, more than 600 suppliers in 33 states have participated in building the first engineering model (EDM–1) of AEGIS.

Aside from the AEGIS Program Office, RCA Laboratories, Government and Commercial Staff, and Central Engineering provide in-depth technical and management support. These organizations, other RCA Divisions and subcontractors contribute reliable equipment manufacturing technology.



matic special mode, targets meeting governing doctrine, barring override, are automatically fired upon.

WEAPON CONTROL: In automatic, semi-automatic and casualty modes, weapon control inserts targets into the engagement queue and schedules equipment for launching and terminal illumination. Trial intercepts are computed and a time to fire predicted. Positive action is required for firing. After missile launch, midcourse commands are generated using AN/SPY–1 missile and target position data. Weapon control reports kill results back to the detection and decision loop. AEGIS offers four operating mode options: automatic special, automatic, semi-automatic, and casualty.

1960 AEGIS: Years of Decision 1969

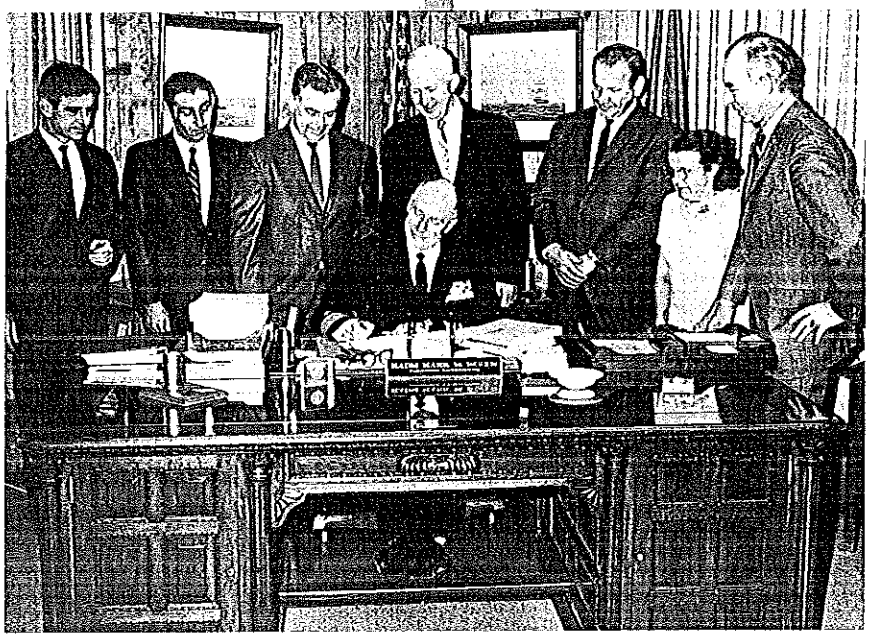
Years of effort preceded formal signing of the AEGIS contract on December 23, 1969.

Radar, a critical component of AEGIS was being developed and refined for its fleet AAW role as early as the late 1940's. Johns Hopkins University Applied Physics Laboratory pioneered in this field. Under contract to the Bureau of Ordnance to develop for the Navy a guided missile technology, JHU/APL achieved outstanding results in their pioneering endeavors. The world's first flight of a supersonic ramjet missile was made in 1945; successful control of a supersonic missile was gained in 1947; in 1948, a supersonic missile was made to ride a radar beam. Within eight short years, the first tactical missile was fired from an operational ship. By the early 1960's, the Navy had 43 guided missile ships. Today that fleet numbers nearly 90 ships.

Even as the first of these early missiles (Terrier, Tartar, TALOS) became operational, the search continued for an effective answer to massed raids and increasingly sophisticated airborne threats. Throughout the 1960's, the Navy constantly searched and studied to define the system that would be AEGIS. Equipment to achieve the modern air defense mission which had begun with the first Kamikaze, was slowly evolving, as the finest professionals in America's electronics industry applied their talents to the solution of the difficult air defense problem.

Before the start of Engineering Development, many American companies had participated in both system concept formulation and contract definition. JHU/APL had put together an advanced model to prove the feasibility of AEGIS. More effort was devoted to identifying the proper course of development of the AEGIS system, and in evaluating the total system than was applied to any previous AAW system.

December 23, 1969



AT AEGIS CONTRACT SIGNING: (l. to r.) CAPT John P. Tazewell, Rockford N. Hamed, John H. Flaherty, RADM Mark W. Woods (seated), RADM Merrill H. Sappington (then CAPT), Carl P. Staton (now deceased), Mrs. Marie Hicks, and CDR William R. Phillips.

Administratively, in the six years preceding formal contract signing, the following events occurred:

1963 – The Department of Defense, Office of Research and Engineering directed the Navy to formulate an AAW missile system as a replacement for 3-T systems.

1965 – Seven contractors proposed 28 system concepts with system characteristics. Navy and contractors assessed concepts and defined optimum system. Assessment Committee headed by RADM Frederic S. Withington forwarded report to Chief of Naval Operations.

1967 – Army/Navy Missile Systen. Commonality Study concluded unique systems were required; Office of Secretary of Defense concurred.

1968 – Development Concept Paper (DCP) approved for Contract Definition (CD). Three prime contractors selected for Phase B Contract Definition.

1969 – Engineering Development (ED) Contract awarded to RCA 23 December 1969.

AEGIS is being developed under a "Fly-Before-Buy" Contract. Successive milestones (A through G) set by the Navy must be met. Milestones have technical performance, cost and time factors. RCA met Milestone A, Preliminary Design Review (PDR) on Schedule and Milestone B, Critical Design Review (CDR) ahead of schedule. Milestone C, Land Based Test completion is set for June 1973.

AEGIS is a large program requiring cooperative effort of many contractors working with RCA, the system contractor, and with the Navy Program Management team. The outstanding success of the AEGIS team effort is depicted on the following pages that show highlights of three years' Engineering Development of the AEGIS Weapon System Mark 7.

1970

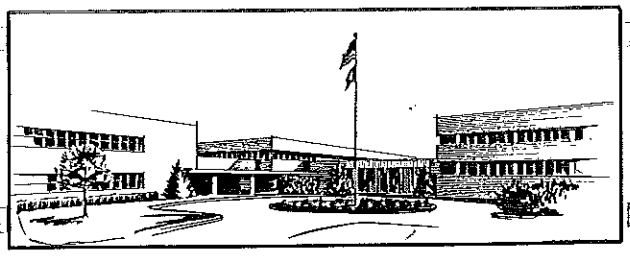
Following contract award, management established ties with suppliers and government agencies to be involved in AEGIS engineering development. This provided an environment for later smooth transition into equipment integration and test. Equipment reliability, maintainability and safety were prime considerations. System manning and training requirements and training plans were established.

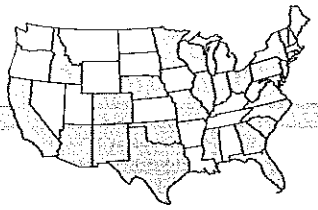
In the equipment areas, radar,

Preliminary Design 1970

NAVY / RCA | SYSTEM MANAGEMENT

RCA-MOORESTOWN

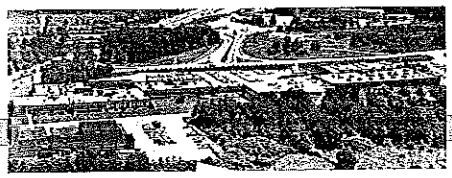




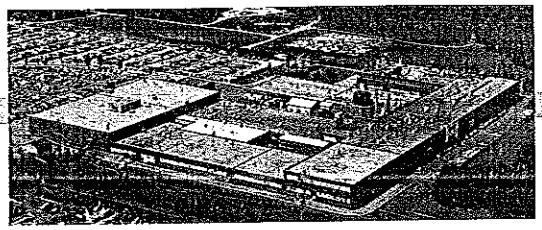
33 SUPPORTING STATES

RADAR SYSTEM AN/SPY-1

FIRE CONTROL SYSTEM MK 99 WEAPON DIRECTION SYSTEM MK 12

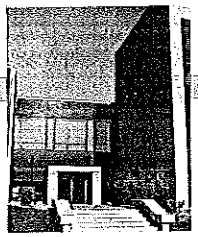


VARIAN ASSOCIATES



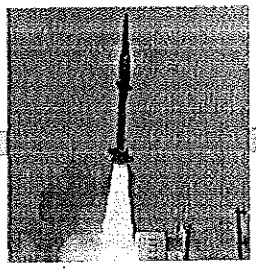
RAYTHEON-WAYLAND

CONTROL COMMAND MK 130

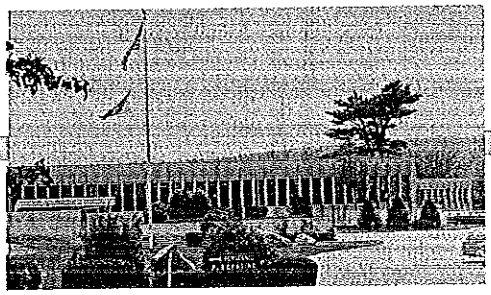


COMPUTER SCIENCES CORP.

WHITE SANDS MISSILE RANGE



SM-2 MISSILE RIM 66C GUIDED MISSILE LAUNCHING SYSTEM MK 26

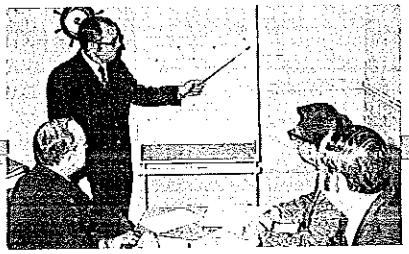


OPERATIONAL READINESS TEST SYSTEM MK 545

RCA-BURLINGTON

SHIP & DECKHOUSE (WEAPON SYSTEM HOUSING MK 20)

DLGN SHIP REQUIREMENTS



ESTABLISHING, MANNING AND TRAINING REQUIREMENTS

PERSONNEL & TRAINING

weapon direction system-fire control system (WDS/FCS), command control and operational readiness test system design began. Interfaces with existing systems: missile, launcher, and computer were planned.

Significant radar equipment studies were performed. Crossed field amplifiers (CFA) were evaluated and after extensive tradeoffs the Varian SFD-261 was selected permitting transmitter design to proceed at Raytheon. Garnet material was selected for phase shifter cores after a garnet-ferrite tradeoff study. Studies of standard packaging resulted in fewer variants of components. Computer program requirements for the signal processor and beamsteering controller were defined.

The WDS/FCS Preliminary Design Review (PDR) at mid-year assured that coming mechanical and electrical design would meet overall requirements for performance and reliability.

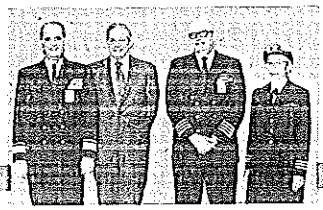
The first computers were delivered to the centers that would generate AEGIS computer programs.

Methods of self-check were studied. By mid-1970 a cabinet-by-cabinet review of test points was underway. Later in the year, design conferences began for ORTS components.

Major contractor representatives,

Critical Design 1971

Jan 1971

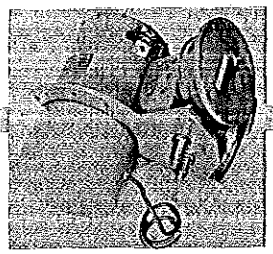


RADM ROGER E. SPREEN
DIRECTOR, NAVY
INFORMATION
SYSTEMS DIVISION,
HEADS GROUP
TO SEE AEGIS

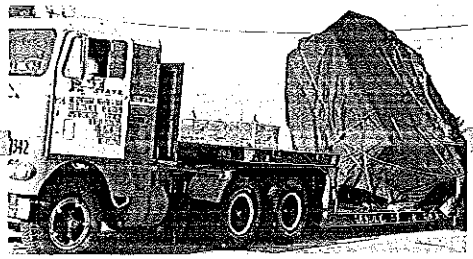
NAVY | SYSTEM
RCA | MANAGEMENT

MILESTONE
A

RADAR
SYSTEM
AN/SPY-1



CROSSED FIELD AMPLIFIER
SELECTED



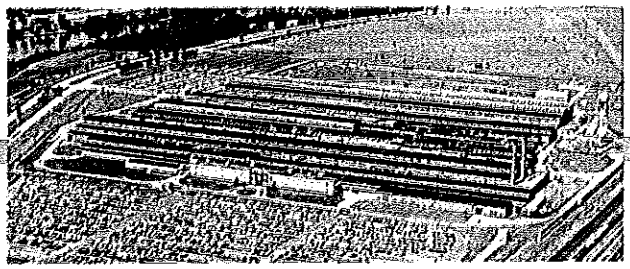
ARRAY CASTING DELIVERED

FIRE CONTROL
SYSTEM MK 99
WEAPON
DIRECTION
SYSTEM MK 12

AN/UYK-7 COMPUTERS
OPERATIONAL

CONTROL
COMMAND
MK 130

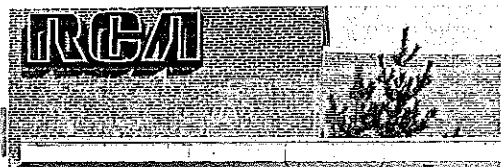
SM-2 MISSILE
RIM 66C
GUIDED
MISSILE
LAUNCHING
SYSTEM MK 26



NORTHERN ORDNANCE DIV.-FMC CORP.

OPERATIONAL
READINESS
TEST SYSTEM
MK 545

SHIP &
DECKHOUSE
(WEAPON SYSTEM
HOUSING MK 20)



ENLISTED CADRE
WELCOMED ABOARD

PERSONNEL
& TRAINING

Navy and consultants convened to achieve maximum missile effectiveness with minimum changes to existing systems. They were directed to agree on system interfaces between the 2-T's, the SM-2 missile and other systems of AEGIS.

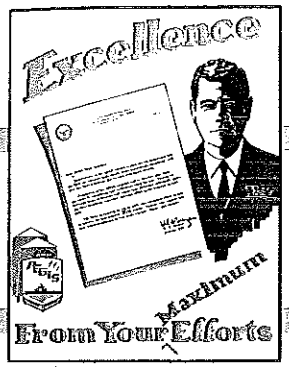
Plans were made for future land based tests at Wayland, Mass., at Moorestown, N.J., and White Sands, N.M. Later, tests would use the USS Norton Sound in the Pacific Missile Range. Deckhouse design and installation criteria for Norton Sound were underway. The Deckhouse was designed for a specified DLGN-38 interface.

1971

AEGIS is a user-oriented system! To make AEGIS personnel directly aware of equipment and user problems at sea, a Shipboard Technical Liaison Program began in which engineers lived aboard warships at sea. A Naval Training Unit was established to monitor system development from a user point of view.

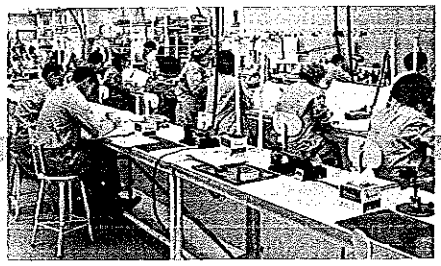
At industry plants, AEGIS moved from planning and study to design. Large equipment castings, the director and the array structure, were machined and delivered. Fabrication of phase shifters and electronics began. Standard module design was complete, and the AEWRAP computer program was used to automate design of digital equipment.

The WDS/FCS was assembled. By mid-year the tracker console digital

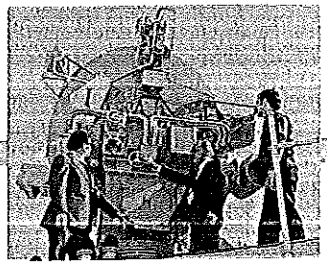


AEGIS EXCELLENCE MOTIVATION PROGRAM UNDERWAY

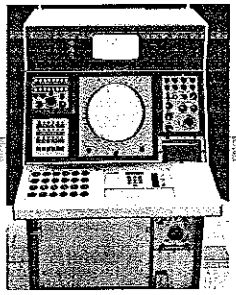
SHIPBOARD TECHNICAL LIAISON PROGRAM UNDERWAY



PHASE SHIFTER PRODUCTION

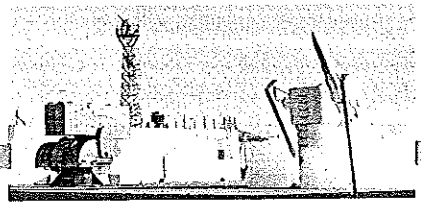


ILLUMINATOR-TRACKER PATTERN TESTING

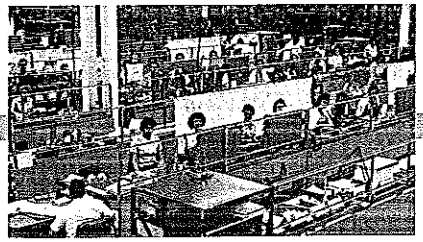


AN/UYA-4 CONSOLE MODIFIED

COMPUTER EQUIPMENT INTEGRATED



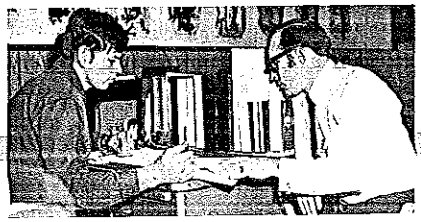
FIRST SM-2 MISSILE LAUNCHED



ASSEMBLING ORTS COMPONENTS

ORTS PRODUCTION CONFERENCE

NTU COMPARES DESIGN WITH USER NEEDS



NTU CLASS GRADUATES

interface was defined. A costly development program was eliminated when controls for the weapon direction system were consolidated into the AN/UYA–4 console. By year-end the director was installed at the Wayland Land Based Test Site and illuminator antenna pattern testing was complete. The pulse transmitter traveling wave tube achieved full power across the band. Environmental tests had begun and CDR successfully held at Raytheon.

The program generation centers continued to receive computers and peripheral equipment.

The interface between the AEGIS command and launch system and the AEGIS SM-2 missile was further defined.

SM-2 missile midcourse guidance schemes permitted intercept of targets at longer ranges than possible with the SM-1, with the same airframe and propulsion system. A unique feature of AEGIS SM-2 is that midcourse guidance calculations are performed on shipboard. First test firing of the SM-2 at White Sands demonstrated successful performance of the missile inertial reference unit. The launcher designated for use with AEGIS underwent a plenum redesign.

ORTS hardware was being built at RCA ASD, the first data acquisition assemblies were accepted by DCAS. CDR was successfully held in December.

The first group of students trained by RCA graduated from the Naval Training Unit.

Fabrication 1972

Jan 1972

NAVY / RCA | SYSTEM MANAGEMENT

MILESTONE B

PRESENTING AEGIS EXCELLENCE AWARD

ROYAL AUSTRALIAN NAVY VISITORS TO RCA

RADAR SYSTEM AN/SPY-1

FIRST PHASE SHIFTER BUILT

DIRECTOR DELIVERED BY G.E.

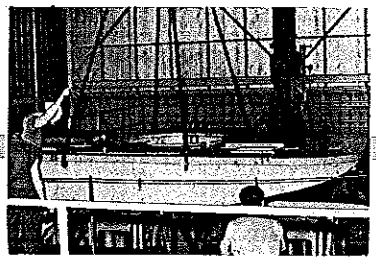
FIRE CONTROL SYSTEM MK 99 WEAPON DIRECTION SYSTEM MK 12

FLOYD N. RYAN AEGIS PROGRAM OFFICE EXAMINES TRANSMITTER

CONTROL COMMAND MK 130

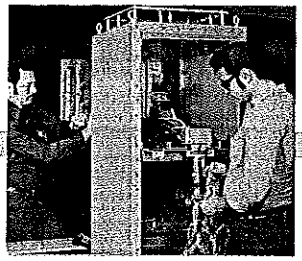
COMPUTER PROGRAMS DEMONSTRATED

SM-2 MISSILE RIM 66C GUIDED MISSILE LAUNCHING SYSTEM MK 26



ASSEMBLING LAUNCHER

OPERATIONAL READINESS TEST SYSTEM MK 645



CABLING ORTS CABINET

SHIP & DECKHOUSE (WEAPON SYSTEM HOUSING MK 20)

GIBBS & COX DESIGN PACKAGE TURNED OVER TO LONG BEACH NAVAL SHIPYARD

PERSONNEL & TRAINING

NTU CHECKS CONFORMANCE TO USER OPERATIONAL NEEDS

1972

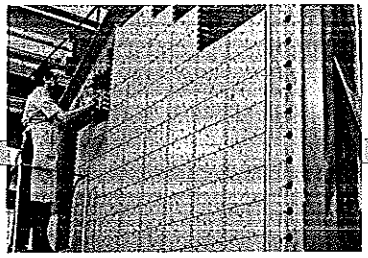
Critical design review in January permitted manufacturing activity to proceed as plants across the country moved to complete production and enter test. Major pieces of hardware were integrated and tested with the aim of entering the RCA Moorestown Land Based Test Site late this year.

For AN/SPY–1, the first phase shifter was built in February. By late Spring, the array was assembled and moved to the test range where pattern tests were completed.

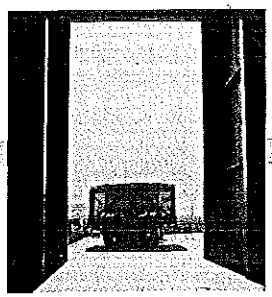
The transmitter was built by Summer. To reduce cost and weight a program was begun for a waveguide switch to permit the transmitter to serve two arrays. A CFA achieved nine thousand hours operation. Meanwhile, the ORTS test and maintenance console was being used with the SiPCO program to

BATTERY ALIGNMENT CONFERENCE

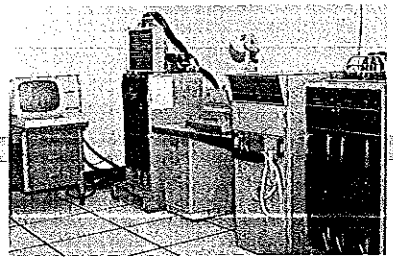
RADM WOODS COMMANDER, NAVAL ORDNANCE SYSTEMS COMMAND REVIEWS AEGIS PROGRESS



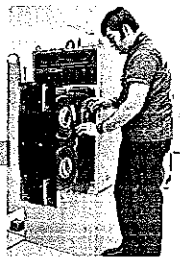
ASSEMBLING ARRAY



ARRAY MOVES TO TEST RANGE



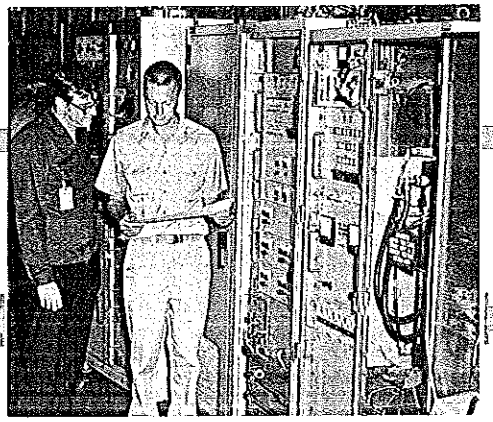
WDS COMPUTER FACILITY



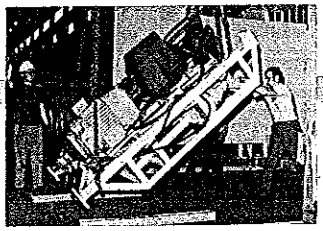
LOADING TAPE FOR TEST

ATEP DELIVERED

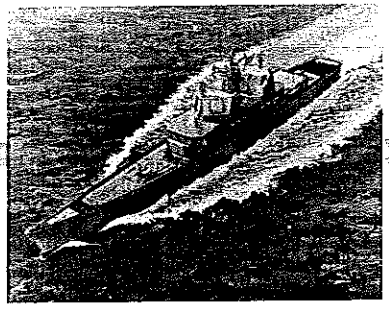
CHECKING OUT MCTS AT WHITE SANDS PREPARATORY TO SM-2 MIDCOURSE GUIDANCE TEST

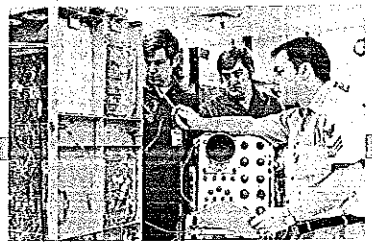


LAUNCHER TRAIN MOTOR INSTALLED

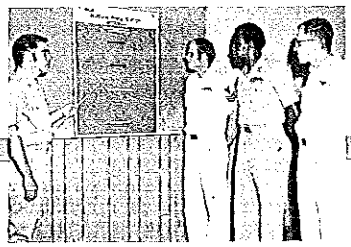


DG SHIP STUDY





NTU EVALUATES TEST OF SIGNAL PROCESSOR



NTU TRAINS SAILORS

provide computerized checkout of the signal processor. The ORTS deckhouse monitor and status cabinet was being installed in the Land Based Test Site (LBTS).

The WDS/FCS was integrated and signals beamed from the antenna. By *(see p. 12)*

"(Our) policy keystones dictate research and development programs which will...ensure our capability to control the seas as necessary to project our tactical forces abroad...preserve the maximum effectiveness of our tactical forces at lower force levels, and not only provide our men with more effective and reliable weapons, but also maintain a strong technological base for the development of improved systems in the future...."

Dr. John S. Foster, Jr., Director of Defense Research and Engineering
(Hearings before Congressional subcommittee of 92nd Congress)

Fabrication 1972

July 1972

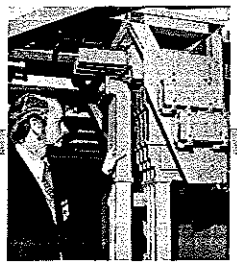
NAVY / RCA | SYSTEM MANAGEMENT

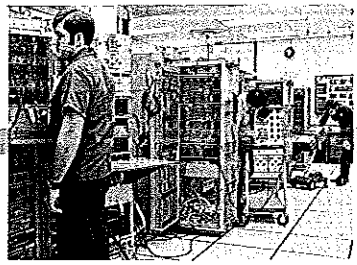
DR. PETER WATERMAN OFFICE OF ASST. SECY OF NAVY WITNESSES AEGIS DEMONSTRATION

ROBERT T. HILL AEGIS PROGRAM (NAVSEC) WITH SAFEGUARD TOUR OF LBTS

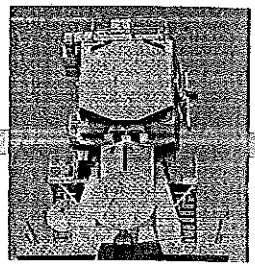
RADAR SYSTEM AN/SPY-1

ASSEMBLING WAVEGUIDE SWITCH





CHECKING OUT SIGNAL PROCESSOR



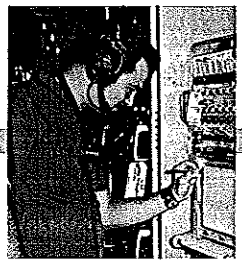
PATTERN TESTING ARRAY

FIRE CONTROL SYSTEM MK 99 WEAPON DIRECTION SYSTEM MK 12

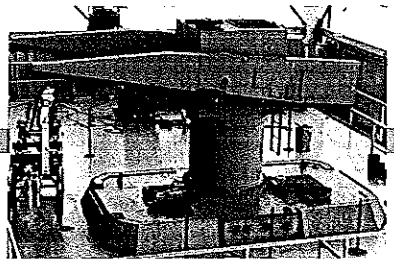
AEGIS TRACKS AT WAYLAND

CONTROL COMMAND MK 130

SM-2 MISSILE RIM 66C GUIDED MISSILE LAUNCHING SYSTEM MK 26

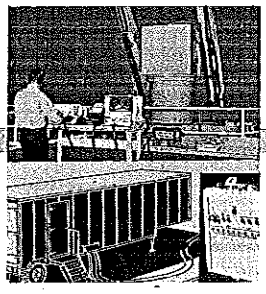


LAUNCH CONTROL CHECK AT WHITE SANDS



LAUNCHER ON TESTBED

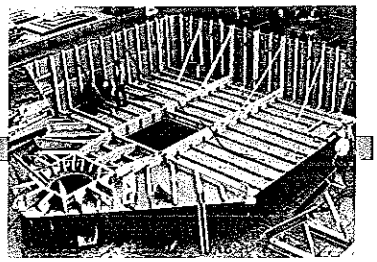
DIGITAL INTERFACE TEST



OPERATIONAL READINESS TEST SYSTEM MK 545

NTU AT COMBAT INFORMATION CENTER, JHU/APL

SHIP & DECKHOUSE (WEAPON SYSTEM HOUSING MK 20)



MODULAR DECKHOUSE AT LBNS

PERSONNEL & TRAINING

late August the tracking loop was closed and the way prepared for tracking fly-over targets.

In the command control area, the first computer executive program (ATEP) for the AN/UYK–7 computer was delivered in June. The AN/UYK–7 exceeded 80,000 hours of running time. Computer programs and all command control equipment were integrated and Category I testing was completed at CSC. The integration of AN/SPY–1 and command control programs was accomplished late in 1972. Four AN/UYK–7 computers were tied together to achieve 3-system communication in preparation for integration at the LBTS.

Early in 1972, the second SM-2 was fired at White Sands. The RCA designed missile communication test set (MCTS) was delivered in May and integrated with other equipment at White Sands. Missile interface tests were performed. In November, the third success-

Dec. 23, 1972

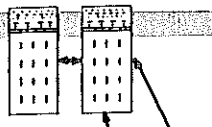
SHIPBUILDING COUNCIL VISITS RCA

VADM ELI T. REICH DEPUTY ASSISTANT SECRETARY OF DEFENSE HEADS GROUP TO SEE AEGIS PROGRESS

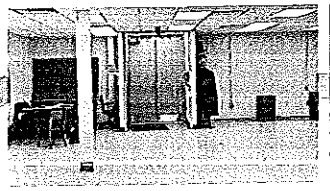
VADM ROBERT E. ADAMSON,JR. HEADS LBTS REVIEW

LAND BASED TEST SITE

DELIVERING 70TH CFA

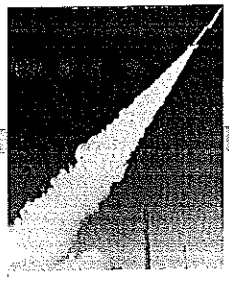


FOUR AN/UYK-7 COMPUTERS COMMUNICATE, INTEGRATING RADAR CONTROL, FCS/WDS AND COMMAND CONTROL COMPUTER PROGRAMS

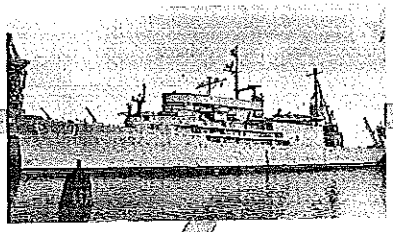


DECK CLEARED FOR ACTION

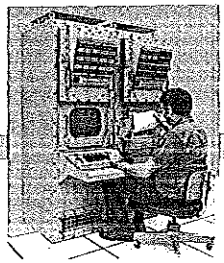
POLISHING OFF ROUGH SPOTS



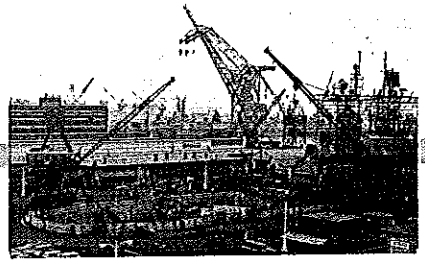
SM-2 MIDCOURSE GUIDANCE TEST



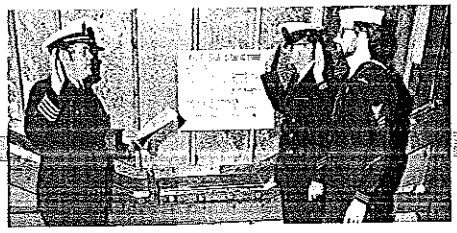
USS NORTON SOUND AT LBNS



ORTS CHECKING OUT DATA PROCESSOR



LBNS READIES TO CONVERT USS NORTON SOUND



85% OF NTU PERSONNEL RE-ENLISTED

GROUP COMPLETES NTU-CONDUCTED TRAINING

ful flight of SM-2 supported the continuing development of the AEGIS missile.

Construction of the deckhouse entered its final stage at Long Beach Naval Shipyard (LBNS). USS Norton Sound entered the shipyard for conversion. The inclining experiment was completed and ship's electrical supply checked out.

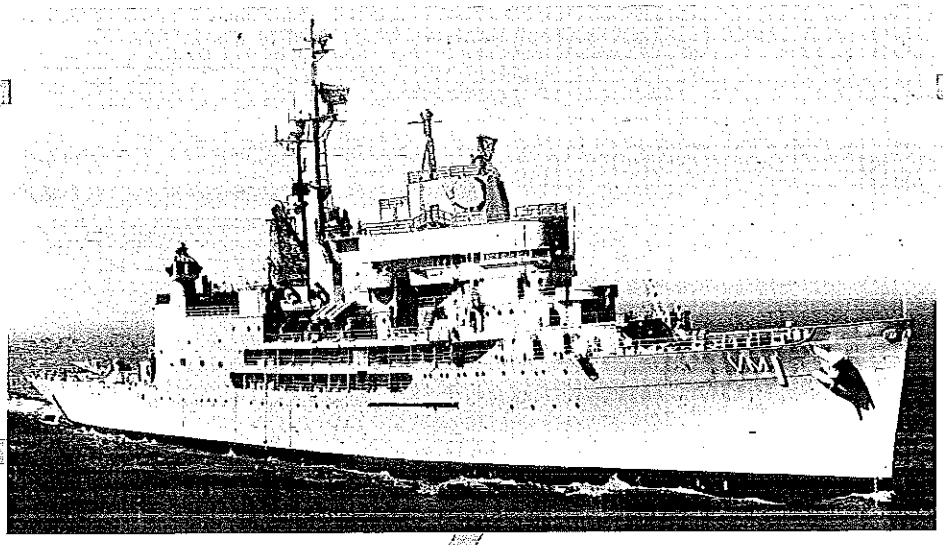
The Naval Training Unit continued to conduct classes for system users. An NTU was established at the launcher manufacturer location.

The Land Based Test Site at RCA was readied to accept equipment from test areas at RCA and subcontractor plants. As AEGIS Engineering Development completed its third year, the focus of attention turned to Land Based test, the coming movement of the first engineering development model (EDM–1) into Norton Sound and the drive to move the AEGIS Weapon System Mark 7 into operational ships.

Sea Tests 1973 and Beyond

NAVY / RCA | SYSTEM MANAGEMENT

MILESTONE C



SEA TEST OF AEGIS IN USS NORTON SOUND
AEGIS ADDITIONS ARE ARTIST RENDERED

FIRE CONTROL SYSTEM MK 99
WEAPON DIRECTION SYSTEM MK 12

SM-2 MISSILE RIM 66C GUIDED MISSILE LAUNCHING SYSTEM MK 26

AEGIS Ship Candidates

DLGN	Original Baseline	MK 7 MOD 0
DD963	Installability Established	MK 7 MOD 1
DG	AEGIS AAW Escort - 5000 Tons	MK 7 MOD 1
CVAN	High performance, Auto Detect and Track, ECM Immune Air Control	AN/SPY-1

PERSONNEL & TRAINING

1973 and Beyond

"Design, fabrication and lower level testing are behind us. Test results to date both on equipment and computer programs have increased our confidence in the success of the land based system test phase this coming spring," William V. Goodwin, RCA Division Vice President, AEGIS Department, declared on the third anniversary of AEGIS Engineering Development.

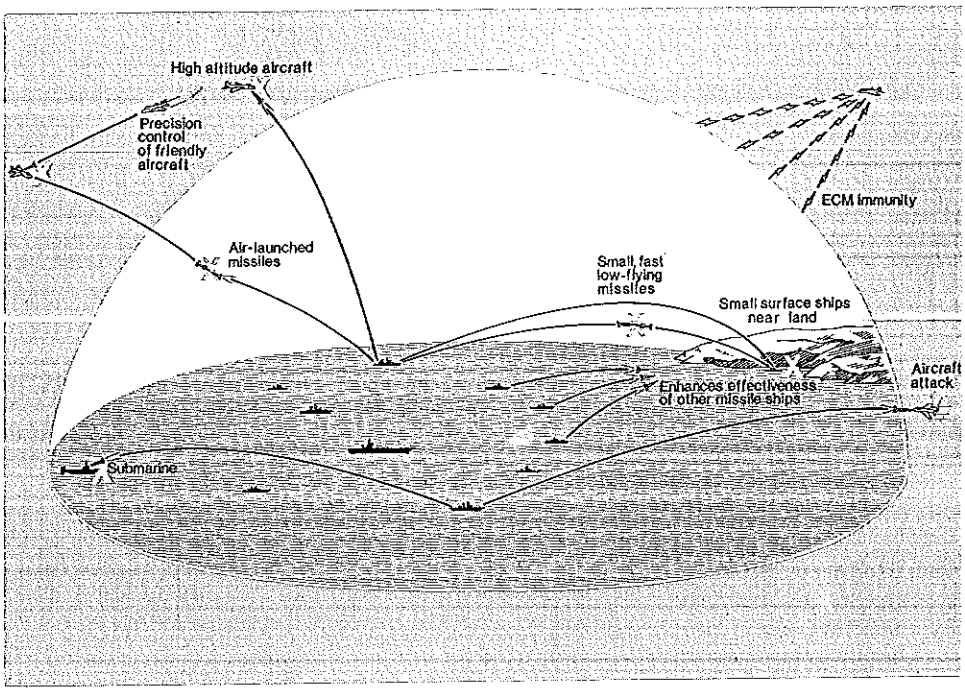
"The present AEGIS design reflects the results of dedicated Navy/RCA team effort, intensive design reviews, and the fleet-oriented system engineering afforded through our on-site Naval Training Unit and shipriding program. Accordingly, we feel that our at-sea tests in Norton Sound this year will determine, not whether AEGIS will perform reliably – we will have confirmed the basic performance on land – but how well, under certain conditions not present in land base testing.

"Lest we forget the past three years, all members of the AEGIS team should reflect on their unique contribution to complex weapon system engineering. At the start, the essential high density digital processing technology simply did not exist. But filling this void was not enough. We simultaneously designed and managed not only the real-time computer programming, but also, and concurrently, the hardware it controls. We now have a reliable, sailor-oriented, fail-safe design in production quality equipment, not glorified breadboards.

MILESTONE D — MILESTONE E — MILESTONE F — MILESTONE G

FOREMOST INNOVATIONS

- Prime contractor assigned overall weapon system performance responsibility.
- User-sensitive designs evolved from fleet experience of sailors continuously stationed in contractors' plants and observations of designers exposed to fleet operations and problems by sailing in missile ships.
- Tri-service approved CSTCS System provides information on cost, schedule, and technical performance.
- System interface definition and control achieved through a disciplined functional analysis technique known as Functional Flow Diagrams and Descriptions (F^2D^2).
- Computer program design driven by radar system engineers, resulted in totally optimized and functionally compatible computer controlled AN/SPY–1 radar system.
- DCAS certified development tests.
- Adversary approach to design review process.
- Established high-yield garnet phase shifter manufacturing facility.
- Inter-company motivational program, featuring semi-technical Newsletter which also serves to inform the fleet of AEGIS progress.
- Equipments and associated computer program builds integrated and tested early in development to ensure compatibility and to verify computer programming procedure.
- Active and continuous user participation.
- Total system approach avoiding functional duplication coupled with automatic digital processing significantly reduces manning requirements.
- Combat system cooling design based on evaluation of total ship operating environment.
- Use of the integral Operational Readiness Test System MK 545 to provide (1) continuous system operability status indication, (2) fault isolation, and (3) computer-assisted training capability.
- Construction of Automated Antenna Pattern Data Acquisition System making possible high speed antenna testing and data collection.
- Adoption of a production sparing concept predicated upon parts usage data accumulated during development and evaluation phases.



Shield of the Fleet: AEGIS protection will be focused over an expanse of ocean to provide area defense for an entire carrier task force, supply and replenishment ships, amphibious group or other major naval force. AEGIS in effect surrounds them with a wavetop-to-stratosphere dome of defensive fire power.

"We have confidence in the future of AEGIS. Our ability to fit AEGIS comfortably in ships of 5,000 tons has been proven. The application of the automatic detection and tracking capability of the AN/SPY–1 to other missions such as carrier air control seems inevitable.

"In the years ahead, AEGIS will permit no respite of team dedication. I am sure that each of us will take a deep, personal pride in his own contribution as we see AEGIS entering the Fleets."

"It needs to be understood with total clarity ... that defense programs are not infinitely adjustable. ...there is an absolute point below which our security forces must never be allowed to go. That is the level of sufficiency. Above or at that level, our defense forces protect national security adequately. Below that level is one vast undifferentiated area of no security at all. For it serves no purpose in conflicts between nations to have been almost strong enough."

President Richard M. Nixon
Feb. 25, 1971

NEWSLETTER published monthly by RCA G&CS Product Assurance, Moorestown, N. J. 08057. Editorial Office: Bldg. 108–102, Phone (609) 963–8000, Ext. PM 2264.

First Guided Flight of SM-2 Missile at White Sands

WHITE SANDS, N. M. – The SM-2 missile with AEGIS midcourse guidance continued its development with the third successful launch of the Standard Missile (SM-2) at White Sands Missile Range in November.

"This was the first guided flight of SM-2 and the third since the initial firing in December 1971. Our next launch will be the SM-2 with the AEGIS midcourse guidance system," John R. Higson, RCA Leader, Systems Engineering, declared.

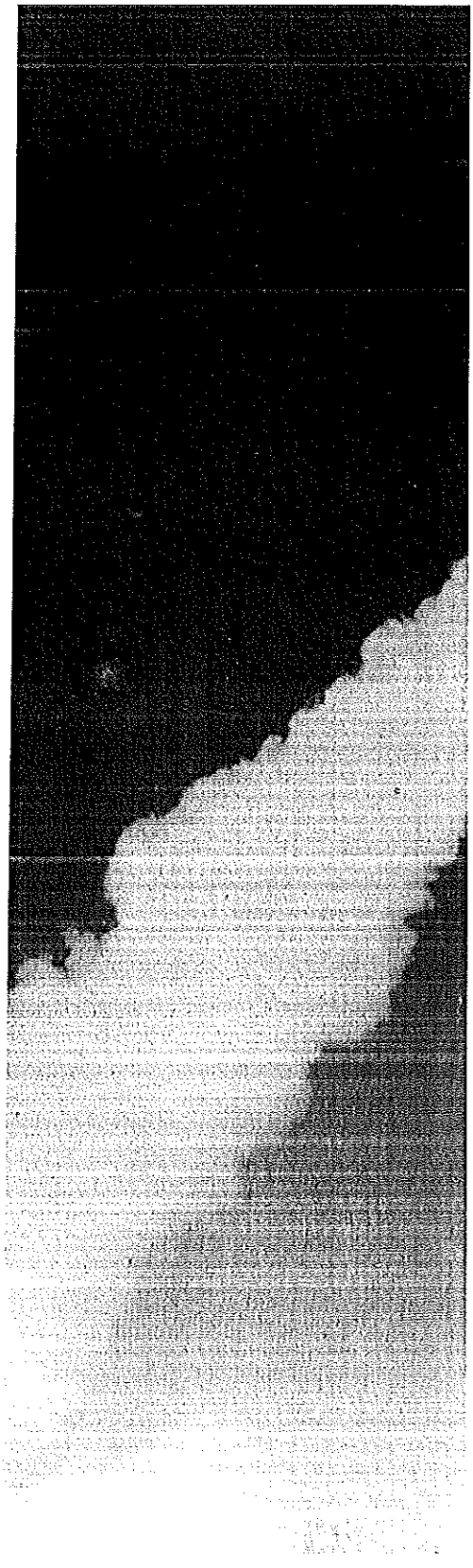
AEGIS midcourse guidance which General Dynamics Corp., Pomona, California, is adding to the Standard Missile (Medium Range) permits an improved guidance scheme that increases the range-altitude envelope of the Medium Range missile 60 percent, and more than doubles the envelope of the Extended Range missile.

Standard Missile for AEGIS evolved from guidance by the SM-2

Second AEGIS Technical Symposium

MOORESTOWN, N. J. – Sixty-five participants in RCA's Second AEGIS Technical Symposium here on November 2, including 18 Navy Captains, received a briefing on the AAW problem confronting the Fleets and saw the solution to that problem: equipment and computer programs of the AEGIS Weapon System Mark 7.

Steering Committee which included representatives of the Navy, RCA, Johns Hopkins University Applied Physics Laboratory, General Dynamics, Vitro Laboratories, Sperry Rand Co., and Raytheon Co. Additionally, RCA and General Dynamics held 22 Technical Interchange meetings during the last three years to assure compatibility between the missile and other AEGIS systems.



PEOPLE FROM MANY ORGANIZATIONS CONTRIBUTE TO EACH SUCCESSFUL MISSILE LAUNCH. Group in front of modified Mark 5 Guided Missile Launching System launcher is part of team for SM-2 flight. (l. to r.) Jack L. Morgan, General Dynamics, Pomona; Robert F. Gregorits, Naval Ordnance Systems Command; James E. Masterson, Physical Sciences Laboratory; George A. Helfrich, Johns Hopkins University Applied Physics Laboratory; LCDR James R. McGregor, AEGIS Field Test Officer, Naval Ordnance Systems Command; LCDR William P. Camp, SMS Officer, Naval Ordnance Missile Test Facility, White Sands; LCDR Donald G. Macdougall, Naval Plant Representative (NAVPRO/GD), NAVORD; James J. Vallas, Naval Ship Missile Systems Engineering Station.