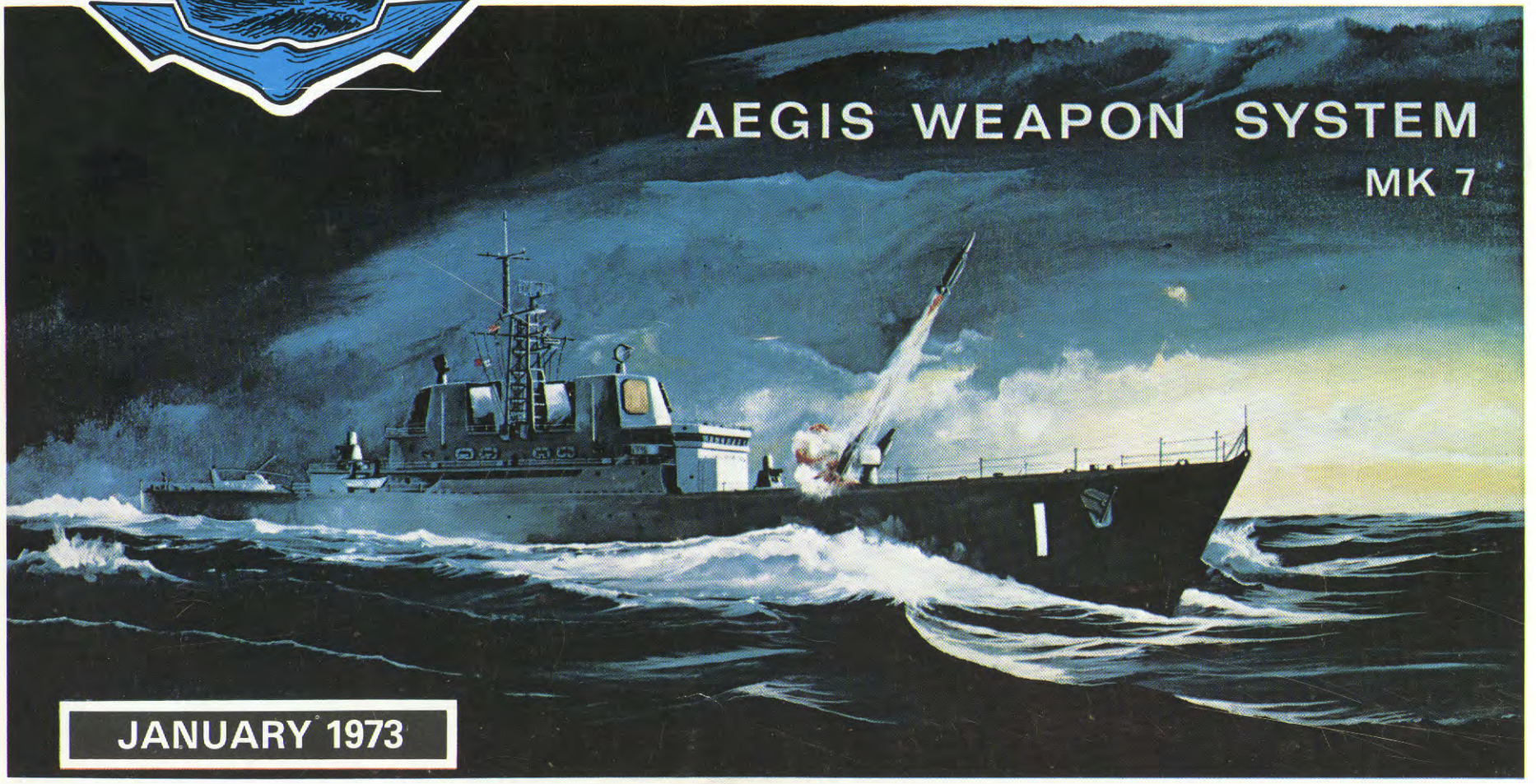
COMBAT SYSTEM CONTROL



JANUARY 1973

THIS BOOKLET WAS PREPARED FOR THE AEGIS WEAPONS SYSTEM MANAGER BY THE APPLIED PHYSICS LABORATORY, JOHNS HOPKINS UNIVERSITY. IT IS INTENDED TO ACT AS A POINT OF DEPARTURE AND TO PROVIDE A BASIS FOR FURTHER EFFORT. ALL CRITICISMS, COMMENTS, AND RECOMMENDATIONS WILL BE APPRECIATED.

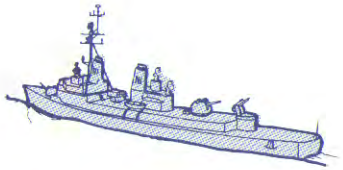
W.E. MEYER
13 DEC 1972

COMBAT SYSTEM CONTROL

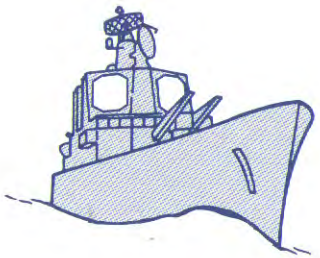
AEGIS WEAPON SYSTEM
MK 7

JANUARY 1973

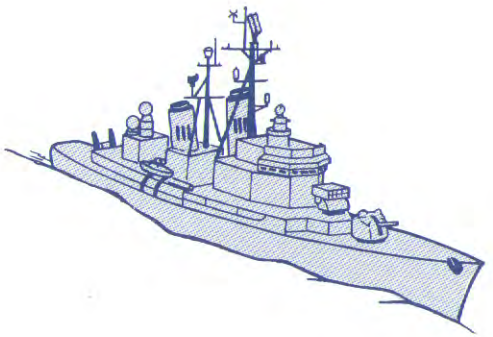
INTRODUCTION



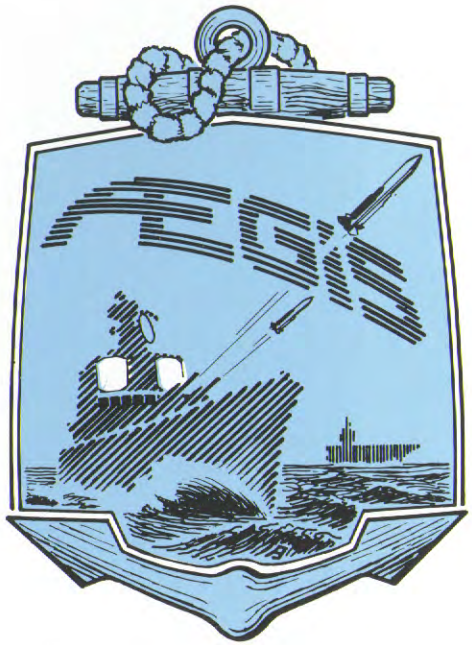
THIS DOCUMENT PRESENTS
AN ORGANIZATIONAL CONCEPT FOR
AEGIS SYSTEM CONTROL
AND ITS APPLICATION TO COMBAT SYSTEM CONTROL
IT WILL DISCUSS —



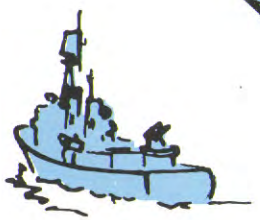
AEGIS SHIP MISSION AND CAPABILITY,
COMBAT SYSTEM CONTROL EVOLUTION,
COMBAT SYSTEM CONTROL OBJECTIVES, AND
CONCEPTUAL COMBAT SYSTEM DESCRIPTION

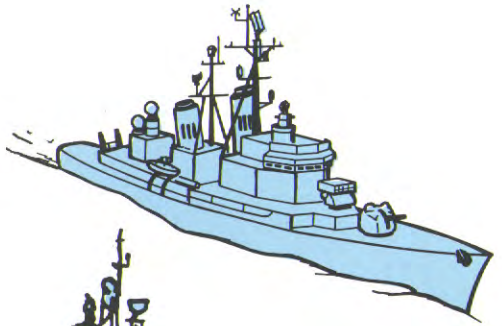


IT SHOWS HOW APPROPRIATE CONFIGURATION
MANAGEMENT OF EQUIPMENTS AND INTERFACES
WILL COALESCE MODULAR WEAPON SYSTEMS
INTO A UNIFIED COMBAT SYSTEM,
RESPONSIVE TO THE INCREASING AAW THREAT

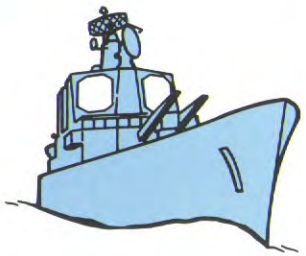


COMBAT SYSTEM CONTROL

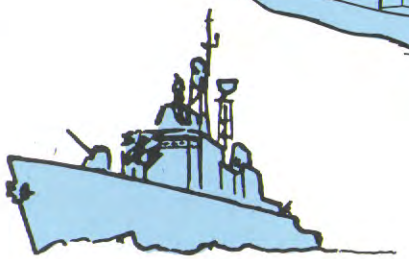


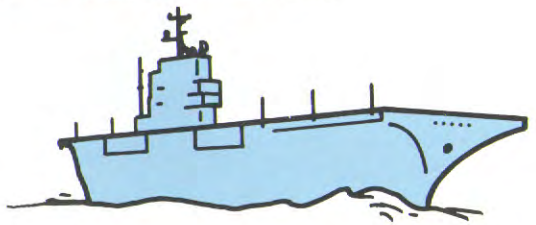


AN APPROACH TO



COMBAT SYSTEM DESIGN





PREFACE

AEGIS SYSTEM CONTROL

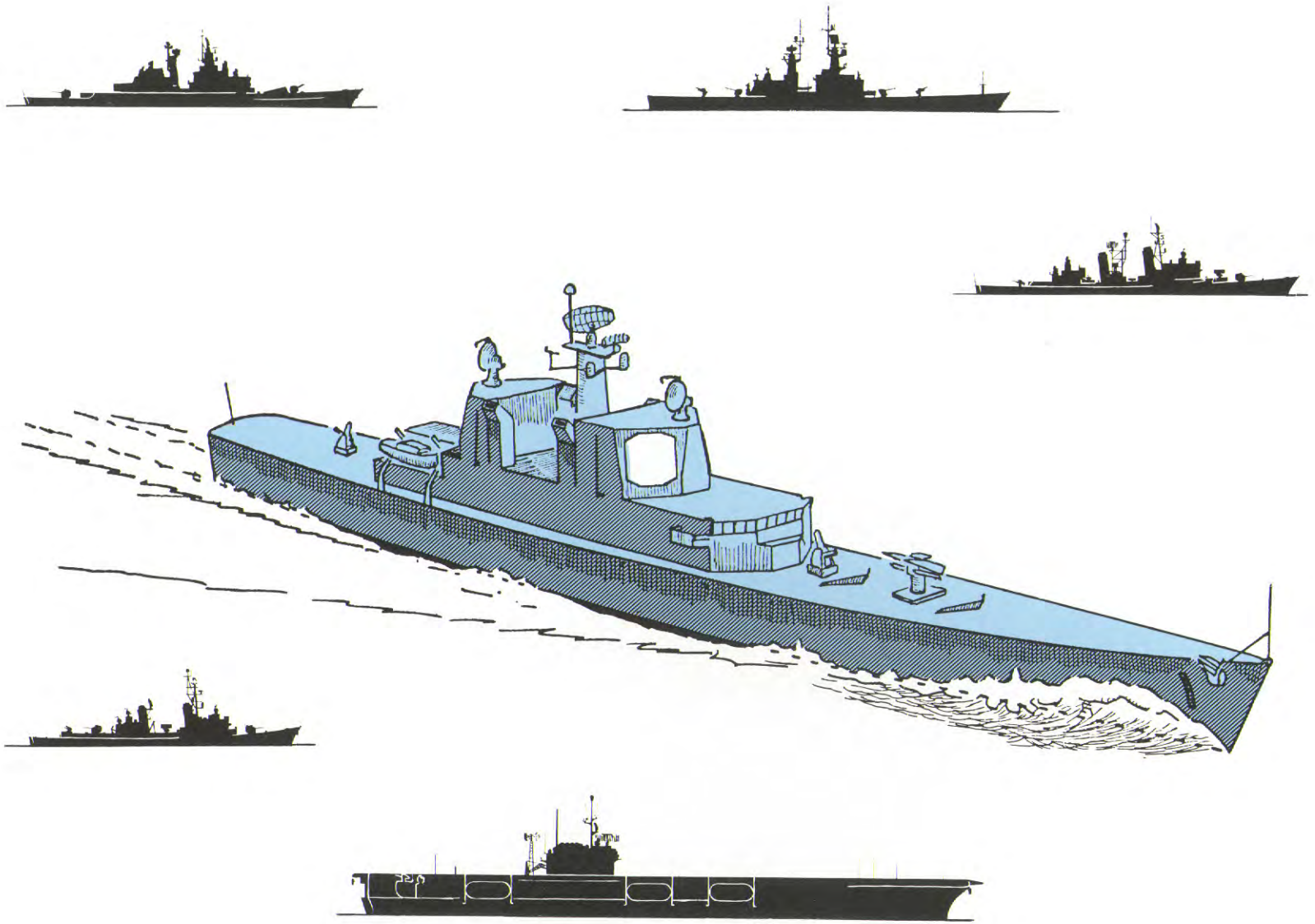
ESTABLISHES AN IDENTIFIABLE INTERFACE
BETWEEN COMMAND AND CONTROL,
FOCUSES THOSE COMMAND ELEMENTS
IN A CENTRAL COMMAND STRUCTURE
AND INTEGRATES THE VARIOUS ELEMENTS
OF THE AEGIS WEAPONS SYSTEM
WHILE PRESERVING THEIR
FUNCTIONAL IDENTITIES AND PHYSICAL BOUNDARIES

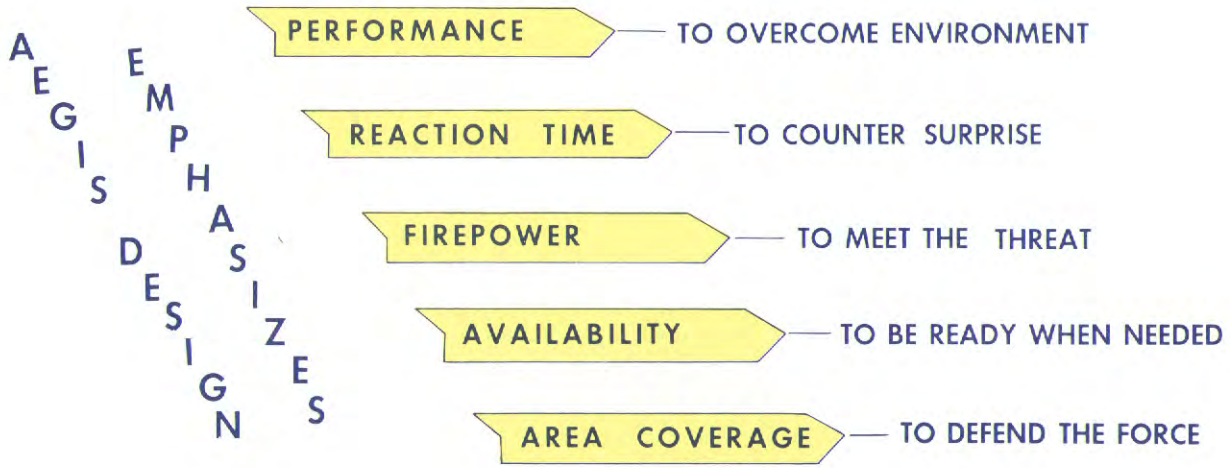
COMBAT SYSTEM CONTROL

EXTENDS THE AEGIS SYSTEM CONTROL CONCEPT
TO INCORPORATE ALL SHIPBOARD SENSORS
AND WEAPONS SYSTEMS INCLUDING AEGIS,
INTO AN INTEGRATED COMBAT SYSTEM

THE AEGIS SYSTEM CONTROL DESIGN, AS DESCRIBED HEREIN,
IS A BASIC DESIGN FOR THE DELIBERATE INTEGRATION
OF WELL—DEFINED AND INDEPENDENTLY PROCURABLE SYSTEMS
APPLICABLE TO A WIDE VARIETY OF SHIP HULLS AND MISSIONS

THIS BASIC DESIGN IS FOUNDED ON THE TWIN CONCEPTS OF—
CENTRALIZED COMMAND WITH ALLOCATED CONTROL AND MODULAR DESIGN,
AND IS DIRECTED TOWARD THE GOAL OF
EFFECTIVE COMBAT EMPLOYMENT OF THE SYSTEM





TO PROVIDE THE FLEET WITH A COORDINATED CAPABILITY FOR

DEFENSE IN DEPTH

AGAINST AIR, SURFACE AND SUBSURFACE ATTACKS
IN CLEAR OR DEGRADED ENVIRONMENTS

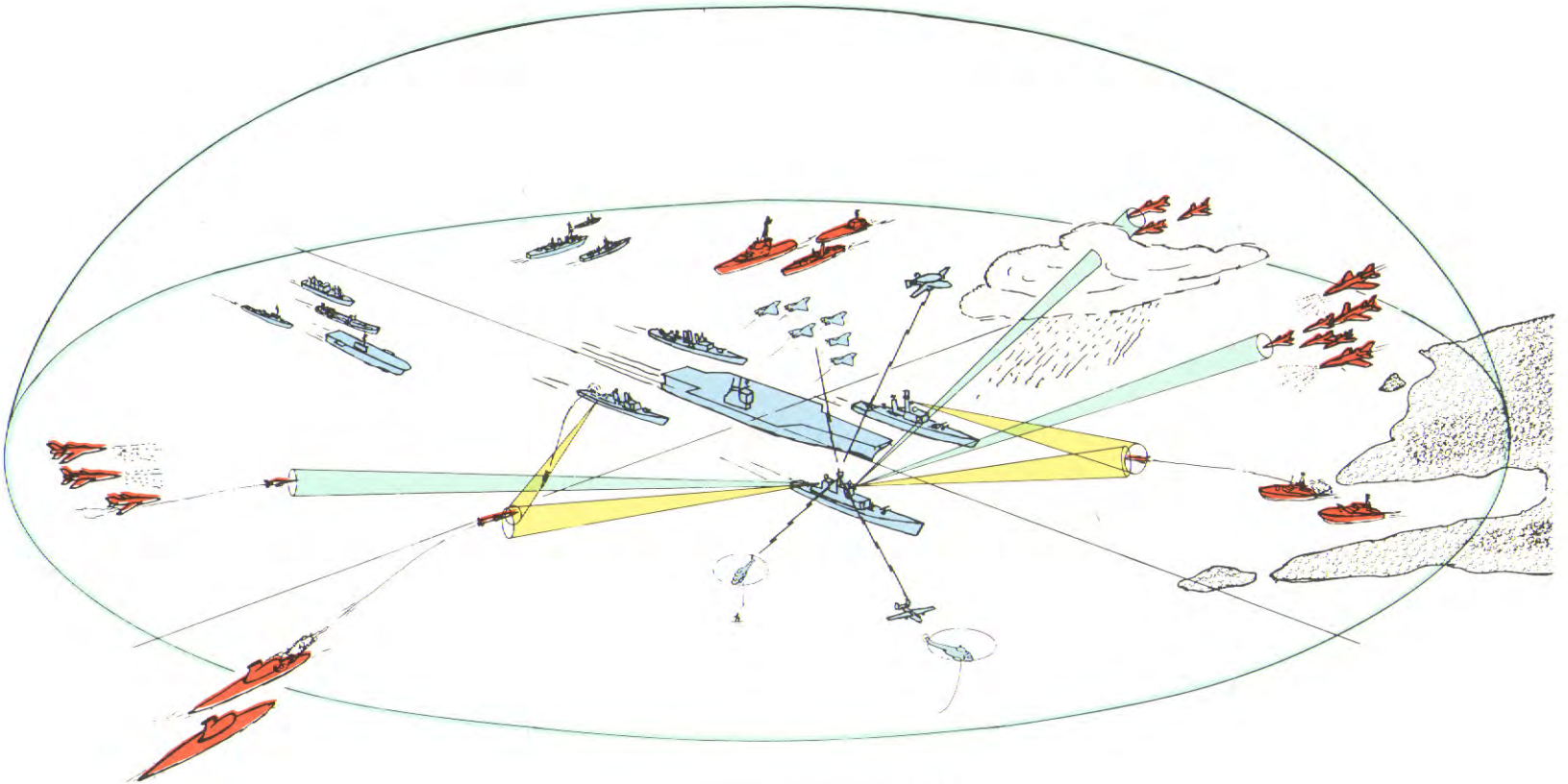
THIS COLOR CODE WILL BE USED THROUGHOUT THIS BOOKLET

AEGIS SHIP MISSION

AN AEGIS SHIP IS AN AAW ESCORT FOR FAST CARRIER TASK FORCES WITH OPERATIONAL CAPABILITIES

PRIMARILY IN
—ANTIAIR WARFARE (AAW), SELF & AREA DEFENSE

SECONDARILY IN
—SURFACE WARFARE (SUW) SELF & AREA DEFENSE
—ANTISUBMARINE WARFARE (ASW) SELF DEFENSE



WITH ADDITIONAL CAPABILITIES FOR

PIRAZ	COVERT ATTACK
SAR	STRIKE SUPPORT
PICKET	EW

AAW COORDINATED DEFENSE

COORDINATED DEFENSE IN DEPTH IS BASIC TO AIR DEFENSE

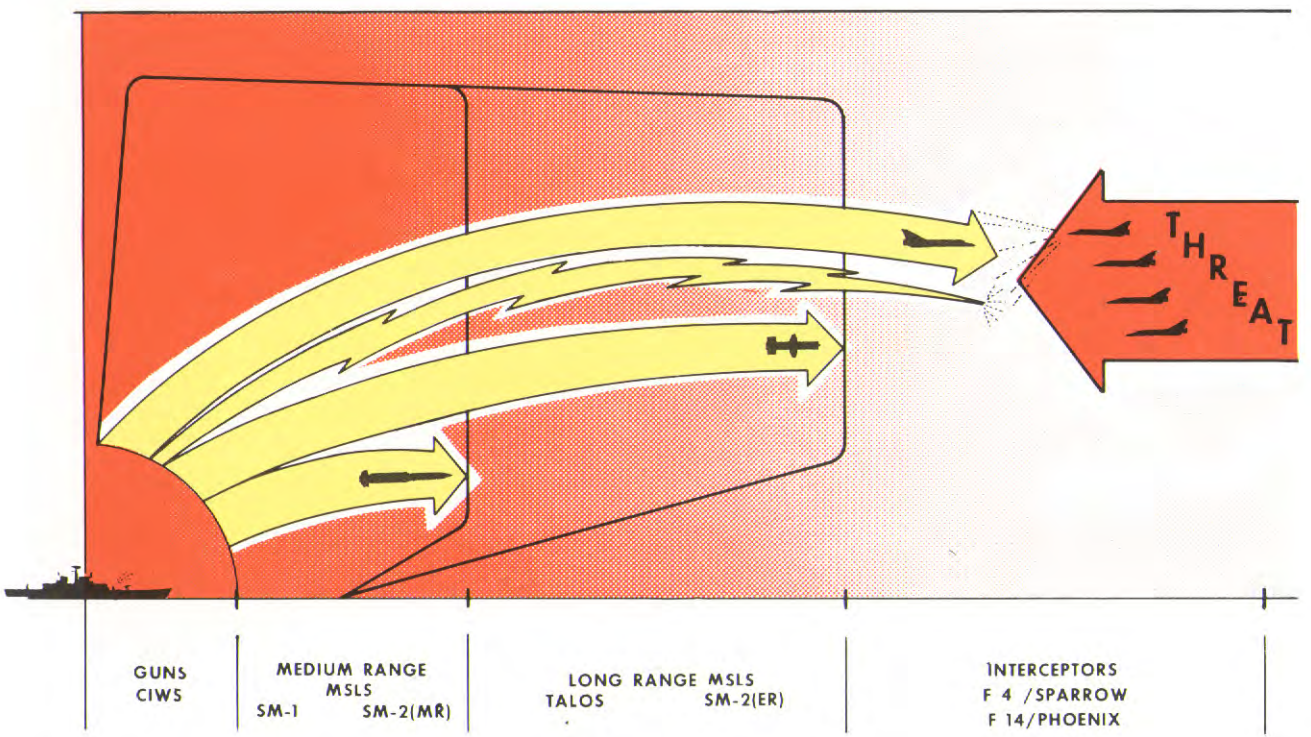
IT SUCCESSIVELY DISRUPTS THE SEQUENTIAL STEPS
THAT AN ENEMY MUST TAKE TO LAUNCH A SUCCESSFUL AIR ATTACK

- DENY THE ENEMY HIS CHOICE OF LAUNCH CONDITIONS BY ATTACKING RECON AND LAUNCH PLATFORMS
- COMMIT CAP AGAINST HOSTILE TARGETS AT LONG RANGE
- DISRUPT ATTACK COORDINATION WITH COUNTERMEASURES AND CAP
- DESTROY PENETRATING HOSTILE AIRCRAFT AND ASMs WITH AREA SAM SYSTEMS
- DESTROY SURVIVING ATTACKERS WITH SHORT RANGE WEAPONS

THE AEGIS SYSTEM WITH ITS ACCURATE,
HIGH CAPACITY TRACK CAPABILITY AND COMMAND GUIDANCE
EVEN IN THE FACE OF CLUTTER AND JAMMING ENVIRONMENTS,
UNIQUELY CONTRIBUTES TO THIS CONCEPT—BY

- SUCCESSFUL FLIGHTS OF LARGE NUMBERS OF FRIENDLY AIRCRAFT WITHIN MISSILE ENVELOPES
- MORE EFFECTIVE USE OF DECK LAUNCHED CAP
- COORDINATION OF FIRE AND REMOTE LAUNCHED CONTROL FROM OTHER SHIPS WHEN THEY ARE DEGRADED BY ENVIRONMENT
- LAUNCH AND CONTROL OF MISSILES WITHOUT FIRE CONTROL SYSTEM SATURATION
- ATTRITION OF ATTACK DENSITY FOR SHORT RANGE WEAPON SYSTEMS
- CLOSE COORDINATION OF SURFACE AND AIR WEAPONS EVEN IN ADVERSE SITUATIONS THROUGH INTEGRATED COMBAT SYSTEM CONTROL

FLEET AAW DEFENSE IN DEPTH



DEFENSE IN DEPTH REQUIRES

- AEGIS TO COORDINATE OTHER WEAPON SYSTEMS USING EACH WEAPON TO BEST ADVANTAGE IN A CONSOLIDATED DEFENSE
- THIS CAN BE ACHIEVED ONLY BY AN EFFECTIVE METHOD OF COMBAT SYSTEM CONTROL

COMBAT SYSTEM CONTROL

A SHIPS COMBAT SYSTEM IS
A VERY COMPLEX ASSEMBLAGE OF PEOPLE, EQUIPMENT AND TASKS

DEPENDING ON THE SHIPS MISSION, THE COMBAT SYSTEM MAY BE REQUIRED
TO ENGAGE SIMULTANEOUSLY IN SEVERAL TYPES OF WARFARE

EVEN FOR A SINGLE MISSION, SUCH AS AAW,
COORDINATED OPERATION OF MANY SOPHISTICATED SYSTEMS IS REQUIRED

EFFECTIVE ORGANIZATION OF THE COMBAT SYSTEM IS CHARACTERIZED BY

- DISTINCTION OF THE COMMAND FUNCTION
  FROM SYSTEM CONTROL AND DATA PROCESSING
- ALLOCATION OF CONTROL FUNCTIONS
  TO SPECIFIC, DEFINABLE SYSTEMS,
  WITH SPECIFIC IDENTIFIABLE INTERFACES
- GROUPING OF SYSTEMS WITH SIMILAR TASKS
  FOR DIRECTION AND MANAGEMENT

COMBAT SYSTEM CONTROL

(AAW ORGANIZATION)*

COMMAND

- COMMUNICATE WITH OTHER UNITS
- ASSESS SITUATION & SHIP POSTURE
- SET BATTLE PLAN
- AUTHORIZE SENSOR & WEAPON OPERATION
- CONTROL/DELEGATE BATTLE DECISIONS

CONTROLS

DETECTION/TRACK

- CONTROL RADAR, IFF, ESM OPERATIONS
- CORRELATE SENSOR DATA
- DISSEMINATE DATA TO COMMAND & WEAPONS
- WHEN AUTHORIZED, EVALUATE DATA FOR QUICK REACTION (QR)

WEAPON DIRECTION

- SELECT WEAPON USE
- SCHEDULE ENGAGEMENTS
- MANAGE SENSOR & WEAPON RESOURCES
- EVALUATE KILL

ENGAGEMENT

- ENGAGE WITH
  - MISSILES
  - GUNS
  - INTERCEPTORS
  - EW

THIS COLOR CODE WILL BE USED THROUGHOUT THIS BOOKLET

*SINCE THE AEGIS SHIP IS PRIMARILY AN AAW SHIP, AAW WILL BE EMPHASIZED THROUGHOUT. SUW AND ASW WILL BE MENTIONED TO SHOW THAT THE COMBAT SYSTEM INCLUDES THEM.

SHIPS OF THE EARLY SIXTIES EXHIBITED
A WELL-DEFINED SEGMENTATION OF FUNCTIONS

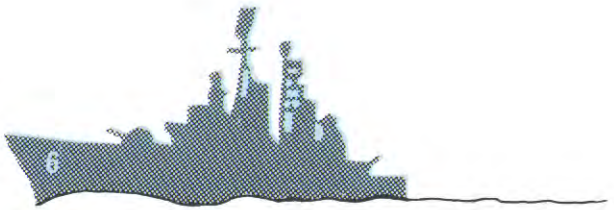
—COMMAND WAS EXERCISED BY THE COMMANDING OFFICER THROUGH CIC
—CONTROL SYSTEMS WERE REQUIRED FOR
—SENSORS
—WEAPON DIRECTION OR DESIGNATION
—FIRE CONTROL

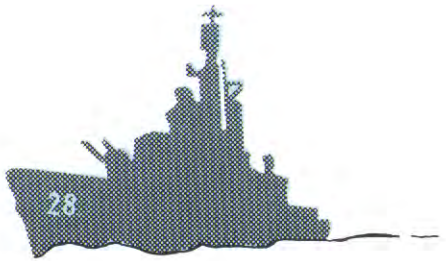
SUBSEQUENT AAW EVOLUTION WAS BASED
ON THE EXPANDING USE OF DIGITAL DATA PROCESSING
AS A MECHANISM TO IMPROVE REACTION TIME
AND RETAIN TACTICAL FLEXIBILITY

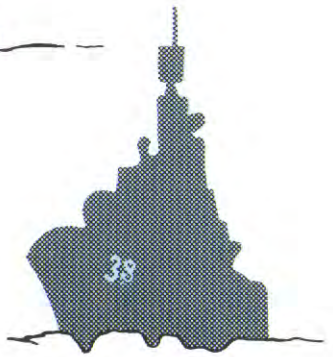
THE RESULTS OF THIS EVOLUTIONARY PROCESS (SHOWN IN THE FOLLOWING PAGES)
ARE TYPIFIED BY

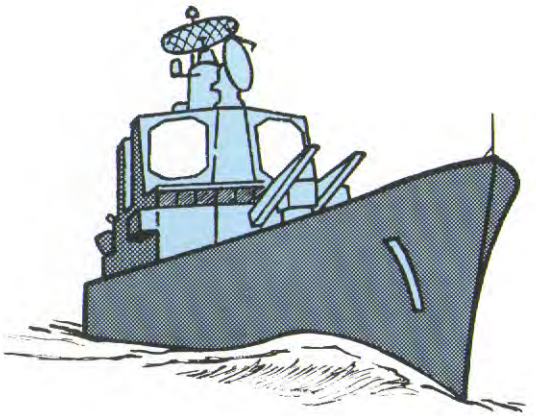
DLG – 6 _____ 1960
DLG – 28 _____ 1965
DLGN – 38 _____ 1970
AEGIS _____ 1975

ANTI-AIR WARFARE SYSTEMS EVOLUTION









PRE-CONVERSION DLG-6

COMMAND MAINTAINED ON MANUALLY UPDATED PLOT BOARDS

SENSOR SYSTEMS PROVIDED ALL DETECTION DATA
VIA VOICE REPORT FROM OPERATORS

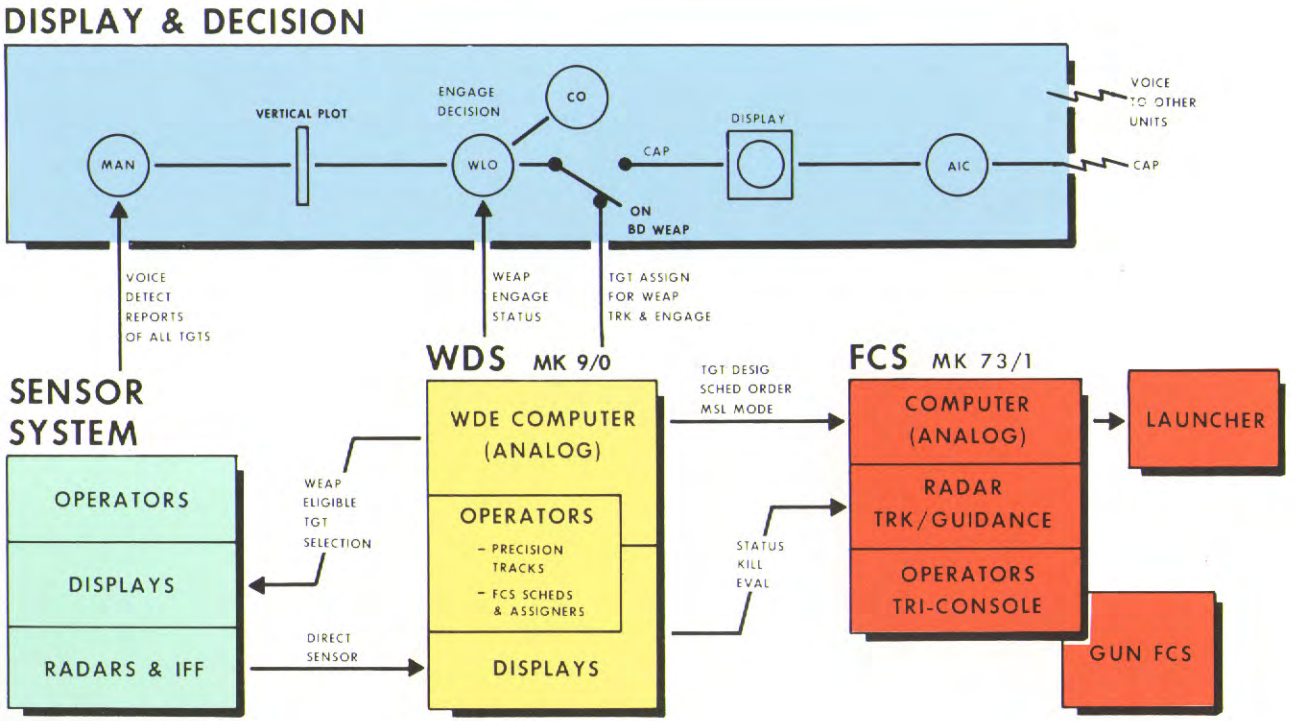
WEAPON DESIGNATION SYSTEM OPERATED
AS A CONTROLLER / SCHEDULER
TO WHICH CIC ASSIGNED TARGETS IN BATCHES
FOR DESIGNATION TO FIRE CONTROL SYSTEMS

FIRE CONTROL SYSTEM CLOSED LOOPS FOR
LAUNCHER POINTING AND MISSILE/GUN CONTROL

USS FARRAGUT

1960

DLG-6 PRE-CONVERSION



(SEE GLOSSARY FOR TERMS & ABBREVIATIONS)

BASIC AAW FUNCTIONS ALLOCATED TO SYSTEMS.
ALTHOUGH SEGMENTED, WELL DEFINED, MANUAL OPERATION AND
ANALOG PROCESSING LIMITED SPEED AND VARIETY OF REACTION

DLG-28

COMMAND RETAINED ITS MANAGEMENT FUNCTIONS WITH GENERAL PURPOSE CONSOLES

RECEIVED OTHER SHIP DATA VIA AN AUTOMATIC LINK AND MAINTAINED DATA IN A GENERAL-PURPOSE COMPUTER SYSTEM

SENSORS STILL DEPENDED ON MANUAL TRACK ENTRY

BUT RELIED ON THE COMMON COMMAND COMPUTER SYSTEM FOR DISPLAY SUPPORT AND ASSEMBLY OF DATA
TRACKING DEPENDED ON LOOP CLOSURE THROUGH THE SENSOR (RADAR), RADAR OPERATOR AND COMMAND COMPUTER

WEAPON DESIGNATION IN SECTORS CONTINUED TO BE BY VOICE

(FROM HIGHER COMMAND) WHILE TARGET ASSIGNMENTS WERE MADE BY SHIP COMMAND VIA THE COMMON GENERAL-PURPOSE COMPUTER/DISPLAY SYSTEM

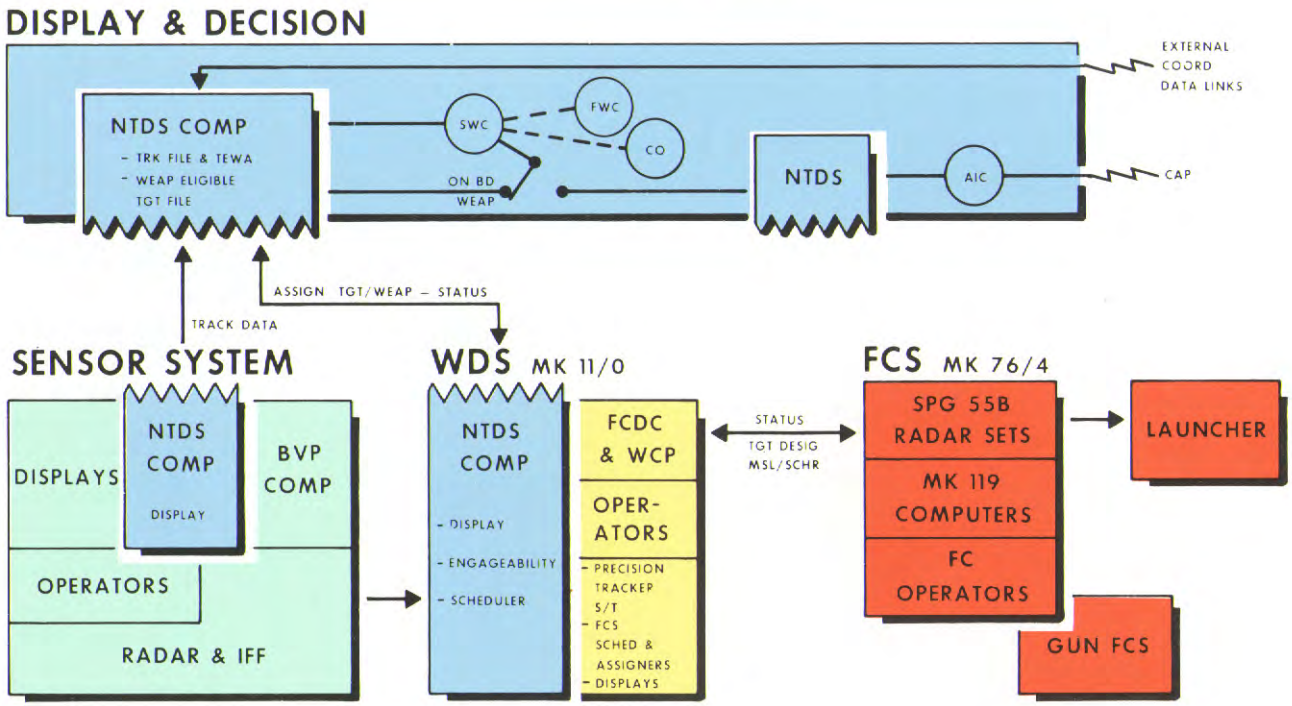
FIRE CONTROL REMAINED AN ANALOG SYSTEM

AND RETAINED ITS BASIC IDENTIFIABLE FUNCTIONS OF CONTROL LOOP CLOSURE FOR BOTH LAUNCHER AND MISSILE/GUN CONTROL

USS WAINWRIGHT

1965

DLG-28



- AUTOMATED DATA SYSTEMS REPRESENTS SIGNIFICANT STEP FORWARD IN DISSEMINATING DATA THROUGHOUT FORCE & ACHIEVING FLEXIBILITY TO MEET CHANGING NEEDS

- FORMERLY CLEAR DEMARCATION BETWEEN COMMAND, SENSOR & WEAPON DESIGNATION IS OBSCURED IN COMMON COMPUTER PROGRAMS

DLGN-38

COMMAND RETAINS ALL ITS COMBAT MANAGEMENT FUNCTIONS DATA COORDINATION AND WEAPONS ASSIGNMENT.

SENSOR SYSTEMS ARE IMPROVED

THROUGH THE ADDITION OF MTI (MOVING TARGET INDICATION)
SENSOR DATA SOURCES STILL LEFT TO THE COMMAND PROGRAMS

WEAPON DESIGNATION CONTINUES TO SHARE

DISPLAY SUPPORT WITH THE COMMAND COMPUTER SYSTEM.
ENGAGEABILITY FUNCTIONS AND WEAPON SCHEDULING, HOWEVER, ARE SUPPORTED BY THE MISSILE FIRE CONTROL COMPUTER

FIRE CONTROL FOR BOTH MISSILE AND GUN

ARE IMPROVED IN REACTION TIME AND FLEXIBILITY
THROUGH DIGITAL PROCESSING, BUT —
SYSTEM INTERFACES, WITH WEAPON DIRECTION BECAME INDISTINCT

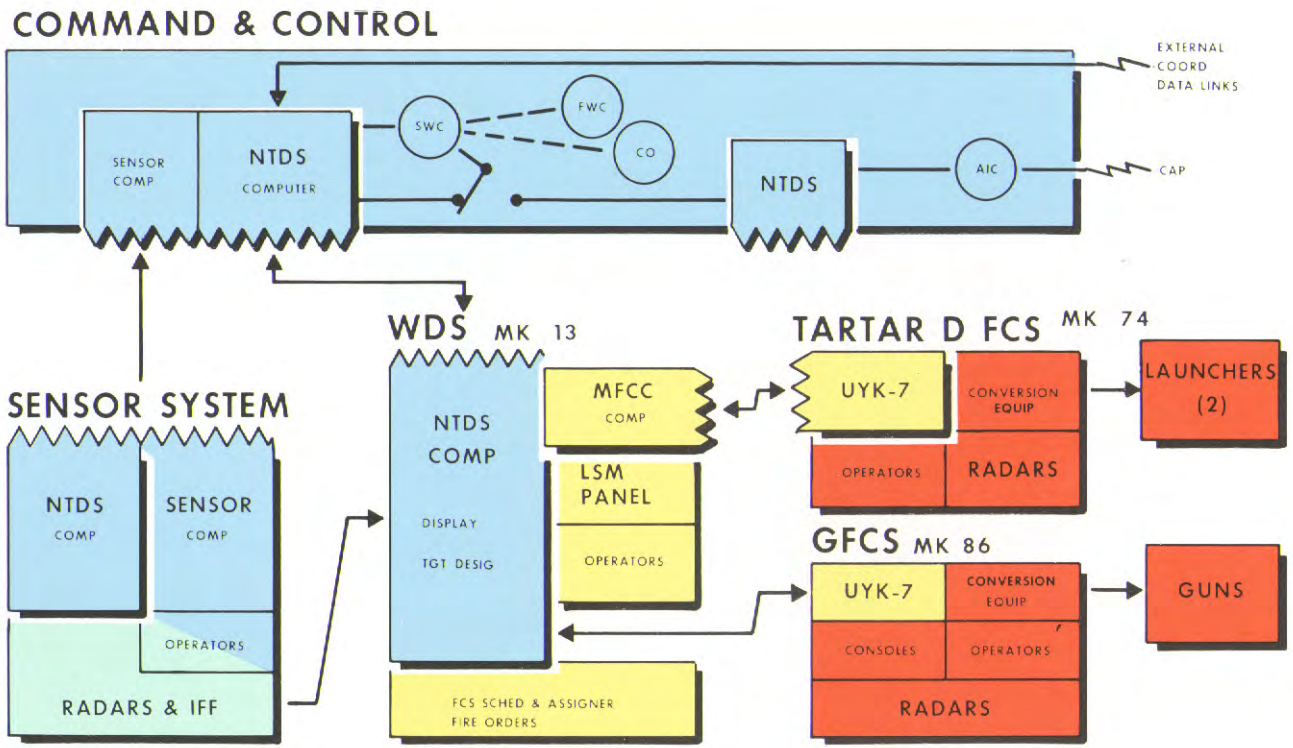
PROGRAMMING, TESTING, TROUBLE-SHOOTING, CASUALTY OPERATION MODIFICATION, MAINTENANCE, AND PERSONNEL DEMANDS ARE INCREASINGLY DIFFICULT PROBLEMS AS CLEAR LINES OF DEMARCATION ARE LOST BETWEEN SYSTEMS

AEGIS COMBAT SYSTEM CONTROL IS DIRECTED TOWARDS SOLVING THESE PROBLEMS.

USS VIRGINIA

DLGN-38

1970



- MISSILE & GUNFIRE CONVERSION TO DIGITAL PROCESSING RESULT IN STANDARDIZATION OF COMPUTING EQUIPMENTS
- COMBAT SYSTEM NOW CRITICALLY DEPENDENT ON COMPUTER RELIABILITY & PROGRAMMING

AEGIS OBJECTIVES

EVOLUTIONARY OBJECTIVES LEADING TO AEGIS:

CENTRALIZED COMMAND WITH ALLOCATED CONTROL MEANS

- HUMAN CONTROL THROUGH PREPLANNING AND EXCEPTION
- RESPONSIBILITY FOR OPERATIONAL DECISIONS AND CORRESPONDING PLAN OF ACTION CLEARLY IDENTIFIED
- DISTINCT CONTROL SYSTEM TO DIRECT SHIP'S ACTIONS
- TACTICAL COMMAND SYSTEM, INCLUDING DATA SYSTEM, TO DIRECT SHIP'S ACTIONS

MODULAR DESIGN INCLUDES

- INDEPENDENT PROCUREMENT SPECIFICATION DEVELOPMENT TEST & INSTALLATION OF INDIVIDUAL SYSTEMS
- SHARPLY DEFINED FUNCTIONS AND INTERFACES
- COMPLETE OR PARTIAL SYSTEM INSTALLATION IN WIDE VARIETY OF SHIP CLASSES WITH APPROPRIATE CAPABILITY
- IMPACT OF FAILURES ISOLATED

TOGETHER THESE PROVIDE
EFFICIENT DESIGN CONTROL AND
PERMIT AEGIS WEAPONS SYSTEM
TO MEET MISSION REQUIREMENTS

AEGIS

CONFIGURATION

CENTRALIZED COMMAND
ALLOCATED CONTROL

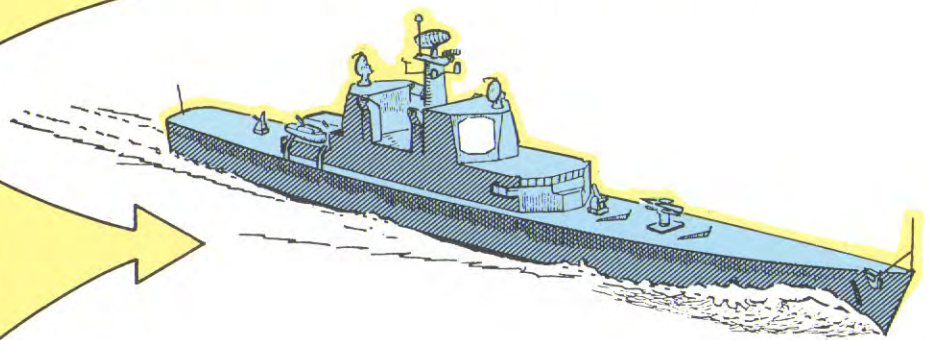
- HUMAN CONTROL THROUGH PRE-PLANNING & EXCEPTION
- CLEAR IDENTIFICATION OF RESPONSIBILITY & PLAN OF ACTION

OBJECTIVES

MODULAR DESIGN

- INDEPENDENT PROCUREMENT OF SYSTEMS
- SCALABILITY & ADAPTABILITY TO FIT A VARIETY OF SHIP CLASSES
- LOCALIZE FAILURE IMPACTS
- IDENTIFY FUNCTIONS & INTERFACES

EFFICIENT
DESIGN CONTROL
OF
THE AEGIS WEAPON SYSTEM



AEGIS 1975

RETAINS THE FULL POWER OF
DIGITAL DATA PROCESSING IN DATA MANAGEMENT
INTER SHIP TRANSFER , TACTICAL DECISION ASSISTANCE ,
WEAPON SCHEDULING , FIRE CONTROL

AND

ADDS A FULLY AUTOMATIC TARGET DETECTION SYSTEM ,
AUTOMATIC CORRELATION OF DATA FROM SEVERAL SENSORS ,
PRE-DECISIONING FOR QUICK REACTION SITUATIONS ,
GREATER FIREPOWER THROUGH MIDCOURSE GUIDANCE

AND

THROUGH A NEW COMBAT SYSTEM CONTROL CONCEPT
RESTORES IDENTITY TO THE CONTROL COMPUTERS AND
DISPLAYS SUPPORTING EACH MAJOR SYSTEM;
REESTABLISHES RECOGNIZABLE AND WELL-UNDERSTOOD
INTERFACES BETWEEN SYSTEMS AND PERMITS

—TACTICAL COMMAND SYSTEM
—SENSOR CONTROL SYSTEM
—WEAPON CONTROL SYSTEM
—FIRE CONTROL SYSTEM

} TO BE SEPARATELY PROCURED AND TESTED

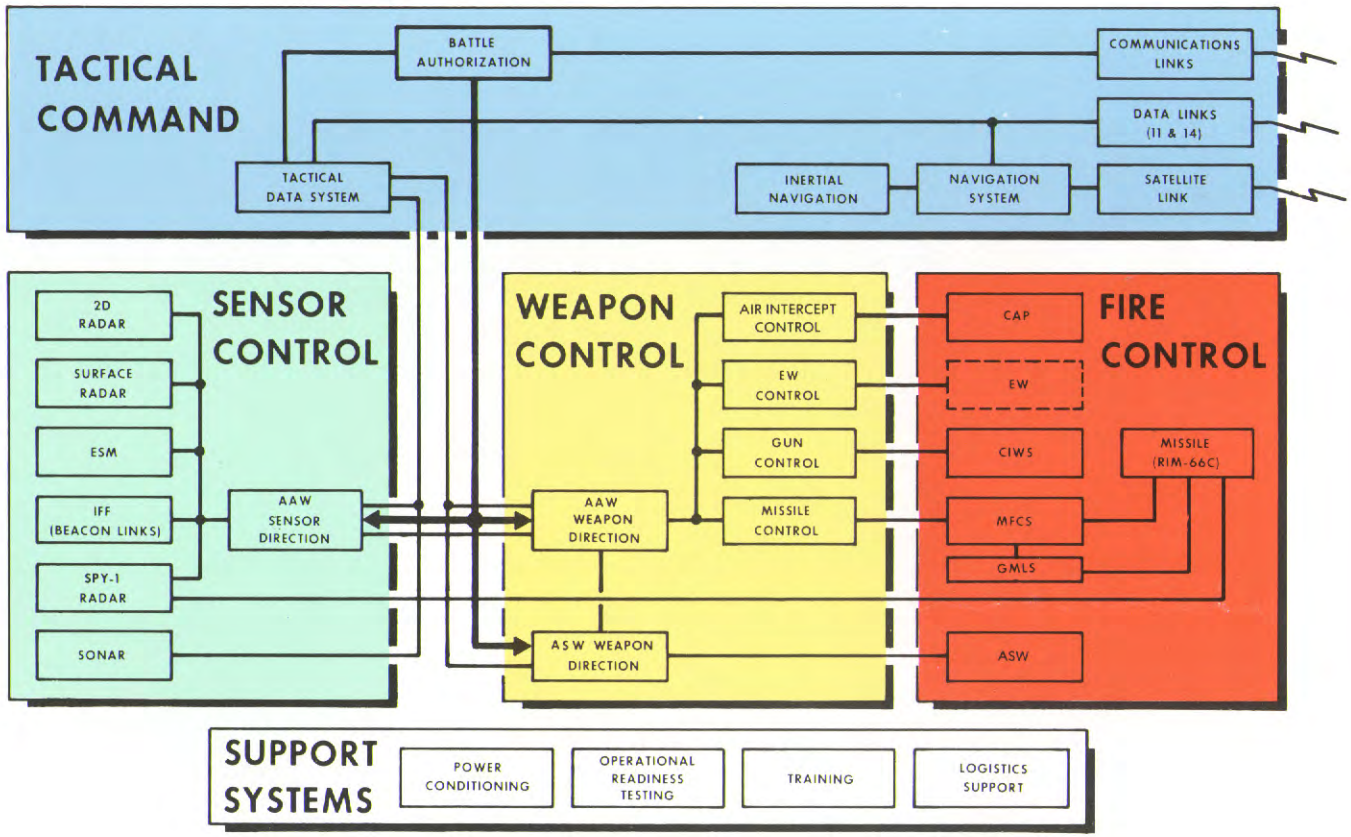
AND

SIMPLIFIES PROGRAMMING , MAINTENANCE AND TRAINING DEMANDS
WHILE IMPROVING FLEXIBILITY AND UTILITY OF THESE SYSTEMS

AEGIS

DG-1

1975



PROVIDES SYSTEM INTEGRATION FOR QUICK REACTION COMBAT UNIT RESPONSE

AAW FUNCTIONAL DESCRIPTION

CENTRALIZING COMMAND AND DECENTRALIZING CONTROL
SIMPLIFIES SYSTEM INTERFACES WHILE
PRESERVING COMMAND AUTHORITY OVER THE TOTAL COMBAT SYSTEM

TACTICAL COMMAND

ASSESS TACTICAL ENVIRONMENT
AND DIRECT SHIP OPERATIONS

SENSOR CONTROL

COLLECT AND DISSEMINATE DATA
PERTAINING TO TACTICAL ENVIRONMENT

WEAPON CONTROL

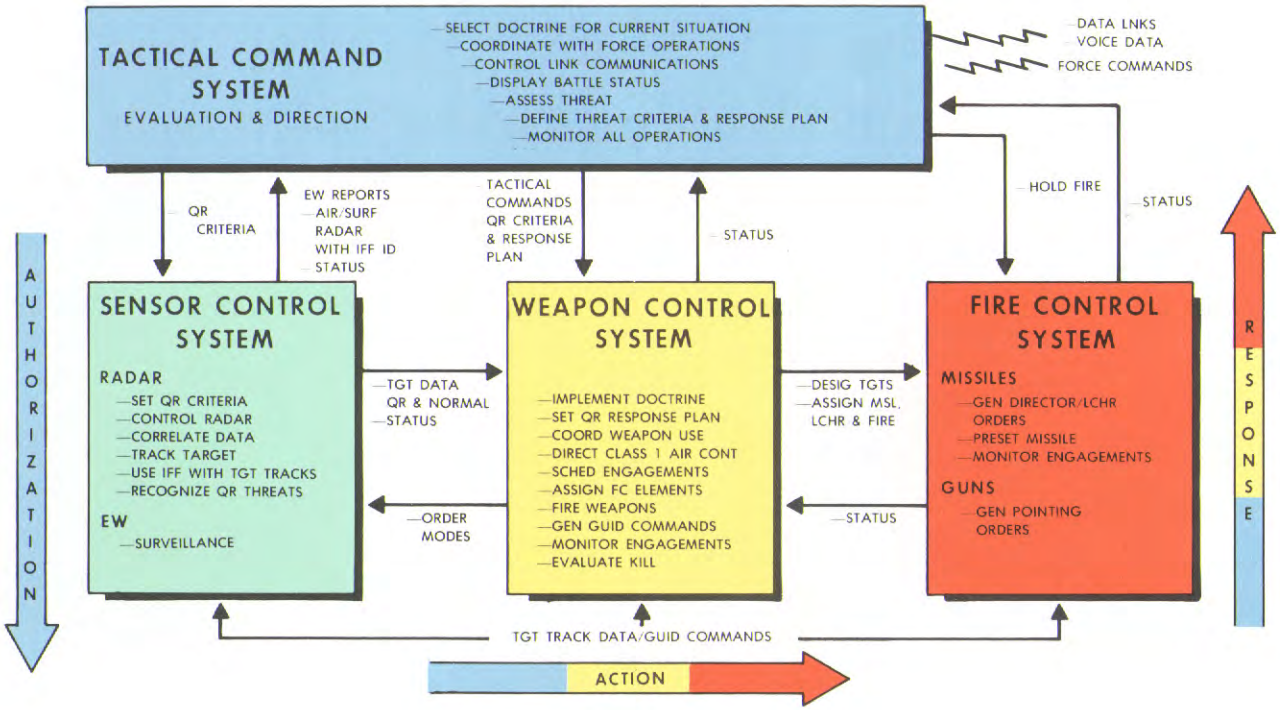
COORDINATE USE AND CONTROL
OF ALL WEAPONS AVAILABLE TO SHIP

FIRE CONTROL

CLOSED LOOP CONTROL OF EACH WEAPON SYSTEM

THE FUNCTIONAL ALLOCATIONS AND INTERFACES OF THESE SYSTEMS
ARE DESCRIBED FURTHER IN SUBSEQUENT PAGES

COMBAT SYSTEM CONTROL
(AAW)



— INTEGRATION IS ACCOMPLISHED BY CENTRALIZING ELEMENTS OF TACTICAL COMMAND AND DIVIDING ELEMENTS OF CONTROL INTO THREE FUNCTIONAL AREAS

SENSOR | WEAPON | & | FIRE CONTROL

TARGET SEQUENCE FROM DETECTION TO KILL

TACTICAL COMMAND

— INSERTS THREAT CRITERIA AND OPERATING RULES
PRIOR TO HEAT OF BATTLE

— MODIFIES ACCORDING TO THE CHANGING ENVIRONMENT

SENSOR CONTROL

— AUTOMATICALLY DECTECTS AND IDENTIFIES A TARGET- BY PROCESSING
RADAR RETURNS, INITIATING TARGET TRACK, REQUESTING IFF INTERROGATION
AND COLLATING ALL INFORMATION AVAILABLE ON THE TARGET

THREAT IS EVALUATED

— ACCORDING TO RULES PREVIOUSLY SET BY TACTICAL COMMAND
TARGET CHARACTERISTICS ARE COMPARED TO THOSE PRE-SET
IN THE QUICK REACTION FILTER, IF CHARACTERISTICS MATCH,
TRACK DATA IS SENT IMMEDIATELY, TO WEAPON CONTROL

WEAPON CONTROL

— AUTOMATICALLY ASSIGNS WEAPONS IN ACCORDANCE WITH PRE-SET WEAPON RESPONSE
PLAN IN THIS CASE MID-COURSE GUIDANCE

— FIRING IS MANUAL OR AUTOMATIC AS DESIRED.

FIRE CONTROL

—PROVIDE MISSILE LAUNCH ORDERS
AND IS SLAVED TO SPY-1 FOR TERMINAL ILLUMINATION

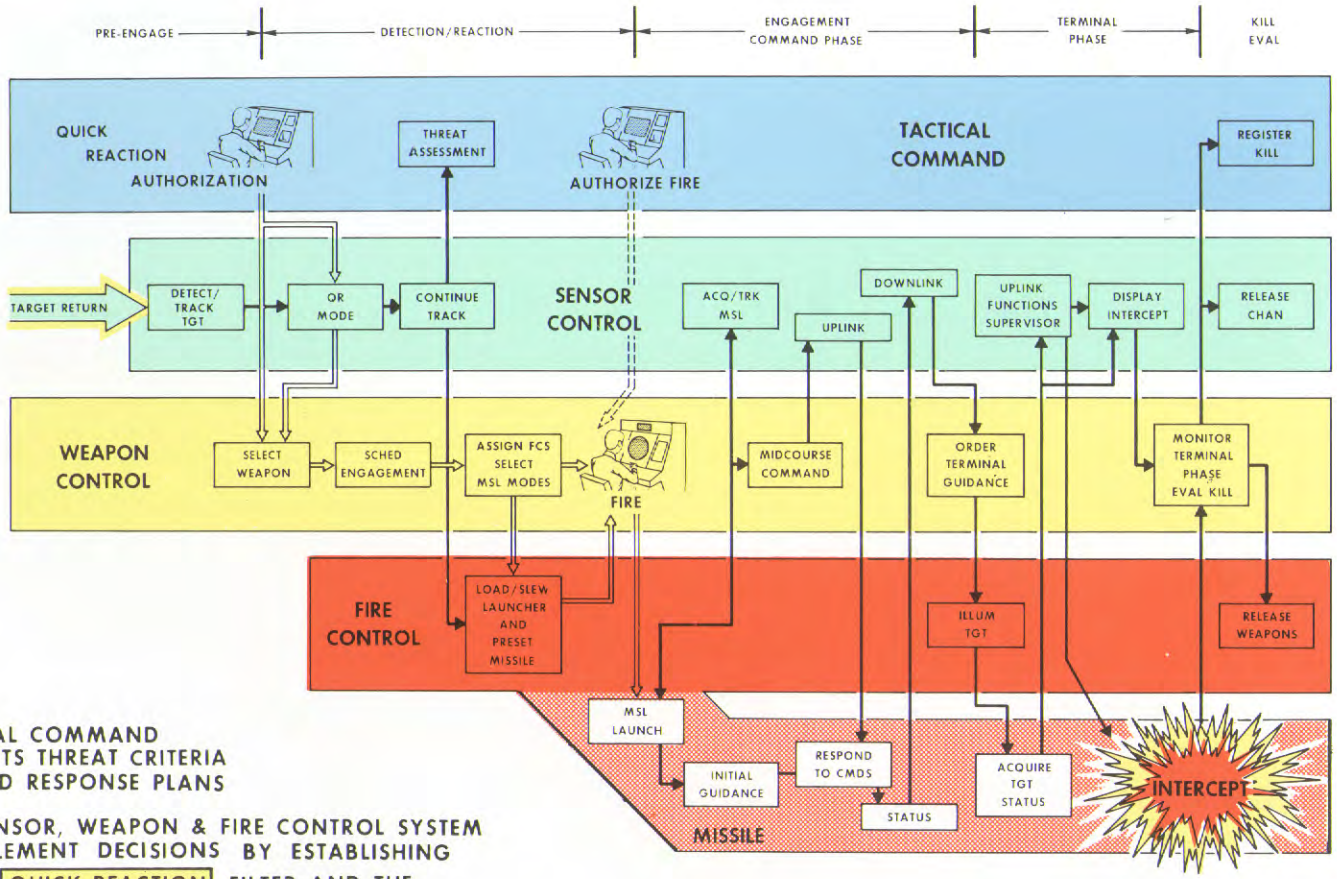
—THE TARGET WILL BE FIRED ON AUTOMATICALLY
UNLESS NEGATED BY TACTICAL COMMAND OR WEAPON CONTROL

TACTICAL COMMAND

—CONTINUES TO MONITOR THE BATTLE SITUATION AND CONTROL
SYSTEMS TO INSURE APPROPRIATE RESPONSE TO ANY CHANGES.
IF NOT A QUICK REACTION TARGET, WEAPON CONTROL ORDERS TARGET
ENGAGEMENT WHILE TACTICAL COMMAND REVIEWS TARGET IDENTITY
AND INSURES THAT FIRING IS AUTHORIZED

COMBAT SYSTEM CONTROL

(OPERATIONAL SEQUENCE FOR QUICK REACTION MODE)



– TACTICAL COMMAND SELECTS THREAT CRITERIA AND RESPONSE PLANS

THE SENSOR, WEAPON & FIRE CONTROL SYSTEM IMPLEMENT DECISIONS BY ESTABLISHING QUICK REACTION FILTER AND THE ASSOCIATED WEAPON RESPONSE.

SYSTEM MANAGEMENT REQUIRES CLEAR DEFINITION OF

- NOMENCLATURE
- FUNCTIONAL ALLOCATIONS
- INTERFACES

COMBAT SYSTEM DEFINED

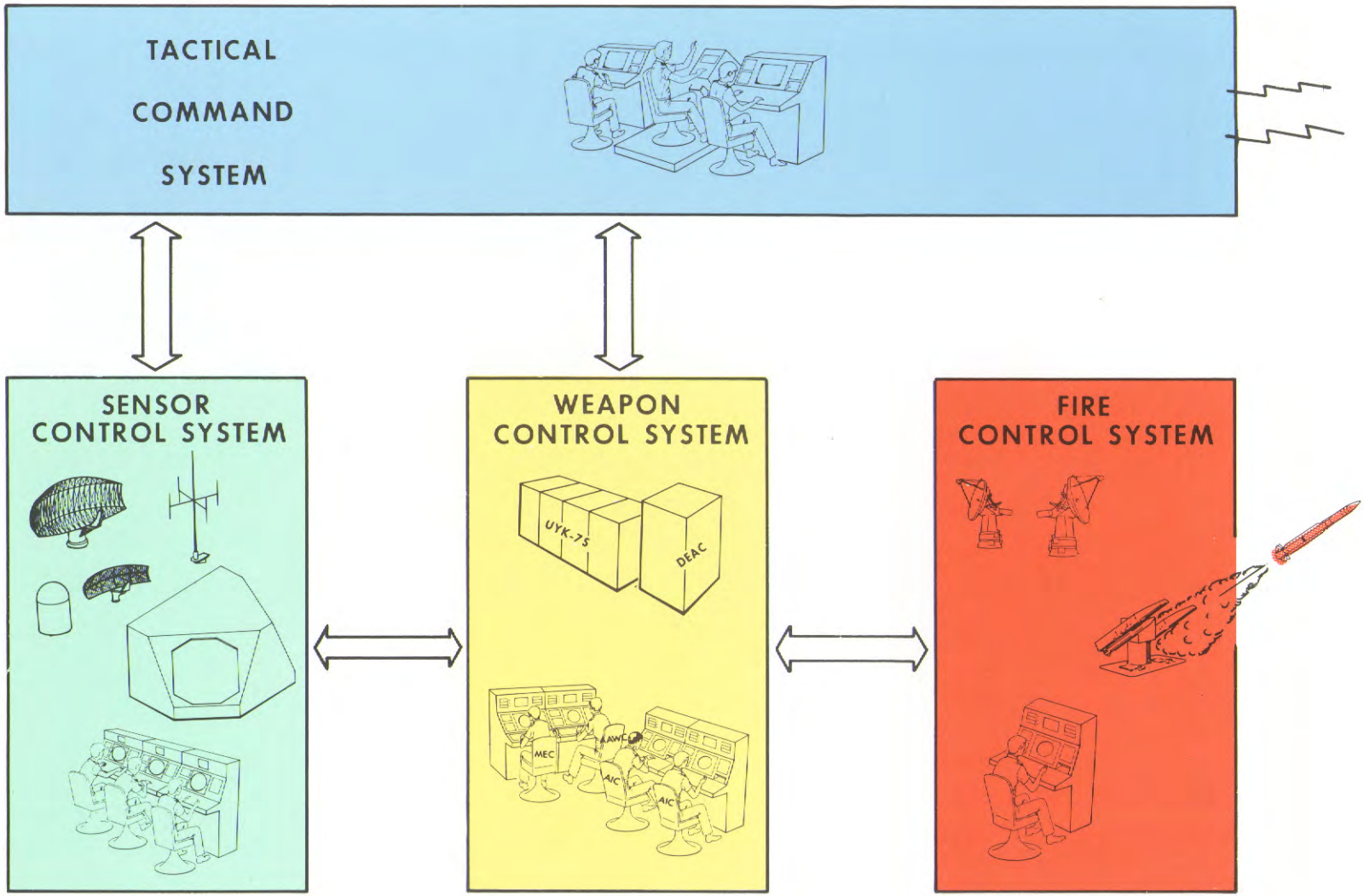
TACTICAL COMMAND SYSTEM
— TO EXERCISE COMMAND FUNCTION

SENSOR CONTROL SYSTEM
— MANAGE ALL SENSOR RESOURCES

WEAPONS CONTROL SYSTEM
— CENTRAL CONTROL OF ALL WEAPONS

MISSILE FIRE CONTROL SYSTEM
— CONTROLS MISSILES

AEGIS DG COMBAT SYSTEM



A COMBAT SYSTEM ORGANIZATION IS SHOWN, AS IT MIGHT BE IMPLEMENTED
FOR A DESTROYER-CLASS AEGIS SHIP WITH A PRIMARY AAW MISSION

TACTICAL COMMAND SYSTEM
(CENTRAL AUTHORITY TO EXERCISE COMMAND)

TACTICAL ACTION OFFICER (TAO)
COMBAT SYSTEM COORDINATOR (CSC)
TACTICAL INFORMATION COORDINATOR (TIC)

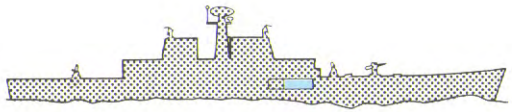
COORDINATION WITH OTHER FORCES IS ACCOMPLISHED THROUGH THIS SYSTEM AND IT CAN ACT AS CONTROL POINT FOR FORCE AAW COMMAND.

EQUIPMENT REQUIRED INCLUDES

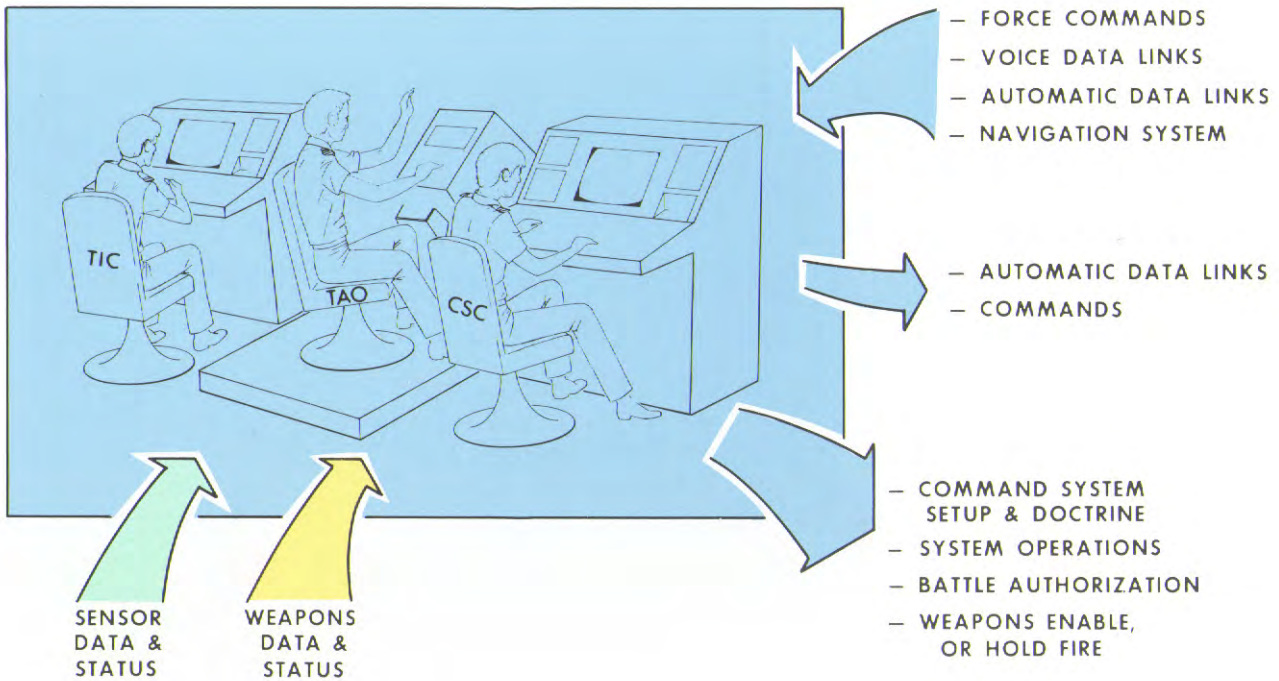
THE COMPUTING SYSTEM NECESSARY FOR DATA ASSEMBLY, STORAGE AND RETRIEVAL, CONSOLES AND STATUS DISPLAYS FOR PRESENTING CURRENT SITUATION, DATA PANELS THROUGH WHICH SHIP BATTLE SETUP IS CONTROLLED AND SUPPORTING SYSTEM FOR COMMUNICATION AND SHIP NAVIGATION

MAJOR OPERATORS FUNCTIONS ARE ENVISIONED

- SET OVERALL POLICY FOR SHIP COMBAT OPERATIONS
- COORDINATE WITH FORCE AAW COMMAND , AND SET SHIP OPERATING MODES
- REVIEW IDENTIFICATION AND CLASSIFICATION OF TARGETS, AND CORRELATE OWN SHIP-DERIVED DATA WITH EXTERNAL SOURCES



TACTICAL COMMAND SYSTEM



– CENTRAL COMMAND AUTHORITY

– SUPPORT COMMAND OPERATORS IN THEIR ASSESSMENT OF SHIP POSTURE AND BATTLE ACTION DIRECTION

AN INTEGRATED SENSOR CONTROL SYSTEM

TAKES MAXIMUM ADVANTAGE OF THE MUTUALLY SUPPORTING ASPECT OF ALL SURVEILLANCE RADARS ON THE AEGIS SHIP

—SPY-1 3D SEARCH AND TRACK RADAR IS PRIMARY SENSOR
OTHERS INCLUDE SPS-49 2D SURVEILLANCE RADAR AND AIMS MK-12 IFF,
ALL REPORTING TO A CENTRAL SENSOR MANAGEMENT COMPUTER

USE OF DATA FROM ALL SENSORS

—PROVIDES MAXIMUM TRACK CONTINUITY IN HOSTILE ENVIRONMENTS,
HIGHEST QUALITY DATA RAPID AND CONTINOUS IDENTIFICATION
AND MAXIMUM TRACK CAPACITY

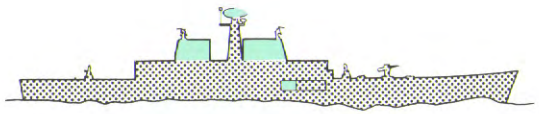
SENSOR CONTROL APPLICATION OF QUICK REACTION CRITERIA

—AS SPECIFIED BY TACTICAL COMMAND, PROVIDES THREAT EVALUATION
FILTERING TO WEAPON DIRECTION AT A MAXIMUM RATE

— CONTROL OF AN ARRAY IFF, IN CONJUNCTION WITH THE SPY-1
AND EW DATA, PROVIDES QUICK IDENTIFICATION

SENSOR CONTROL ALLOCATES RADAR RESOURCES

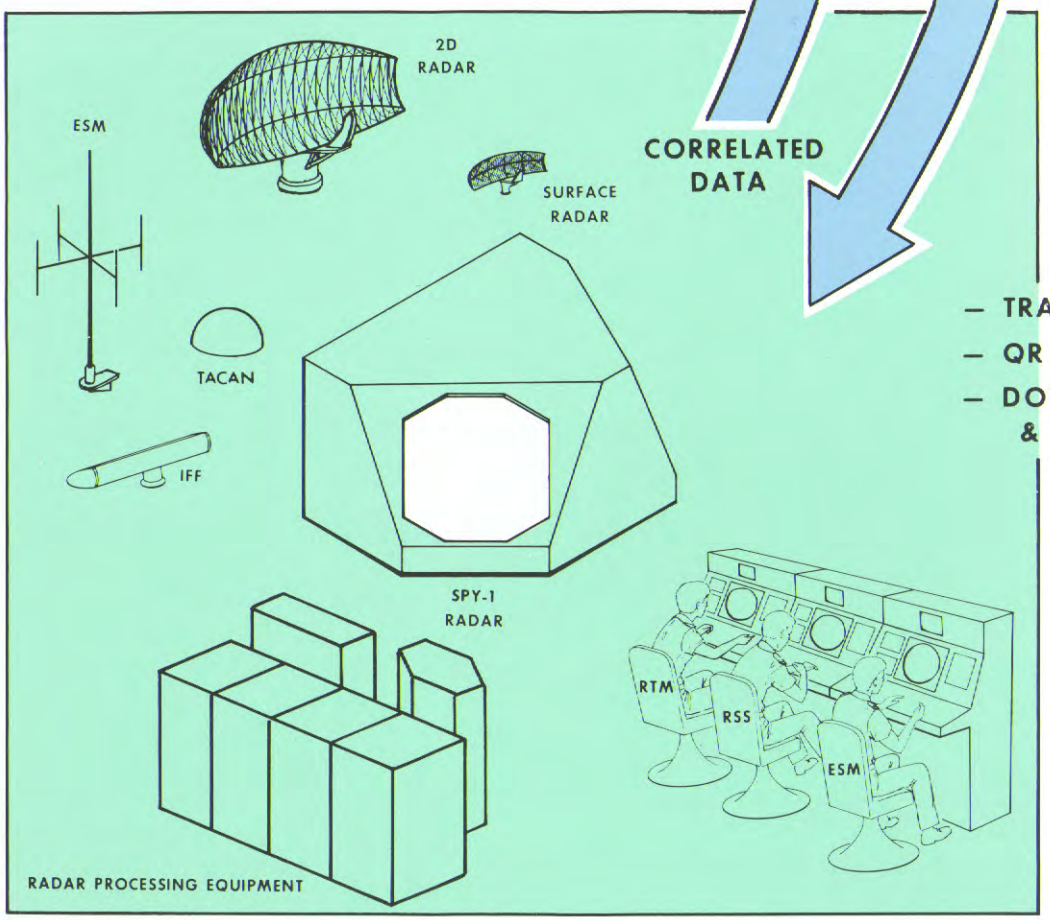
—MANUAL TRACKING IS ELIMINATED FROM THE OPERATORS DUTIES
SINCE SPY-1 BACKUP DETECTION CAPABILITY
IS PROVIDED BY ALTERNATE SENSORS



SENSOR CONTROL SYSTEM

ORDERS
QR MODE

CORRELATED
DATA



- TRACK DATA
- QR MODE
- DOWNLINK
  & MISSILE TRACK

- WEAPONS RQMTS
- MISSILE UPLINK

TRACK DATA

COMBAT SYSTEM CONTROL APPROACH HAS LOCALIZED
ALL WEAPONS CONTROL INTO A SINGLE SYSTEM

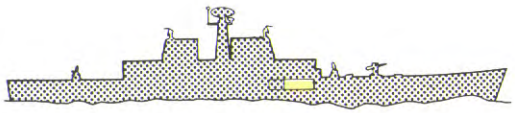
CONSEQUENTLY A DEFENSE—IN—DEPTH CAPABILITY
CAN BE REALIZED BY EFFECTIVELY COORDINATING
VARIOUS WEAPONS AT A LEVEL CONSISTENT WITH
THE ENGAGEMENT DATA REQUIREMENTS FOR THOSE WEAPONS

ONCE THE DECISION TO ENGAGE
A PARTICULAR TARGET HAS BEEN MADE
THE WEAPON CONTROL SYSTEM WILL DETERMINE

- WHAT WEAPONS ARE APPROPRIATE
- WHEN THEY ARE REQUIRED
- WHEN THEY ARE AVAILABLE

THIS WILL INCLUDE

- THE SCHEDULING OF TARGETS
- ISSUING THE FIRING ORDER
- CONTROLLING THE WEAPON TO INTERCEPT

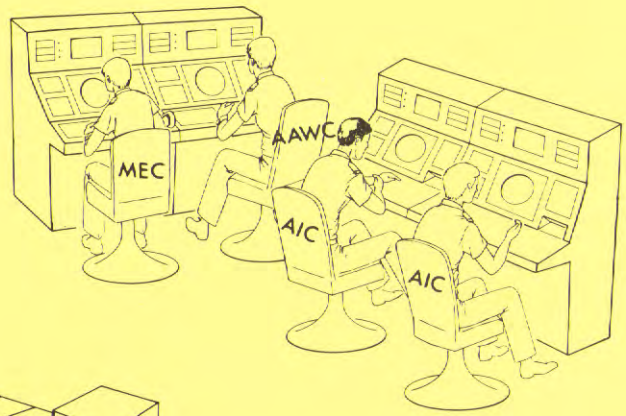


- BATTLE PLAN & AUTHORIZATION
- QR MODE

WEAPONS CONTROL SYSTEM

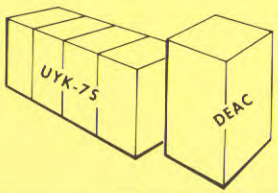
- TRACK DATA
- QR MODE
- DOWNLINK & MISSILE TRACK

- STATUS



- WEAPON RQMTS
- MISSILE UPLINK

- TARGET ASSIGNMENT
- FIRE



- UYK-7 COMPUTER
- UYA-4 CONSOLES
- DATA EXCHANGE AUX CONSOL (DEAC)
- FIRING SWITCH ASSEMBLIES

THE MISSILE FIRE CONTROL SYSTEM
GENERATES DIRECTOR AND LAUNCHER COMMANDS FOR
SEMI-ACTIVE HOMING VIA SLAVED ILLUMINATORS

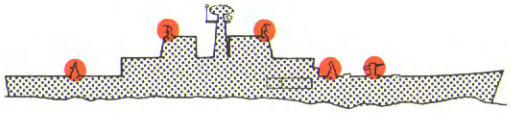
- PROVIDES AN ALTERNATE MISSILE ENGAGEMENT MODE
  BY ACCEPTING TARGET DESIGNATION
  ACQUIRING AND TRACKING THE TARGET
  AND GENERATING DIRECTOR AND LAUNCHER COMMANDS
  WITHIN THE FIRE CONTROL SYSTEM

- PROVIDES TARGET ILLUMINATION FOR OFF-SHIP LAUNCHED MISSILES

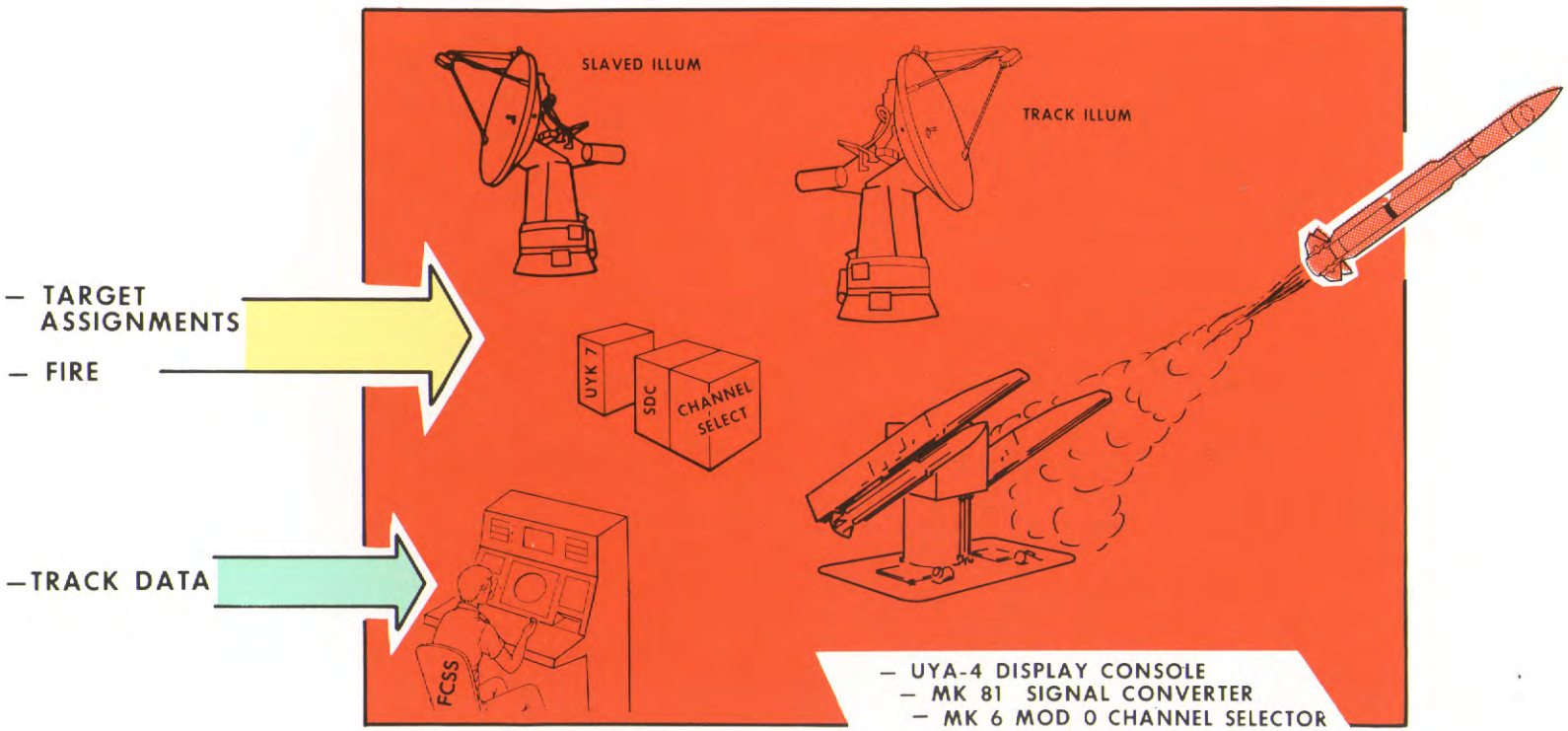
- ALLOWS UPDATING OR REPLACING OF INDIVIDUAL EQUIPMENTS
  IN THE SYSTEM

- ACCEPTS TACTICAL ORDERS FROM WEAPON CONTROL SYSTEM

- CARRIES OUT THE ABOVE FUNCTIONS INCLUDING
  RECEIPT OF TACTICAL ORDERS IN EVENT OF FAILURE
  OF OTHER AEGIS SYSTEM ELEMENTS



MISSILE FIRE CONTROL SYSTEM



– UYA-4 DISPLAY CONSOLE
– MK 81 SIGNAL CONVERTER
– MK 6 MOD 0 CHANNEL SELECTOR
– MK 90 GUIDANCE ILLUM
– MK 91 TRACKER ILLUM

AND

– UYK-7 COMPUTER
– MK-26 MOD 1 GMLS
– RIM 66C MISSILE

SM-2 AEGIS OPERATIONS INNOVATIONS

— MIDCOURSE GUIDANCE OPERATION WHICH ALLOWS MULTIPLE TARGET ENGAGEMENT AND EXPANDED INTERCEPT COVERAGE

—SUPERVISORY CONTROL OF GUIDANCE LOGIC WHICH IMPROVES PREFORMANCE IN ECM ENVIRONMENT

PRE-LAUNCH

— PRE-LAUNCH MISSILE ORDERS WHICH DEFINE GUIDANCE MODE, COMMUNICATION CODES, ORIENTATION COORDINATES, AND GUIDANCE PARAMETERS FOR PREDICTED INTERCEPT POINT

BOOST

— MISSILE IS GUIDED BY INTERNAL STABILIZATION INDEPENDENTLY OF SHIP

— THE SPY-1 DETECTS AND ESTABLISHES MISSILE TRACK

MIDCOURSE

— LASTS UNTIL A FEW SECONDS BEFORE INTERCEPT

— THE MISSILE IS GIVEN STEERING ACQUISITION AND SUPERVISORY COMMANDS FROM THE SHIP WEAPON CONTROL SYSTEM VIA THE SPY-1 COMMUNICATION LINK

TERMINAL

AN ILLUMINATOR IS ASSIGNED TO THE TARGET UNDER ENGAGEMENT

— ON COMMAND FROM THE SHIP, THE MISSILE SEEKER ACQUIRES THE TARGET AND GUIDANCE IS TRANSFERRED FROM MIDCOURSE CONTROL TO INTERNAL HOMING.

— THE SHIP CONTINUES MISSILE TRACK AND PROVIDES SUPERVISORY LOGIC CONTROL TO THE GUIDANCE SYSTEM

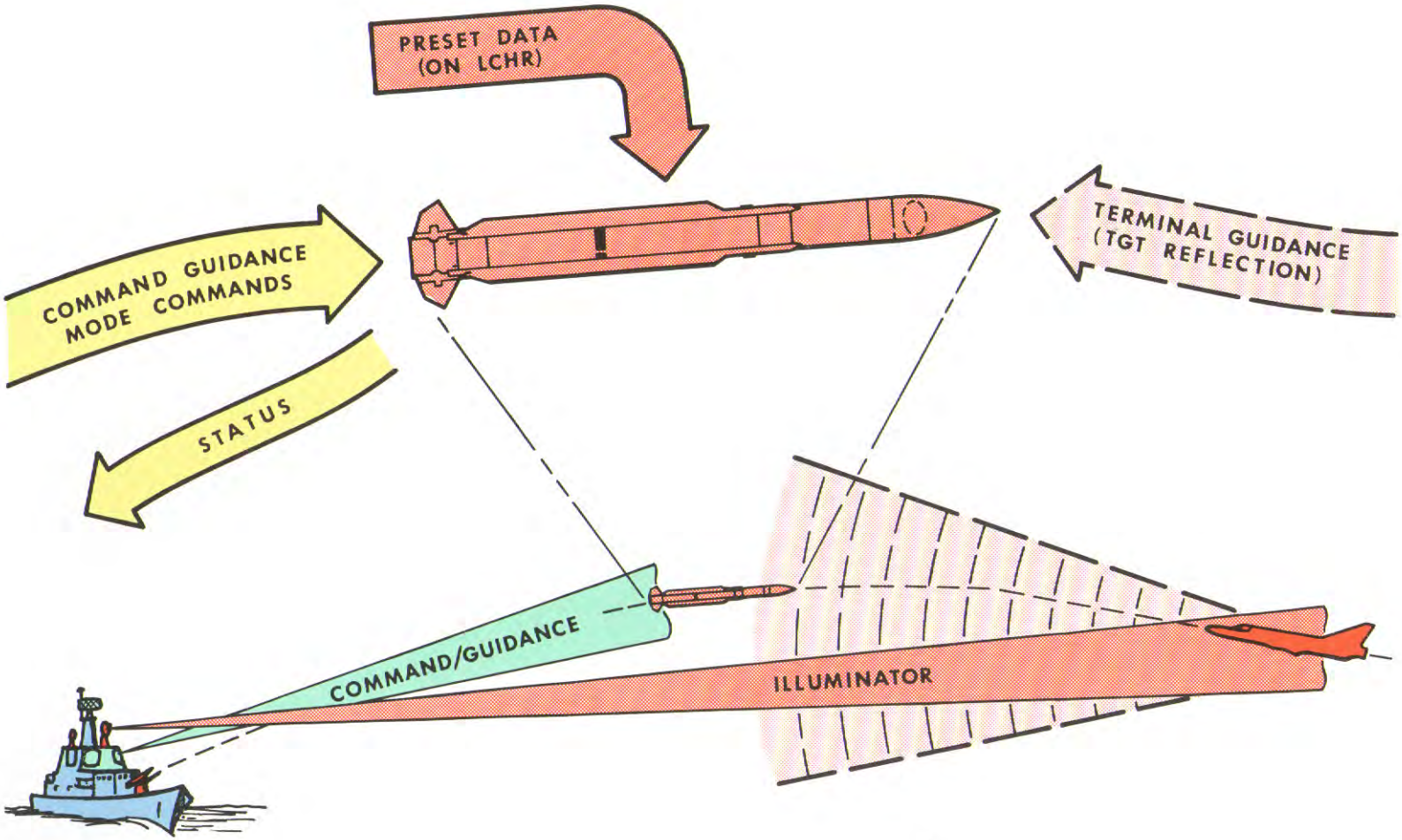
INTERCEPT (ENDGAME)

THE PROXIMITY FUZE SENSES TARGET POSITION

COMPUTES APPROPRIATE TIME DELAYS, AND FIRES THE WARHEAD

STANDARD MISSILE-2

RIM-66C-1



TACTICAL COMMAND

TACTICAL ACTION OFFICER (TAO)
DIRECT REPRESENTATIVE OF COMMANDING OFFICER. SET COMBAT POLICY

COMBAT SYSTEM COORDINATOR (CSC)
COORDINATE THE UTILIZATION OF SHIPBOARD AND OFF SHIP WEAPONS AND SENSORS. SET SHIP OPERATING MODES

TACTICAL INFORMATION COORDINATOR (TIC)
COORDINATE ON SHIP AND OFF SHIP SENSORS RESPONSIBLE FOR IDENTIFICATION AND CLASSIFICATION

SENSOR CONTROL

RADAR SYSTEM SUPERVISOR (RSS)
SUPERVISE THE OPERATION OF ALL SHIPBOARD SENSORS

RADAR TRACK MANAGER (RTM)
MONITOR & CONTROL THE TRACKING FUNCTIONS OF THE SENSOR SYSTEM

ELECTRONIC SUPPORT MANAGER (ESM)
PROVIDE ELECTRONIC SUPPORT DATA TO THE SENSOR SYSTEM

WEAPON CONTROL

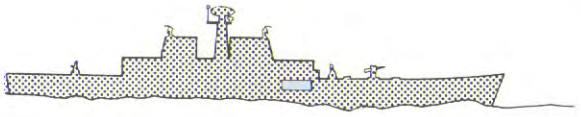
ANTI-AIR WARFARE COORDINATOR (AAWC)
DIRECT THE EMPLOYMENT OF AAW WEAPONS

MISSILE ENGAGEMENT CONTROLLER (MEC)
SCHEDULE AND OPERATE THE MISSILE SYSTEM. FIRE MISSILE AND MONITOR INTERCEPT

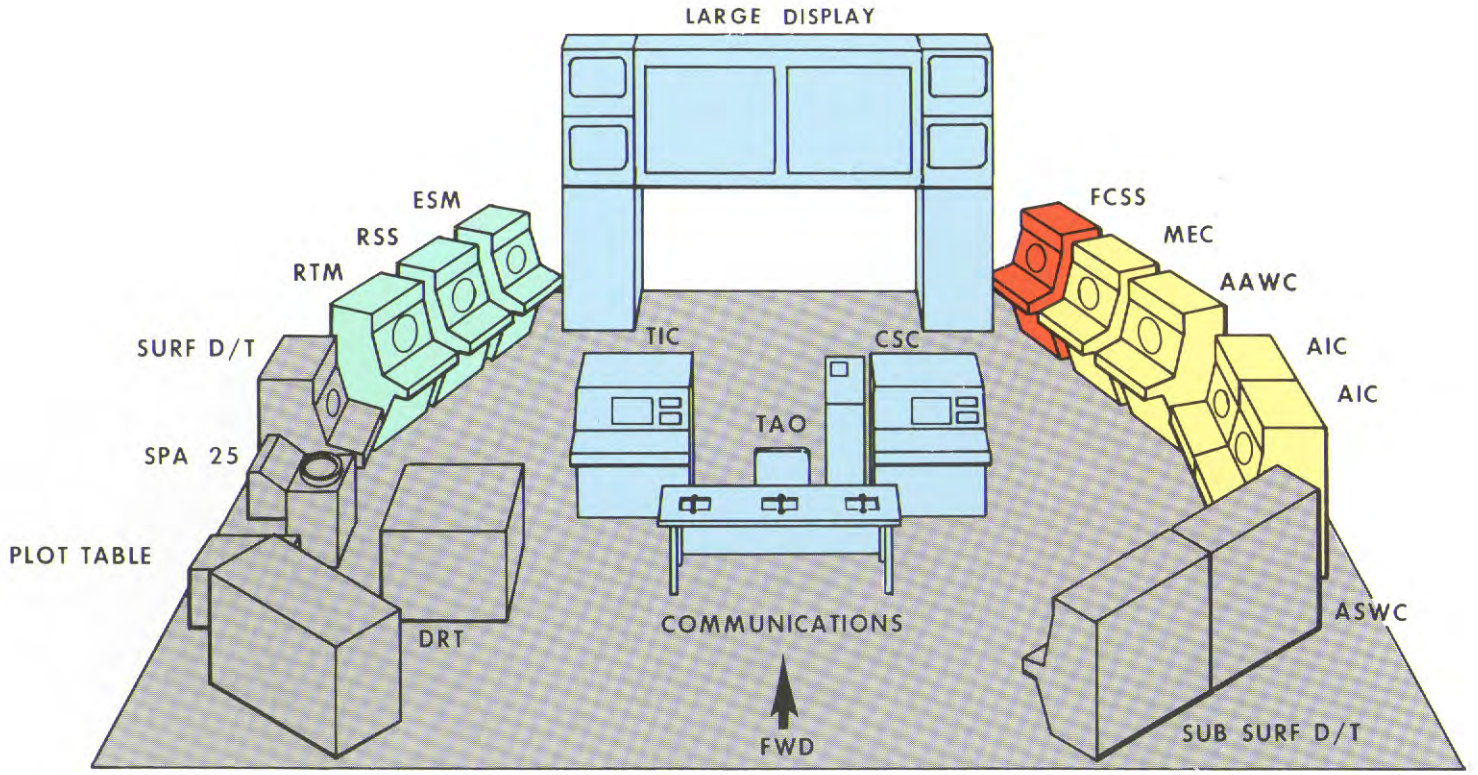
AIR INTERCEPT CONTROLLER (AIC)
DIRECTS ASSIGNED INTERCEPTORS

FIRE CONTROL

FIRE CONTROL SYSTEM SUPERVISOR (FCSS)
SUPERVISE THE OPERATION OF THE FIRE CONTROL SYSTEM. CONTROL DEDICATED ENGAGEMENTS



COMBAT INFORMATION CENTER (CIC)



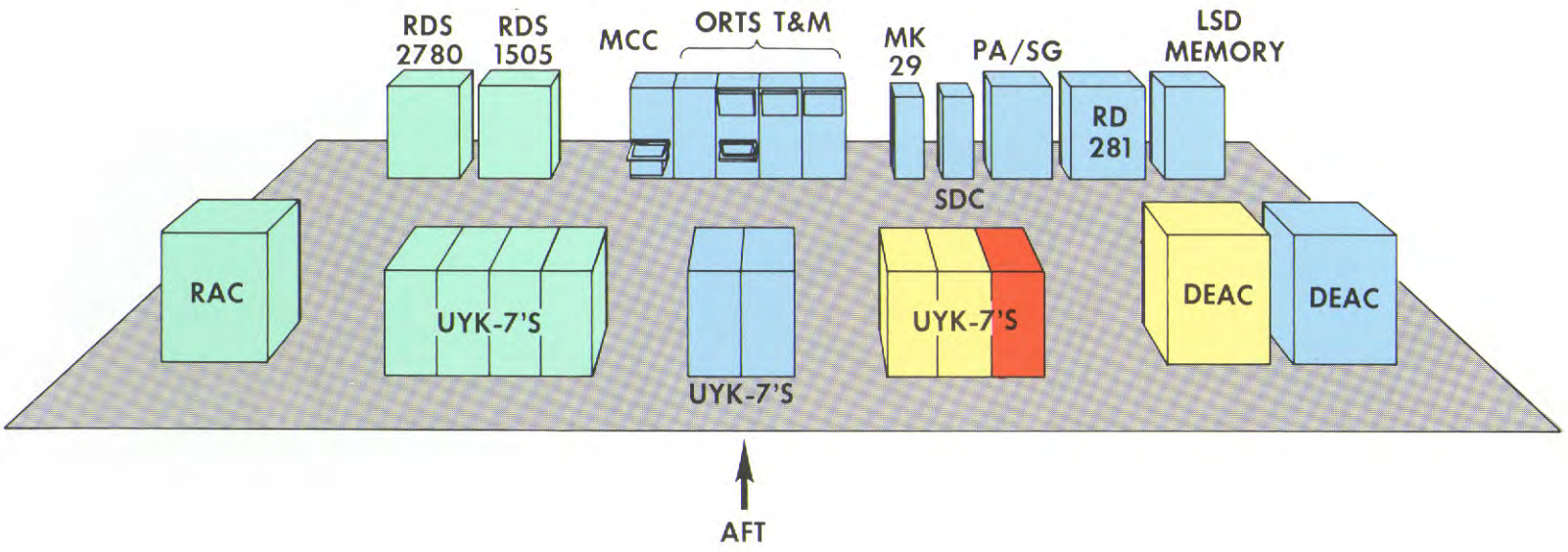
CIC SUPPORT ROOM CONTAINS ALL THE EQUIPMENTS NECESSARY TO SUPPORT AND MAINTAIN THE TACTICAL COMMAND , SENSOR CONTROL, WEAPON CONTROL AND FIRE CONTROL SYSTEMS.

THIS INCLUDES THE COMPUTERS , PERIPHERALS, SWITCHBOARDS AND MAINTENANCE CONSOLE ASSOCIATED WITH EACH SYSTEM.

OPERATIONAL READINESS TEST SYSTEM (ORTS) IS AN AUTOMATIC MONITORING SYSTEM DESIGNED TO GIVE THE CURRENT STATUS OF THE AEGIS WEAPONS SYSTEM CONTINUOUSLY.

ORTS COMBINES DATA ACQUISITION ASSEMBLIES , COMPUTER PROGRAMS AND DISPLAYS INTO A SUBSYSTEM WHICH AUTOMATICALLY DETECTS FAULTS , ISOLATES AND REPORTS THEM, RECOMMENDS THE CORRECTIVE ACTION AND RETESTS THE FUNCTION AFTER REPAIRS HAVE BEEN EFFECTED

CIC SUPPORT ROOM



DG AEGIS DESIGN IS BASED ON THE CONCEPTS OF MODULAR CONSTRUCTION (PRE-CONFIGURED AND PRE-TESTED TO BE LIFTED ON BOARD SHIP), AND CENTRALIZED COMMAND WITH ALLOCATED CONTROL

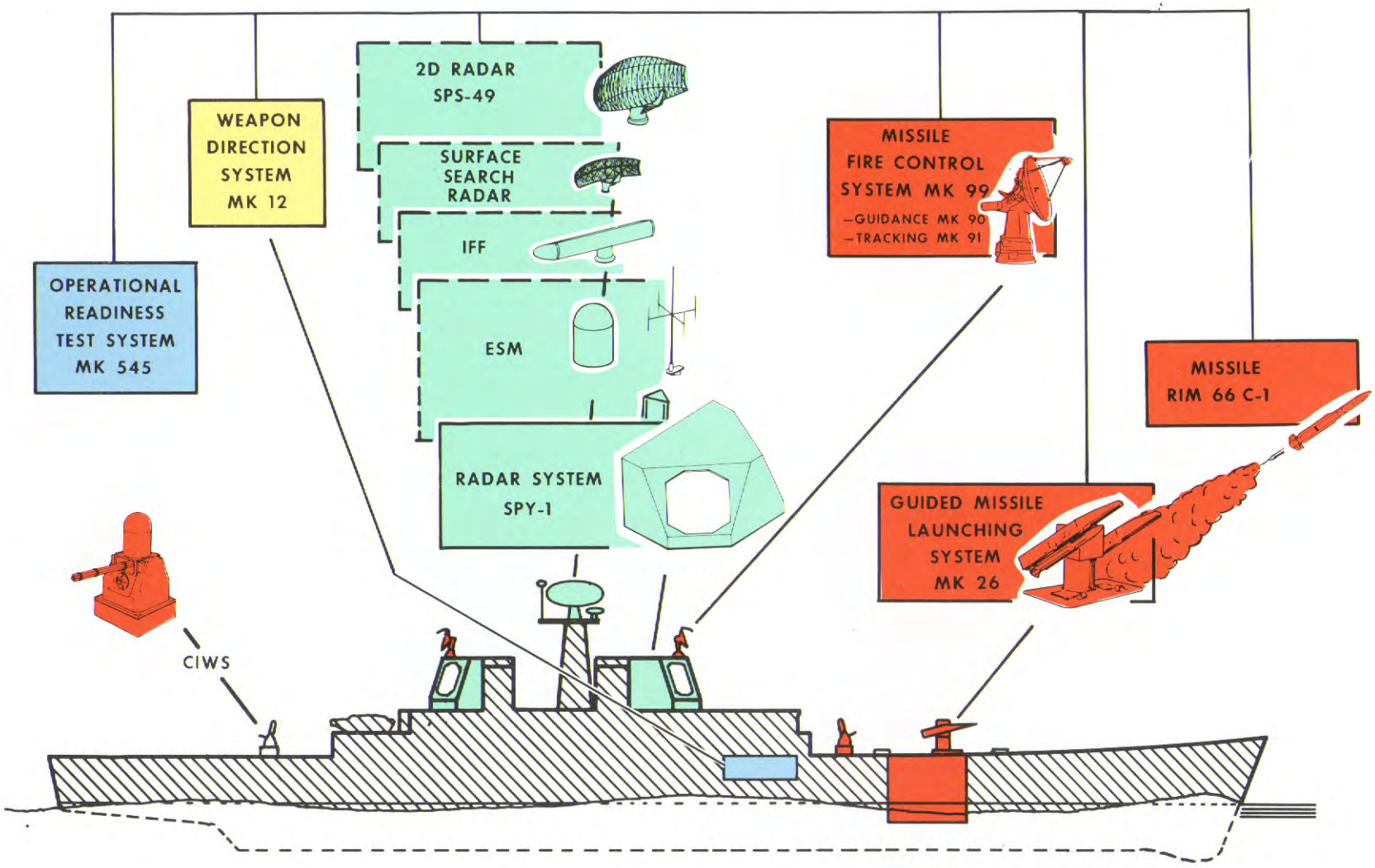
EACH SYSTEM IS COMPLETE, SEPARATE, SHARPLY DEFINED, AND CAN OPERATE AS AN INDEPENDENT UNIT. FAILURES CAN BE LOCALIZED TO INDIVIDUAL SYSTEMS.

COMMAND IS STILL FOCUSED AT ONE POINT WITH CONTROL ALLOCATED TO THREE AREAS

THE AEGIS WEAPON SYSTEM, THEREFORE, CAN BE SCALED TO FIT THE DG OR LARGER SIZE SHIP, AND VARIOUS AEGIS SYSTEMS OR MAJOR EQUIPMENTS CAN BE INSTALLED IN OTHER SHIP CLASSES SUCH AS THE CV OR DDG

AEGIS WEAPON SYSTEM

DG INSTALLATION



COMBAT SYSTEM CONTROL PROVIDES THE CAPABILITY FOR MULTI-FUNCTION OPERATION AND USE

SIGNAL PROCESSING, DATA PROCESSING AND DISPLAY ARE DESIGNED TO PROVIDE COMPLETELY AUTOMATIC DETECTIONS AND TRACK AND AUTOMATIC ENGAGEMENT SEQUENCING SUBJECT TO COMMAND OVER-RIDE AND MANUAL FIRING

WHEN A TARGET IS DETECTED

TARGETS DECLARED HOSTILE AND WITHIN ENGAGEMENT RANGE ARE QUEUED, LAUNCHER ASSIGNMENT MADE, AND MISSILE LAUNCHED IN ACCORDANCE WITH SYSTEM SCHEDULING

THE LAUNCHER FIRES DUAL MISSILE SALVOS

THE SPY-1 AUTOMATICALLY INITIATES TRACK

THE SPY-1 CONTINUES TARGET TRACK

AND GUIDES THE MISSILE IN ITS MIDCOURSE FLIGHT VIA A CODED RADAR LINK

SECONDS BEFORE INTERCEPT

AN ILLUMINATOR, SLAVED TO THE SPY-1, IS BROUGHT TO BEAR ON THE TARGET

SEEKER ACQUISITION IS INITIATED IN THE MISSILE

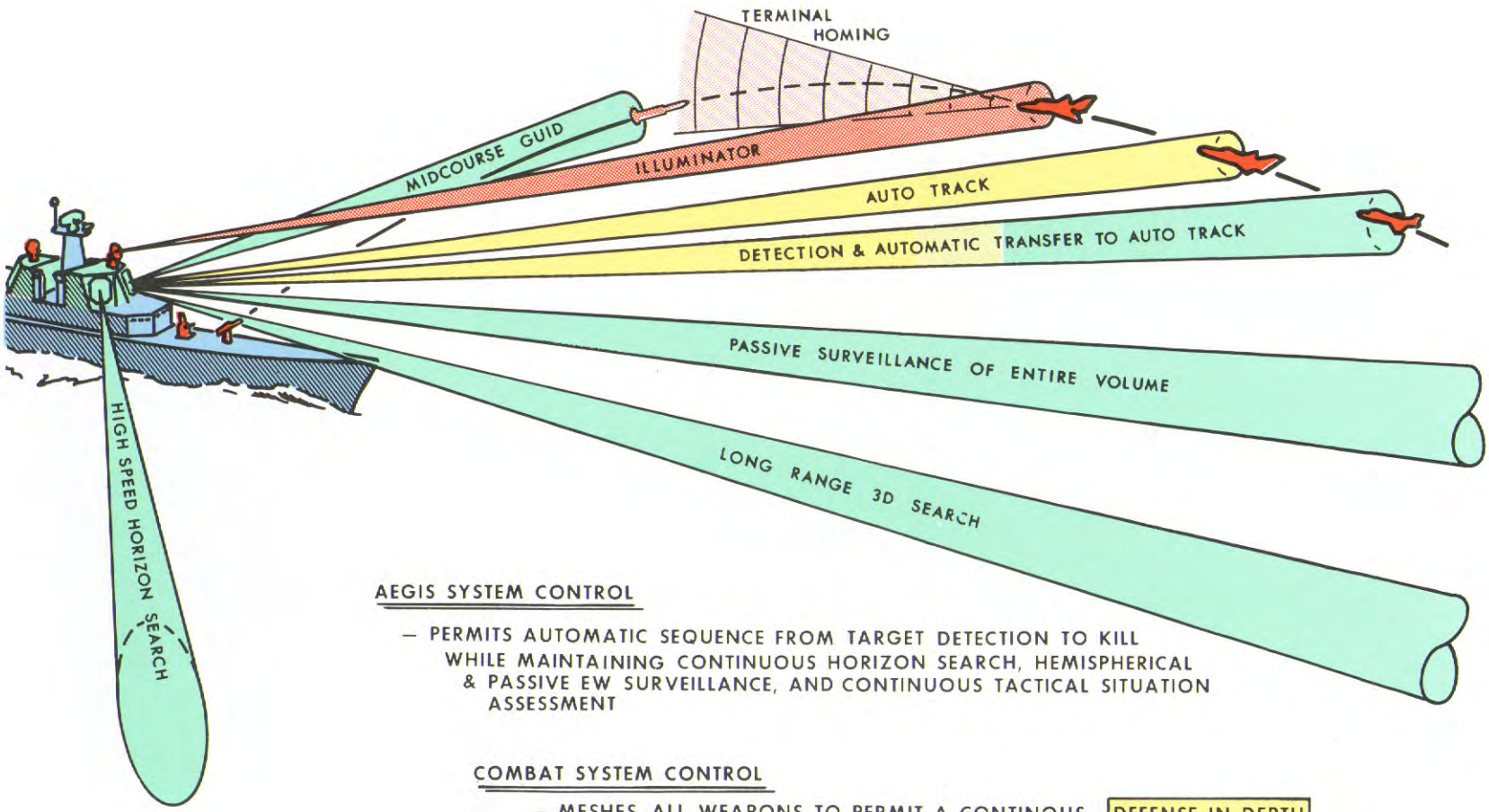
AND THE ENGAGEMENT IS CARRIED OUT TO INTERCEPT IN THE SEMI-ACTIVE HOMING MODE

SEVERAL MISSILES CAN BE MAINTAINED IN COMMAND MIDCOURSE CONTROL

WITH ADDITIONAL MISSILES IN TERMINAL SEMI-ACTIVE HOMING

AEGIS MULTI-FUNCTION SYSTEM

MK 7



AEGIS SYSTEM CONTROL

– PERMITS AUTOMATIC SEQUENCE FROM TARGET DETECTION TO KILL WHILE MAINTAINING CONTINUOUS HORIZON SEARCH, HEMISPHERICAL & PASSIVE EW SURVEILLANCE, AND CONTINUOUS TACTICAL SITUATION ASSESSMENT

COMBAT SYSTEM CONTROL

– MESHES ALL WEAPONS TO PERMIT A CONTINOUS DEFENSE IN DEPTH AND STILL REMAINS RESPONSIVE TO TACTICAL COMMAND

AEGIS FORCE COORDINATION PROVIDES CENTRALIZED AAW CONTROL DURING A BATTLE TO GIVE THE BEST DISTRIBUTION OF AVAILABLE FIREPOWER OVER THE ATTACKERS

USING AEGIS TO COORDINATE AAW DEFENSE WILL SIGNIFICANTLY INCREASE FORCE EFFECTIVENESS

—AEGIS COORDINATES FIRE OF ALL SHIPS AND DESIGNATES TARGETS BY SPECIFIC COORDINATES FOR ACQUISITION AND ENGAGEMENT. MIDCOURSE AND TERMINAL ILLUMINATION CARRIED OUT BY FIRING SHIP.

—AEGIS COORDINATES, DESIGNATES TARGETS TO SPECIFIC SHIPS, ORDERS FIRING, AND PROVIDES MID-COURSE GUIDANCE COMMANDS. TERMINAL ILLUMINATION CARRIED OUT BY FIRING SHIP OR AEGIS.

—AEGIS PROVIDES CLASS I AIR CONTROL VECTORS CAP AND DLI TO ENGAGE HOSTILE AIR TARGETS AT LONG RANGE IN COORDINATION WITH MISSILE DEFENSE

—AEGIS MAINTAINS FAST REACTION OWNSHIP AND AREA DEFENSE

AEGIS FUNCTIONS

—TARGET DETECTION AND TRACK
—IDENTIFICATION AND EVALUATION
—TARGET ASSIGNMENT AND SCHEDULING
—MISSILE MID-COURSE GUIDANCE
—KILL EVALUATION

FIRING SHIP FUNCTIONS

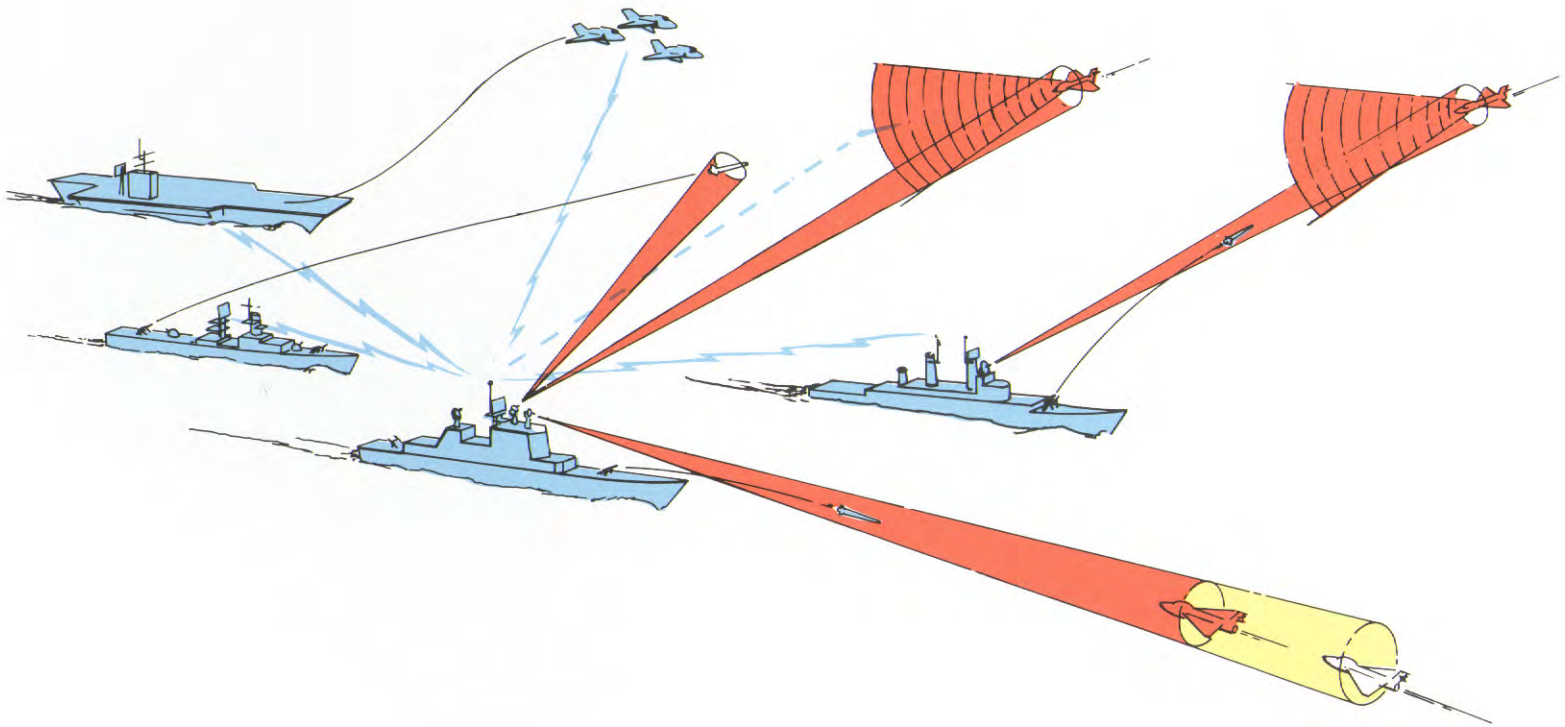
—LAUNCHER POINTING
—MISSILE FIRING
—TARGET ILLUMINATION

AEGIS AAW
FORCE COORDINATION & CONTROL

CLASS I
AIR CONTROL

OFF SHIP DESIGNATION &
MID-COURSE GUIDANCE

OFF SHIP COORDINATION &
DESIGNATION



COMBAT SYSTEM CONTROL
MAJOR ADVANTAGES SUMMARY

FLEET DOCTRINE MORE READILY IMPLEMENTED
AND COORDINATED WITH OTHER FLEET UNITS

FIGHTING CAPABILITY AND EFFECTIVENESS IMPROVED

SYSTEM INTERFACES IDENTIFIABLE AND MORE EASILY MANAGED

COMPUTER PROGRAMMING, PROCESSING
AND MEMORY REQUIREMENTS REDUCED

COST AND MANNING REQUIREMENT SUBSTANTIALLY REDUCED

TRAINING AND MAINTENANCE IMPROVED

SUBSYSTEM FAILURES LOCALIZED AND MINIMIZED

OVERHAUL AND MODERNIZATION SIMPLIFIED

ADAPTABILITY TO ALL SHIP CLASSES ASSURED

IN CONCLUSION

AAW SYSTEM TECHNOLOGY HAS EVOLVED THROUGH A SERIES OF STEPS FIRST DEPARTING FROM AND FINALLY APPROACHING A BASIC SET OF FUNCTIONALLY ORIENTED ELEMENTS

COMPUTER TECHNIQUES HAVE YIELDED SUBSTANTIAL POTENTIAL IMPROVEMENTS IN SYSTEM PERFORMANCE AND INTEGRATION

CURRENT AEGIS DIRECTION IS TOWARD THE DELIBERATE INTEGRATION OF WELL-DEFINED AND INDEPENDENTLY PROCURABLE SUBSYSTEMS APPLICABLE TO A VARIETY OF SHIP SIZES AND MISSION CONFIGURATIONS

AEGIS SYSTEM MAY BE OPERATED IN CONJUNCTION WITH OTHER WEAPON SYSTEMS UNDER CLOSE TACTICAL COORDINATION FROM COMMAND – TAKING FULL ADVANTAGE OF ALL DATA AVAILABLE TO CIC

IT ALSO MAY BE OPERATED UNDER ONLY GENERAL GUIDELINES FROM COMMAND SUCH AS A FREE-FIRE DIRECTION FOR SPECIFIED CLASSES OF TARGETS OR DESIGNATED AREAS OF COVERAGE.

FINALLY, PROVISION IS MADE FOR A COMPLETELY AUTONOMOUS CAPABILITY UNDER CASUALTY, TRAINING, OR TEST CONDITIONS

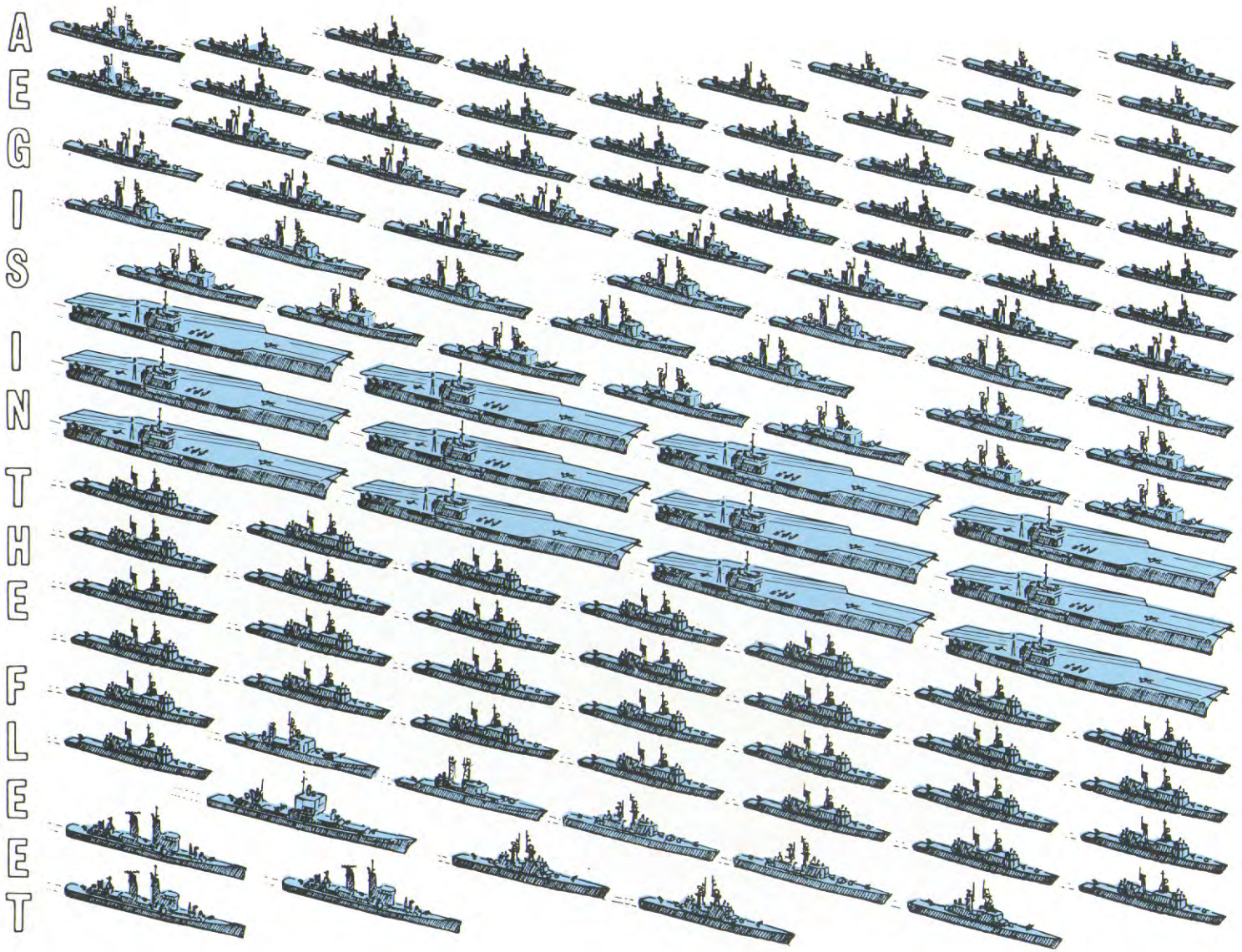
EPILOG

AEGIS IN THE FLEET

THERE ARE APPROXIMATELY 107 SHIPS CARRYING SURFACE MISSILE SYSTEMS IN TODAY'S NAVY OR IN PRESENT PLANNING. THESE SHIPS ARE DESTINED TO CARRY EITHER A THREE-T SYSTEM OR SOME VERSION OF A SHORT RANGE DEFENSIVE SYSTEM.

THE COMBAT SYSTEM CONTROL CONCEPT ENABLES THESE SHIPS TO BE EQUIPPED WITH THE AEGIS WEAPONS SYSTEMS OR ITS ELEMENTS, THIS WILL RAISE THE AAW EFFECTIVENESS OF THE FLEET TO LEVELS NEVER BEFORE ACHIEVED.

THE ADDITION OF AEGIS TO THE FLEET WILL BRING OUR FIRST CAPABILITY TO COORDINATE ALL UNITS OF THE FLEET TO PROVIDE STRONG DEFENSE IN DEPTH AND TO GIVE THE FORCE A CROSSFIRE CAPABILITY FOR AREA DEFENSE



GLOSSARY OF ABBREVIATIONS

AAWC—AAW COORDINATOR
A/C—AIR CONTROLLER
A/D—ANALOG TO DIGITAL
AIC—AIR INTERCEPT CONTROLLER
ASW—ANTI-SUBMARINE WARFARE
ASWC—ASW COORDINATOR
ASWO—ASW OPERATOR
BVP—BEACON VIDEO PROCESSOR
CAP—COMBAT AIR PATROL
CSC—COMBAT SYSTEM COORDINATOR
CO—COMMANDING OFFICER
DDSM—DIGITAL DATA SWITCHING MATRIX
DEAC—DATA EXCHANGE AUXILIARY CONSOLE
DLI—DECK LAUNCHED INTERCEPTORS
ESM—ELECTRONIC SUPPORT MANAGER
FCDC—FIRE CONTROL DIGITAL COMPUTER
FCSS—FIRE CONTROL SYSTEM SUPERVISOR
FWC—FORCE WEAPONS COORDINATOR
LSD—LARGE SCREEN DISPLAY
LSM—LAUNCHER SYSTEM MODULE
MAN—MANUAL (TRACKER)
MCC—MONITOR & CONTROL CONSOLE
MEC—MISSILE ENGAGEMENT CONTROLLER
MFCC—MISSILE FIRE CONTROL COMPUTER
PA/SG—PULSE AMPL/SYMBOL GEN
RAC—RADAR AZIMUTH CONVERTER
RDS—RADAR DISTRIBUTION SWITCHBOARD
RSS—RADAR SYSTEM SUPERVISOR
RTM—RADAR TRACK MANAGER
SDC—SIGNAL DATA CONVERTER
S/T—SPECIAL TRACKER
SUW—SURFACE WARFARE
SWC—SHIP WEAPONS COORDINATOR
TAO—TACTICAL ACTION OFFICER
TEWA—THREAT EVALUATION AND WEAPONS ASSIGNMENT
TIC—TACTICAL INFORMATION COORDINATOR
T&M—TEST & MONITOR
WCP—WEAPON CONTROL PANEL
WLO—WEAPONS LIAISON OFFICER