Ship Self Defence System Mk 2 and Data Distribution Standard (DDS)

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Evolving USN Functionality

SSDS MK 1
Standalone Self Defense
- LSD 41 Class
- 3 Operators
- 10 External Interfaces

SSDS MK 2 Mod 0
Weapon Control Integrated with existing CMS
- CVN 68 Only
- ACDS BLK 1 and CEC are Primary CS Elements
- 1 Operator
- 7 External Interfaces

SSDS MK 2 Mod 1/2/3
Multi-Warfare Combat Management System
- CVN 76/LPD 17/LHD 8
- CEC Fully Integrated
- Air/Sea/Under Sea/Land Track Picture
- 24 Operators
- 16 External Interfaces
- Includes C4I Connectivity, Data Links, Air Control, Force Orders, Etc.
- Mod 1A/2A/3A Have Hardware Technology Upgrade
Today’s Littoral Operations

- Close Proximity of Operating Forces
- Neutrals Mixed With Hostiles
- ID Deconfliction
- Environmental Factors
  - Ducting
  - Clutter
- Battlespace Encroachment
- Shallow Water ASW
- Mine Warfare
- Threat Diversity

Compressed Reaction Time

Degraded Situational Awareness
Anti-Air Warfare Threat

- Ownship must be capable of defending itself in the modern Anti-Ship Missile environment:
  - Less time to react
  - Larger raids of threats
  - Littoral Environment
The Evolving Threat

1998-2005
Near-Term is TOUGH

2006-2011
Mid-Term is HARDER

2012+
Far Term is DEADLY

THE RESPONSE

SSDS Layered/Automated
Detect-Control-Engage

Faster
Advanced Seeker
More Maneuverable
Increased Lethality
Low Altitude
Stealthy

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Layered Ship Self Defense

SEDUCTION
- Chaff
- Decoys
- Sophisticated Jamming Techniques

DISTRACTION
- Decoys
- Jammers
- Chaff

ELECTRONIC WARFARE

• Automated weapon response
• Doctrine-based control of automation
TECHEVAL Results

- First Successful Demonstration of a Fully Distributed, Open Architecture Combat System Utilizing:
  - Multi-Sensor Integrated Tactical Picture
  - Doctrine-based Defense Decisions
  - Automatic Detect - through - Engage Processing
  - Integrated Scheduling of Hard Kill and Soft Kill Weapons
- Detected, Tracking and Destroyed Multiple Missile Threats With RAM and CIWS
- Four Target Kills in Four Attempts
Physical Distribution and Redundancy Achieves Readiness Requirements

Tactical LAN (100 Mbps Ethernet)

- Tactical Picture LAU
- ASW/SUW LAU (Port)
- Nav LAU
- Point Defense LAU
- MK41 VLS
- MFR LAU
- MFR LAU
- ADIR MFR
- Acoustic LAU
- CIWS Barak
- MCMS Network
- METOC
- Depth Sounder
- Nav Bridge Control
- Propulsion Control
- Machinery Control
- Damage Control
- Torpedo Launcher
- SSM EOS
- LAU (Port)
- LAU (Stbd)
- CDS LAU
- EW LAU
- Radar/Intel LAU
- Data Recording LAU
- Met WS
- MCC Printer
- LAN (100 Mbps Ethernet)

LAU (Port)

LAU (Stbd)

SSM Torpedo Launcher

IRST ESM ECM DCLS

Data Link X-band Nav Radar IFF COMINT/DF

Raytheon Integrated Defense Systems

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SSDS Open Architecture

■ Open Architecture Precepts
  – Designed in from the ground up
  – Evolved from architecture established in SSDS MK 1
  – COTS processor and network technology
  – C++, CORBA, ACE, POSIX OS
  – Common data communications standards
  – Physically distributed for expansion

■ Extensible application design
  – Information-driven
  – Object-oriented
  – Component-based
  – Layered architecture
  – Survivable
  – Fault tolerant

■ Single Source Baseline
  – Supports three ship configurations
  – Supports three hardware configurations
SSDS MK 2 Open Architecture Migration

- U.S. Navy Open Architecture Computing Environment (OACE) Standards Compliance
  - Publish/subscribe middleware replacement with OACE compliant COTS (DDS)
  - OACE compliant processors and operating system (Intel/LynxOS)
- Elimination of Multiple LANs
- Gigabit Redundant Core Switch
- General Processing and External I/O Processing in Separate Cabinets
Hardware Configurations

SSDS MK 2 Mod 1A/2A/3A

- NSSMS LAU
- NAV LAU
- CDS LAU
- RAM 1 LAU
- RAM 2 LAU
- SLQ-32 LAU
- GW LAU
- Data Recording LAU
- SPS-67/73 LAU
- BFTT LAU
- Tactical LAN LAU
- Display LAN LAU
- Display Aux LAN LAU
- Display LAN
- Display Aux LAN A
- Display Aux LAN B
- 1/2 ASTABS (OPTIONAL)
- AN/YUQ-70s
- Command Control Group
- SWCH IO CHASSIS 2
- GP CHASSIS 2
- PCS
- Printer
- Printer
- Printer
- Printer

SSDS MK 2 OA

- AN/YUQ-70s
- Command Control Group
- OA LAN
- LAN SWITCH
- IO CHASSIS 1
- IO CHASSIS 2
- GP CHASSIS 1
- GP CHASSIS 2
- PCS
- Printer
- Data Recording
- ASTABS (OPTIONAL)

Single SSDS OA LAN
I/O processors separate from general processing
Data Recording moved to PCS
Components:
- manage subset of system attributes
- reporting changes in state of attributes
- triggered by changes in system state
- conform to common message definitions
OA Software Component Layered Abstraction Model

Software component structure is independent of OS platform
Model Driven Design

- Object Oriented Design
- Common message definition classes
- SC specific behavior added to derived class
- Auto-generation of skeleton code
Common Software Component Framework

Programmers add application-specific message and periodic processing to the standard frameworks.

The Local Track Server is tailored to include supporting source track data required by the host application.

Application Builder
- Alert Client
- Role Arbitrator
- State/Mode Client
- Persistent Data Client

Message Factory
- Common Message 1
- Application Specific Processing
- Common Message n
- Application Specific Processing

Periodic Manager
- Application Specific Periodic Processing 1
- Application Specific Periodic Processing n

Local Track Server
- System Track
- Tracker Supporting Source
- TDL Supporting Source
- SLQ-32 Supporting Source
U.S. Navy Standard Command and Control

- Establish a Common Architecture for all Navy Command and Control Systems
- Core Extensible Infrastructure to Provide Common Services and Capability
  - Resource Management
  - Navigation Data
  - Time Services
- Compile Inventory of Reusable/Configurable Functional Components
  - Track Management
  - Weapons Management
- Cooperation with Industry
  - Raytheon
  - Lockheed Martin
Extensibility Was Major SSDS Architectural Driver

- Open computing architecture
  - COTS processor and network technology
  - C++, CORBA, ACE, POSIX OS
  - Common data communications standards
  - Physically distributed for expansion

- Extensible application design
  - Information-driven
  - Object-oriented
  - Component-based
  - Layered architecture
  - Survivable
  - Fault Tolerant
When Seconds Count

SSDS Provides Cost Effective Ship Self-Defense
With High Probability of Raid Annihilation Through:
• State of the Art Sensor Integration
• Quick Reaction Through Automation & Efficient Human / Machine Interface
• Coordination of Weapons
• Based on Industry Standards