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

<table>
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<th>Time to Impact Ship (Sec)</th>
<th>2000's</th>
<th>1980's</th>
<th>1970's</th>
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- Detectors: Pop-up, High Altitude, High Divers, Bombs and Aircraft Launched ASMs, Stand-off Jammer, Grenades/Rockets/Laser Guided Missiles
- Classifiers: Fighter Bomber
- Killers: Sea Skimmer
The Evolving Threat

1998-2005
Near-Term is TOUGH

2006-2011
Mid-Term is HARDER

2012+
Far Term is DEADLY

– Faster
– Advanced Seeker
– More Maneuverable
– Increased Lethality
– Low Altitude
– Stealthy

THE RESPONSE

SSDS Layered/Automated Detect-Control-Engage

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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, Tracked and Destroyed Multiple Missile Threats With RAM and CIWS

- Four Target Kills in Four Attempts
Physical Distribution and Redundancy Achieves Readiness Requirements
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
SSDS Layered Architecture
Open Architecture with TSCE-I

Presentation
Operator Mode Control
Graphics
Operator Mode Tcl Scripts

Application (Kernel)
System Track Mgr
System Track ID
Decision Aids
Engage Decision
Weapon Scheduling
Air Control

Application (Adaptive)
SIAC SC
Supporting
Supporting
Supporting

Common Application Services
Data Recording
NAV/GPS
Map Builder
Graphics Lib Mgr
Alert Manager
Display Data Servers
Display Filters
Local Track Server

Common Technical Services
Persistent Data
Data Extraction
Error Logging
Message Factory
Node Management
SCSM Client
Role Arbiter
Tcl/Tk Interpreter
TDK (CDK 4.0)

Middleware Services
IRIG
NTP
Local Resource Mgr
Time Services
CORBA TAO ORB
R/T Event Channel
AMI
ACE Notifier
ACE

Message Transport Services (DDS)

Operating Environment
Lynx OS
UDP/IP
TCP/IP
SOLARIS

Physical Environment
Intel x86
NTDS
External I/O
FDDI
SCSI
Ethernet
SUN SPARC

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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
- Tactical LAN LAU
- Command Control Group
- AN/UYQ-70s
- Display LAN LAU
- Display LAN Router LAU
- Display Aux LAN LAU
- BFTT LAU
- PCS
- MC 1
- Printer
- MC 2
- Printer
- 1/2 ASTABS (OPTIONAL)
- Tactical LAN

SSDS MK 2 OA

- AN/UYQ-70s
- Command Control Group
- LAN SWITCH
- IO CHASSIS 1
- IO CHASSIS 2
- GP CHASSIS 1
- GP CHASSIS 2
- OA LAN
- NTP & FILE SERVER
- PCS
- ASTABS (OPTIONAL)
- Printer
- Single SSDS OA LAN
- I/O processors separate from general processing
- Data Recording moved to PCS
Publish/Subscribe Common Information Model

Components:
- manage subset of system attributes
- reporting changes in state of attributes
- triggered by changes in system state
- conform to common message definitions

Data-Oriented API (Publish/Subscribe Model)

Common Information Architecture

Data Transport Services
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