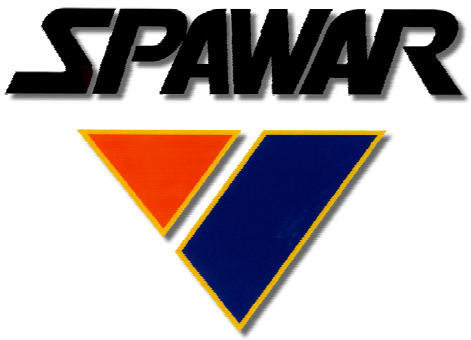


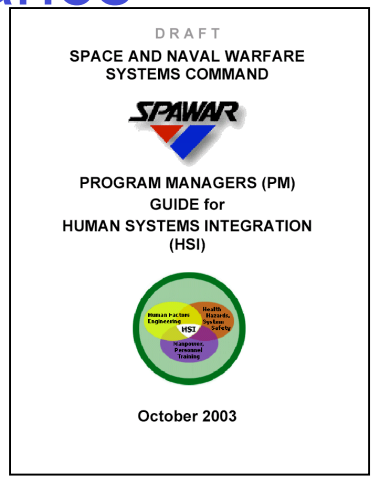
Human Systems Integration (HSI):

Trident Warrior

FORCEnet Assessment

HSI at SPAWAR

- Architecture, Standards, and Compliance
  - Program Managers Guide
  - HSI Plans
  - Compliance Checklists for PMs
- HSI Lessons Learned Data
  - Human Performance Center
  - Operation Iraqi Freedom post deployment Qs
    - SSC San Diego and NETWARCOM
- Education Program
  - Symposia and Workshops on HIS for SPAWAR Execs and PMs



Support Program Management

- PMW 157 - Naval C^2 Systems PM
  - Assess HSI problems reported with GCCS-M
    - Human Performance Center, Norfolk
    - NETWARCOM / SSC San Diego survey
  - Usability test of GCCS applications
- PM liaison, e.g.
  - PMW 179 - Advanced Automated Tactical Communications
  - PMW 165 - Naval Afloat Networks
  - PMW 189 Ships Signal Exploitation Equipment
  - PMW 150 METOC
  - PMW 176 Navy Satellite Communications

HSI at SPAWAR

- Working Groups/External Forums
  - Virtual SYSCOM HSI Working Group
  - SEAPRINT
  - FORCEnet HSI Working Group
  - SEA WARRIOR
- Fleet Exercise and Simulation Assessments and Analyses
  - Limited Objective Experiments: JRaptor
  - Fleet Exercises: Trident Warrior

What is a Trident Warrior?

Trident Warrior is:

- The Major FORCEnet Sea Trial Experiment
- Annual
- NETWARCOM sponsored

Trident Warrior Experiment Intent

- Provide a rapid fielding of improved warfighting capability to the Fleet, with full supportability and maintainability.
- Develop supporting Tactics, Techniques, Procedures, and Concepts of Operations (CONOPS) on how best to use FORCEnet to optimize Naval operations.

Trident Warrior 03 and 04

TW 03		TW04
NETWARCOM	**Executive Agent**	NETWARCOM
OP 61	**Resource Sponsor**	OP 61
SPAWAR	**Chief Engineer**	SPAWAR
COMSEVENTHFLT	**OCE**	COMTHIRDFLT
Naval PG School	**Analysis**	Naval PG School
Essex ESG	**Participants**	Tarawa ESG
Sep 2003	**Date**	Oct 2004
WESTPAC, Okinawa	**Location**	EAST/MIDPAC Op Areas
	Forces	USS Georgia SSGN 729

* Ohio class SSBN converted to SSGN w/ Tomahawk

- NETWARCOM coordinates / leads Fn experimentation
- SPAWAR funds and executes experimentation
- TW 04 Linked with Exercise Silent Hammer: COMSUBPAC OTC

TW 03 FORCEnet Demonstration

HSI Objectives: Identify HSI requirements and deficiencies with FORCEnet technologies

- Shared Situation Awareness: A common perception and understanding of the tactical battle space and of the roles, responsibilities, and actions of other War fighters
- Efficiency of Asset Utilization: Length of time needed to assign an asset, time needed to complete a mission, number of tasks accomplished
- Speed of Command: Time from when an event occurred until the ordered action was completed

FORCEnet Processes and Technologies: TW 03

Call for Fires

- NFCS Gun Fire Control
- AFATDS Fire Planning Deconfliction, Scheduling
- SACC and FSCC Coordination Centers

Command Control and Collaboration

- GCCS-M
- Web Common Operational Picture (WebCop)
- Chat and MS NetMeeting

Network Operations

- IT Network Monitoring and Traffic Management

HSI Metrics for TW Series

- Common understanding among decision makers
  - Degree of shared situation awareness
- Number of requests for additional information
- Time to receive information requested
- Workload rating
- Use of chat for collaboration
- Awareness of network status and other system conditions
- Time to complete tasking and produce reports
- Time to detect and correct for network change / outage
- Accuracy in locating training materials and job aids
- Time to access Sea Warrior information
- How Sea Warrior fulfills skill requirements of Fn systems

TW-03 HSI Evaluation

- Loss of SA
  - Displays did not support Flag Plot functions
  - Poor workspace layout (screen real estate)
  - Many websites / portals / chat rooms to monitor
- Speed of Command Not Enhanced
  - 26 minutes for NBC report
  - 8 minutes to assess hostile intent of track
- Information Exchange Shortcomings
  - Chat orders not always acknowledged - lack of standard protocol
  - Technical incompatibilities among different chat systems
- Little or no system integration training provided for new Fn systems
  - Crew unaware of Fn capabilities
- Manpower analysis for new Fn systems not addressed; legacy systems remain

TW 03 HSI Evaluation

- User interfaces need improvement: display configurations, workspace layouts, inefficiencies in how information was transferred within and between command centers; legibility of shared displays, and access to task-relevant information
- While training was provided on individual FORCEnet systems, no instruction was available on how to employ systems for maximal operational effectiveness resulting in operational inefficiencies
- Insufficient manpower available for new FORCEnet capabilities and legacy systems
- Lack of shared awareness between ESG and SACC
  - ESG Flag Plot did not know about every target being taken until Supporting Arms Coordination Center (SACC) asked for a battle damage estimate

TW03: HSI Evaluation

- Flag Plot in Expeditionary Strike Group (ESG) did not know about every target being taken until Supporting Arms Coordination Center (SACC) asked for a battle damage estimate
  - Lack of Shared Situation Awareness between ESG and SACC
- Insufficiently developed concept of operations for integrating Fn technologies with current information transfer procedures.
- Warfighter unable to fully understand how to employ Fn capabilities.

TW 03: Recommendations

- Develop Concept of Operations for FORCEnet technologies within ESG organization
- Deliver scenario-based training for operators followed by opportunities to use the systems
- Employ a total systems training approach, including use of job aids (both paper and electronic) and context-oriented on-line help

HSI Objectives in TW-04

Improve integration and employment of the warfighter with FORCEnet systems for more effective command and control. Enhance COP and SA

- Increase efficiency of asset use
- Increase speed of command
- Reduce training requirements
- Reduce manning requirements

HSI Differences Between TW03 and TW04

- Longer lead time and better planning
  - HSI involved from the beginning
- More objective measures
- Better design of some user interfaces
- Integrated training environment
- Incorporating SEAWARRIOR

Trident Warrior 05

TW 05 Plans

- Carrier Strike Group TBD
- Coalition Networks
- Multi-Level Security Systems
- Inter-Force Wireless Networks
- Joint Distributed C^2

Continued HSI Involvement

- Continued HSI assessment of FORCEnet
  - Fleet exercises
  - Experiments
  - Demonstrations

- Provides valuable insight into
  - Fn effectiveness
  - Diagnosing problem areas … leading to recommendations for improvement
  - Cost benefit … pointing to areas of manning and training savings
  - Increased operational effectiveness and efficiency

BACKUP

Why do HSI?

- **Aegis Combat Information Center**
  - Combat team of 4 doing the work of 8
  - No increase in overall workload
- **Tactical Tomahawk (v 5)**
  - 40% reduction in cognitive workload over v 4
- **COMCARGRU 3 Knowledge-Web (OEF)**
  - Command decisions 6X faster (1.5 vice 8 hours)
  - "Knowledge" disseminated as it is created (.5-1 vice 8-24 hours)
  - Near real-time SA in distributed command environment .25 vice 4-8 hours)
- **Tactical Decision Making Under Stress (TADMUS) - Vincennes accident**
  - Fewer Situational Awareness errors - 35% improvement in identification of critical contacts
  - Faster sharing of information - 30% fewer clarification communications
- **Comanche Crew**
  - Number of Soldier skill ratings required reduced by 70%
- **Fox Combat Vehicle**
  - Reduced crew size from 4 to 3
  - 20% reduction in mission time

Cost Savings

✓Comanche - $3.29B
✓Aegis - $1.3B (projected)
✓Fox - $2-4M

TW 03 Finding: MOEs

Operational Process	Measure of Effectiveness				
	Performance	User Interface	Information Transfer	Training	Manpower& Personnel
Call For Fires	G	G	Y	Y	Y
C^2 / Collaboration	Y	Y	Y	Y	G
Network Operations	G	Y	⊘	Y	⊘

- G — Fully functional. Meets requirements but can be improved with minor modifications.
- Y — Functional but requires substantial modifications.
- R — Largely non-functional and needs major modifications.
- ⊘ — Inadequate data were available for valid assessment.

TW 03 HSI Finding: User Interfaces

User interface to collaboration and communication management tools were complex and difficult to use.

- **Material:**
  - **Action: Use FORCEnet Compliance Process and Checklist to assure usability in designing the following capabilities:**
    - **A naval enterprise chat tool for Operational Forces**
    - **Communications and Bandwidth Management tools**
  - **Impact: Improved user interfaces will reduce workload and time to perform mission critical tasks.**

TW 03 HSI Finding: Systems Training

No System of Systems Training

- **Training:**
  - **Action: Require that participating programs provide 'Watch Officer/Manager' level training for each participating technology. Resource the appropriate agent to develop 'System of Systems' training for Trident Warrior founded on CONOPS, TTP and the Watch Officer/Manager level training from each of the programs. Prepare content to be delivered in multiple formats including Web-Based, Computer Based and Instructor Led.**
  - **Impact: System of systems training on how to employ capabilities for maximal operational effectiveness will greatly improve acceptance and increase utility of FORCEnet systems.**

TW 03 Finding: Call For Fires

Performance

- Very limited shared SA among Flag Plot, SACC, and LFOC.
- SACC
  - Drawbacks: did not hold BDA on targets once the target was issued to a Fires resource. Flag Plot did not know about every target being taken until SACC asked for BDA.
- ADOCS: Supplies adequate amount of task-relevant information
  - Drawbacks: very slow when running other software, including C
  - PC.
- AFATDS: Works well if operator is well trained: maintains COP, deconflicts fires, and has good interoperability. Simplifies identification of force locations and status.
  - Drawbacks: a need to enter database and IP addresses and slow processing speed.
- NFCS: Presents information so it can be readily understood.

User Interface

- ADOCS: No specific usability problems were noted. Displays are easy to read.
- AFATDS: The better trained, frequent users rated AFATDS as very usable. Displays were easy to read, and information was presented logically.
  - Drawbacks: limited error prevention and detection, inconsistent color-coding, use of non-standard commands, and incomplete user feedback.
- NFCS: Provides immediate error notification.

TW 03 Finding: Call For Fires

Information Transfer

- Technical integration across systems for fires process worked very well.
  - Drawbacks: Problems observed in transferring information between SACC and ESG. Only way to exchange information between SACC, LFOC, and Flag Plot was via Chat.
- Time Sensitive Targeting messages were often sent directly from JIC to SACC.
  - Drawbacks: Flag Plot was not always aware of TST in progress.
- ADOCS: 2/3 of users felt that ADOCS did not enhance SA and did not help to identify force locations, understand status of users and equipment, and track tasking and scheduling.
  - Drawbacks: Problems noted in understanding status of other users and their equipment, estimating opposing forces capabilities, anticipating responses to Blue actions, identifying and resolving scheduling conflicts, time lag between SA and real events, and shared SA among team members.
- AFATDS: Supported SA and helped to identify force locations, understand status of users and equipment, and track tasking and scheduling.
  - Drawbacks: Potential SA problems noted in monitoring critical events; resolving scheduling and resource conflicts, and anticipating responses to blue actions.
- NFCS: Presents information so it can be readily understood.

TW 03 Finding: Call For Fires

Training

- A systems integration guide is needed to show how individual CFF technologies relate to each other from an operational (task) perspective.
- ADOCS: Training was described as inadequate. Procedures were not well understood and users wanted more training.
- AFATDS: More extensive formal training is needed. Users often did not understand AFATDS procedures or find job aids useful. The number of requests for technical assistance (to setup the system) was excessive.
- NFCS: More training needed to gain competence (4 hours training provided).

Manpower/Personnel

- Manpower was only one-deep for most CFF technologies.

TW 03 Finding: C² / Collaboration

Performance

- The Flag Plot watch team took 14 minutes to find the right format for an NBC-1 Report and 12 minutes to draft the message.
- The best SA was gained through the voice SITREPS.
- Chat:
  - Drawbacks: Multiple Chat tools caused confusion. Several users noted that monitoring several chat rooms increased their workload. Navy Enterprise Portal helps to consolidate chat rooms, but does not work with all chat programs.
- GCCS-M: Frequent users can reduce the time needed to organize information and decide what actions to take.
- NetMeeting:
  - Drawbacks: Requires a lot of bandwidth. Consistent availability is an issue. Whiteboard slowed system down too much, creating unacceptable time lags. The 10 user limit was a serious shortcoming. File transfers were rated disorganized and ineffective.
- WebCOP: Worked well; used for briefs in Flag Plot.
  - Drawbacks: Occasionally, COP was lacking: (a) COP in Flag Plot was did not match COP on the Chancellorsville; and (b) specific objects could not be located or their map locations were inaccurate.

TW 03 Finding: C² / Collaboration

User Interface

- Ergonomic deficiencies in the Flag Plot workspace:
  - High traffic and noise levels hindered task performance and development of SA.
  - Traffic flow intermittently blocked view of large screen displays at front of Flag Plot.
  - Legibility of text on large screen displays in Flag Plot was poor for observers seated in the back of Flag Plot.
  - Locations of some displays produced difficult viewing angles.
- Technical incompatibilities among the different Chat systems.
- Flag spaces need larger displays for watch-standers.
  - Multiple-screen console (e.g., Multi-Modal Watch Station or Knowledge Desk) would be helpful.
- Chat: Good screen legibility, information presentation, and navigation.
  - Drawbacks: (a) inadequate feedback, (b) poor error prevention and recovery, (c) difficulties in gaining SA without viewing entire chat sequence (scrolling issues), (d) limited formatting capabilities, and (e) pressing the Enter key inadvertently sends Chat message.
- GCCS-M:
  - Drawbacks: non-standard and/or inconsistent icons, menus, buttons, navigation, operating procedures, and commands. Large amount of information clutters its display. Inadequate error prevention and recovery.
- NetMeeting:
  - Drawbacks: information presentation, navigation, and error detection and recovery. A single user was required to participate in different chat rooms to talk to different echelons, making it difficult to coordinate fires, creating delays, and increasing operator workload.
- WebCOP: Displays were easy to read and information was presented logically.
  - Drawbacks: non-standard tab structure, scroll bars, commands, button placement, and option selection format on some menus.

TW 03 Finding: C² / Collaboration

Information Transfer

- Much 'sneaker net' occurred between key watch standers in the JIC and LFOC going to and from the Flag Plot.
- Chat: Chat generally reduced time and effort needed to identify users, exchange information, and support coordination among users.
  - Drawbacks: Confusion occurred when orders sent via Chat were not acknowledged. Timely messages dependent on typing skills of sender. BWC had to approve all chat dialogue before it was sent.
- GCCS-M: Generally, simplified identifying force locations.
  - Drawbacks: SA problems: (a) Keeping track of tasking, scheduling, and critical events; (b) Identifying scheduling and resource conflicts; (c) Tracking progress toward objectives, and (d) Anticipating responses to blue actions. Some users felt their SA lagged significantly behind actual events. (Catastrophic effect if GCCS is used to provide track information for fire support systems.)
- WebCOP: Kept track of mission goals and objectives, critical events, and goals and actions.
  - Drawbacks: SA ratings were moderately negative.

TW 03 Finding: C^2 / Collaboration

Training

- Crew was largely unaware of capabilities of Fn technologies.
- New concepts of operations, with staff familiarity, is needed to promote effective collaboration using the Fn technologies.
- The tempo of operations in Flag Plot was very high, due in part to confusion over the use of the new C^2 Fn technologies.
- Lack of standardized message posting procedures on the ESG web site complicated finding information.

GCCS-M:

- Many users did not understand procedures, felt inadequately trained, and that documentation and online help needed improvement.

Chat

- Drawbacks: More simultaneous chat rooms were in use than could be effectively monitored and serviced by the assigned staff.

TW 03 Finding: Network Operations

Performance

- The Marines' HF ALE radios do both voice and data. Shipboard radios could not handle data, voice only.
- SHF was difficult for the operators and administrators to manage. If the hardware is powered down, all configuration settings are lost, requiring increased workload to reconfigure.

Training

- Training for the new network technologies was marginal and left to individual ships. ITs were not given training on the Network Operations system as a whole. Single technology expertise is inadequate since network technologies are becoming highly interrelated.

Manpower/Personnel

- Manpower insufficient to cover new FORCEnet systems. IT manning was already minimal for established systems. The new technologies put IT departments in a manpower deficit.