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Commander,
Surface Warfare Development Group
(SWDG – 21)

“SHAREM – 37 Years of Lessons Learned”

David E. Gilbert – SWDG TD
SHAREM
37 Years of Lessons Learned

- Background/Overview
- Improved-SHAREM Process
- Metrics
- Lessons Learned
Naval Warfare Center of Excellence

- Develops, improves, tests, validates, and evaluates fleet doctrine and platform- and mission-specific TTP
- Secondary roles in enhancing the capability of the Navy forces to operate effectively in unilateral, joint, and coalition operations
- Additional Duties Include:
  - Responsibilities in the areas of operational test and evaluation,
  - Research and development,
  - Experimentation,
  - Modeling and simulation,
  - War gaming,
  - Requirements definition,
  - Joint and allied doctrine and TTP development.
The Readiness Effectiveness Measuring (REM) Program(s)

**Technical ...**

*How well does it work?*

- Systems
- Sensors
- Weapons
- Command and Control
- Systems Integration

**Training ...**

*Do we know how to operate it?*

- Systems
- Sensors
- Weapons
- Command and Control
- Systems Integration

**Tactical ...**

*How is it employed against the threat?*

- Tactics, Techniques & Procedures

---

Empirical Data
High Level Assessment vs. REM

- **High Level Assessments conducted at the integrated or Warfare Commander & above level**
  - Primarily ascertains Staff’s ability to effectively plan & implement a campaign at the operational & tactical level
  - Planning considerations are driven by expected unit performance
  - Asset allocation driven by performance trade-offs

- **REM analysis conducted at the unit level down to the individual unit, sensor package & weapon**
  - Empirical data collected provides critical performance feedback to tactical & operational planners
  - Allows individual units to ascertain innate capabilities and adjust operational plans at the tactical level
  - Identifies performance levels and sets operational capabilities
  - Provides optimal asset mix for various tactical considerations
  - Identifies potential game changer systems or weapons
  - Identifies and provides capability gap non-materiel solutions
REM Program

Where is the Focus?

Fundamentally unit performance determines IPCLs & Gaps

- **REM programs analyze unit performance**
  - Sensor performance
  - Weapon effectiveness
  - Human factors
  - Overall system effectiveness
  - Causality factors

- **Integrated assessment is the Monday morning Coaches debate**
  - What could have been done differently?
  - How well did we execute the plan?

- **Individual units make the plays on the battlefield – not the staff**
  - Unit performance determines where gaps exist
  - Gaps determine integrated priority capability lists

**Find – Fix – Track – Target – Engage – Assess**

All Unit Level Functions – Regardless of Warfare Area
REM Program
What does it Measure?

- **Find** – sensor capabilities against known targets
  - Structured events establish optimal performance – “as good as it gets” – involves ability to correctly classify
  - Exceptions: National Sensors and other programs

- **Fix** – ability of sensor system to localize TOIs
  - Function of sensor’s collective errors in range and bearing

- **Track** – ability of sensor system to maintain contact and establish course and speed information

- **Target** – ability of sensor-weapon system pair to achieve targeting quality solution

- **Engage** – sensor-weapon system ability to consummate the kill chain

- **Assess** – ability of sensor-weapon system pair to ascertain engagement success
  - May be some staff functions in this area

Generally Broader in Scope ... Than pure experimentation
REM Program
What does it Provide?

- **Acquisition Community**
  - Provides legacy system performance feedback – identifies potential upgrade points
  - Early evaluation of developmental systems
  - Identifies human factor issues
  - Operational capability vs. engineering assessment

- **Research & Development Community**
  - Focuses R&D efforts in capability gap areas
  - Venue for evaluating developmental efforts

- **Training Community**
  - At-Sea Operational Feedback loop
  - Data for FST-U implementation
  - Identifies NCEA requirements

Real World – Operational Environment – Representative Threats
Systems Tactically Employed – ROC & POE Validation – Fleet Operators
REM Program
What does it Provide?

- **Warfighter**
  - Hot Wash-up Rapid feedback on exercise results – 90% solution
  - What happened – may not have answers to why it happened
  - Current capability assessment in areas of immediate interest
  - Feedback for MCO planning

- **Doctrine & Tactics Community**
  - Tactical development, validation, verification & refinement venue
  - Identifies and develops non-materiel solutions to mitigate or resolve current capability gaps

Real World – Operational Environment – Representative Threats
Tactically Focused – Areas of Interest - What it takes to win...
REM Program
What makes It Effective?

- Annual Goal End State established
- Objectives agreed upon up & down Chain of Command
  - Prioritized to achieve End State Goals
- Analysis Plan developed that supports objectives
- Exercise/Experimentation Time & Assets Allocation
  - Determined by assessing the objective data collection requirements
- Post-ex Analysis – Levels of Granularity
  - Participant Feedback
  - Determine progress towards end-state goals
  - Assess key performance parameters
  - Update trend analysis
- Review, Revise & Refine Annual Plan to attain Goals
  - Compare to hypotheses – make corrections as necessary
  - Feedback to Sponsor & Stakeholders
Established by CNO in 1969 to quantitatively assess surface ship ASW performance (circa UPTIDE Experimentation)

- COMSURFWARDEVGRU: Executive Agent

- Assess surface ship and ASW force performance
- Identify fleet deficiencies and shortfalls
- Informs Fleet Investment Strategy - identifying requirements and guiding procurement process
- Provide test bed to evaluate new technologies, systems, and prototypes
- Maintain database on ASW sensor & weapon performance
- Site specific areas of interest shift in 1992 – more tactically relevant/representative – response to C5F request

**SHAREM History**

**Ships’ ASW Readiness, Effectiveness Measuring (SHAREM) Program**
SHAREM Evolution

- **Originally purely an engineering evaluation**
  - ASW systems were groomed
  - Performance evaluated against established acceptance metrics

- **Gradual shift to tactical evaluation**
  - Exercises limited, primarily, to East Coast assets
  - Typically regarded as goal-post to goal-post events

- **Area of interest shift in early 1990s**
  - Conduct exercises in forward deployed, tactically significant areas
  - Participants on deployment
  - Representative threats and/or threat tactics
  - Assess current state expected performance
  - Combination structured and freeplay evaluations
Think Again…
SHAREM
37 Years of Lessons Learned

✓ Background/Overview
❖ Improved-SHAREM Process
❑ Metrics
❑ Lessons Learned
**Improved SHAREM Analysis Thread**

**Objectives**
- Standard
- Detection
- Classification
- Localization
- Attack
- Specific
  - FLT CDRs
  - DESRONs
- System Tests

**Analysis Plan**
- Define COI
- Analytical Procedure
- Evaluation Criteria
- Specifies data to be collected

**Test Plan**
- Detailed Procedures for Conducting Events

**Data Collection Plan**
- Data collected supports objectives and R&A

**Process Management Plan**
- Provides processes/procedures for SHAREM Program execution

**Out Products**
- Hot Wash Brief
- Quicklook MSG
- Flag Brief
- R&A Report

**Improved SHAREM Timeline**

- COMEX (-6 mos)
- COMEX (-5 mos)
- COMEX (-4 mos)
- COMEX (-3 mos)
- COMEX (-2 mos)
- COMEX (-1 mos)
- Conduct Exercise
- FINEX (+1 mos)
- FINEX (+2 mos)
- FINEX (+3-6 mos)

**IPC**
- MPC
- Analysis Plan
- FPC
- Hot Wash Brief
- Flag Brief (45 days)
- Quicklook MSG (7 working days)

**Reach Back Cell Stands Up**
- Provide in-stride R&A and Event Replay (AVI’s)

**We do the work!**

**Rapid Warfighter Assessment & Feedback Desired**
Provide a tactical development and validation vehicle
- Realistic, tactically significant environments
- Multi-platform USW force: ships, aircraft, submarines, SURTASS
- Coalition partner involvement
- Ground truth track reconstruction
- Extensive analysis & meteorological impact assessment
- Validated results for training, doctrine, and programmatic decisions
- Identify and provide non-materiel solutions
- Mitigate current gaps and optimize fielded systems with TTP
- Address Warfighter concerns and provide rapid feedback

Sensor & Weapon System performance assessment
- Employed in tactical areas of interest
- Representative threats & tactics (or emulations thereof)
- Performance across the ‘kill chain’
- Identify materiel performance shortfalls
I-SHAREM
Measurements & Evaluations

- Acoustic & non-acoustic sensor detection & classification effectiveness
- ASW localization procedures & tactics; accuracy & timeliness
- ASW attack procedures, weapons & tactics
- ASW C4I and data fusion in Task Force operations
- Acoustic and non-acoustic vulnerability to detection and attack by (diesel) submarines
- Ability of ASW forces to exploit the environment
I-SHAREM
Hot-Wash Products
Multi-Static ASW
Physics Experiment/Test

Surface Warfare Center of Excellence
Multi-Static ASW

Tactical Experiment

Surface Warfare Center of Excellence

22 nm

30 nm

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SHAREM
37 Years of Lessons Learned

- Background/Overview
- Improved-SHAREM Process
  - Metrics
- Lessons Learned
**Improved SHAREM Analysis**

*Best metrics are independent of platform actions or exercise design*

- **Probability of Detection as a Function of Lateral Range**
  Proper implementation requires imposing course and speed restrictions on the target.

- **Hold Time**
  Assumes the presence of a target in the area. Difficult to normalize size and shape of the target OPAREA.

- **Contact Validity Ratio**
  Assumes the presence of a submarine in the operating area and is a function of target operating area and target density.

- **Cumulative Probability of Detection**
  Accounts for target distance regardless of target movement.

- **Time Expended Tracking Invalid Contacts**
  Independent of submarine location or size of the target operating area “cost of doing business” concern relatively independent of other factors.

- **False Contact Rate**
  Considers invalid contacts only. Submarine location and OPAREA size do not matter.

---

“An exercise without analysis is, at best, a demonstration...”
Improved SHAREM Metrics

**Find**

Detection and Classification
- \( CP_d \)
- \( CP_{d&c} \)
- False Contact Rate
- Probability of False Contact

**Track**

Tracking
- Percent Time Tracking Invalid Contacts
- Ability to maintain track

**Fix**

Localization
- Localization Probability

**Target**

Attack Effectiveness
- Invalid Attack Rate
- Invalid Attack Probability
- Valid Attack Probability

**Engage**

Assess

Independent & Defensible Measures
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I-SHAREM
One Exercise – One Day

Graph showing the relationship between Range (kyd) and Probability of Detection.
**I-SHAREM**

*Same Exercise – Another Day*

Judging overall performance based on data from one event = Danger!
SHAREM
37 Years of Lessons Learned

- Background/Overview
- Improved-SHAREM Process
- MOEs & MOPs
- Lessons Learned
Lessons Learned
Evolving to Match Environment...

- Exercises designed to objectives - Sequence is critical
  - Start with objectives – limit the number or acknowledge failure
  - Develop analysis plan to support objectives
  - Identify data requirements based on objectives and analysis plan
  - Design exercise (experiment) to support objectives
  - Detailed data collection and analysis plan up-front!

- Expanded use of Limited Objective Experiments (LOEs)
  - Smaller scale easier to manage,
  - Better ensures goal attainment

- Trade-offs between exercise and experiment requirements
  - Requires early “buy-in” on priorities by all concerned
  - Prioritization of events to ensure realization of objectives
  - Incorporation of desires requires deconfliction

- SHAREM IPT sets objectives and schedules venues

SWDG remains the honest broker for Surface Warfare Capabilities
Lessons Learned
Technologies - Only part of the solution

- Unrealized potential remains when systems are used without complete understanding
- New systems require different thinking & TTP
  - Systems lacking TTP will be sub-optimized
  - New systems may not perform as advertised – but will definitely be sub-optimized without accompanying TTP
- Technology inserts are not silver bullets and may only have niche applications
  - Systems need to be integrated & interoperable
- Improved SHAREM analysis provides comparable answers between disparate technologies

“Any order of magnitude change requires completely new thinking – old methods may no longer be applicable...” – Richard Hamming
Training provides basics – practice yields proficiency

Establishing training & proficiency levels key
- Assesses training/proficiency impact on overall performance
- Informs training community on knowledge gaps
- Establishes ‘remedial’ and/or ‘refresh’ training requirements
- Guides synthetic trainer developments
- Informs Fleet Response Plan requirements

Feedback for acquisition and research & development communities

Consistent & coherent metrics needed
Lessons Learned

Metrics

- **Metrics ‘musts’:**
  - Translatable
  - Defensible
  - Comparable
  - Understandable
  - Reproducible
  - Objective based
  - Identify KPPs
  - Pass Independence test

- **Introduction of new metrics will meet resistance**
- **Single point evaluations are suspect**

"Not everything that counts can be counted, and not everything that can be counted counts." - Einstein (attributed)
Lessons Learned

Kitchen sink...

- Quicklooks are always inaccurate
- Human factors and memories can skew results
- Piggy-backed evolutions will generally fall short
- True Freeplays yield little insight - often result in “no tests”
  - Freeplays with objective focused instructions can produce insight
- All results scrutinized – especially those contrary to perceptions
- Repeat Lessons Learned are Ongoing Discrepancies!
- Rapid warfighter/participant feedback critical
  - Best practices may only apply to given circumstances
  - Documentation is key to moving forward and not forgetting…
Questions?
**I-SHAREM -> SURFREM**

**Extension Across All Warfare Areas**

**SURFREM ... The Future Of The SHAREM / MIREM Process**

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- **SHAREM**
- **MIREM**
- **ADREM**
- **SUWREM**
- **EWREM**
- **GWOTREM**

**Executive Steering Group(s)**
- Fleet Collaborative Team (Surface)
- Sea Trial/STIMS

**FLEET LIAISON**
- (C2F/C3F/C5F/C6F/C7F)
- Scheduling Conferences

**Exercise Planning Process (IPC/MPC/FPC)**
- CSG, ESG, DESRON, PHIBRON, Ships, CSFTL/P, TTGL/P & ATGL/P

- **10-Day Quicklook**
- **OPS Research**
- **OPS Analysis**
- **Final Report**

**Immediate Feedback**
- **Sea Trial STIMS FCT**

**Global Influence International Liaison**
- **Event Dates Assets**
- **OPAREA Ranges Weapons**

**Surface Force Programmatic Input... Tactical Development... Analytical Feedback**