Strike Group Defender: 

*EW Missile Matrix*

PMR-51 and MIT Lincoln Laboratory
MIT and ONR Objectives

- Office of Naval Research (ONR), PMR-51
  - Coordinates, executes, and promotes the S&T programs of the Navy and Marine Corps. PMR-51 is responsible for the management oversight of Integrated Air and Missile Defense (IAMD) Science and Technology (S&T) project development and transition

- MIT Lincoln Laboratory, Air and Missile Defense Technology Division
  - Investigate, develop, and prototype advanced sensor, electronic warfare (EW), and decision support technologies. Transfer advanced technologies and prototypes to government contractors responsible for developing operational systems

- Not here to replace existing systems, processes, training or related EW efforts
  - Employ new S&T and R&D, investigate, develop and prototype the art of the possible to support EW human performance in the EW and ASMD mission areas
  - Design and architect for optimized scalability, flexibility, and capability delivering maximum potential employment possibilities for the Navy
Business Model

- Rapid, economical, flexible
- Collaboration between gov’t, academia, defense and commercial industry
- Can support discontinuous or incremental production
- Integration and innovation focused to respond to evolving S&T
- Employ commercial business practices and value propositions
- Develop technologies and remain within S&T and R&D framework
OPERATIONAL NEED

Objective:
• Advance warfighter performance in EW ASCM Softkill systems and tactics to counter emerging world threats

Value to Warfighter:
• Enhance information-processing abilities in young adults
• Shorten training time, reduces training costs and maximizes training impact
• Tools and techniques achieve engaging, scenario-based training immediately required by the Fleet

SOLUTION

The Technologies:
• Emerging technologies in analytics, big data, crowdsourcing, and cloud architecture
• AI and machine reasoning for behavior modeling
• Create a ubiquitous interactive training “ecosystem” to support other warfare disciplines
• High Granularity analytics “dashboards” for training analysis

BUSINESS CASE

Start date: Aug 2013
End date: Dec 2013
Performer: ONR (PMR-51)/MIT Lincoln Labs

S&T Focus Area: Warfighter Performance
Supporting Fleet Requirements

- Support the CFFC #1 priority – defeating anti-ship cruise missiles
- Respond to the CNO’s call to generate forward thinking and solutions in EMMW
- Advance MIT and Navy Efforts in next generation evolution of EW Red/Blue simulation
- Improve the effectiveness of sailors EW systems employment in an anti-ship missile defense (ASMD) environment
- Augment existing fleet training with a realistic live/virtual training environment emphasizing war fighting in dense, contested, and degraded ASMD scenarios against near-peer adversaries
• Technology and architecture must:
  
  – Act as an extension of existing training for trainers and trainees and pick up where training stops, whenever and wherever they are connected
  
  – Remain system agnostic and support existing EW continuum efforts
  
  – Be compelling and competitive. Sailors must want to train with it on duty -- and “play” with it off-watch
  
  – Target cognitive and experiential skills to enhance warfighter performance across all systems and scenarios
  
  – Design analytics and big data analysis that extracts best behaviors and applies them in game play for other players
Human Performance Objectives

- Improve personnel effectiveness by advancing the cognitive skills supporting tactical planning and decision-making
- Learn, adapt, and prevail in constantly changing and degraded conditions
- To address the following axiomatic concepts:
  - Are we manning the equipment, or equipping the man?
  - The true measure of a systems’ capability is not merely how capable it is, but how capably it is employed
  - Equipment is not usually underemployed because an operator doesn’t know how to use it; rather, they usually don’t know why to use it
• **M² Year One Goal** – Rapid Transition from Labs to the Fleet
  - Improve the effectiveness of Sailors and Marines in the field of EW Softkill by increasing proficiency in the ships’ ASMD employment capabilities
  - Provide a direct means for the FLEET to S&T community through data analytics and crowdsourcing
  - Enable RAPID TRANSITION of technologies from the government and commercial laboratories to the fleet
  - Support unclassified baseline for maximum deployment with subsequent upgrade modules to secret
  - Within 12 months deliver a TRL 7 technology demonstration with developing systems and subsystems
ANALYTICS Objectives

- Move metrics from “what happened?” to “WHAT IS HAPPENING?” and, “WHAT WILL HAPPEN?”
- Consolidated USER LEADER BOARD: Compete, score, and rank user effectiveness, efficiency, speed and skills
- MEASURE, SCORE and REPORT on individual, unit, strike-group, or fleet proficiency
- Live-support backend model supports TAILORED REPORTING and CONTENT CHANGE requirements
- Measure the BEHAVIORS and QUALITIES of the top players and use to improve rest of workforce
There are 3 areas M$^2$ aimed to advance the EMW mission:

- **Interact:** Rapid, fleet-wide CONOP and TTP development and advancement of EW experimentation through deployed Tactics “Battle labs.” Doctrine and tactics in EMW can be rapidly developed, tested and trained to.

- **Measure:** A new data and analytics architecture to capture what, where, when, why and how navy personnel learn, perform, and understand and respond to their proficiencies at the fleet, unit, and individual levels.

- **Appeal:** New technological approaches to overcome deficiencies in training and proficiency, Synthetic Training and Onboard Training that resonate with today’s personnel and emerging technologies.
Scenario Based Interactivity

- Blue vs. Red
- Tactics Battle lab

Leaderboard and Metrics

Big Data
Crowd Sourcing
Advanced Analytics
Behavior Modeling
Cloud

Requirements & ROI
Content Ecosystem

Single-player modules teach ASMD basics and theory
✓ Reporting, scoring and metrics for users and chain of command
✓ Commercial quality graphics, UI, UX for maximum engagement
✓ Emulator and Simulator. Emulates system capabilities in a simulated warfare scenario

- “Battle room” to test, create and collaborate on new tactics for rapid EW experimentation
- Multi-player Red vs. Blue and role reversals
Completed Alpha Prototype Dec 13.

Form partnerships with Navy organization(s) to achieve the following:
- Measure the training efficacy
- Help design, use and analyze game analytics
- Investigate the use of commercial (or Navy) cloud for simulation deployment
- Study the ASMD model fidelity
- Use of IT existing infrastructure while in R&D phase

Starting production Increment 2: Mar 14
- New Features
  - Player Profile and Social network backbone
  - Leaderboards and Exchange
  - Scenario Editor (Tactics War Room)
  - Analytics enhancement
### Leaderboards

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**Filter: Overall**  
**Total Players: 3216**  
**Find My Profile**  

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**Compare Scores**  
Compare your high score against your friends and against the world. Check your score breakdown against the best of the best to see where you can improve the most to maximize your personal best.

**Watch Playthroughs**  
Watch scenario playthroughs by your friends and the best players in the world. See what they did to achieve their score to pick up tips and tricks to try out yourself. Our Event Based Timeline records only the player's individual actions and recalculates the results on your local computer, meaning you can download a playthrough instantly.

**Jump Right to a Scenario**  
Once you have compared player scores and watched replays of some of the top scoring competitors, jump directly into the scenario to try it again. Improve on other players' tactics to take the top spot for yourself!
EVENT TRACK
The event track allows you to add and select new events to your custom scenario. Scenarios can have any number of events of many different types. These include:
- Missile Launches
- Communication Updates
- Changing Objectives
- Waypoints and Destinations
- And many more event types!

ADJUST TIMING
The Event Track allows you to change and adjust event timing on the fly. Dynamic sliders show you event lengths and timing relative to each other. Using the sliders, you can easily time a series of updates to occur one after the other, a salvo of missiles to be launched simultaneously or stepped events to trigger a ship breakdown halfway through a missile attack.

CUSTOMIZE EVENTS
Each event type allows you to customize a number of variables and provides valuable feedback to make each event unique. Set the missile type, determine when it will launch during the scenario, from how far away it will be fired and the direction it will come from.

Using these controls, you can create very different challenges, from a mass of missiles being fired from a distant, land-based missile battery to a short range, surprise attack from behind the fleet. Events can be themed to mimic a real world environment or represent a worst case scenario with missiles from all directions to really test your EW skills!

PLAY WHILE YOU EDIT
Seamlessly switch between editor and game to make changes and then test them out on the fly! Because SG2:EWMM is an event timeline based game, you can make changes anywhere in the scenario timeline and see the results update instantly.

SCENARIO INFO
ADD NEW EVENT
- EVENT LIST ITEM 1
- EVENT LIST ITEM 2
- EVENT LIST ITEM 3
- EVENT LIST ITEM 4
- EVENT LIST ITEM 5
- EVENT LIST ITEM 6
- EVENT LIST ITEM 7
- EVENT LIST ITEM 8

EVENT 2 (EXPANDED INFO)
MISSILE TYPE: IR PASSIVE
LAUNCH TIME: 5:30
DISTANCE: 300 NM
HEADING: 120
EST TIME TO IMPACT: 2:45
EST IMPACT TIME: 8:15

EVENT TRACK 1
EVENT TRACK 2
EVENT TRACK 3

Scenario Editor
Strike Group Defender: The EW Missile Matrix
Scott Orosz
Deputy for EW Programs
PMR 51, Office of Naval Research
391 Brookley Ave SW
JBAB DC 20373
202 284 2247

Daniel E Finkel PhD
Assistant Group Leader
MIT Lincoln Laboratory
781-981-7394
• Overall Classification: FOUO (later at Secret)
  – Production at FOUO level, placeholders for classified content integration

• Tradeoffs
  – Access and maximum deployment
  – 90 vs. 10 percent tradeoff for Secret and SIPRNET

• Solutions
  – FOUO variant and Secret upgrade version