ASW VAST MRT3: The Tip of the Virtual Spear

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ABSTRACT

"Only perfect practice makes perfect." Warfighters must train as they would expect to fight to ensure that sound mental habits are established that will increase their opportunities to make good (and winning) decisions in stressful situations. In 2004, we reported on the Mission Rehearsal Tactical Team Trainer (MRT3), a new program sponsored by the Office of Naval Research (ONR) under the Virtual At Sea Training (VAST) program, which provides SH-60B aircrews the ability to rehearse Anti-Submarine Warfare (ASW) tactical missions as a team. This follow-on paper discusses current Navy initiatives to enhance MRT3 training capabilities to include integration into the Navy Continuous Training Environment (NCTE), thereby bringing together the total ASW Strike Group team: Aviation, Surface, and Undersea platforms and Strike Group Staffs during an in-port Fleet Synthetic Training (FST) event. This paper will explain the significant training benefits of using MRT3 technologies to provide a complete Integrated ASW training capability within the NCTE and to sites around the globe that do not possess tactical team trainers.

This paper also discusses the technical challenges that were overcome while interfacing with the NCTE, including passing real-time environmental updates including Meteorological and Oceanographic (METOC) data, among the training system components. Results of using MRT3 during FST events will be presented. Additionally, the paper provides an overview of ongoing improvements that will enhance the fidelity and resolution of the underlying MRT3 acoustics modeling.

Finally, the paper will discuss how MRT3 technologies are on the tip of the virtual spear and will become the new training paradigm, and how PC-based simulation has been demonstrated as being an effective "disruptive technology" within the entire training industry. The case will be made for using MRT3 technologies to enable Warfighters to cost-effectively train in an operationally relevant synthetic battlespace, just as they would fight during combat operations.

ABOUT THE AUTHORS

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INTRODUCTION

Background

In 2004, our team presented a paper at I/ITSEC titled "*Stick and Rudder Training for the Mind*," which discussed the application of PC-based simulation in an Office of Naval Research (ONR) funded Mission Rehearsal Tactical Team Trainer (MRT3) program. As a component of ONR's Virtual At Sea Training (VAST) program, the focus of the project was on the SH-60B aircraft and the Antisubmarine Warfare (ASW) mission area. The concept of this program was that by taking advantage of the significant advances in Modeling and Simulation (M&S) technologies along with rigorous matching of M&S capabilities to training objectives, the Navy could increase training effectiveness while reducing training costs.

The long-term goal of the program is to develop a deployable, integrated, netted system that will cognitively challenge its users to think, plan, and employ coordinated and integrated ASW tactics. Metaphorically, it will enable tactical "stick and rudder training for the mind." Tactical training that would have previously been expensive to develop and difficult to provide will be readily available to Warfighters on a laptop with a relatively low cost and small footprint. **PC-based simulation has the potential to do for tactical team training what the Internet has done for creating communities of learners, i.e., it will facilitate access and act as the catalyst to spur "in-situ" tactical thought – anywhere and at any time.** If this is done correctly, the quality of the training accomplished during the precious few at-sea ASW training periods will be improved. The tactical proficiency of teams/crews will also increase. **This in turn will significantly enhance combat readiness, which is the ultimate goal of the program and the bottom line.**

This paper is a follow-on to our 2004 paper. It presents the lessons learned from the SH-60B MRT3's participation within the evolving Navy Continuous Training Environment (NCTE) as envisioned by Commander Fleet Forces Command (CFFC). Specifically, MRT3 was invited to participate in the Fleet Synthetic Training Joint (FST-J) 06-1 event in March 2006. FST-J 06-1 was the single largest distributed training exercise ever held by any service or nation. This event was the first of its kind and was significant in that it demonstrated first hand how the MRT3 and PC-based simulation is "the tip of the virtual spear" by providing the conduit ashore to allow individual Warfighters to "train as they would fight."

Since December 2004, the MRT3 team has focused on producing enhancements to the prototype PC-based SH-60B MRT3 system and establishing connectivity into the NCTE. A major goal of the program was met with MRT3's successful participation in a FST event. Other tasks were also undertaken, such as developing a SH-60F (dipper) platform MRT3 version, but these tasks are not the subject of this paper.

Figure 1 below depicts the full SH-60B MRT3 suite. Figure 2 is a close-up picture of the displays.

Figure 1. SH-60B MRT3 Suite

Figure 2. SH-60B MRT3 Station Displays

FLEET SYNTHETIC TRAINING

Overall Concept of Operations (CONOPS)

CFFC is charged with the conduct of FST events as part of a training strategy designed to develop and maintain war fighting proficiency through in-port tactical exercises to further enhance underway training during the Fleet Response Training Program (FRTP). To quote VADM Mark P. Fitzgerald (Commander Second Fleet) "train in-port, validate at sea." One enabler of the FST program is the evolving NCTE infrastructure, which is the backbone for the networks required to connect all warfighting teams together in an in-port, integrated, synthetic training environment. CFFC has appointed the Navy Warfare Development Command (NWDC) as the Chief Engineer for NCTE, responsible for the development and maintenance of this infrastructure. The NCTE provides for the data flow connectivity that must be present for this kind of realistic, integrated training to occur. Such an M&S-based environment is required to provide geographically dispersed warfighting teams the connectivity to train together as they would when they are at sea. The FST program is best optimized when it precedes underway training events and supports strike group interoperability.

Until recently, Naval Aviation has been unable to participate in realistic in-port FST training, in large part because it lacked trainers capable of being networked or connected to other trainers. Since the necessary data flow could not occur, the Navy was unable to take advantage of a significant amount of integrated type training that was available.

FST-J CONOPS

Using the SH-60B platform as an example, it was envisioned that ASW VAST MRT3 could be used as an aviation training system to facilitate participation in an FST event to rehearse Integrated ASW. The ultimate goal of this type of training event is to provide a fair fight to the Warfighter in a realistic and operationally relevant synthetic battlespace as presented within the NCTE. A single SH-60B crew was identified by the Helicopter Maritime Strike Atlantic (HSMLANT) Weapons Training Unit (WTU) for FST-J participation using the MRT3 system. One SH-60B system (called a suite) ,which is made up of a Pilot Station, an Airborne Tactical Officer (ATO) Station and a Sensor Operator (SENSO) Station, was manned by the East Coast HSM Wing and NAVAIR Orlando, Training Systems Division (TSD). Additionally, a manned Instructor Operator Station (IOS) and an unmanned Acoustic Generator (AG) were also provided.

The MRT3 suite possesses its own communications equipment that enables each crew to communicate within its own suite or externally to platforms outside their environment. Internal communications (e.g., ICS) and external communications (e.g. UHF) can be recorded for After Action Review (AAR) on the system's logger within the IOS. All platform locations, courses, speeds, weapons employments, and other data displayed on the IOS can also be recorded for AAR. At the end of an FST event, the crew will be able to participate in the Carrier Strike Group (CSG) hot wash-up/debrief and also participate in a full individual crew debrief of a specific ASW event, as desired.

The end result is that the SH-60B aircrew (Pilot, ATO, and SENSO) will all be able to perform their specific crew mission tasks using their individual station equipment, while at the same time coordinate with their ship and train with the entire CSG ASW team. In short, they will be performing Integrated ASW in a synthetic training environment just as they would in the real, operational world. Most important for learning perhaps, is that each individual aircrew is able to receive a detailed debrief of the ASW event in which they just participated.

What follows is a discussion of some of the major events surrounding MRT3's participation in the FST-J 06-1 event.

Pre-Event Planning and Integration Testing

The MRT3 development team participated in all the necessary FST planning meetings and technical conference calls. The required documentation and Technical Engineering Plan (TEP) were prepared and submitted as appropriate. Early on, the team identified the following program risks:

- An aggressive schedule, with very limited home-based testing time available to the team
- Evolving software on systems outside of MRT3 control
- NCTE participation requirements to utilize the NCTE environmental data in real time
- The requirement to be interoperable with both Battle Force Tactical Trainer (BFTT) and Non-BFTT equipped ships.

The only way to mitigate these risks was through constant open and honest communications coupled with proper detailed planning, which included the sharing of information across the entire FST technical and exercise team. Additionally, participation in all of the scheduled NCTE advance integration testing was fully supported. Early on-site participation in all of these scheduled March testing events as well as close coordination with the NWDC experts, CFFC, and Fleet ASW Command (FLTASWCOM) were significant factors contributing to the team's overall success.

THE CALM (?) BEFORE THE STORM

During the very short development and test period prior to the event, the team discovered that there were several configuration problems, which required a considerable amount of time to debug and fix. Hindsight always being 20/20, it would have been better to travel to NWDC earlier in the schedule in order to expedite the solution to the final software design. The mandatory requirement that MRT3 receive and use real-time environmental data from NCTE by using the Ocean, Atmosphere, and Space Environmental Services (OASES) application proved to be a major hurdle to overcome. (The OASES system is used by NCTE to publish Meteorological and Oceanographic (METOC) data in a common format over the High Level Architecture (HLA) simulation network.) Overall OASES planning included the incorporation of temperature and salinity, rain rate, and sea state into the MRT3 acoustics problem. Temperature and salinity were used to generate Sound Velocity Profile (SVP) data for input to the ocean Propagation Loss (PL) model; rain rate was used to affect ambient noise levels; and sea state was used to affect ambient noise levels and surface roughness calculations.

As environmental solutions were found, the MRT3 team also worked to determine how best to interface with the NCTE. Some early concerns were:

- Obtaining the required Federation Object Model (FOM), Runtime Infrastructure (RTI), and OASES software, along with the required Data Distribution Management (DDM) software patch
- Building a computer in house that would run the target Operating System (OS)
- Redesigning the MRT3 AG as its own HLA Federation.

As NCTE related software (external to MRT3) was received, it was found that the DDM patch for OASES did not work with the current MRT3 system configuration. Unfortunately, time constraints prevented significant testing with DDM before shipping the latest version of MRT3 system to Dam Neck, VA (Gallery Hall), which was just three weeks prior to the exercise. The lack of DDM testing in the lab resulted in engineers at Dam Neck discovering problems with subscriptions. When connectivity was required between the AG's Acoustic Transmission Loss Server (ATLoS) (see below) and Joint Synthetic Automated Forces (JSAF), the IOS gateway, and the Common Distributed Mission Training Station (CDMTS) on the IOS, the engineers discovered that MRT3 was not subscribing to many of the necessary messages, including the ASWVAST Message, Uniform Weather, Tracks, and Damage Assessment messages.

Fortunately, the solutions involved relatively simple one or two line fixes, which allowed the JSAF entities from NCTE to be passed to and from the SH-60B MRT3 suite and also permitted the data to be processed within the suite. In addition to the OASES model, the NCTE METOC Base Object Model (BOM) also includes the interactions used to support ATLoS. ATLoS is a scaleable acoustic propagation service that provides transmission loss and reverberation to those federates that are solving the sonar equation for signal excess between targets and sensors. This is a unique wrapper used by NCTE. Though the MRT3 does not use this wrapper, MRT3 does rely on the same propagation model used by NCTE's ATLoS, called FeyRay. FeyRay represents the foundation of a continuous quest to present a fair fight to the Warfighter within the simulated ocean environment.

Lessons Learned from Dam Neck (Gallery Hall)

The overall plan for scheduled engineering work at Dam Neck was to create two small engineering teams to support the three weeks of NCTE integration testing that was scheduled for March 06. The first team arrived in early March and was relieved at the midway point by the second team after a face-to-face turnover. Having at least one full day to allow the relieving engineers to transition in order to get into the "swing of things" was definitely helpful.

Testing and updating code while on site was not an easy or efficient task. Since the NCTE system was classified, great care was required to ensure strict security procedures were followed. Therefore, any development had to occur on a separate unclassified development machine (which in hindsight was not adequately setup to use effectively) or on unclassified laptops. Every resultant software change had to be copied to a CD and then "dropped" on the classified system for testing. This got the job done, but it was very cumbersome to the team. The engineers eventually decided to just put the source code on the classified system so they could make changes and test those changes more efficiently. This made merging changes into the Configuration Management (CM) source code repository more difficult, but as long as the documentation is thorough, this is probably the best way to do it. In the future, setting up a development environment on the classified system beforehand would alleviate the issues encountered after the security scripts had already locked down the machines.

Filtering

As with any integration of a stand-alone system into a large-scale exercise, there were many unforeseen issues with the use of filters. Typically, during one of the stand-alone ASW scenarios there will be no more than a handful of submarine entities, so ghosting (or making a local "invisible" copy on the MRT3's JSAF) of all the submarine entities for torpedo acquisition purposes seemed like a good idea. However, this caused problems during integration into a FST-J level event and resulted in overloading the IOS. The solution was to ghost only the JSAF submarine entities within a limited number of yards of the newly created torpedo. Similar issues were encountered with detonation sounds appearing on the SENSO Operator (SO) station and with torpedo acoustics generated on the AG. The SO station would play explosion sounds for every detonation in the exercise, and the AG would start acoustics for every exercise torpedo that was launched. Though it was interesting to hear the acoustics of torpedoes dropped off the coast of Maine while in the Virginia area, it was in fact negative training. Therefore, both stations were updated to use the same distance filter; this way, only explosions within that filtered distance of a sonobuoy are heard on the SO station, and only torpedoes within that distance of a target are modeled on the AG processor. This is a good example of the kind of integration issues that need to be addressed during an integrated training event such as a FST.

The "pre-FST" MRT3 design was such that the gateway on the IOS created all of the entity state Protocol Data Units (PDU) that were sent to the entire MRT3 system. This gave the PDUs the gateway's site/host information that resulted in actually preventing the site/host filter on the pilot station from integrating with NCTE as was originally envisioned. The solution was to turn off this filter at the Pilot Station. Not using the Pilot Station filter resulted in some unintended benefits; it allowed for the tuning of remote sonobuoys dropped by other NCTE system constructive P-3C aircraft (only after the exercise JSAF operators incorporated the MRT3 naming convention for defining the sonobuoy Radio Frequency (RF)). Additionally, not using the Pilot Station filter allowed the AG to start the acoustics needed for all remote torpedoes. Both of these tasks would have been impossible if the pilot had been filtering outside sonobuoys and torpedoes as the system was originally designed.

The Gateway filter was used to limit the amount of entities the pilot station was passing, since the filter on the pilot station was not filtering correctly. Internal filter range rings were adjusted on the pilot station to allow entities to show up on radar.

On the plus side, MRT3 did have many elements that worked right out of the box. MRT3 was able to kill remote submarines with no difficulty. (However, according to the NWDC engineers, MRT3 should not have to ghost an HLA submarine entity for the torpedo to acquire it, so this is something that the team will look into.) Also, the JSAF controlling the submarine needs to be altered so that it takes more than one torpedo for a kill. This, however, is not an engineering issue; it is an important training issue that has to be thought out and addressed by the training community or negative training will most likely occur. The MRT3 also received weather data from NCTE during testing at Dam Neck, but the weather master never actually sent out any weather updates during the real exercise. It was very satisfying to see clouds being generated on the MRT3 Pilot Station during testing, but this capability was not used for the FST-J. The bottom line is that the MRT3 system successfully received OASES data on both the IOS and AG, which was a major goal critical to the MRT3 system's success, and it was probably a first in the distributed simulation training world.

MRT3 Communications and After Action Review

After some minor set-up issues, communications worked very well. Having a red Voice over Internet Protocol (VoIP) phone in the MRT3 cubicle was very helpful because it allowed testing to ensure that Marine Digital Voice (MDV) communications were going out correctly over the NCTE. It also allowed communications checks without having to use the system's headsets, and it enabled the Instructor to monitor the crew's interaction with the ship during the exercise through the VoIP phone's built in speaker.

The MRT3 AAR capability (less communications) also worked well during both testing and the FST-J exercise. MRT3 was not able to capture voice communications on its logger, since MRT3's MDV uses Distributed Interactive Simulation (DIS) voice, which is on a separate network from the local IOS/Pilot DIS network. This issue will also have to be addressed in the future. MRT3 will need to come up with an improved method to do AAR playback. For example, in order to prevent MRT3 playback from broadcasting over the entire FST-J NCTE federation, MRT3 had to unplug the network cable, which connected the MRT3 IOS to the NCTE federation. This worked well enough, but there may be a better way to do it, such as launching the IOS applications on a different federation.

The Acoustic Generator's Playbox

Another lesson learned was the discovery that the AG's acoustic "playbox" was too small. On several occasions the MRT3's SH-60B aircraft had to be launched outside of the acoustic playbox due to the current location of the mother ship. This prevented the aircrew from using passive sonobuoys because they were beyond (outside of) the acoustic generator's environmental database. This was also a problem when prosecuting a submarine near the boundary of the acoustic playbox because any sonobuoys out of the AG's acoustic playbox area could not be tuned. Operating outside of the AG's acoustic playbox also required a re-centering of the CDMTS range filter, since it was originally set to show only the entities within the MRT3's exercise area. These are further examples of issues that need to be addressed by any simulation joining the NCTE in order to provide a fair fight to the training audience.

It is interesting to note here that after the exercise ended, the MRT3 instructors coordinated in real time with Submarine Multi-Mission Team Trainer (SMMTT), which was operated from Groton, Connecticut. The instructors were able to quickly arrange a short coordinated ASW training period between the submarine trainer and the SH-60B trainer. It was very exciting to watch the MRT3 aircrew prosecuting a virtual submarine operated by a real submarine tactical watch station (crew). This was real "tip of the virtual spear" type of training made possible by the NCTE synthetic environment and should be pursued further to make this training even more realistic. For example, integration efforts need to be explored to allow the SMMTT to hear the "pings" of the active sonobuoys and the torpedo acoustics of other simulators. This was an exciting first for Navy training and it demonstrates the true, yet untapped power of the NCTE.

Lessons Learned from the Surface Warrior Side

The MRT3 system (simulating a LAMPS detachment helicopter) was assigned a "mother ship" to embark upon for the three day FST-J exercise. The LAMPS aircrew "logged" a total of 13.2 hrs of MRT3 trainer time in the exercise. Therefore, the shipboard Combat Information Center (CIC) team had the use of a simulated LAMPS in the same way that it would have had a real crew with an actual SH-60B onboard. This training included the decision process as to when to launch the LAMPS, for what tasking it would be used, and direct communications with the Warfare Commanders for other warfare tasking such as LAMPS Surface Surveillance and Control (SSC). There was even a request to use the LAMPS for a passenger transfer. This degree of realism would never have been accomplished by using a sailor operating the ship's SQQ-89 On Board Trainer (OBT), which was the training paradigm in the past.

The MRT3 was assigned to participate with two different ships on three different days. One ship was BFTT capable, and the second ship was not. The team had many concerns, but among them communications was perhaps the most critical. As you would expect, there are not yet enough UHF radio channels to support all of the FST exercise communication demands; therefore the MRT3 utilized VoIP phones with headsets (as discussed briefly earlier). These phones provided the required connectivity to the ship's Anti-Submarine/Anti-Surface Warfare Tactical Air

Controller (ASTAC). The team discovered that there needs to be, at the very least, three VoIP phones dedicated to the shipboard ASW team (Evaluator/Plot, ASTAC, and Acoustic Sensor Operator (ASO) stations). In addition, the SQQ-89 OBT operators need to have a direct line to the NCTE JSAF representative who is tasked with "driving" the submarines and ships during the event for coordination purposes. On a BFTT ship, the need to talk directly to this individual is less crucial, but there still needs to be a communications capability to ensure that this ship is receiving the proper contacts and that connectivity is not an issue. For non-BFTT ships, communications are absolutely essential (especially if the Training Control Device (TCD) is not being used). Otherwise, the SQQ-89 operator has no way of knowing where the exercise contacts are, where his ownship is in the virtual world, or when any of the contacts change course or speed.

The team was able to procure one VoIP headset for the ASTAC (as opposed to a handset). Trying to hold a handset and operate the console would have been nearly impossible and unrealistic.

The MRT3 team also developed a preliminary shipboard checklist for coordinating the MRT3 with the SQQ-89 OBT. Without a direct acoustic and sonobuoy connection with the MRT3 (more on this issue later), the 89 OBT operators must "mirror" the event on the OBT so that the ship's ASO can participate. Due to numerous shipboard equipment difficulties, this new procedure was not completely tested, but preliminary results using the developed checklist looked very encouraging.

FST-J 06-1 (MRT3) Event Execution

As exercise events unfolded, the ship crew's use and understanding of the MRT3 simulated helicopter rapidly increased. They soon pressed the "I believe" button, and their use of the MRT3 system quickly escalated into a realistic tactical use of an actual sensor. As each ship's Tactical Action Officer (TAO) and ASTAC got used to operating with the simulation, the benefit of having a real aircrew on the other end of the communications network working their own sensors and weapons added significantly to the scenario training value received. From an observer's perspective, the CIC team could very well have been operating with a live SH-60B.

Each FST scenario was eventually directed toward an ASW interaction. After a Day 1 tactical error that led to an inadvertent torpedo launch, it became apparent that communications between the ships and the Warfare Commanders needed to be as refined and disciplined as real world events would require. There was also a renewed emphasis on the importance of knowing the Rules Of Engagement (ROE) and the ship's Commanding Officer's Battle Orders, as well as other ASW planning documents.

Integrated and Coordinated ASW Training

Equipment issues that surfaced on both of the assigned ships detracted from coordinated operations. In spite of these problems, the ship's ASW Evaluators (ASWEs) and Plot Teams did receive valuable training, the TAOs were able to utilize a sensor that they normally would not have had access to during a synthetic exercise, and the ASTACs were actually delighted with the crew interactions. Future events and a refined procedure to "pipe" the scenario into Sonar Control should add significantly to the tactical team training aspect of the event.

Shipboard Communications

In addition to the VoIP phones and headsets, the FST White Cell member onboard the ship must have access to Secret IP Router Network (SIPRNET) chat. There were several potential issues with VoIP communications and additional scenario information that could only be expeditiously passed to the ship via this medium. Chat was also useful in passing critical information directly to the ship's TAO to prompt actions such as launching the helicopter.

With TCD not receiving the security clearance to participate in the FST event, a non-BFFT ship is essentially blind for the ASW scenario and it is difficult for these assets to follow the scenario as it plays out. Additionally, if the non-BFTT ship has nothing more than Link 11, there is no means available to provide the ship's position update to the event coordinators located in exercise control. A number of issues are therefore created and illustrated as follows:

- JSAF controllers must "drive" the mother ship in the virtual environment.
- Ship's course and speed changes must be transmitted via VoIP to the JSAF ship driver.
- The ship's position (LAT/LONG) must be verified at least every 30 minutes to ensure positional mismatches are alleviated.
- The SQQ-89 OBT operators must drive ownship in concert with the JSAF FST exercise representative.
- Blue/Red Force composition must be transmitted to the SQQ-89 OBT operator via SIPRNET chat to

the White Cell member onboard, and then ownship system should be utilized.

Lastly, the mother ship(s) must "build" a mirrored sonobuoy loadout in the OBT, and this takes time! Once BFTT has taken OBT to "remote" and released the page control to the operator, the team found that they did not have to wait for the rest of the buoys or the helicopter to be built. (This issue caused major delays in our ship's ability to reenter the scenario in a timely fashion when their BFTT dropped out of training.)

ASTAC/HAWKLINK

Without HAWKLINK (a type of datalink that transmits communications and sensor data from the SH-60B to the mother ship), the ASTAC and the LAMPS helicopter crew must conduct ASW in a fashion unfamiliar and somewhat unrealistic from the real world. (This is actually a step backwards to the days of the LAMPS MK-1.) Although the MRT3 helicopter is currently acting in "Helo Control" mode, the ASTAC still must operate his console as in "Ship Control" mode. In order to "mirror" the event in OBT and with a lack of Fly-To-Points (FTPs) either given to or provided from the helicopter, the ASTAC must enter all FTPs to drive the OBT generated helicopter. This is a good-news, bad-news story. The good news is that both the LAMPS crew and ASTAC must operate their systems in their preferred "mode" of operations. The bad news is that it does not support the "train as you would fight" philosophy. (Note: Some form of real or synthetic HAWKLINK capability is currently in work and will eventually be incorporated into MRT3.)

BFTT/OBT

There were numerous shipboard equipment challenges throughout the FST-J; some of which have already been discussed. Due to the up and down nature of the system, the SQQ-89 OBT was also rendered inoperable during any BFTT Operators Console (BOPC) down time. (On the BFTT ship, BOPC was "down" until 1500 on Day 1 of the event.) All entries of sonobuoys and FTPs must therefore be associated with a fixed point which adds more complication to an already complicated exercise. (Even BFTT ships, where the contact and ship update is provided by JSAF via the onboard BFTT, will still have this issue as far as sonobuoys are concerned.)

Acoustics/Oceans

Due to the missing electronic Hawklink, the OBT must "mirror" the scenario to allow the SQQ-28 operator to see the submarine contacts acoustically. Management of this will be an unknown for most shipboard personnel due to the newness of the MRT3 system. Until the crew is comfortable operating with MRT3, an MRT3 specific White Cell member familiar with the SQQ-89 OBT should be present on the ship to assist the crew.

The shipboard OBT oceans do not have nearly the fidelity of the MRT3 oceans. The OBT operator must be made aware of the MRT3 ranges in advance; to ensure "fair fight" the OBT must be "tuned" to achieve the same approximate ranges for the chosen OBT ASW playbox. There will also be differences in water depth and bottom topography. OBT oceans are rudimentary and are not going to be changed with the upgrade to SQQ-89A (V) 15. However, as far as contact acoustics, the contact database for the new SQQ-89A (V) 15 will be using the current Acoustic Training and Simulation (ATaS) database, which is the same Office of Naval Intelligence (ONI) approved database that MRT3 is using.

METRICS

"This is the first time for the SH60B to participate in a FST. This is just the kind of training we need to get going. Train in port. Validate at sea."
VADM Mark P. Fitzgerald; FST-J 06-01 debrief.

Before the exercise, the team identified 13 potential Naval Tactical Activities (NTAs) that could apply to this FST training using the MRT3. The intent of ten of the thirteen NTAs (77%) was identified by the aircrew as having been completed. It is important to note that had the scenario been executed more like it was planned, with the SH60B doing a swap report with a P-3C, two more NTAs would have been completed. In any event, the NTAs completed were based on a single experienced aircrew, training in one case with an ASTAC who had never worked with a real aircrew before.

The FST evaluation is one data point that looks very positive. (It should also be noted here that actual flight time is required to satisfy the NTAs for qualification purposes.) As we have discussed here as well as in our 2004 paper, the decision to augment training time with this type of simulator is totally up to the Operational Community, and is an issue still to be determined. That said, no matter what one's belief is or what argument that one may present, it does seem reasonable that this technology could certainly assist more Warfighters with maintaining a higher level of tactical proficiency, especially when there are so few other valid integrated training options available. This equates to higher combat readiness. Virtual simulations like MRT3 also bring more of the human element into training, allowing for much more robustness and realism in the decision making processes.

Figure 3 below is a generic graphic that is representative of the traditional continuum of training devices, where increases in capability are associated with the requisite increases in trainer cost. Note that PC-based simulation breaks that paradigm, as MRT3 has demonstrated that significant increases in capability can be achieved without the usual associated massive increases in cost. If you have already mastered the individual skills (i.e., an experienced crew) but need to focus on the team cognitive skills such as tactics, crew coordination, and situational awareness, a different training strategy (PC-based in this case) may make more sense if used in the right training circumstance.

As we stated in our 2004 paper, PC-based simulation is still a disruptive technology in the making. (Clayton M. Christensen of the Harvard Business School (1997) describes disruptive technologies as ones that "…bring to market a very different value proposition than had been previously available. …they have other features that a few fringe (and generally new) customers value. Products based on disruptive technologies are cheaper, simpler, smaller, and frequently, more convenient to use.")

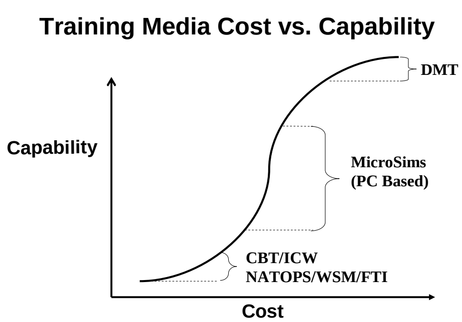

Figure 3. Cost vs. Capability

WARFIGHTER FEEDBACK

Combat System's Officer – "This system would be great to have considering the only way we have to simulate the helo is with the OBT. The operator needs the direct communication with a live helo crew."

ASTAC – "I just graduated from ASTAC school and this was the first time I've ever spoken to a real helo crew."

Ex-Operations Officer and TAO – "I wish we had this all the time and we didn't have to wait for events like FST-J. We last spoke to our DET on COMPTUEX and won't see them again until deployment. We should be able to train with them inport."

Leading Sonarman – "I think this is a great idea! I can play OBT helo all day long and I won't be able to give the ASTAC the type of challenge that operating with a real helo or helo crew can. I just don't know the language and tactics like they do."

LAMPS Crew – "The MRT3 value comes from the ability to conduct coordinated training with multiple surface units and other aircrews using simulated devices."

LAMPS Crew – "The greatest strength is the ability to interact with other intelligent agents that act with their own motives and situational awareness. It was remarkable how much like real world ops the coordinated aspects were."

EPILOGUE

Since this writing, the SH-60B MRT3 has successfully participated in FST-F 06-2 with two MRT3 suites, and MRT3 has also been integrated with the Multi Mission Tactical Trainer (MMTT) in San Diego during a FLTASWCOM Integrated ASW Course (IAC) exercise. The technology continues to demonstrate the power to bring realistic, affordable, available (and deployable) integrated and coordinated tactical team training to the Warfighter.

Planning is underway to deliver three desktop-based SH-60B MRT3 suites to both HSL-37 (2 suites) and ATG MIDPAC (1 suite) in Hawaii in September 2006; all for only the cost of desktop hardware and a week or so of the associated labor and travel! A SH-60Foxtrot version is also nearing delivery, and work is starting to design and build an initial P-3C (AIP) MRT3 suite for COMPACFLT in Hawaii. Lastly, work has started on delivering a simulated Hawklink for the LAMPS MRT3. But all this is perhaps a topic for another paper.

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