Connected Training at JMRC

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Abstract — Training in isolation does not reflect the reality of modern military response. The US Army deploys with partner nations, sister services, and other organizations. Engagements take place across multiple locales. Equipment from different origins needs to work together to enable the best response. To meet these training needs connections across four dimensions are necessary.

The first need is the physical connection to disparate geographical locations. The second dimension is training across services to engage more capabilities. The third aspect is training with partner nations improving communication and preparing to respond effectively. Both the second and third areas involve human communication and communication between equipment which was not necessarily designed to interoperate. Finally, the fourth dimension is the technical connections between live, virtual, and constructive training devices. This is an example of simulator reuse in a manner that was not necessarily planned by the original designers.

Using the example of EX SABER GUARDIAN 17, the paper will feature how the US Army transforms training with the use of sensors, cameras, and controllers, to blend live, virtual, and constructive training into a training environment which permits multi-echelon training for commanders, staffs, and large unit formations across borders. This presentation touches on the challenges faced, including: meeting export-import requirements, coordinating the technical support to meet all units' training objectives as well as allowing their simulations to operate in a single exercise.

1 BACKGROUND ON COMBAT TRAINING

The mission of a combat training center (CTC) is to replicate combat or operational conditions as closely as possible in order to better train units for actual missions. The key output of a CTC event is the after-action review (AAR). AARs, however are only as good as their fidelity and quality. To ensure high fidelity and high quality AARs, combat training center instrumentation systems capture all aspects of a unit's performance during a rotational training event. Instrumentation systems also have the ability to play-back key events in a training rotation so as to help a unit see what it did right and what it did wrong and to understand why.

Army training instrumentation provides the AAR capability by capturing all aspects of unit performance. In live training, Army vehicles, aircraft, all soldiers, and weapons systems are fitted with the tactical engagement simulations systems; in the case of the US, the Multiple Integrated Laser Engagement System or MILES. The U.S. Army Tactical Engagement Simulation System (TESS) uses lasers and blank cartridges to simulate actual battle engagements and permit their being recorded in instrumentation systems.

TESS-replicated firing events are recorded and training battlefield action is captured using video cameras and fed via wireless and fiber optic networks to a central exercise control location. Training data; to include tactical voice and other communications; is captured, collated, processed, and used to show a unit how it actually performed during the exercise – what it did well, and areas for improvement. Professional Observer Coaches Trainers (OCT) analyze the data, providing it to training units in the form of an interactive after-action review.

On U.S. Army live fire ranges, digital targets record actual hits scored. Software engineers also created the capability to integrate live-fire ranges into live training instrumentation. The potential exists for virtual and gaming systems to shoot live targets which are "destroyed" on the live range. Live-fire targets appear in the exercise instrumentation system as well as the training unit's command and controls systems.

2 Early Connections

The original design of the Instrumentation System involved interacting with US MILES gear and displays for US Army participants. The displays held graphics appropriate for Army

units and Army maneuvers. These rotations took place entirely within Hohenfels where the connectivity is permanently installed to support capture of audio and video. The area supports transfer of MILES status from the unit to the training facilitators and back. As rotations through the JMRC took new direction, the desire to connect results from the ranges at Grafenwöhr to the exercise at Hohenfels. In 2008, the first rotation with this extension completed. Some of the additional support requirements are shown in Figure 1.
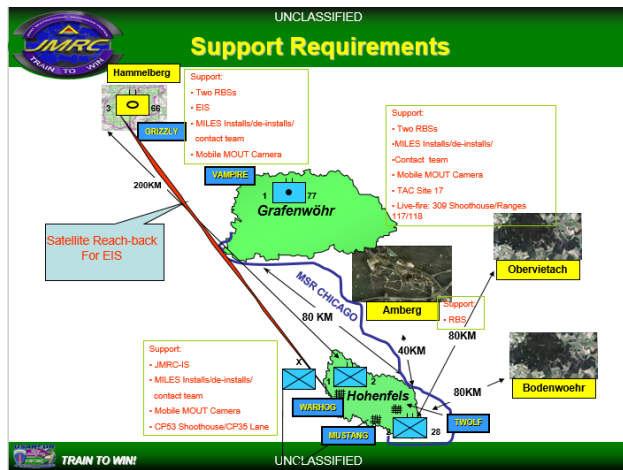

Fig. 1. First Connection Configuration.

Practical experience has validated the need to participate in exercise planning beginning with concept development. This allows us to identify potential challenges and develop solutions to them. Delivering these solutions in time to meet the needs of the exercise is facilitated with integrated planning.

4 Current State

Currently U.S. Army training in Hohenfels is supported by the Joint Multinational Readiness Center Instrumentation System (JMRC-IS). This instrumentation system is an example of a simulation system which gathers GPS data and MILES data for all players. The units use the same equipment they will use in deployment which is outfitted with Multiple Integrated Laser Engagement System (MILES) gear. The center supports 8 to 12 rotations of an average 26 days per training event annually.

The center collects audio recordings based on tactical communications which units will use in

deployment. The CTC is equipped with video recording capability in key locations to record specific training events. Since 2014 the ability to integrate virtual devices into the live training exercises has been evolving. TESS is used to ensure all parts of the tactical systems can be engaged during training. TESS was designed to replicate direct and indirect firing events. Replication of firing events provides a way to accurately and fairly adjudicate training battles. The planning for each training event includes determining the parts of the tactical communications system expected to be exercised through TESS. The specifics of the tactical communications plan is often dependent upon the location of the training event. Therefore, being able to support engagements in different locales can result in practice on different portions of the tactical communications system.

Operators have also experimented with what is called "dynamic entity relocation." This is basically the ability to take live entities in one location and position them on all exercise systems in such a way that they appear to be adjacent to live entities in another location. For example, we have "moved" units exercising in Latvia to make them appear to be adjacent to live units in Germany. There are, obviously, a lot of challenges to using dynamic entity relocation. There is the issue of resolving conflicting geography between the live units' locations and where they are positioned in the exercise terrain. There is also the objection due to "fooling" the computerized C4ISR systems.
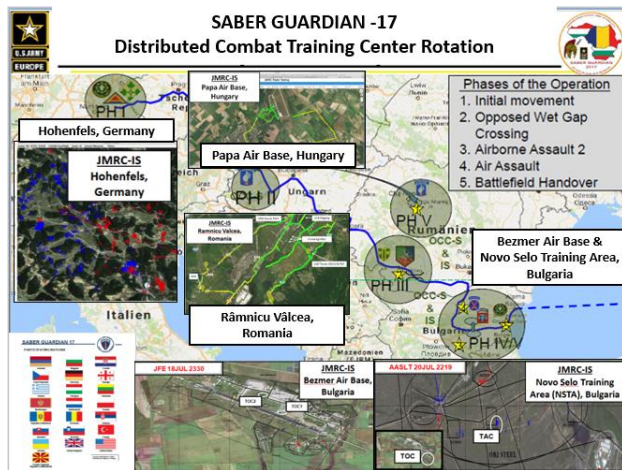
Fig. 2. Saber Guardian 17 Connections

Perhaps the biggest change since the inception of connected training, has been the ability to connect LVC training over thousands rather than just hundreds of kilometers. The first few training events covered less than 500 KM. We are now up to 2K KM. The advantage is being able to connect participants from more distant geographic regions. This is shown in Figure 2 with the many places participating in Saber Guardian 17. The challenge for long distance communication is latency. The engineers have reduced latency to about 1 second over the entire exercise area.

Coalition units choosing to train using simulation equipment provided by the U.S. generally have access to the same level of simulation and data recording that are available to U.S. units. There are some limitations to setting up coalition forces with U.S. equipment. The U.S. MILES gear does not always fit the combat vehicle platforms of our coalition partners. The U.S. gear may prevent the coalition units from fully exercising their capabilities or performing as they would in an actual combat engagement. This can translate into negative training as the unit does not practice as they will actually perform. Alternatively, their actual abilities may not be correctly represented in the system. Again this can lead to negative training when others do not have correct information regarding the capabilities of these units. Furthermore, there is a cost in training time as the U.S. MILES gear

has minor differences from the gear the coalition units have been using for their own training. The units need to understand the data feeds they will be receiving, they need to adjust targeting for a MILES system zero which is different from the weapon's zero and ensure there is no interference caused by the U.S. training equipment. This is in addition to the cost to the U.S. of developing additional MILES solutions.

Alternatively, coalition units may prefer to train using their own training support equipment. Many of the coalition units already have MILES solutions which they use in their own national training programs. These kits, tailored to fit the vehicles using them, are typically compatible with the U.S. MILES and TESS systems. The units are familiar with these kits and know how they operate. The kits have been designed to account for the unique properties of the vehicles using them and relay these properties to the instrumentation system using existing interface standards.

We are working with industry partners to develop a universal translation capability to allow units to show up at a training center and be able to quickly integrate into that center's instrumentation system. The idea is to allow units to "plug and play" without making expensive purchases of new TESS.

4 Conclusions and Future Directions

The JMRC mobile IS capability changes how live simulation training is conducted. Units don't need to be physically co-located to train together. Effects from live, virtual and constructive training can all be integrated into a single, seamless whole, enabling more realistic and challenging training. Combining live, virtual and constructive simulations across dispersed geographic locations to present exercise participants an integrated exercise view provides a very cost effective, large unit, full-spectrum, multi-echelon training capability in resource constrained environments.
For all the advantages the capability provides, there are still challenges to making it more efficient for training units from different

nations. Raytheon is researching solutions to make the capability more interoperable in a variety of ways. Making instrumentation systems and tactical engagement simulations systems more interoperable would allow the mobile instrumentation system to be employed in training areas with no instrumentation system available while leveraging those that have one. By making constructive and virtual simulations more interoperable, it would not only speed the integration of those simulations into exercises but also permit more venues to take part in exercises with live simulations, particularly in joint exercises. One major challenge to integrating virtual and constructive simulations is the development of information assurance solutions that allow nations to protect, for example, weapons data used in simulations. A similar challenge exists with tactical voice communications. Engineers are actively working towards solutions to all these challenges.

Connecting training allows units to train together which would otherwise not have the opportunity to do so. A mobile instrumentation system provides a solution to connecting geographically dispersed units in a combat training center environment, allowing them to take advantage of all the a CTC has to offer to better prepare units for their missions. The JMRC mobile IS makes the CTC experience available at a lower cost resulting in more value for the budget spent on training in a multinational setting.