VIRTUAL COMBAT CONVOY TRAINER:
SUCCESSFUL RAPID PROTOTYPING

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ABSTRACT

The Lockheed Martin (LM) and Fire Arms Training Systems (FATS) Virtual Combat Convoy Trainer (VCCT) was developed as a rapid prototype to address the convoy training deficiency highlighted in operations in Iraq and Afghanistan. The system was based on two, mature, COTS-based systems with complimentary capabilities which allowed the system to go from concept to deployment in under 21 days.

The LM-FATS VCCT solution (aka VCCT-L) provides basic to advanced convoy skills training and mission rehearsal, incorporating precision weapons engagement training, realistic weapons, a full-scale HMMWV mockup, high-fidelity mobility model and multiple, manned, network simulators with after action review playback capability. The systems interface using DIS and HLA protocols: these protocols, the open architecture, and commercially available database sources allow the VCCT to interoperate with other simulators. Multiple senses are engaged with the wide field-of-view geo-typical scene, weapons recoil, physical limitations within the HMWWV, high-fidelity sounds for weapons, engines, and battlefield sounds, as well as simulated voice and digitized communications.

To meet the short delivery schedule for a production-level mobile VCCT, the team leveraged other commercial companies for a modified commercial trailer, including power and HVAC, a HMMWV shell manufacturer for the mockup, COTS projectors which include night vision capability, COTS image generators, simulated voice and digitized communications (PC-based), and simulated weapon and battlefield sounds.

The focus of the VCCT is collective convoy training but can also be used to train basic convoy techniques. Soldiers are immersed in the virtual environment and can practice and be graded on basic skills such as crew communication, weapons handling in the HMMWV, proper entry and exit techniques and defensive positions, shoot-on-the-move, and recognition of potential improvised explosive devices (IEDs), convoy discipline (speeds and distance between convoy vehicles), and scanning sectors, and standard operating procedures (SOPs). Instructors are provided with radio and digitized communication for role-playing and can also modify the scenario in realtime. The training scenarios immerse soldiers into a variety of real life situations designed to train and evaluate their ability to recognize and react under stressful conditions, using proven techniques, thus providing the soldier and convoy leaders with the skills necessary to save lives.

1. INTRODUCTION

There's nothing like the pressure of three weeks to a demonstration and less than three months to multiple mobile production systems to make everyone roll their eyes and say "They want what?"

Short turnaround programs are often equated with smaller companies due to their reputation to be nimble and fast responding. They have smaller overhead and aren't as loaded with bureaucracy, paperwork, or multiple levels of approval. So how is it a large company like Lockheed Martin was able to respond so quickly? The answer: resources, relationships, reuse, and standards.

2. RESOURCES

The basic resources that are required for this activity are not any different than any other program: technical knowledge, personnel, materials, money, and possibly a baseline depending on whether or not you are starting from scratch. The difference for this type of program was it required in-depth technical knowledge, "A" team personnel, available materials, available funding, and mature products.

PRODUCTS. Part of the success of this venture was due to using mature products. Rather than creating a rapid-prototype to quick-start a new application or technology into a program, the VCCT-L leveraged existing product line capabilities and maturity in creating a new prototype. The mature products provided several key components: (1) a baseline that met many of the Request for Information (RFI) goals, (2) a stable baseline to add other features that were key goals in the RFI, and (3) industry-standards in databases, software, and interfaces.

FUNDING. Just responding to an RFI requires labor which costs money. Purchasing equipment, databases, etc. for a demonstration takes money. Companies have to have the funds and be willing to apply them to support this type of venture. Money alone, however, is not

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enough for a quick-turnaround program. Materials in house for the prime and key subcontractors play a significant part in being able to meet the challenge. Anything from computers to plywood to COTS products on the shelf may be needed immediately. Remember, subcontractors and stores generally aren't open at 2am.

TECHNICAL KNOWLEDGE. The challenge has been explained, now how do you get there? This is where the company draws on its technical experts. The experts came from multiple areas: those that knew the base products to be used, those that knew other in-house products that were candidates, and those that knew what was available on the market. Combining these experts' knowledge was key to finding a solution that could be prototyped and subsequently produced in a short time. It was not the only possible solution, and maybe not even the best: but it was viable. Experts in several areas on all the teams and contractors involved were key for not only making it happen but also making it happen *quickly*: there is no time for a learning curve on this type of program.

"A" TEAM PERSONNEL. You may think I already mentioned them in the last paragraph when I talked of the need to have technical experts on the team. Yes, they are part of the "A" team but "A" stands for type "A"; dedicated, focused, detail-oriented, etc. You will need these people in *every* area such as shipping, procurement, technical support, manufacturing, and management. This is the group that isn't just "here to help" but "here to make it happen". Having team members that know the corporate policies and processes, government regulations, rules, and laws, and personnel can play as an important role as knowing which version of a database to use. By the way, don't forget needing a few good jokesters, professional attitudes, and interpersonal skills on your teams.

3. RELATIONSHIPS

VCCT-L used a combination of existing relationships as well as the development of new relationships to meet the demands of the program. One of the benefits of having mature products and product lines is the development of long-standing relationships.

New relationships can be very difficult to forge, especially with a compressed schedule and under cost constraints. New relationships between companies often end up with lots of road bumps as the companies learn more about each others' culture, methods of doing business, and even something as "simple" as terminology. The companies involved in VCCT-L went in with a win-win attitude – at *all* levels. Several visitors commented how they couldn't readily tell who worked for whom when watching the teams putting the systems

together: pretty amazing for a group that has worked together for less than a month.

4. REUSE

Since software reuse was promoted by industry, it has often times been incorrectly applied. Many people believe that securing any piece of code or database and plugging it into a computer with any operating system with or without COTS applications, is "reuse". Well, it is, but you may spend more time trying to force fit it into your architecture, or making it work in a different operating system, or with new hardware than if you had written that piece of code from scratch.

For VCCT-L, the key software components not only reused the code, they reused the architecture and COTS applications. The software and databases for the system are based on primarily COTS hardware, COTS operating systems, and open architecture. This type of reuse allows the systems to be turned around more quickly with lower technical risk. In addition, additional functionality required to meet some of the goals was easier to add since there was a mature architecture on which to base the new functions.

5. STANDARDS

The products used in VCCT-L use industry standard computers, databases, and interfaces. These standard interfaces were another key reason the companies were able to combine their systems quickly and provide a flexible system.

In addition to industry standards, the internal standards for hardware, database, and software development allowed the teams to dive into integration quickly without having to fight how to do it, learning the tools required to do it, and what kind of controls are needed. Process standards for design, configuration management, development, etc. were leveraged from the existing mature product baselines, saving time to work on the integration and new development rather than reinventing the wheel in areas that don't add value to the product.

CONCLUSION

VCCT-L is a successful example of how mature products, resources, standards, and reuse can be combined to meet new needs quickly and effectively. The companies combined products that leveraged their strengths and unique capabilities to meet the myriad of requirements for a robust training system to meet basic, advanced, and mission rehearsal convoy training.