Accelerating Marine Corps Training through Innovation

Capt Garrett Loeffelman

U.S. Marine Corps
Quantico, VA
garrett.loeffelman@usmc.mil

Mr. Paul Butler, Ms. Amy Lim,
Mr. George Dias, Mr. Tarun Nadipalli
The MITRE Corporation
Orlando, FL; San Antonio, TX; McLean, VA
pvbutler@mitre.org, ahblim@mitre.org,
gdias@mitre.org, tnadipalli@mitre.org

ABSTRACT

U.S. Marine Corps (USMC) synthetic training lacks consistent, reusable, and standards-based training materials that are required to maximize the effectiveness of fielded training systems. Training support packages (TSPs) consist of a stand-alone, exportable package that integrates training products, resources, and materials necessary to plan, prepare, execute, and assess operating force training. Since 2019, the USMC has invested in developing a standard TSP that enables faster skill acquisition and improved engagement during training. This has led to the development of the TSP Rapid Generation Tool (TRGT). The TRGT enables the generation of consistent, reusable, standards-based training materials that maximize the effectiveness of fielded training systems while minimizing training preparation time.

The 2019 effort focused on the design, development, and testing of a Virtual TSP model that standardized an exportable and dividable format for delivering training content. In 2020, the USMC used an agile framework to build, test, and refine the TRGT to support collaborative product development. The TRGT enables exercise designers and simulation professionals to work together and expeditiously generate, store, and reuse training content in a repeatable, standardized manner. The TRGT is built on the Electron framework, which provides a desktop application using modern Hypertext Markup Language (HTML) libraries. It maintains a local database and allows users to export data in JavaScript Object Notation (JSON) format. The USMC is exploiting this technology to crowdsource standardized training materials throughout the fleet. These materials have already demonstrated a training relevance that vastly outpaces traditionally contracted efforts by enabling real-time collaboration at the point of need. This paper summarizes the 2019 and 2020 efforts, from the development of a standardized TSP model for describing training in virtual environments and to the design, development, and testing of the TRGT. The paper concludes with plans to implement TRGT across the military services to better manage enterprise training programs and mitigate historic modeling and simulation shortfalls.

ABOUT THE AUTHORS

Capt Garrett Loeffelman is an Infantry Officer currently serving as the Science, Technology, and Analysis lead for the Marine Corps Range and Training Programs Division in Quantico, VA. He holds an M.S. in Modeling, Virtual Environments, and Simulation from the Naval Postgraduate School, and a B.S. in Computer Science and Information Technology from the U.S. Naval Academy. His background includes 12 years of military experience,

Mr. Paul Butler is MITRE's Project Leader for the U.S. Army PEO STRI. His 36 years of work experience comprises DoD modeling and simulation, systems engineering, and research and analysis.

Ms. Amy Lim is a software developer with MITRE. She supports PEO STRI on the development of front-end web applications that provide training and standardized guides.

Mr. George Dias is a MITRE systems and software engineer with over 30 years of training and battle command systems experience, including support to gaming simulations and web application development.

Mr. Tarun Nadipalli is a MITRE data scientist and software engineer specializing in development of full-stack applications that optimize workflows in training and medical simulation related subject areas.

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PROBLEM STATEMENT

The 38th Commandant of the U.S. Marine Corps (USMC) has highlighted that "Training must be focused on winning in combat in the most challenging conditions and operating environments" (CMC, 2019, p. 17). Accessing the operating environment is typically impossible; as a result, units train at home station bases using live, virtual, and constructive (LVC) training technologies to mimic future conflicts and "train like we fight." Unfortunately, current simulator technologies and training systems were fielded as blank sandboxes that support a variety of use cases, but they often fail to put training experiences in context or to organize training within the USMC's training and readiness (T&R) structure. To create standardized, relevant, and impactful learning experiences, the USMC must provide training design resources that deliver important tactical and environmental information to guide training. These resources are required for Marines to conduct adaptive and proficiency-based training that ultimately "changes the Training and Education Continuum from an industrial age model to an information age model" (CMC, 2019, p. 13).

Simulators and simulation systems have traditionally been developed, tested, and fielded in accordance with systems engineering-based processes that focus on delivering hardware and software tools. Department of Defense Instruction (DoDI) 5000.61 states that "Models, simulations, and associated data used to support DoD processes, products, and decisions shall undergo verification and validation (V&V) throughout their lifecycles…and shall be accredited for an intended use" (2009, p. 10). Verification determines if the implementation of a model or simulation accurately represents the developer's conceptual description and specifications. Validation determines the degree to which a model or simulation accurately represents the real world from the perspective of the intended users. Accreditation criteria are the set of standards that a particular model, simulation, or federation must meet to be accredited for a particular use (2009, p. 9). Following this instruction, acquisition partners developed, tested, and fielded systems that can support specific purposes. We do not dispute that the current USMC systems can support these purposes; however, the USMC never considered defining how they are best employed to maximize training effectiveness. Ultimately no instructional materials, supporting documentation, or scenario elements were developed to guide how training will be conducted using these systems.

A training system alone only provides the media that support the conduct of training. According to the Systems Approach to Training (SAT) manual, "In any instructional situation there is a message to be communicated. Video, television, diagrams, multimedia, computers, and printed material are examples of media used to communicate the message. Media are the delivery vehicles used to present instructional material or basic sensory stimulus presented to a student to induce learning. In other words, the means used to give information is to the students" (USMC, 2004). A simulator or similar training system provides the delivery vehicle for training, but without relevant lesson materials the instruction will lack context, structure, or objectives. Furthermore, lesson materials are needed to guide the configuration, integration, and development of software scenarios that ultimately bring virtual training to life.

For the past several years, the USMC has researched and analyzed technologies and training solutions whose aim is to formalize how Marines train. The outcome is an effective, standards-based package of training resources and lessons that guides consistent, repeatable training and a technology that quickly enables development of these training packages.

TSP DESIGN: PROVIDING A STANDARD FOR THE USMC

Background

The United States Army Training and Doctrine Command (TRADOC) defines a training support package (TSP) as a complete, stand-alone, exportable training package that integrates all training products, resources, and materials necessary to support training of the operating force. A TSP consists of a set of materials that include the tools to cause certain events to occur or cue the individual or unit to take certain actions, and contains all the information necessary for a training event or exercise to be conducted in a way that meets its objectives. A virtual TSP (VTSP) is a TSP that uses virtual or gaming training aids and devices as described in TRADOC Pamphlet 350-70-1 (2019). This section summarizes the methodology used to design a VTSP for the USMC. The USMC Training and Education Command (TECOM) approved the VTSP design at the end of fiscal year 2019.

In May 2019 a study team, comprising members from the TECOM Simulation Training Integration Management (STIM) Branch and The MITRE Corporation, began developing a Virtual Battlespace 3 (VBS3) Fires VTSP. The training package was designed to provide Fire Support Team (FiST) Operations training, leveraging the Deployable Virtual Training Environment (DVTE), which includes VBS3and VBS3 Fires FST. During this project, MITRE and TECOM developed a VTSP structure and design intended to formalize documentation for planning, preparing, executing, and assessing Training & Readiness (T&R) events in a virtual training environment.

The goal of this VTSP is to aid home station units in utilizing the DVTE, and specifically VBS3 Fires, so that multiple units can train together in one environment. To accomplish this, the FY19 study executed the following six engineering tasks:

1. **VTSP Research and Analysis**. Evaluate and reuse, as appropriate, components from existing USMC and Army TSPs.
2. **VTSP Design**. Develop a VTSP structure that minimizes content duplication and supports the overlapping and unique information required by VTSP users (evaluators, administrators, response cells).
3. **Scenario Design and Development**. Identify a VBS3 Fires Scenario that supports the collective training of at least two training audiences in one environment. This included travel to a site to identify a scenario and gather all the information needed to plan, prepare, and execute the scenario.
4. **VTSP Development**. Populate the VTSP structure with information that guides administrators on how to set up and execute scenarios, evaluators on how to evaluate the performance of training audiences during a scenario, and response cells on their role and function in the training exercise.
5. **VTSP Verification**. Verify VTSP design with a training audience to gain feedback and improve the VTSP product.
6. **VTSP Delivery**. Deliver a final VTSP that enables units receiving training to participate in a scenario, provide quantitative feedback, and learn the skills associated with the scenario.

Overview

The Fires VTSP developed by the study team supports planning, executing, and assessing Marine/team performance-focused training exercises. It provides detailed information on the exercise construct and describes the roles, responsibilities, and resourcing required. It supports situational training exercises (STXs) that deliver training through a progression of virtual exercises (crawl/walk), culminating in a complex scenario (run).

The details of this training are contained in Version 1.0 of the VTSP (Loeffelman, 2019), which supports the following USMC T&R events (Department of the Navy, 2016):

- Conduct FiST Operations
- Call for Fire (CFF) Using the Grid Method
- CFF Using the Polar Method
- CFF Using the Shift from a Known Point Method
- Conduct Live Terminal Attack Control Integrated with Suppression of Enemy Air Defenses (SEAD)

The training scenarios were simulated to take place at the Twentynine Palms training ranges but were designed to be tailorable to meet individual training site requirements and commander training objectives. The scenario activities can address static, dynamic, or single threats in LVC training to accommodate available personnel and training resources. They can be modified and executed in rural or urban training environments.

The VTSP design organized information into sections named for the major elements listed below.

1. VTSP Overview
2. VTSP Structure
3. High-Level Evaluation Guide
4. T&R Events Trained
5. Scenario Descriptions
6. Event Tactical Products
7. Administrative Materials
8. Scenario Tactical Products
9. Evaluation Guide
10. Scenario Execution Guide

The VTSP package includes a folder, 'VBS3 Fires Supplemental Training Materials,' that contains VBS3 scenarios developed by the USMC Training Support Center (TSC) Twentynine Palms for this study.

Research and Analysis

The VTSP analysis involved interviewing subject matter experts (SMEs) to determine TSP requirements, researching existing TSPs, and analyzing existing TSP components to identify reusable/tailorable components. Over the course of several weeks, MITRE met with TECOM and the Program Manager Training Systems (PM TRASYS) to discuss the VTSP, and documented the following characteristics required in the VTSP design:

- Enables rapid tailoring and modification to enable training for other T&R events
- Is extensible to include additional training scenarios
- Is accessible to trainers and training units
- Provides step-by-step setup and execution procedures
- Provides performance measurement checklists.

During the course of its analysis, MITRE reviewed the following TSPs, which were largely developed based on the TRADOC Pamphlets identified after each TSP:

- U.S. Army Squad Overmatch (SOvM) Individual Training Support Package (ITSP) (DOTD, 2016)
- U.S. Army SOvM Virtual Training Support Package (VTSP) (DOTD, 2016)
- U.S. Army SOvM Warfighter Training Support Package (WTSP) (DOTD, 2016)
- Future Combat Systems (FCS) Training Support Package (TSP) (TACOM, 2007).

Design Methodology

Figure 1 illustrates the initial TECOM concept for the VTSP. This concept prescribes that each TSP contain a series of scenarios (each supporting one or more T&R events) and step-by-step instructions for preparation ('New Equipment Training and Familiarization'), execution ('Step-by-Step Set-Up & Operating/Guidance Procedures'), and assessment ('Performance Evaluation Checklist').

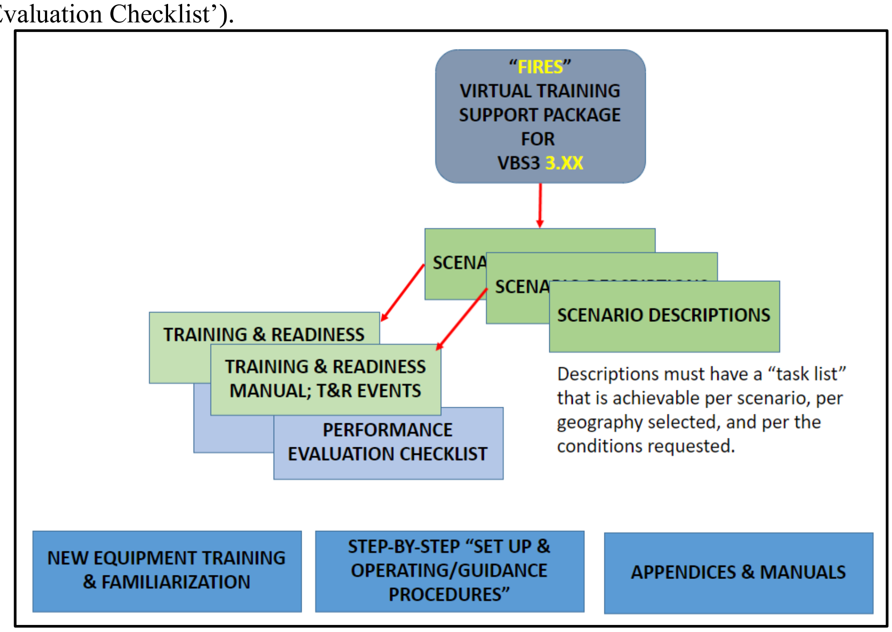

Figure 1. TECOM Concept for a VTSP

The SOvM VTSP and WTSP proved particularly relevant to this concept, as the SOvM study's objectives for developing a TSP were closely aligned with the objectives for this USMC effort. The SOvM TSPs were designed based on the Army's prescribed structure (HQDA, 2015; HQDA, 2019). The study team created a database of the SOvM VTSP and WTSP components and evaluated each to determine whether it would become a requirement for the USMC Fires VTSP. The team evaluated over 300 components of the SOvM VTSP and WTSP and made a determination as to their applicability for USMC training. In some instances, components were reused "as is," retaining the original intent and meaning from their Army heritage. Examples include the collective event trained, training event security classification level, and supported tasks. Some components were re-purposed with a new meaning or application. Other components were deemed not relevant and not recommended for inclusion in a USMC TSP; for example, the list of tasks for performing the observation role.

At the conclusion of this analysis, the study team organized the structure of the VTSP, based on the component analysis, into the following general areas:

- TSP Identification
- Exercise Overview
- Tactical Materials
- Exercise Control Materials
- Exercise Set-Up Materials
- Evaluation Plan
- Administrative Materials.

The design also reflected the users of the VTSP (evaluators, administrators, response cell) and the areas they would need to support their function.

TSP DEVELOPMENT: ENABLE AND PROMOTE COLLABORATION

VTSP Development Methodology

Through discussions of VBS3 training scenarios with TECOM, TSC, and the Battle Simulation Center (BSC) at Twentynine Palms, the study team discovered that the BSC was already developing scenarios to train a FiST. Because FiST operations scenarios provide training for FiST Leader, Joint Terminal Attack Controller (JTAC), and Forward Observer (FO) audiences, these scenarios were ideal for the VTSP as they met the requirement of training more than one audience and supported realistic operational training. With direction from TECOM, the team selected the VBS3 Fires FiST/FO training progression scenarios for the development of the VTSP.

Following the decision to use the VBS3 Fires FiST/FO scenarios, the study team coordinated with Twentynine Palms BSC and TSC leadership. This partnership enabled the study team to access SMEs and VBS3 Administrators to obtain a better understanding of how to set up, execute, and evaluate the FiST training. To ensure the VTSP integrated all the necessary training products and resources needed to support future planned training of the operating force, the partners focused on the following activities:

1. The study team presented and trained the BSC and TSC audiences on the VTSP structure. Collaboration between the two teams resulted in enhancements to the VTSP structure to better align with the needs of stakeholders involved in the training preparation and execution processes.
2. The study team received training aid (VBS3) scenario files from the BSC and verified that the scenarios loaded and executed properly. This step was important to ensure the scenario setup and execution were well understood and later documented properly.
3. The study team observed a scenario testing event held at the BSC and documented detailed instructions on the installation, initialization, and execution of each scenario. During the event, Administrators provided a detailed VBS3 walk-through of each scenario and answered administrative questions along the way. The study team used these findings to update and improve all related VBS3 instructions and draft a Scenario Execution Guide for each scenario. This guide lays out instructions in a sequence of screen captures for the Administrator, Evaluator, and Response Cell to facilitate the training.
4. The study team documented and collected all artifacts regarding the training evaluation plan. The team held evaluation-related discussions twice daily with TECOM and the Twentynine Palms training SMEs. The

information gathered from the discussions was critical in drafting sections such as the performance evaluation description, High Level Evaluation Guide, and the Evaluation Interpretation Guide.

5. The study team documented and collected all tactical products required for the FiST/FO scenarios. TSC – the scenario designers – provided a tactical walk-through of the scenarios and addressed all questions. The study team directly applied information learned from the walk-through to the Scenario Descriptions section of the VTSP. TSC also provided the Handbook for the overall mission, which included the Fragmentary Order (FRAGO), Intelligence Preparation of the Battlespace, and Training Event Execution Guides (TEEGs) for each individual mission.

It was imperative that the study team leverage all local resources available to develop the content and deliver an initial draft of the VTSP for verification.

Tailoring the VTSP

The VTSP was designed to serve as a template enabling rapid tailoring and modification of content to support many T&R events. The VTSP structure is flexible and accommodates additional VBS3 scenarios that support tailored training and additional training audiences.

The study team documented guidance for tailoring the VTSP design that addressed the following use cases:

- Addition of a new high-level T&R event
- Support for additional / different T&R events
- Support for additional VBS3 scenarios and additional tactical products
- Support for additional VTSP stakeholders.

For a new high-level T&R event, the guidance specifies that trainers should develop an entirely new VTSP – one that adheres to the structure in Figure 2 (left side). The VTSP is designed to guide one high-level collective T&R event; however, the structure accommodates many supporting collective and individual events. The right side of Figure 2 highlights the VTSP components that should be modified if the training provided covers additional supporting T&R events. The guidance ranges from how trainers should create new sections in the VTSP to how the evaluators should modify performance evaluation processes to support the additional T&R events. For the sake of brevity, this paper does not cover the details, but they are discussed in depth in the FY19 Study Report (Loeffelman, et al., 2019).

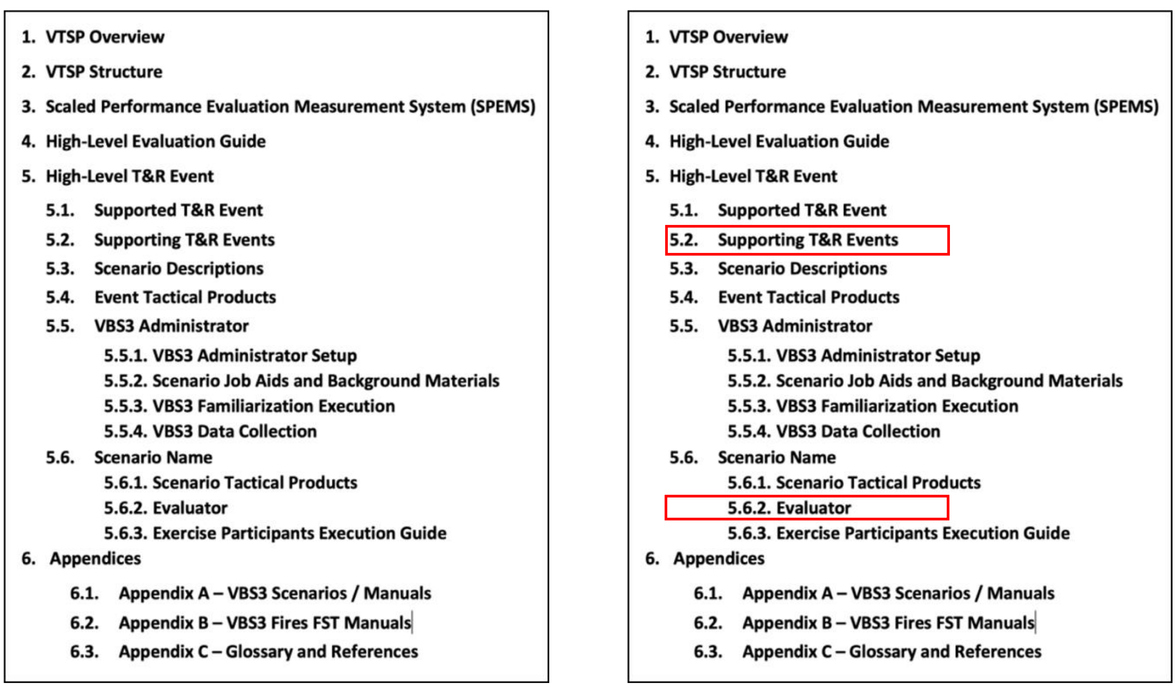

Figure 2. VTSP Structure and Supporting T&R Event Components

VTSP Verification

The study team verified the Conduct FiST Operations VTSP using a variety of methods and sources. Various sections of this VTSP directly leveraged content created by USMC SMEs. For example, TECOM developed the information on the scaled performance evaluation measurement system (Loeffelman et al., 2019), and the Twentynine Palms TSC designed the FiST operational scenarios. During the core development initiative (while onsite at Twentynine Palms), the study team conducted a series of walk-throughs of the VTSP structure and content with the TSC and BSC. The team also leveraged additional experts to walk through the VTSP instructions "line by line" to verify accuracy of the administrator and evaluator instructions. The team incorporated feedback received from SMEs in the final version.

Additionally, in early FY20, simulation training SMEs at Camp Pendleton, who were not involved in the VTSP development, used the VTSP to conduct FiST training with fleet Marines. Their observations provided the motivation for the FY20 study. These SMEs reported the need for an expert system that (1) guides coordination and collaboration during TSP development, (2) enables TSP developers to leverage a repository of training resources, (3) guides TSP development while minimizing reliance on the TSP standard experts, and (4) decreases the cost of TSP development by greatly reducing the need for SME manpower. In FY20 the study team also analyzed courses of action related to potential existing solutions for the expert system and eventually developing the expert system using open-source technologies.

Lessons Learned

The FY19 Final Report (Loeffelman, et al., 2019) documented numerous lessons learned during the research, analysis, design, development, and verification of the VTSP. They included that VTSP developers must strike a balance between including primary instructions and guidelines in the VTSP document main body versus less-used instructions that could be included as reference material in an appendix. This will ensure that the document is readable, and information is easy to find. Additionally, the VTSP must be designed as a "flexible template" to support rapid tailoring and modification for training in multiple T&R events. The template must account for a variety of virtual technologies in use, and possibly for numerous training scenarios and different training audiences. Both the VTSP designers and developers must understand the current state of the virtual technology being used to ensure extensibility and must update instructions to reflect the current technology version and thus ensure accuracy and completeness.

However, developing a usable VTSP requires more than just a template. The VTSP must be created by SMEs who have a solid understanding of, and preferably experience in training with, the T&R events. Since the VTSP provides instructions for evaluating performance, its developers must describe the assessment approach and scoring methodology. In support of the assessment, the VTSP design must include a strategy for continued sustainment training, remedial training, and advanced training for complex conditions. Often overlooked, performance checklists and performance evaluation criteria are essential components of the TSP.

In 2020, the study team codified many of these lessons learned into an expert system that automates TSP development. The system has received praise from USMC leadership for the substantial time savings it provides, given that a team of experts previously required nine months to design and develop the FiST TSP (Loeffelman, et al., 2019). The USMC currently plans to develop three TSPs during a one-week TSP development conference supported by TRGT to demonstrate the significant decrease in development time and manpower requirements. This expert system enforces a TSP structure, reduces errors through controlled field entry, and improves efficiency through collaboration during TSP development.

TSP RAPID GENERATON TOOL: INNOVATE TO ACCELERATE

TRGT Introduction

Based on the four SME-recommended expert system requirements, the study team focused on standardizing and streamlining the creation, hosting, implementation, and reuse of TSPs that support virtual training. In FY20, the study team identified the requirements and conducted an Analysis of Alternatives (AoA) to scope the system. Ultimately, the team concluded that developing a custom application, the TRGT, provides the flexibility, adaptability, and scalability required by USMC trainers. The TRGT is a modern desktop application that automates the creation of TSPs while ensuring consistency, efficiency, and security.

TRGT Design Process

In FY20, the study team scoped the needs and vision of the system by first identifying the requirements. From the requirements, the team developed a list of criteria to standardize the AoA. The AoA criteria were:

- Solution Category (e.g., existing solution or a new solution)
- Functionality (e.g., ability to integrate with other solutions)
- Complexity (e.g., level of difficulty to set up and maintain the software)
- Cost (e.g., acquisition of software, software licensing, customer support)
- System Properties (e.g., flexibility, usability, security).

The study team researched and identified potential solutions (e.g., HotDocs, Docassemble, Electron), and evaluated each solution against the defined AoA criteria. Based on the AoA, the study team recommended investigating the limitations of the open-source system, Docassemble, and pivoting to a custom-developed solution (e.g., Electron) if necessary. After further analysis and investigation, the study team determined that use of a custom-developed solution represented the best approach for the following reasons:

- HotDocs and other similar commercial products guided users through a process of gathering information and generating a document. However, the information inserted cannot be reused for other documents. This would not meet the requirement to leverage a central repository of training resources and would constrain coordination and collaboration between TSC and BSC SMEs.
- Because the data structure was expected to evolve, the team determined that a NoSQL database would be ideal because of its flexibility and scalability for rapid prototyping. Docassemble's built-in database is SQL-based and setup presents difficulties due to unclear documentation. Docassemble can leverage an external NoSQL database, but this would add redundancy, inefficiency, and complexity to the underlying implementation.

The study team moved forward with the development of a custom desktop application by utilizing modern web technologies (e.g., HTML, CSS, JavaScript) and leveraging Electron as the framework to create the application.

TRGT Architecture

The main objective of the TRGT application was to create an ecosystem that allows for rapid, accurate, and consistent development of TSPs. After a thorough AoA, the team decided that Electron offered the best option for accomplishing this goal. Electron is a framework for creating cross-platform desktop applications using web technologies. It uses Chromium[1] and Node.js[2] to build applications with HTML, CSS, and JavaScript (Darvin, 2017).

[1] Chromium is an open-source browser project that builds a way for all users to experience the web.
[2] Node.js is a platform built on the JavaScript runtime environment for building network applications (Tutorialspoint, 2019).

The TRGT application was developed using existing technologies as shown in Figure 3. The front-end of TRGT is built upon the basic toolset of HTML, JavaScript, and CSS leveraging the UIKit[3] library. By contrast, the server-side architecture of the TRGT application consists of a more complex integration of different technologies. The transfer of information from the client to the server is facilitated through Express.js, a framework that simplifies the creation of robust APIs.

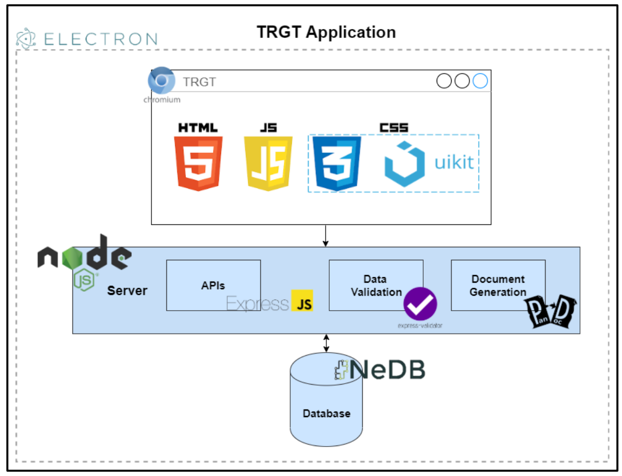

Figure 3. TRGT Architecture

The team selected NeDB, an embedded/lightweight NoSQL database that is ideal for small desktop applications that do not handle large amounts of data, to enable transformation of the TRGT from a desktop application to a web application. The team then used the Pandoc library to generate the VTSP document. Pandoc converts data between markup and word processing formats. It can parse text and create a native representation of that data in a target format (Pandoc, n.d.). For TRGT, the team first converted sanitized, persisted JSON data to HTML, and then leveraged Pandoc to convert the HTML to a Microsoft Word document.

The TRGT application underwent several Fortify[4] security scans, which assessed and mapped findings to security risks and vulnerabilities. Since TRGT was built on Electron, the application is exposed to common web vulnerabilities such as cross-site scripting (XSS), Open Redirect, SQL injection, and authentication and authorization flaws. To address these findings, the study team leveraged a middleware library, express-validator, to validate and sanitize data. For example, the study team implemented whitelisting, blacklisting, and value range limitation, which are proven security practices for server-side validation on user data.

In summary, the study team designed the architecture with the above technologies to enable scaling from a standalone to a networked solution in a future TRGT release. For example, removing the Electron framework from the TRGT architecture enables this desktop application to become a web application and NeDB provides the backbone for a transition to a large-scale database such as MongoDB.

TRGT Features

TRGT simplifies the document generation process by leading users through a series of input forms with clear instructions and an intuitive flow. The user interface first presents a homepage that offers a quick introduction to the tool and a navigation menu (Figure 4). This menu contains eight sections that are aligned with the FY19-developed VTSP design. Each section follows a similar three-step flow. The first step is an introduction page that defines the information users are expected to provide.

[3] UIKit is a lightweight, modular front-end framework that provides the scaffolding for the development of web interfaces.
[4] Fortify™ is an application security analyzer that helps developers identify and eliminate vulnerabilities.

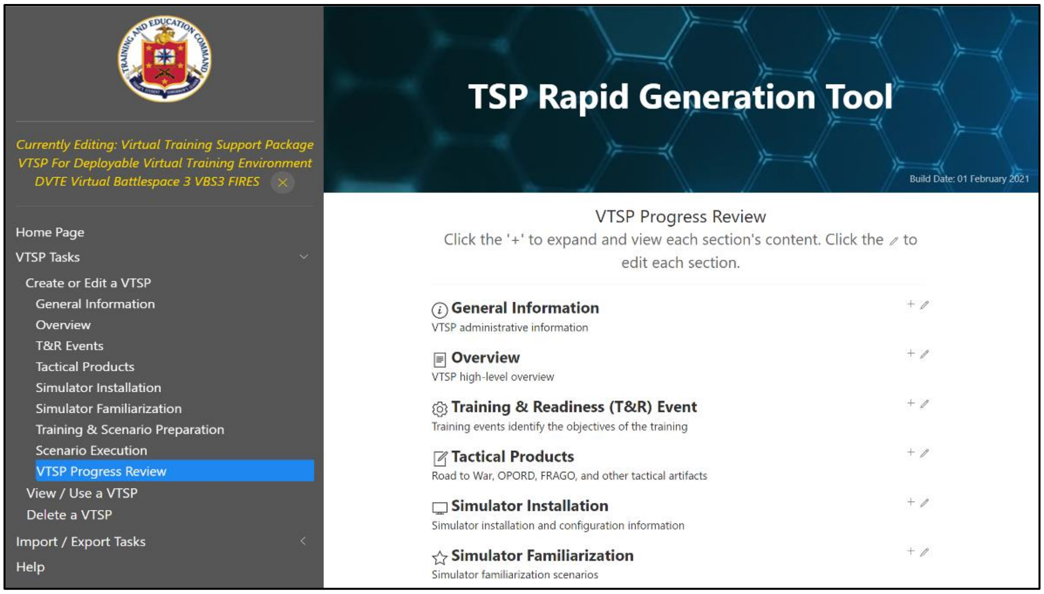

Figure 4. TRGT Application

Following the introduction is the information provisioning section, where users select from one of three options: create a new instance of a section by filling in the input forms (Figure 5), select a pre-written section from a SME "crowdsourced" database, or edit a pre-written section. If new information is required, the TRGT guides users through a sequence of fields and provides tooltips containing additional descriptive information. Otherwise, the application automatically pre-populates the input forms. This gives TSC exercise designers and BSC simulation professionals the ability to build upon each others' work, facilitating collaboration and encouraging creation of reusable, standardized content.

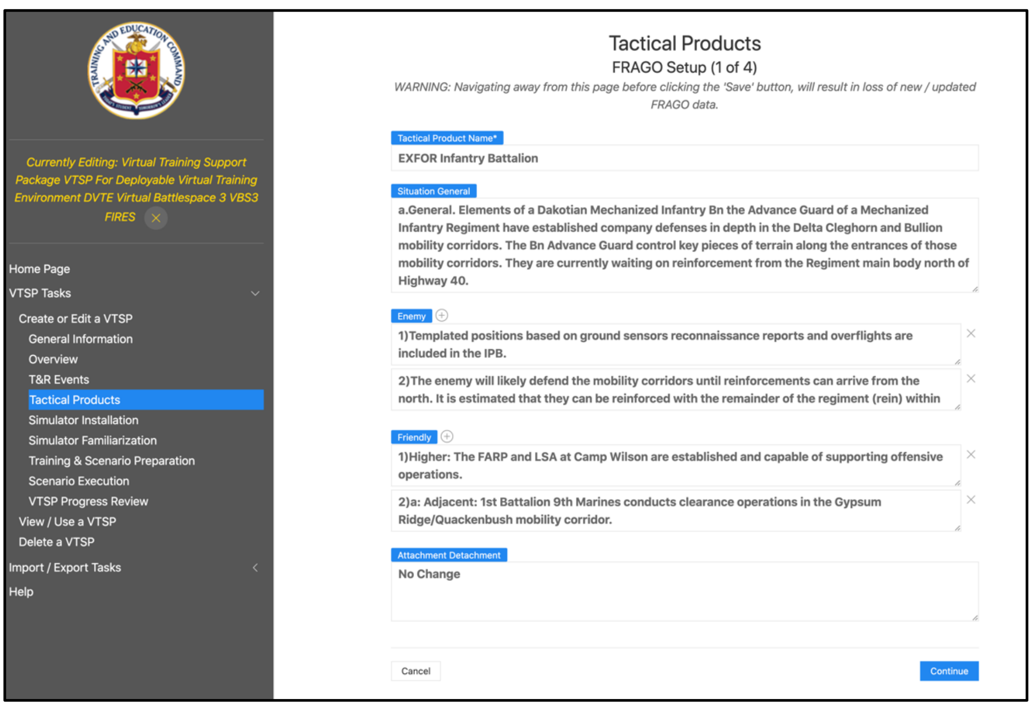

Figure 5. TRGT Input Entry

After completing the input stage, users are presented a summary page where they have the option to review and make any necessary edits (Figure 6, left). Additionally, the TRGT application enables users to preview the fully formatted VTSP document inside the application (Figure 6, right) or save the VTSP to their filesystem as a .docx file.

Even though TRGT is a standalone application, users can import and export data from the application to facilitate collaboration. It is important to note that the study team intends to extend TGRT to become a distributed application. The study team chose to implement import and export capabilities in an early TRGT release to break down traditional barriers between the training and technology communities. The TRGT enables TSC and BSC SMEs, whose work is generally distinct, yet related, to integrate information more effectively and collaborate on the same VTSP. Thus, the standardized flow in combination with the generation and collaboration functionality makes the creation of VTSPs consistent and efficient.

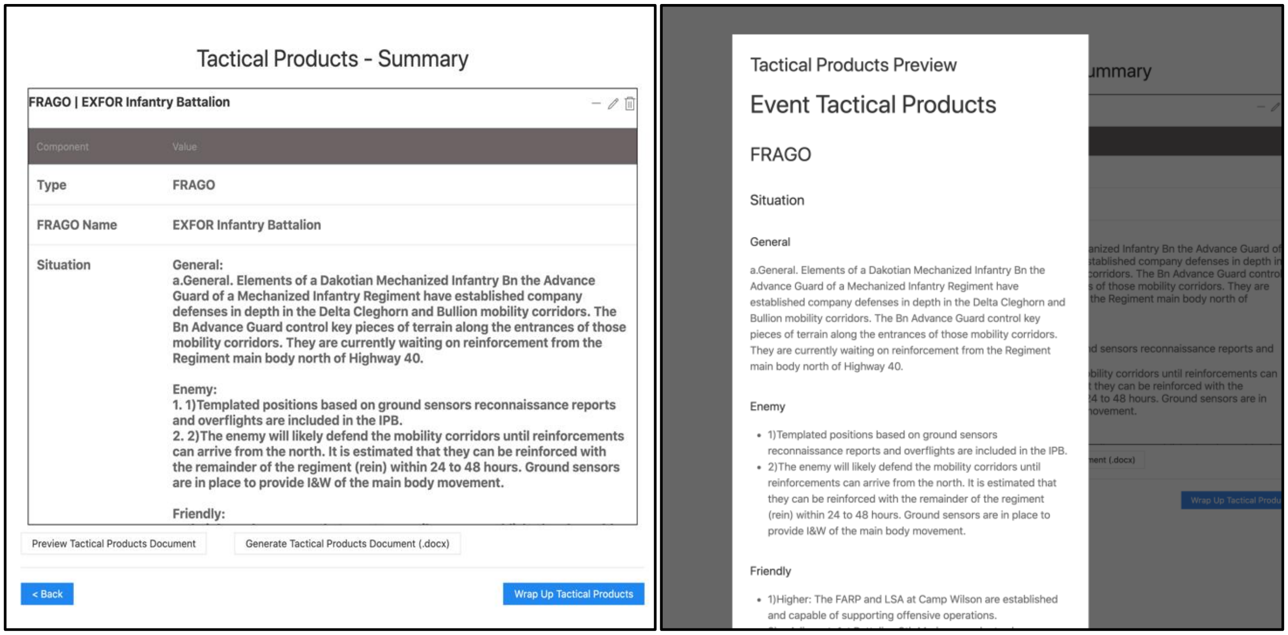

Figure 6. TRGT Summary Section and Preview Capability

WAY FORWARD: ENABLING ENTERPRISE-LEVEL ADOPTION

TRGT provides training professionals with an accessible software application that streamlines the process for building standardized, relevant, and reusable training packages. Every TSP produced by TRGT follows the same formatting guidelines, includes all required elements, and guarantees traceability to DoD training and readiness (T&R) frameworks. Additionally, the study team specifically designed TRGT to run on enterprise workstations to provide both training designers and simulation operators with an interface for developing materials. TECOM intends to deploy TRGT throughout the USMC to provide training developers with a collaborative tool that crowdsources standardized lesson plans and helps them to rapidly generate simulation scenario products.

TRGT's collaborative environment allows training designers to plan a synthetic or live training exercise grounded in T&R tasks that contains the necessary content, including grid locations, fragmentary orders, intelligence reports, and other training support materials. Passing these critical pieces of environmental and training information to simulation operators allows them to select optimal systems, instantiate entities, gather synthetic terrain, configure systems, and set up interoperability gateways. TRGT harnesses the strengths of the design and simulation communities to deliver a high-quality training product, namely the TSP. The TSP provides the documentation that guides Service members through the exploitation of fielded training devices to practice specific T&R tasks. TRGT provides a crowd-sourced alternative to traditional contracting solutions that allows services to develop training more rapidly and ensure scenarios remain relevant to current operating environments.

As with any crowd-sourcing initiative, the USMC recognizes the need to advance this effort. The USMC will use the previously mentioned SAT to develop a standardized curriculum for each simulator system. This curriculum will provide the instructional framework (learning objectives, concept cards, master lesson files) in which TRGT-generated TSPs will reside as scenario media products. With the framework established, many of TRGT's information requirements can be retrieved from the tool's parent documents to reduce the effort required to populate a TSP. TRGT constitutes the central theme of ongoing TSP development conferences that enable curriculum developers, system operators, and training designers to collaborate and produce complete TSPs during week-long sprints. This timeline would not be supportable without TRGT. Furthermore, the USMC should continue to refine the TRGT to interface with enterprise-level information systems in a networked configuration. Connecting to the Marine Corps Training Information Management System (MCTIMS) would allow TRGT to pull up-to-date reference information (such as T&R task descriptions) and push approved training scenarios that directly link T&R tasks to the systems that support them. Additionally, network capabilities would allow increased collaboration, simultaneous development, and, potentially, integration with simulators themselves. The USMC plans to distribute TRGT throughout the training community, develop specific training scenarios, assess the capability, and integrate TRGT's capabilities into the USMC LVC Training Environment (LVC TE) exercise design tool (EDT) design.

Ultimately, TRGT's flexible framework supports military use cases in both the operational and training domains. TRGT provides a dynamic documentation tool that standardizes and streamlines the development of training materials and can be modified to support operational documents like orders, intelligence products, or other requirements. As the USMC integrates TRGT's capabilities into product baselines, it anticipates identifying additional areas where the rapid development of standard training documents could be inserted into information process flows to gain efficiencies and improve product quality.

SUMMARY AND CONCLUSION

To create standardized, relevant, and impactful learning experiences, the USMC must provide training design resources that deliver important tactical and environmental information to guide training. Marines need such resources to adopt adaptive and proficiency-based practices that ultimately "changes the Training and Education Continuum from an industrial age model to an information age model" (CMC, 2019, p. 13).

The USMC has made significant progress towards this goal. The journey began in 2019 when the USMC and MITRE partnered to create a new TSP standard. The outcome was a VTSP structure and design that formalized documentation for planning, preparing, executing, and assessing T&R events in a virtual training environment. Collaborating with USMC training SMEs, the study team developed a Fires VTSP and validated this product with TSC and BSC end users at Twentynine Palms and Camp Pendleton. The users' feedback − highlighting the need for an expert system that guides TSP development, includes a repository of training resources, and minimizes reliance on the TSP experts − was invaluable in shaping the next phase of the study: developing the TRGT expert system.

The study team first performed an AoA to determine the best technical approach for automating TSP development. The outcome of the AoA led the team to develop a custom modern desktop application that leverages Electron as its framework. Combining this framework with other middleware and libraries, the application has become a robust tool with many capabilities. Furthermore, Electron's native abilities and implementation of the best secure coding practices have increased TRGT's security. Accordingly, the TRGT application competently guides users through an intuitive flow that consistently and efficiently generates VTSP documents.

Finally, it is essential that not only the USMC, but also all Military Services and DoD agencies, develop usable and useful training support tools to increase the combat capability of the warfighter. Without such tools to support simulators and systems, training will lack the context, structure, and objectives to be effective. Training support tools enable warfighters to acquire skills more rapidly, improve training engagement, and have the potential to pave the way for other self-paced 21st century learning environments.

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