Training Beyond 2025: A Vision for Synergizing RRL and STE

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ABSTRACT

The goal of training and learning in the US Navy and US Army is to develop holistic, inclusive future training systems by 2025 and onward to enable training cycles from basic training environments (classroom and field) to operational unit environments. The Navy and Army are modernizing training delivery through Ready Relevant Learning (RRL) and the Synthetic Training Environment (STE), respectively, by 2025 and onward. These programs will streamline and merge training skill cycles across career paths and readiness cycles. The audacious deployments of RRL and STE will revolutionize Sailor and Soldier preparation and sustainment, but each program will incur a hefty price tag while foregoing critical capabilities. Both services plan on having artificial intelligence (AI)-based learning systems, dynamic scenarios, and intelligent tutors. This paper examines the Navy's Ready Relevant Learning (RRL) environment and the Army's Synthetic Training Environment (STE), highlighting commonalities and differences to achieve readiness. Our intent is to not only discuss the two programs, but also look at ways the adjoining services, defense agencies, and other non-DoD agencies could apply the same tenets for the education and training of their workforces.

ABOUT THE AUTHORS

George Stone, Army Portfolio Manager, Aptima, Inc. has more than 35 years of US DoD and Army experience in education and training. Within the US Army and DoD, Dr. Stone served as a program technical advisor and Army representative in multiple large, complex, and cross domain simulation systems to improve unit performance, output visualization, usability, database configuration, software quality and information assurance. Dr. Stone has supported technologies enabling the integration of warfighting through virtual and constructive simulations in a common synthetic battlespace. Dr. Stone earned his BS in engineering from USMA, MS in IE from Texas A&M, and Doctorate in IE from UCF. Dr. Stone is currently the Army Portfolio Manager at Aptima for learning and simulation integration, adaptive training, learning management, virtual reality, and simulation testing.

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INTRODUCTION

Modeling and simulation (M&S) have been key components of service training systems since the 1990s. Starting in the 1980s, the military started to use the value of M&S by using simulations and simulators for training. Continuing into this decade, the positive trend has enabled readiness for our military personnel and leadership in our defense posture and security on a global scale. To defeat near-peer threats, training with M&S empowers the development and evaluation for implementing new mission tactics, techniques, and procedures within the context of the system that is our National Defense.

Figure 1. Army marksmanship simulator. Such systems can train specific tasks but not the whole, highly physical skillset required for infantry combat, which is why the Pentagon is developing more immersive "augmented reality" techniques.

*Training is critical: Secretary Mattis has said infantrymen must fight '*25 bloodless battles*' before they first see combat. Traditional training methods will never adequately prepare a close combat soldier for the horrific shock of the first time under fire. Thus, a first priority of the Task Force is to develop small unit simulations that replicate the shock, uncertainty, chaos, and fear of the close fight. The team is well along in creating virtual environments enhanced by* ***augmented reality technologies****, immersing infantrymen inside simulations that offer the repetition with variation, scenario after stressful scenario with new surprises each time, thus providing a truly transformational training experience.*

With respect to US sea and land power, the Navy and the Army have established and programmed two major efforts to meet the Nation's security and readiness requirements. They are modernizing training delivery through Ready Relevant Learning (RRL) and the Synthetic Training Environment (STE), respectively, by 2025 and onward. These programs will streamline and merge training skill cycles from basic training environments (classroom and field) to operational unit environments (garrison, theater). The bold deployments of RRL and STE will revolutionize Sailor and Soldier training, but each program will incur a sizable price tag while foregoing critical capabilities.

At the 2021 Interservice/Industry Training Simulation and Education Conference (I/ITSEC), Chief of Naval Operations, Admiral Michael Gilday said, "It's easy to take your eye off training, but we've made training and readiness a priority. We are funding new platforms and looking at what we should invest more in and what we should look at sundowning to invest that money somewhere else." It is not enough to have training or modeling and simulation; an integrated deployment of each of these elements is needed to provide a platform for Warfighter readiness. Simulations ensures that the sailor and soldiers remain the most important component in simulators and simulations. Jack Thorpe, a founding father of SIMNET wrote: *The dominant orientation for simulator designers should be the warfighting world outside the simulator, not inside. For those life-or-death battles in which the combatant has fully projected himself, the effort and money that goes into micro-fidelity has little return. It is the interaction of the individual and his crew with the world outside which deserves the highest attention to fidelity*.

Although RRL and STE share a common vision to produce proficient, ready, and lethal Warfighters, the execution differs with a focus on individual versus collective training. These focus areas are complementary but require different training delivery approaches and data utilization strategies. RRL focuses on skill/task performance supported by granular data linked to competency frameworks whereas STE focuses on full-scale exercise

performance supported by task-level data. The development of RRL and STE will require a combined total of approximately $2.5B, but each of the two programs will lack the capabilities offered by the other: RRL will not provide collective training at scale and STE will lack personalized training. This presents an immense opportunity for each program to add these critical capabilities and cost-share the efforts. Additionally, this can be made possible by leveraging related end-user technologies and a similar modular open-system architecture.

The following sections will provide an overview of each program, a vision for RRL and STE synergy, training symbiosis and implications, and wraps up with conclusions and recommendations.

PROGRAM OVERVIEWS

RRL Overview

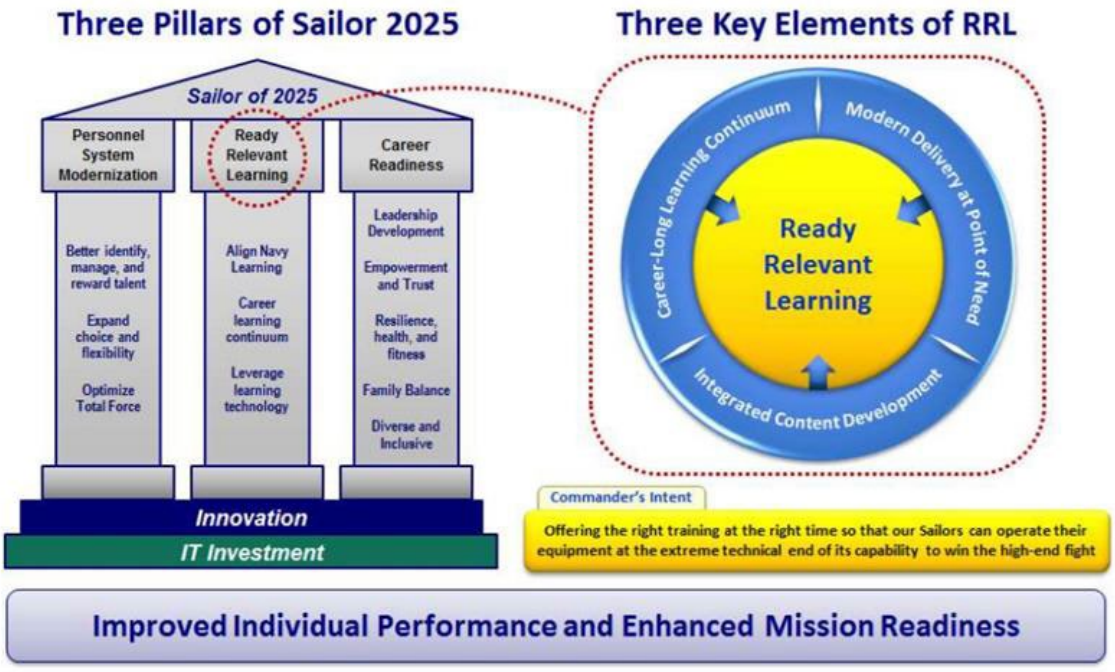

Figure 2. Ready Relevant Learning (RRL)

"Ready, Relevant Learning" is one of three pillars under the Navy's Sailor 2025 program, calling for a career-long learning continuum, modern delivery at the point of need, and integrated content development. RRL encompasses software and architectural design, development, integration, testing, and operational sustainment. At its core, RRL is about creating more proficient and technically capable Sailors as they head to operational fleet units. The RRL mission is to recruit, develop, and train those who serve our nation, and it is critically important that our Navy employ the most effective and sophisticated means available to train the newest Sailors into skilled combat-ready Warfighters who are both disciplined and tough. RRL provides the mechanism to modernize our institutional training system. To accomplish this vision, the Navy has three lines of effort: (1) career-long learning continuum, (2) modern delivery at the point of need, and (3) integrated content development.

STE Overview

The **STE** Overview in **Figure 3** depicts how the Army will train and maintain readiness and skill proficiency at individual, team, and unit levels. The Army will use STE's major components (e.g., One World Terrain, Training Simulation, Virtual Trainers, and the Training Management) to integrate live, virtual, constructive (LVC), and gaming training environments at the point of need. The STE's advanced technologies enable current and future force Warfighting functions, joint operations, multiple domains, and threat capabilities. The STE enables tough, iterative,

dynamic, and realistic multi-echelon/combined arms maneuver, mission rehearsal, and mission command collective training in support of multi-domain operations. The STE will provide units the repetitions necessary to accelerate proficiency in individual-through-unit skill and collective task levels resulting in achieving and sustaining soldier readiness for units which are rated the highest C rating for training, C-1. For individual and team, they are rated as Trained, Partially Trained, and Untrained. The STE provides complex Operational Environment (OE)

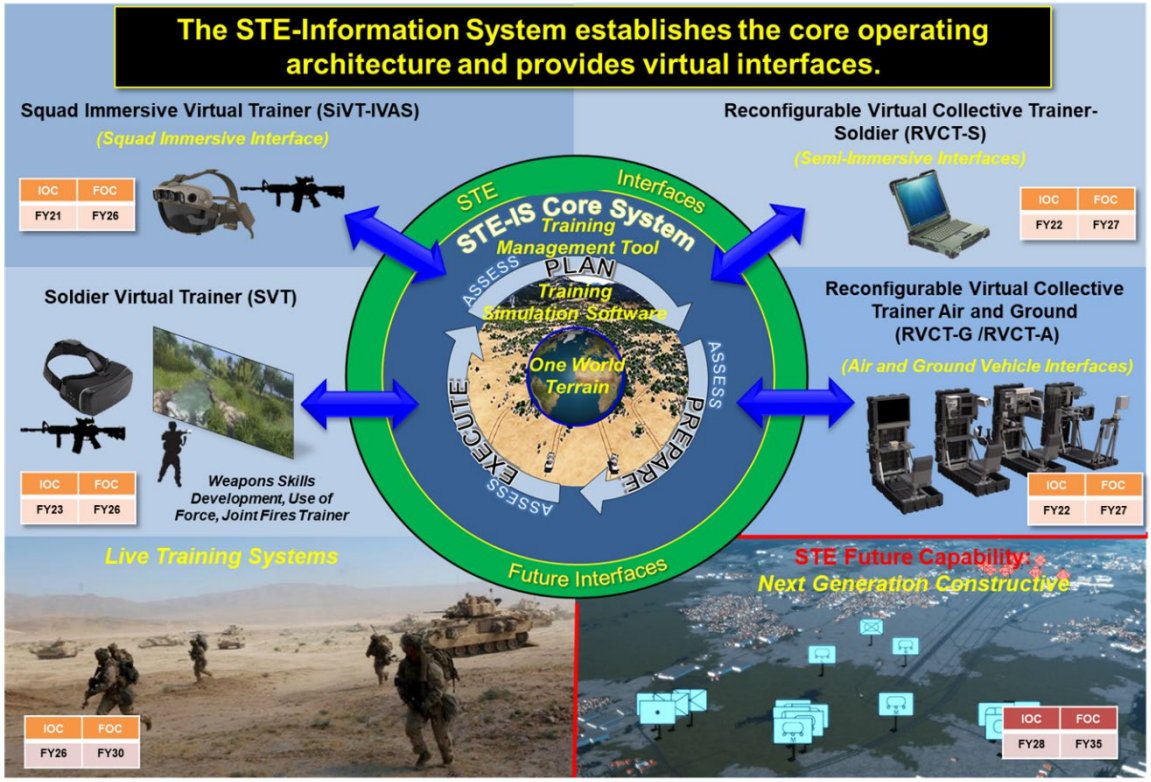

Figure 3. Synthetic Training Environment (STE) Overview

representations anytime and anywhere in the world. The STE will deliver collective training, accessible at the point of need in the operational, self-development, and institutional training domains.

Similarities and Differences between RRL and STE

The similarities between RRL and STE are the access to training occurring on demand at the point of need. The point of need for the training occurs when their current readiness does not align with their immediate task or mission. RRL and STE will accelerate the learning of every Sailor and Soldier by providing training at the point of need while accounting for curriculum updates in support of changing Warfighting requirements. Both programs will enable warfighters to train for their mission as an individual and with their teams in complex environments. STE and RRL support a mixture of LVC training modalities. All training will be available in locations that balance delivery logistics with training effectiveness (home station, combat training centers, armories, institutions, shipboard, deployed, etc.). The success of both programs provides a more capable and lethal warfighter who will achieve optimal performance to win the fight. Finally, the objectives for both STE and RRL are to transform outdated training content and archaic methodologies into a modernized, on-demand, responsive learning system—the next-generation of personalized and holistic collective training capabilities.

Differences worth noting are that RRL is primarily individual centered with aspirations to support teams through the unit/ship level. On the other hand, while STE includes individual weapons training, more of the focus is on the team and unit levels (e.g., crew, squad, company, battalion). STE includes standardized APIs for terrain data and assessments of performance and evaluation of learning, while RRL focuses on the learning architecture for content and performance assessment results. **Table 1** provides a summary of information on the differences and similarities between RRL, and STE. Differences will be notated in the first two rows (RRL; STE), while similarities will be notated in the third row (both RRL and STE).

Table 1. Differences and Similarities Between RRL and STE

Program	End-User Technology	Media Strategy	Delivery Method	Data and Assessment	System Architecture
RRL			Instructor Facilitated Interactive Training (IFIT), Self-Directed Interactive Training (SDIT), Structured On-the-Job Training (SOJT), Performance Support (PS)	A Learning Assessment System (LAS) delivers assessments and surveys. A Learner Record and Learner Profile maintains updated assertions of competencies.	
STE			Mission Rehearsal/ Exercise for Individual, Crew, Team, and Unit		
Both RRL and STE	Computer, Tablet, Mobile device, Head Mounted Display, Reconfigurable Virtual Trainer, Paper Document	Actual Equipment, Part-Task Trainer, Augmented Reality, Virtual Reality, Mixed Reality, Interactive Multimedia Instruction, Animation/ Video, Immersive Virtual Environment, Job Aid		Management System (LMS) hosts, delivers, tracks, and reports online learning. A Learner Record Store (LRS) holds and shares xAPI student data.	Distributed training using modular open system architecture that follows guidance from the Total Learning Architecture (TLA).

A VISION FOR RRL AND STE SYNERGY

Aligned Goals and Hypothetical Scenarios

STE and RRL capabilities can enhance each program's goals and objectives and reduce costs by reusing each program's technology investments and lessons learned. For instance, on the Navy RRL program, innovative content conversion processes and learning technology stacks are utilized to deliver classroom, immersive, and ship-board training. This enables the Navy to assess and monitor Sailor performance on tasks down to the individual knowledge and skill level. With this information, training can be tailored to Sailors in the way that best supports their needs. These processes and technologies complement the mission rehearsal and exercise capabilities of STE. Functionally, this could support Soldier development by leveraging data from the STE environment.

Imagine a hypothetical scenario where a Soldier participates in a mission rehearsal exercise and during one of their tasks and they underperform in Battle Drills (BD) 9 React to Indirect Fire, BD 11 React to an IED, and BD 4 React to Ambush. Through similar RRL-derived capabilities, the Soldier can receive this specific feedback, review training content on reacting to indirect fire, IEDs and ambushes, practice scenario vignettes on these tasks, and

replay exercising on these Battle Drills in a situational training exercise (STX). As the Soldier completes these Battle Drill tasks, their performance is monitored until they have closed their skill training gaps. Then, in subsequent mission rehearsals, their growth will be evaluated to ensure it is sustained. Now, in this hypothetical scenario the impact for one Soldier may be slight, but if this is applied to hundreds of thousands of Soldiers, the impact will be immense and undeniable.

Likewise, RRL could incorporate mission rehearsal exercises into their LVC training, especially their team training (e.g., watch teams). Imagine another hypothetical scenario where a group of Sailors who recently completed a series of trainings are ready to test their skills in a capstone exercise. Upon arrival they pickup immersive technology mimicking their actual equipment and a virtual environment that mirrors an operational mission. Based on their previous performance and skill levels, a scenario is selected, and the associated parameters are finely tuned to challenge them in an exercise. Once the exercise begins the Sailors' actions are tracked, data on task success is generated, and the outcomes are recorded. After the exercise, a debrief is conducted and new performance insights are fed back into the system to improve the training. When scaling this hypothetical scenario across all schoolhouses, the impact will be more proficient Sailors and a Fleet that is better prepared to fight.

Notional Use Cases

An Army and Navy collaboration would improve warfighter preparedness while avoiding "reinventing the wheel" and save time and money for each service. In the interest of thinking big and starting small, there are a few recommendations for embarking on this endeavor. To start small, launch a pilot effort for individual training with a role such as computer or network technician. This type of role will have a high probability of overlapping Army and Navy knowledge, skills, tasks, and subtasks, therefore lowering the barrier of entry for collaboration. This type of role is typically situated on the maintenance side, job criticality depends on system support, and the tasks vary in complexity providing an opportunity to scale the capability. Once the individual training has been accomplished, move on to Army squad team training event and Navy Combat Information Center (CIC) watch team exercises. These teams will also have a higher probability of overlapping Army and Navy knowledge, skills, tasks, and subtasks for training. These types of teams are typically situated on the operations side, are highly critical, and the tasks vary in complexity, providing an opportunity to scale the capability. After training at the individual and team level, STE stakeholders can shift focus to the crew and unit level.

In addition to starting with the individual and team use cases, it is also recommended the RRL and STE stakeholders focus on training at the task level as an initial common ground. Based on the respective services' training structure, the figure below represents the primary delivery methods and data focus areas for collaboration. Primarily, RRL is focused on identifying how knowledge and skills are impacted by performance on tasks and subtasks, if applicable. However, STE is primarily focused on how the events and ultimately the outcome is impacted by the performance on tasks and subtasks, if applicable. This common ground provides an opportunity for each program to support the other in mapping individual and team performance frameworks.

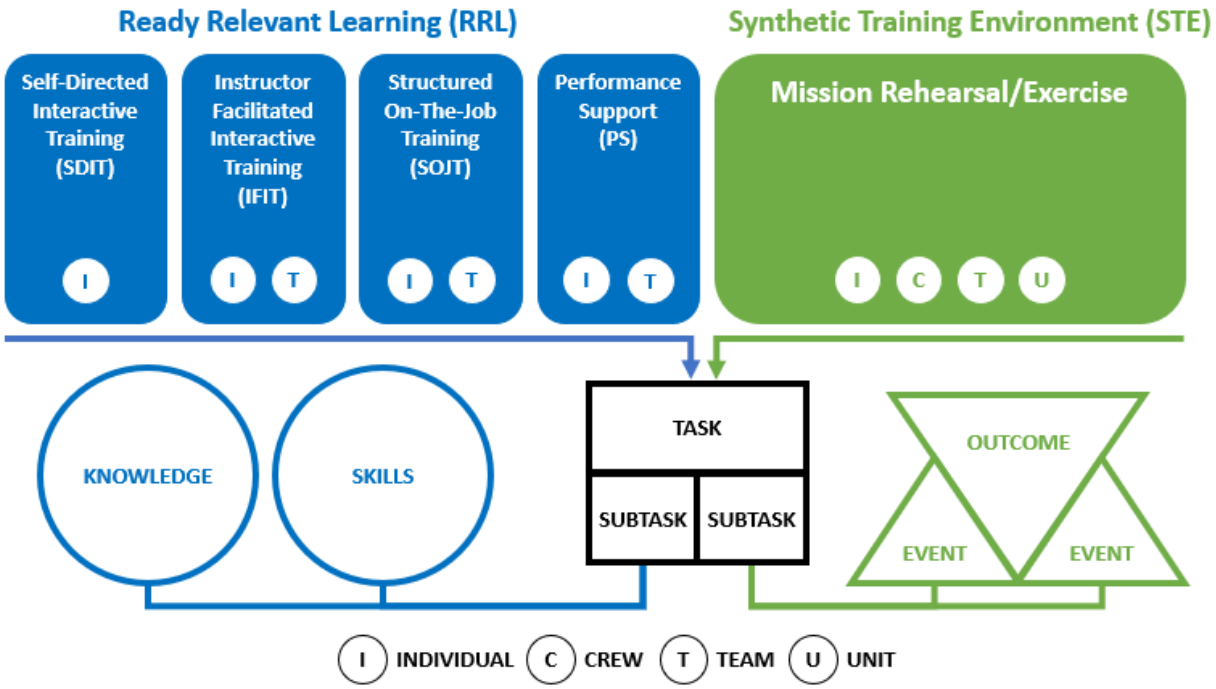

Figure 4: Training Common Ground Between RRL and STE

Specific examples of aligning systems are the instructor/mentor compilations of training task results and evaluations. Trends for training also could be standardized and reviewed to determine what paths for further training are applicable. The STE's Training Management Tool provides capabilities to plan, prepare, execute, and assess a holistic training solution; this suite of tools, data sources, and workflows could also be applied to RRL for the Navy to perform a training exercise in LVC environments. The RRL program should employ this strategy to ensure they connect training/learning from the classroom to the Fleet operational environment.

The Army's STE program needs to ensure linkages from operational environments back to the classroom (and vice versa); the Navy's RRL program provides a comprehensive content conversion process and learning stack (e.g., Learning Management System, Learning Assessment System, Student Information System, Collaborative Learning Environment, Learning Object Repository, Learning Record Store) to model and support learners. The STE program should employ this process and system architecture to ensure they connect mission rehearsals and exercises to the prerequisite knowledge and skills.

Budgetary Data

The combined total projected funding for RRL and STE is just under $2.5B, RRL accounting for ~$930M and STE ~$1.5B. To give a sense of recent funding for both programs (FY2020 through FY2022) in the President's Budget, **Figure 5** depicts yearly funding rates. Both programs have increasing levels of funding from Fiscal Years (FY) 2020 to 2022; the Army's STE almost doubles between FY21 and FY22.

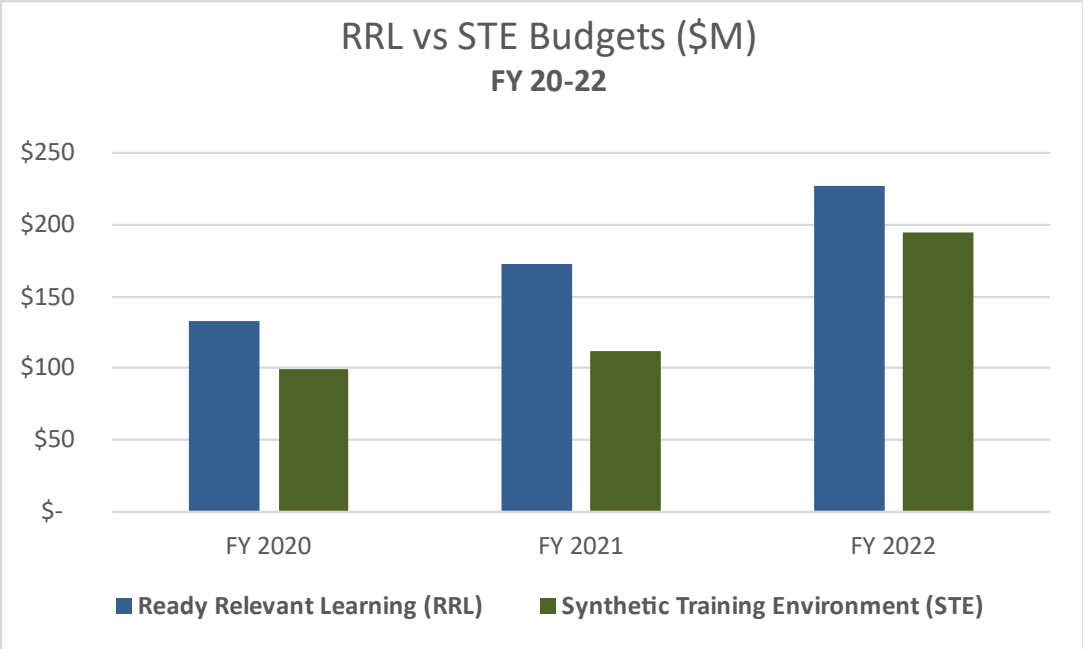

Figure 5. Budget Comparisons of RRL and STE (FYs 2020 to 2022)

Table 2. Total FY20-22 Funding

	Total	Type Funds
RRL	532.733M	O&M,Navy
STE	405.645M	RDT&E, Army

The overall totals for FYs 2020 to 2022 (**Table 2**) are over 500 million dollars for RRL and 400 million dollars for STE. The interesting note here is the type of funding for each program. The Navy is using Operations and Maintenance funding, while the Army is using Research, Development, Testing, and Evaluation (RDT&E) funding. The Army's STE effort is still being developed, while RRL is being built as an operational system. The implications of this suggest that STE may first want to adopt RRL capabilities as the system should have a higher Technology Readiness Level (TRL) and RRL may want to wait for the STE capabilities to mature.

If RRL and STE pursue a synergistic collaboration, assuming a modest 15% cost savings per program, this would amount to roughly $225M for RRL to build out an LVC mission rehearsal capability and $140M for STE to build out a learning ecosystem. This results in a combined $365M. While these cost savings are significant, it warrants an investigation into the Return on Investment (ROI). Namely for RRL, what are projected benefits for the Sailor and Fleet (e.g., safety, readiness, mission success) and are the mission rehearsal capabilities worth the investment? For STE, what are the projected benefits for the Soldier and the force (e.g., lethality, proficiency, qualification) and is a learning ecosystem worth the investment?

CONCLUSIONS AND RECOMMENDATIONS

Conclusion

While both RRL and STE share a common vision to produce proficient, ready, and lethal Warfighters, the execution differs with a focus on individual versus collective training. These focus areas are complimentary but require different training delivery approaches and data utilization strategies. RRL focuses on skill/task performance supported by granular data linked to competency frameworks whereas STE focuses on full-scale exercise performance supported by task-level data. RRL will not provide collective training at scale whereas STE will lack individualized training. This presents an immense opportunity for each program to add these critical capabilities and

cost-share the efforts. Additionally, this can be made possible by leveraging related end-user technologies and a similar modular open-system architecture.

Recommendations

The authors would like to make four recommendations based on our research and review of RRL and STE:

1. By 2025 RRL and STE will have achieved success or be nearing completion. This offers an opportunity for an evaluation of the program and determination of the path forward. It is recommended the program stakeholders consider the areas outlined in this paper as a starting point to determine the impact of adding the other program's capability. Each program should conduct an evaluation to determine a projected ROI across their respective areas of interest. If the investment is determined to be worthwhile, the stakeholders should meet to discuss program synergy and the capabilities of interest.
2. Areas the Army and Navy can share or synergize on—the Army and Navy could synergize on developing a joint Army/Navy simulation system that shares data back and forth between their models. This would allow each service to understand the data from the other's simulation system and pave the way for future consolidation of simulation models. As suggested in the Introduction section, the LVC for each service could use the STE-IS Architecture and its components. An SBIR research topic could support this integration by adding this topic for advanced technology areas each service is looking at.
3. If RRL or STE stakeholders determine the other program's capabilities warrant the additional investment, several technical decisions must be made to determine *how* to move forward. It is recommended the program stakeholders consider if they will simply incorporate the other program's best practices into a new version of the capabilities, if they will integrate the respective systems to form one common system, or if they will design a hybrid approach somewhere in between. Either way, the program stakeholders should establish a tiger team and select a specific use case (e.g., network technician or Army squad/Navy CIC team training event) to start with that has overlapping qualities to support the collaboration and communication process.
4. If a successful adoption or integration of RRL and STE capabilities enhance Sailor and Soldier performance, mission readiness, and proficiency, the same process can be applied for Airmen, Marines, Troops, and Space Force Operators. It is recommended the other services investigate the benefits of pursuing a synergistic capability set while reducing overall cost. This type of capability is also applicable to police, firefighters, emergency personnel, and more. The underlying foundation to succeed in such a highly ambitious and expensive program must design, apply, and integrate the most advanced software and hardware technologies within a short timeframe.

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