Stress Inoculation Training (SIT-NORCAL), Part 2

A Pilot Study Among Explosive Ordnance Disposal Special Warfare Enablers

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ABSTRACT

Background: Despite being a well-supported strategy, Stress Inoculation Training (SIT) has not been fully incorporated in the advancement of human performance among most military personnel. The RAND Study recommendations for maximizing SIT's potential within high-risk/ high-intensity occupational groups were used in designing the Core Training protocol targeting psychological performance, SIT-NORCAL (Part 1). **Purpose:** The current project (Part 2) sought to further develop the protocol as a health and human performance hybrid through quality improvement analysis of the content, process, and measurement elements for use in the human performance context. **Methods:** Evidence-based/evidence-driven methodologies were used in collaborative design tailored to the unique needs of special warfare enablers specializing in Explosive Ordnance Disposal (n = 17). The resultant three-phase training was conducted with a novice group (n = 10) using standardized measurements of collaboration, human performance, and adaptive capabilities on identified training targets. **Results:** Process elements demonstrated high feasibility, resulting in high collaboration and trainee satisfaction. Significant improvements in psychological performance targets were observed pre- to post-training, and during an Adaptive Environmental Simulation designed by unit members. Two weeks post-training, unit members (n = 5) responded to an actual crash of an F-16 aircraft; measurements indicated maintenance of skill set from training to real-world events. **Conclusion:** Deployment of the elements in the SIT-NORCAL protocol demonstrated early feasibility and positive training impact on occupationally relevant skills that carried over into real-world events.

KEYWORDS: *stress inoculation; training; performance training*

Introduction

Battlefield airmen represent a unique subset of United States Air Force (USAF) personnel traditionally exposed to repeated and extreme stressors under intense occupational conditions. The USAF continually strives to ensure airmen receive the most intensive and effective training, to enhance both battlefield lethality and post combat resilience. This is especially prominent within occupations in which these natural occupational hazards for human performance exist, and for which management of extreme stress is mission critical.[1]

Stress Inoculation Training

Background

SIT has demonstrated effectiveness in enhancing performance on a wide array of human performance targets, among multiple high-intensity/high-risk career fields within the US military.[1] The performance targets in prior studies have included increasing stress tolerance during high-intensity battlefield operations simulated virtually, managing physiological arousal and complex decision-making under stressful conditions, applying novel, complex skills while rendering first response, and executing real-world aviation tasks.[2–10] More crucially, SIT has demonstrated a high level of efficacy and cultural acceptability in military populations.[1,11] As a result, the US Navy, US Army, and, more recently, the US Air Force, have all developed integrated frameworks incorporating formalized SIT or Stress Exposure Training curricula for specialized occupational designations – Navy Seals, Special Forces, and Special Operations/Special Tactics, respectively.[1,12]

Nature of the Problem/Significance (Knowledge Gap)

The RAND study, *Enhancing Performance Under Stress: Stress Inoculation Training for Battlefield Airmen*, identified that efforts to formally incorporate the recommended core cognitive and behavioral skillset in SIT have been sporadic (see Part 1).[1] Training instructors were found to be offering some of these training techniques, but most were "ad-hoc" without formal pre- and post-evaluation of the effectiveness in improving performance skill sets. Most were also without the time-intensive repetition and training required for mastery and adaptation to unique mission-relevant skills in real scenarios. Further, training targets were not typically anchored in a specific core occupational task, and measurement systems were not in place to evaluate training effectiveness on producing improvements in that core occupational task. Additionally, it was found that psychologists supporting battlefield airmen have only been able to offer limited support for human performance optimization surrounding stress exposure. The RAND study also highlighted challenges with incorporating SIT more

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formally, which included a lack of manualized guidelines for configuration of content and processes, as well as measurement systems in addressing occupational specialty groups.[1]

Human Performance

This project was undertaken in response to the recommendations of the RAND study (discussed in Part 1) to address these challenges and opportunities.[1] SIT-NORCAL (HP) is a flexible, manualized intensive Core Training protocol targeting psychological performance optimization that can be delivered on the unit level in modules or phases. The protocol retains a traditional tri-phasic design targeting **N**europsychological **O**ptimization and **R**epair of **C**ognitive flexibility and agility, and **A**ffect regulation (emotional control/physiological control skills), utilizing enhanced **L**earning science methods to increase efficiency in acquisition and recall of task and goal-relevant skill sets.

Purpose

Explosive ordnance disposal (EOD) specialists within the US Air Force are Special Warfare enablers, whose primary occupational tasks include location, disarmament, neutralization, recovery, and disposal of hazardous explosives. These professionals have complex cognitive and physical skill requirements that often require engagement in austere environments during chaotic, highly pressurized, high-risk/high-intensity situations. The current project sought to implement and evaluate SIT-NORCAL (HP's) evidence-based/evidence-driven human performance enhancement protocols within a group of special warfare enablers assigned to EOD. The primary aims of the project included exploring the acceptability (cultural congruence), feasibility, and impact of introducing both the content and process elements associated with SIT-NORCAL (HP) alongside traditional military training and simulation capabilities. Approval for quality improvement analysis of the existing SIT-NORCAL protocol was secured jointly by the Department of Defense Human Subjects Review Officer (HSRO) and the Institutional Review Chief at the VA Northern California Health Care System, Mather, CA.

Methods

Integration of the Performance Improvement/ Human Performance in Technology (HPT) Model

The HPT model (detailed in Part 1) was used as a structural guideline to develop processes for unit collaboration on primary training elements and identification of goals and objectives via needs assessment (Phase 0). It was also used for selecting and designing training modules for Phase I and II, and for structuring effective simulations while leveraging existing training and unit resources (Phase III).[13] Additionally, this model allowed for effective change management within the protocol's material content and processes, enhanced integration of technological resources, and improved measurement capability at each of the process phases (HPT model) and of the intervention (SIT-NORCAL).

Population: Intervention Selection, Design, and Development

Phase 0

The USAF EOD teams in Northern California (n = 17) initiated collaborative efforts with the Principal Investigator (PI) on engineering the existing SIT-NORCAL protocol elements for use in the human performance context in 2017. Two subject matter experts (SMEs) in upper-level enlisted ranks (13+ years of EOD experience) collaborated with the PI to refine educational elements (Catalytics and Adaptives, Phase I–III), and Simulations (Phase III). Modifications to the content and process elements in the protocol were generated via informal and formal feedback as well as measurements of trainee satisfaction at three separate time points during planned unit trainings (2017–2019). Trainees generated information and recommendations for protocol content improvement in the Core Training modules, improving cultural/occupational relevance (Phase I, and II) and leveraging existing unit resources to enhance opportunities and procedures for occupationally relevant practice via Adaptive Exposure Simulation (AES) in Phase III.

Core training modules were designed to target rapid acquisition of fundamental psychological performance knowledge, skills, and abilities (KSAs) relevant among high-risk/high-intensity occupational groups. To preserve fidelity and allow for greater reproducibility, the content of four primary training elements were defined (Education, Catalytics, Adaptives, and Simulation). In order to maintain SIT's flexibility and responsiveness to individual occupational demands, standardized procedures were developed for collaborating with SMEs in building the Catalytic and Simulation training elements that were incorporated in pre-defined areas of the training sequence.

Measurement

Unit Collaboration

The Wilder Collaboration Factors Inventory (WCFI) is a tool that uses 20 factors to identify strengths and weaknesses of collaborative groups.[13] These factors are measured by 40 items grouped into six categories: Environment, Membership Characteristics, Process and Structure, Communication, Purpose, and Resources. Responses are measured on a 5-point Likert scale from "Strongly Disagree" to "Strongly Agree." Scores form the basis for constructive discussion and planning during collaboration. A score of 4.0 or higher on a factor indicates a strength, 3.0–3.9 is considered borderline and may require attention, and 2.9 or lower indicates a concern and should be addressed. If most scores are above 4.0, each party can be confident the collaboration has no major shortcomings that require immediate attention, but the WCFI should be periodically readministered as part of continuous quality and outcome improvement monitoring. This is particularly important as unit members take full ownership in planning, logistics, coordination, and deployment of training elements in consultation with the SIT Trainer.

Human Performance Targets

The Test of Performance Strategies (TOPS) was administered pre- and post-training to track progress on identified human performance target skills, due to high alignment with the psychological performance targets within the SIT-NORCAL protocol.[14] This 64-item self-reported instrument assesses the psychological skills and strategies used by athletes during competition and practice across a wide range of performance standards and sports. Self-talk, emotional control, automaticity, goal-setting, imagery, activation, and relaxation are measured in competition and at practice, in addition to negative thinking in competition and attentional control at practice. Each subscale consists of four items measuring the frequency of use of a specific skill or strategy on a 5-point Likert scale from 'Never'

to 'Always'. For increased salience, trainees were advised to interpret 'competition' items as the use of skills during operations, real-world events, and simulations with an evaluation component (including the Adaptive Environmental Simulation during training). They were also advised to regard 'practice' items as those skills used during self or unit-based practice, drills, educational upgrade training, and physical training.

Incorporation of Heart Rate Variability Biofeedback

To further engage trainees in objective self-monitoring and improve immediate feedback in response to skills practice, the emWave Desktop (HeartMath, www.heartmath.com), a heart rhythm monitoring system, was installed on laptops for use by participants during training (Phases I and II). It was also used as a demonstration tool to increase physiological awareness in response to training. One or two trainees demonstrated the use of the skill being practiced (e.g., diaphragmatic breathing retraining, progressive muscle relaxation). Results were monitored continuously throughout the skills practice and utilized as a visual learning tool for the group to enhance discussion, insight, and adaptive skills practice. All trainees were measured pre- and post-training, given the instructions to 'use every skill they know to relax for 10 minutes.' Measurements for both achievement scores and efficiency scores (time required to threshold over an achievement score of 40) were recorded and incorporated into trainee feedback. During the Adaptive Environmental Simulation, the device was attached to the back of a flak vest worn by the trainee, with the readout facing the observer, who was trained to interpret color-coded readouts (red = stress, blue = neutral, green = calm) from the trainee's response to elements within the simulation.

Adaptative Capability

The SIT-NORCAL protocol was established as a health and human performance hybrid. Therefore, the Situational Adaptation to Stress Scales (SASS) were designed as a hybridized measurement system capable of measuring across a spectrum of skills and abilities targeted by a hybrid protocol. The SASS system measures adaptive capability, despite the impact of physical and psychological stress. The SASS for Health Sustainment and Restoration (SASS-HSR) was originally designed for measuring training impacts on adaptative and functional capability in the SIT-NORCAL (HSR) protocol.[15] The initial baseline measurement is a 9-item Likert self-report scale measuring how well trainees perceive they are performing before SIT (score range 9–45), where higher scores indicate higher perceived skill or ability. Post-training measurement is an 18-item scale, where the original nine items from the baseline measurement are completed to measure perceived change. Items 10–18 are designed to measure perception of pre-training ability and performance (insight/hindsight; i.e., how well participants feel they were actually performing at Time 1, pre-training, given the skills and knowledge they acquired in SIT-NORCAL [HP]). The wording in items nine and 18 from the original SASS-HSR was augmented for salience in the human performance context (SASS for Human Performance [HP]). Additionally, all items were used as anchors for the development of an expanded measurement system for exploring specific training impact and the ability to deploy target skills during the Adaptive Environmental Simulation (SASS-Simulation (SIM)), and Real-World events (SASS-RW). Open feedback areas were incorporated to allow additional information to be generated by trainees and further training opportunities to be identified.

Training Satisfaction

A training satisfaction questionnaire was developed to mirror salient items in the Client Satisfaction Questionnaire (CSQ-8), an eight-item measurement of global satisfaction used widely in evaluating client satisfaction with care. It is utilized in the SIT-NORCAL (HSR) protocol measurement system (see Part 1).[16] Items include feedback on the trainee's perception of training in five domains: training quality, value, amount, occupational relevance, and salience, as well as whether they would recommend the training to others. Additional information was gathered on perception of relevance for each of the modules in the training, and open feedback areas were incorporated to allow for additional recommendations for enhancing training.

Procedures

Intervention Implementation and Maintenance (Unit Tailoring and Engagement Procedures)

Following Phase 0, the resultant draft of the protocol was initiated with a group of USAF EOD personnel in Southern California (n = 10, 2019) by one of the SMEs from Phase 0 who had transferred during protocol development. Planning and final protocol tailoring occurred intermittently over 1 month (via email and phone) with both SMEs from Phase 0 to ensure fidelity across simulation components and advancement from lessons learned.

Training Sequence

Overarching training goals identified by the RAND study were utilized in anchoring the design and development.[1]

Phase I: Education/Conceptualization

1. Increase battlefield airmen's conceptual understanding of how stress affects their emotions, thoughts, decision making, and performance.

Phase II: Skills Acquisition and Consolidation

2. Increase battlefield airmen's repertoire of behavioral and cognitive skills that can aid performance under stress.

Phase III: Application and Follow Through

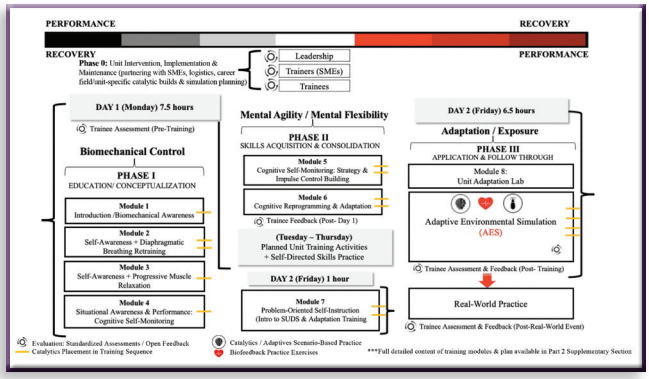
3. Provide opportunities for battlefield airmen to practice these new skills while performing job duties under stressful conditions that approximate the operational environment.

Educational, Catalytic, Adaptive, and Simulation elements were integrated into the training sequence. Core educational concepts were selected based on those likely to confer the greatest advantage in expanding core capacities. These concepts were then sequenced and organized strategically to ensure self-awareness and that physiologic regulation skills were mastered prior to engaging cognitive skills, as these require greater levels of physiological awareness and control.[17–20] Biomechanical Control skills in Phase I (e.g., Human Physiology/Cognitive Neurobiology, Self-Awareness, Diaphragmatic Breathing, etc.) are trained prior to introducing the higher-level cognitive skills in Phase II (Mental Agility/Flexibility). This ensures the trainee has adequate self-awareness, a grasp of how to manipulate their physiology when the fight/flight response is activated, and skill mastery in deploying the prescribed countermeasures. This enables rapid recognition and restoration of bioavailable oxygen required to 'power' key brain functions related to physical and psychological performance.

A recognized example is that poor breathing regulation reduces speed of information processing, fine motor dexterity,

and tracking of physical movements.[21,22] Slowed recognition, or lack of awareness or adaptive skillsets, would delay efficiency or completely disrupt optimal performance restoration. However, effective breathing regulation techniques can improve fine motor dexterity, working memory, and attention – all of which are critical requirements for complex skills in multiple occupational specialties (e.g., stripping a wire on an improvised explosive device (IED), calling in close air support or 9-line MEDEVAC, venipuncture, etc.).[21–24] Therefore, modules should be delivered in the established sequence, but training plans can be tailored to unit needs and capacities (Figure 1).

FIGURE 1 *SIT NORCAL Human Performance (HP): Training Sequence.*



Education

Core concept education occurred throughout all phases, centering on increasing knowledge and enhancing self-and-situational awareness (i.e., human physiology, neurocognitive impacts of stress, learning sequence of procedures to counteract the stress response, etc.). PowerPoint (Microsoft®, www.microsoft.com) materials were projected onto a large (5 ft × 8 ft+) dry-erase board, creating a simple interactive user interface for embedded videos, discussions, pictorial representations, graphics, demonstrations, discussions, and activities.

Catalytics

Unit SMEs collaborated on the construction of Catalytics (similar to highly detailed case reports/vignettes) using structured guidelines provided by the PI. These components were fully constructed and integrated at pre-identified points in the training sequence (Figure 1). Presentations of these highly stressful, occupationally relevant scenarios focus on synthesizing existing knowledge with self-and-situational awareness. The goal was to enhance trainees' understanding of the connections between stressful environmental demands and their effects on physiology, cognition (thinking, decision-making, distractibility, etc.), emotion, behavior, and task performance.

Adaptives

Adaptive components are a set of group exercises designed to simultaneously employ both the Educational and Catalytic components, while acquiring advanced skills in preparation for simulation. Adaptives afford trainees the opportunities required to convert abstract knowledge to concrete skills through repeated practice with novel tasks and occupationally relevant scenarios. In Phase I (Biomechanical Control), trainees engaged in exercises utilizing heart rate variability (HRV) biofeedback while learning how to manipulate their physiology when the stress response was activated. In Phase I and Phase II (Mental Agility/Mental Flexibility), trainees were given opportunities to practice sequences required for identifying, challenging, and replacing distorted/performance degrading thoughts with more accurate/performance-enhancing thoughts. Catalytic narratives were presented to the group projected onto the dry-erase board, followed by a Scenario Strategy Grid with a partially worked-out example of the cognitive skill being learned (SEASITE method).[25–26] Trainees were tasked with generating ideas, strategies, solutions, and working the scenario as a team with feedback from the trainer.

Adaptive Environmental Simulation (AES)

Information on the simulation was withheld from trainees to preserve novelty. The AES generated by the unit SME was a prisoner of war (POW) scenario, in which a member was being held in X country. There was a rescue attempt. All enemy forces were eliminated, but the POW was wearing an improvised explosive homicide vest and could not be moved. An EOD team was there to disarm the vest. The goal of the scenario was to stimulate or stress all five senses while the tech (SIM trainee) integrated both SIT and occupationally relevant skillsets to disarm the IED. Further details of the training program are provided in the Supplementary Materials.

Results

Demographics

All technicians were from the same unit in Southern California, and all were male. Eight were full-time with an average of 7.47 years in specialty (standard deviation (SD) = 4.42). Two had both part-time and full-time years in specialty, averaging 8.5 years full-time (SD = 2.12), and 6.5 years part-time (SD = 4.95).

Human Performance Targets/ Trainee Satisfaction Highlights

Due to small sample size, the Wilcoxon signed rank test was used to establish pre- and post-changes on the TOPS, with *r* as an estimate of change magnitude. An overview of the average practice and competition category scores of the TOPS resulted in significant improvements with large effect sizes (Figure 2).

FIGURE 2 *Test of Performance Strategies* **(LEFT)**, *Trainee Satisfaction Questionnaire* **(RIGHT)**.

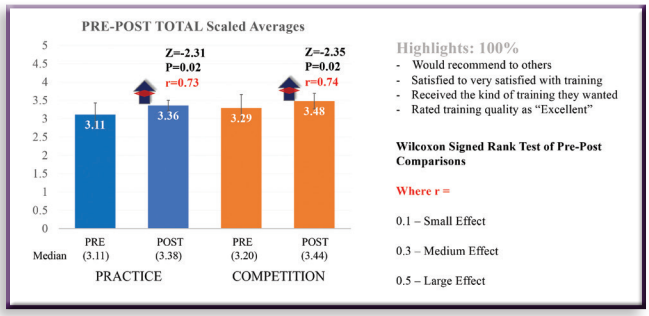
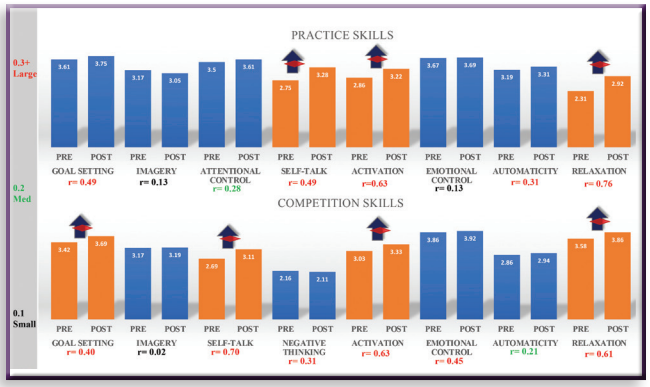


Figure 3 provides a breakdown of the scales within the competition and practice categories using the same metrics as described in Figure 2. Goal-setting, self-talk, activation, and relaxation strategies showed the largest improvements in both categories following engagement in SIT. Automaticity from the practice skills and emotional control from the competition skills also resulted in changes with large effect sizes. Columns represented in 'orange' indicate the highest dosage (time spent) in core skills trained.

FIGURE 3 *Test of Performance Strategies.*



Heart Rate Variability Highlights

At the beginning of training, participants were tasked with the objective of thresholding an achievement score up and over 40 in less than 2 minutes. Eight of the 10 trainees were able to achieve this goal pre-training. All 10 were able to achieve this during post-SIT assessment. Their overall achievement scores increased by 50% (a large effect). They also more than doubled their time-based efficiency pre-to-post Training. This is especially relevant to the EOD specialty. Activation of the stress response can cause significant degradations in fine motor capability, which makes disarming bombs more challenging and can increase safety hazards. It is far more optimal to regain fine motor control in 2.325 minutes, as opposed to 4.81 minutes when disarming a bomb (Figure 4).

FIGURE 4 *Biofeedback Results.*

N = 10

Biomechanical Regulation/ 'Coherence'

	Achievement (Group Averages)	Heart Rate	RED% (Suboptimal)	BLUE% (Neutral)	GREEN% (Optimal)
PRE-SIT	175	70.8	28.3	27.6	44.1
POST-SIT	374.7	71.8	7.5	10.3	82.2
Minimums	120	58	0	0	70
Maximums	619	92	38	31	100

PRE-Efficiency: 288.86 seconds (4.81 min).
POST-Efficiency: 139.5 seconds (2.325 min).

Z=-2.50
P=0.01
r=0.79

Adaptive Capability

Results from the Situational Adaptation to Stress Scale for Human Performance (SASS-HP) indicated positive and significant gains in all targeted areas (Figure 5). Most changes also included large effect sizes indicative of skill enhancement effectiveness. While a full review of these results exceeds the scope of this article, the usefulness of incorporating an insight measurement in human performance training is demonstrated in more significant insight post changes vs. pre-post measurements. Once trainees developed knowledge, skills, and abilities (KSAs) through additional training, they rated their pre-training KSAs as lower via the 'insight' score.

SIT-NORCAL: Real World

Nineteen days after training, half of the unit (n = 5) was dispatched to manage a joint response focused on retrieving ordnance from an F-16 that had crashed near the base, downed in a residential area. Data gathered using the Situational Adaptation to Stress – Real World (SASS-RW) identified their perceived adaptive skill was retained during a novel, high-intensity/high-risk situation (Figure 6). Additional data

FIGURE 5 *Situational Adaptation to Stress Scale.*

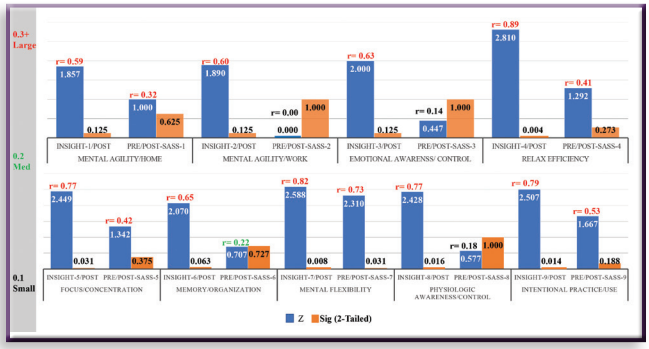


FIGURE 6 *Situational Adaptation to Stress Scales, HP & RW.*

identified their use of targeted skills in this context. Feedback reiterated requests for additional training and highlighted the previous recommendations for multi-agency collaboration with community first-response groups.

Discussion

Lessons Learned

Leadership, Unit, and Culture Assessment (Environment Analysis)

The single most critical process element in the SIT-NORCAL (HP) protocol involved high collaboration with unit leadership and the unit members themselves in the weeks leading up to the training, immediately upon initiation of the training in Day 1, and during all phases of the training. This was essential for accuracy in making core content determinations, and for the development of occupationally relevant Catalytics. It was also crucial in developing and coordinating a reasonable, occupationally relevant Adaptive Environmental Simulation in Phase III that aligned with all safety and procedural parameters to 'test out' target skills. In the cases of both units, success of the protocol can be attributed to excellent leadership and unit collaboration efforts, as measured via the WCFI (all elements above 4.0 and determined to be excellent).[13]

Feasibility

The processes established in Phase 0 allowed for initial implementation of the training by the PI and a single unit SME (the unit's senior master sergeant). Units frequently operate in resource constrained environments, thus material needs, manning, time and resources for training had to be optimized and thoughtfully leveraged. Unit members were fully incorporated into these processes as logistical supports, with brief intermittent trainings on incorporated elements at the start of training and assigned rotating roles throughout the training (manning). Implementation required the full involvement of the unit. It is also likely that high unit involvement significantly influenced the high satisfaction ratings achieved in this pilot study. The training was scheduled to coincide with previously planned Unit Safety Training (time) and utilized only materials the unit already had on hand and/or could access as part of their yearly

budget (materials). The full cost of this training did not exceed $780 (existing unit resources).

Limitations

This training was conducted with a small, highly specialized unit. Larger units would require process alterations for effective orchestration, specifically additional logistical support (SMEs aiding in preparations), and additional time to ensure each trainee has an opportunity to engage and receive feedback in the Adaptive Environmental Simulation. Limits on the study's generalizability include the use with a single career field, lack of gender representation, and small sample size. Use of HRV biofeedback during the AES was valuable. Further study should incorporate more rigorous psychophysiological measurement during the simulations. Additionally, future studies should incorporate the most recent versions of the TOPS (version 3) and the Wilder Collaboration Factors Inventory (3rd edition).

Conclusion

Initiation of the Core Training processes and content demonstrated high feasibility and acceptance among this high-intensity/high-risk occupational group. Furthermore, the training acted as an evidence-based/evidence-driven 'engine' that generated data points on areas for growth and further training opportunities, as well as areas of strength for the unit. Detailed feedback and recommendations based on the data generated by the unit (as a whole) were given to the unit to develop further training, and to individuals who participated in the training for their own use.

The most common requests were for a full (third) day dedicated solely to Mental Agility/Mental Flexibility training and additional Simulation training. Opportunities for sharing Catalytics and Simulations between units to expand training repertoire and intermittent repetition following Core Training were evident. They are now being pursued to enhance skill maintenance. Further, it is highly likely nonpsychologists (e.g., SMEs, unit medics) could be trained to implement SIT-NORCAL with consultation from a trained psychologist. Processes, risks, and benefits should be fully explored.

Core Training could be easily expanded to support more complex skills or target other areas of health and human performance. Additional career field and unit-specific training targets could be identified via evidence-based community engagement and assessment processes such as the Community Based Blueprint (CBB).[27] The CBB process aids in the construction of a precision targeting system by identifying 'demand signals' (gaps in knowledge, skill, ability, training and performance resource availability) within a specific occupation/unit, tied to physical and psychological requirements, in order to optimize performance on occupational core tasks. Demand signals generated by the CBB analysis of a specific occupational group would provide critical data, triggering implementation of SIT, refinement of specific modules and/or formulation of complementary training modules to meet the identified demand.

There is substantial opportunity to overcome barriers by shifting focus to a cultural *integration* of psychological services and paradigms that embrace the skills and values of high-risk/high-intensity career fields. Traditionally, efforts to reduce stigma or improve mental health perception and care-seeking among service members has been focused on changing an individual's mindset about treatment. This is in contrast to changing the intervention to meet the cultural needs and leverage the strengths of individuals and their units. Strategies that have focused on changing negative perceptions or views of mental health services have had only mild success. Embracing the performance mindset of operators as a means of overcoming stigma and barriers to psychological health integration presents opportunities to close these critical gaps. SIT-NORCAL should be more fully explored to determine scope and reach.

References

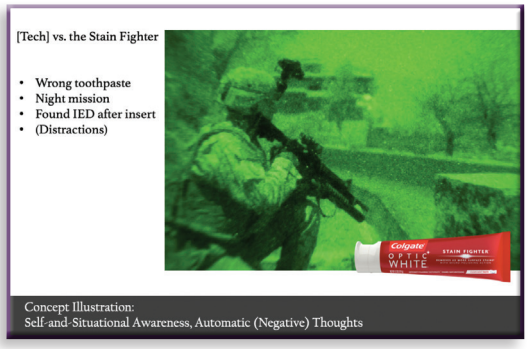
1. **Robson S, Manacapilli T.** *Enhancing performance under stress: Stress inoculation training for battlefield airmen*. Santa Monica, CA: Rand Corporation; 2014.
2. **Rizzo A, Pair J, Graap K, et al.** A virtual reality exposure therapy application for Iraq War military personnel with posttraumatic stress disorder: From training to toy to treatment. *IOS Press*. 2006;(6):235–247.
3. **Stetz MC, Long CP, Schober WV, et al.** Stress assessment and management while medics take care of the VR wounded. *Ann Rev CyberTher Telemed*. 2007;5:165–171.
4. **Wiederhold MD, Wiederhold BK.** *Virtual reality training transfer: A DARWARS study. Physiological monitoring during simulation training and testing*. San Diego. CA: The Virtual Reality Medical Center; 2006.
5. **Wiederhold MD, Wiederhold BK.** Training combat medics using VR. *Cyberpsychol Behav*. 2004;7(3).
6. **Barwood MJ, Dalzell J, Datta AK, et al.** Breath-hold performance during cold water immersion: effects of psychological skills training. *Aviat Space Environ Med*. 2006;77(11):1136–1142.
7. **Stetz MC, Long CP, Wiederhold BK, et al.** Combat scenarios and relaxation training to harden medics against stress. *J Cyberther Rehabil*. 2008;1(3):239–247.
8. **Stetz MC, Wildzunas RM, Wiederhold BK, et al.** The usefulness of virtual reality stress inoculation training for military medical females: a pilot study. *Annu Rev CyberTher Telemed*. 2006;4:51–58.
9. **Driskell JE, Johnston JH, Salas E.** Does stress training generalize to novel settings? *Hum Factors*. 2001;43(1):99–110.
10. **McClernon CK, et al.** Stress training improves performance during a stressful flight. *Hum Factors* 2011;53(3):207–218.
11. **Hourani L.** Testing and evaluation of a predeployment stress inoculation training program (PreSTINT). Research Triangle Institute Durham United States. 1 July 2016. https://apps.dtic.mil/sti/citations/AD1024710. Accessed 6 June 2021.
12. **Rocklein Kemplin K, Paun O, Godbee DC, Brandon JW.** Resilience and suicide in Special Operations Forces: state of the science via integrative review. *J Spec Oper Med*. 2019;19(2):57–66.
13. **Mattessich P, Murray-Close M, Monsey B.** Wilder Collaboration Factors Inventory. 2001. https://ktdrr.org/ktstrategies/ktstrategies_search.cgi?location=sr&sel_1=187. Accessed 6 June 2021.
14. **Thomas PR, Murphy SM, Hardy L.** Test of performance strategies: Development and preliminary validation of a comprehensive measure of athletes' psychological skills. *J Sports Sci*. 1999;17(9):697–711.
15. **Jackson S, Baity MR, Bobb K, et al.** Stress inoculation training outcomes among veterans with PTSD and TBI. *Psychol Trauma*. 2019;11(8):842–850.
16. **Attkisson CC, Zwick R.** The client satisfaction questionnaire. Psychometric properties and correlations with service utilization and psychotherapy outcome. *Eval Program Plann*. 1982;5(3):233–237.
17. **Goswami U.** Principles of learning, implications for teaching: A cognitive neuroscience perspective. *J Philos Educ*. 2008;42(3–4):381–399.
18. **Knox R.** Mind, brain, and education: A transdisciplinary field. *Mind Brain Educ*. 2016;10(1):4–9.
19. **Mayer RE.** *Applying the science of learning*. Boston, MA: Pearson/Allyn & Bacon; 2011.
20. **Mayer RE, Alexander PA.** *Handbook of research on learning and instruction*. New York, NY: Routledge; 2017.

21. **Telles S, Singh N, Balkrishna A.** Finger dexterity and visual discrimination following two yoga breathing practices. *Int J Yoga*. 2012;5(1):37.
22. **Krupnik V, Nietzold I, Bartsch B, Rassler B.** The effect of motor-respiratory coordination on the precision of tracking movements: influence of attention, task complexity and training. *Eur J Appl Physiol*. 2015;115(12):2543–2556.
23. **Schöne B, Gruber T, Graetz S, et al.** Mindful breath awareness meditation facilitates efficiency gains in brain networks: a steady-state visually evoked potentials study. *Sci Rep*. 2018;8(1):13687. Published 2018 Sep 12.
24. **Zanesco AP, Denkova E, Rogers SL, et al.** Mindfulness training as cognitive training in high-demand cohorts: an initial study in elite military servicemembers. *Prog Brain Res*. 2019;244:323–354.
25. **Renkl A.** Worked-out examples: instructional explanations support learning by self-explanations. *Learn Instr*. 2002;12(5):529–556.
26. **Clark RC, Mayer RE.** *E-learning and the science of instruction: Proven guidelines for consumers and designers of multimedia learning*. San Francisco, CA: John Wiley & Sons; 2016.
27. **Lunasco T, Chamberlin RA, Deuster PA.** Human performance optimization: an operational and operator-centric approach. *J Spec Oper Med*. 2019;19(3):101–106.

SUPPLEMENTARY MATERIALS

Catalytics Construction. Unit SMEs are given detailed instructions in writing occupationally relevant narratives of incidents in which challenges to the fight/flight system, psychological and physical performance are encountered. These capture the nature of the incident, resources (tools, people, etc), timelines of events in which they occurred, sensory details (time of day, climate, temperature, environmental context -– sight, smell, sound, touch/ kinesthetic, taste), internal experiences (thoughts and physical sensations), and lastly – outcomes. Catalytics are then fully constructed by the Trainer, and integrated (interchangeably, in specific locations in the materials, Part 2, Figure 1) forming the basis for specific education components, including learning activities and structured discussions used throughout all phases. These components focus on *synthesizing existing knowledge with self- and situational-awareness* to enhance understanding of the connections between stressful environmental demands and their effects on physiology, cognition (thinking, decision-making, distractibility, etc.), emotion, behavior, and performance.

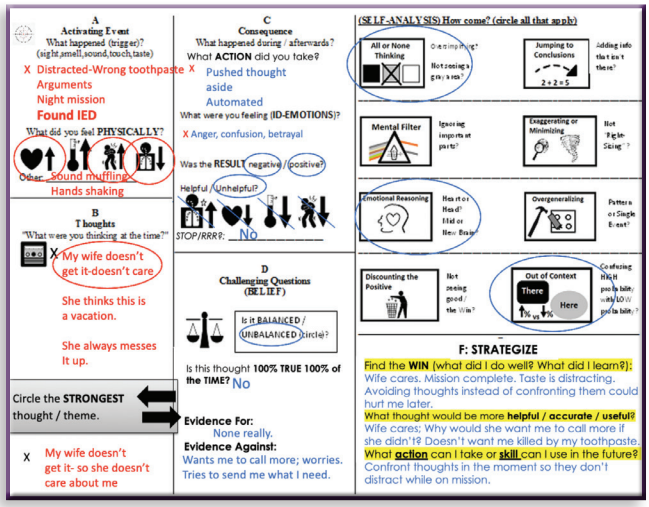
FIGURE 1 *Phase II (Mental Agility / Mental Flexibility): Example Catalytic.*



The above example developed for this training involves a situation in which challenges with communication on the home front create distractions in the deployed environment. The technician (represented as the protagonist in the narrative) outlines the repeated dismissal of negative, unbalanced, performance-degrading thoughts that return exactly when least optimal - as he's hovering inches above an Improvised Explosive Device, fingers searching in the dirt, on a night mission. He becomes distracted by the taste of the wrong toothpaste in his mouth triggering an earlier argument with his wife about it. He is mentally pulled away as the negative thoughts return at exactly the wrong moment and provide a dangerous distraction, then suddenly pulled back by a wave of adrenaline when he finds what he's looking for (triggering the fight/flight response, degrading fine-motor, and reducing hearing/communication ability). The Catalytic illustrates the importance of staying aware of cognitions that can produce performance degradations, and the importance of developing skills to identify, challenge, and replace negative unbalanced thoughts before they result in dangers to health or safety in the field.

Adaptives: Adaptive components are a set of established group exercises designed to simultaneously employ both the Educational and Catalytic components while learning and practicing advanced skills. Catalytic narratives (like the above) are presented to the group projected onto a whiteboard, followed by a Scenario Strategy Grid (below) with a partially worked out example of the cognitive skill being learned.

FIGURE 2 *Scenario Strategy Grid.*



In this example from Phase II (Mental Agility / Mental Flexibility) trainees are guided through the Catalytic scenario (e.g., identification of the thoughts, cognitive distortions, associated performance enhancing vs. degrading thoughts, emotions, and behaviors) utilizing a Scenario Strategy Grid. These activities are constructed to allow for structured intermissions where trainees are required to apply skills and knowledge, encourage inductive reasoning, generate discussion and sharing of ideas, information, and strategies among the unit members to complete the exercise. This further allows trainees to simultaneously mentally rehearse and practice retrieval of skills from Phase I and enhances Mental Agility / Flexibility skills application in Phase II and Phase III labs with real-time feedback from both the trainer and training cohort. It additionally aids in filling gaps in existing knowledge and resources to enhance skill application during sessions while gaining further occupationally relevant knowledge.

Phase Descriptions: See Part 1 for a detailed description of Phases I through III.

Schedule: The following schedule was used as a guideline establishing rough time points to improve time management. Unit members were trained on protocol elements by the primary SIT Trainer (Phase I through III) at available time points and assigned rotating roles and duties throughout the training (i.e., set up, operating HRV biofeedback equipment for demonstrations, collecting measures, etc.). Trainees were engaged in active training for no more than 30–45 minutes at a time before breaks to reduce mental fatigue and improve encoding/engagement. Modules 5, 6, and 7 were streamlined to focus on skill-building in preparation for Adaptive Environmental Simulation (Phase III).

DAY 1:	
0830-0915	Orientation
0915-1015	Self-Assessments / HRV Biofeedback Baselines
	Phase I: Biomechanical Control
1015-1100	**Module 1:** Introduction / Biomechanical Awareness
1100-1110	BREAK
1110-1200	**Module 2/3 *combined:** Self-Awareness (Physiologic Self-Monitoring & Countermeasures (Diaphragmatic Breathing Retraining / Progressive Muscle Relaxation)
1200-1230	LUNCH
1230-1330	**Module 4:** Situational Awareness & Performance: Cognitive Self-Monitoring
1330-1340	BREAK
1340-1440	Phase II: Mental Agility / Mental Flexibility
	Module 5: Cognitive Self-Monitoring: Strategy and Impulse Control Building *streamlined
1440-1450	BREAK
1450-1550	**Module 6:** Cognitive Reprogramming and Adaptation (Cognitive Training Catalytics) *streamlined
1550-1600	Wrap Up, Day 1 Assessments, Practice Assignments (practice Tue, Wed, Thu with apps: Breathe2Relax, Tactical Breather)
DAY 2:	
0800-0900	**Module 7 *streamlined / 8 Adaptation Lab:** Orientation to Adaptive Environmental Training (Sensory Training Procedures (SUDS) / Self - Other Observation, Structured Debriefing and Installation Techniques) + AES Procedural Roll-Through.
0900-1300	**Module 8:** Adaptive Environmental Simulation (AES) Rotations

Unit members were oriented to the AES procedures (Module 7), and assigned rotating roles in cycles (Rotation A, Rotation B). The first cycle of Rotation A was delegated to two Unit Members (HRV Simulation/HRV computerized games). The SIT Trainer and the Unit's Senior Master Sergeant (SME) started Rotation B. The Unit SME acted as the Simulation Observer/Controller (manipulating simulation elements and observing). The SIT Trainer acted as the first Observer/Debriefer. Trainee #1 engaged the simulation, was allowed to recover, then given structured feedback on observed performance within the AES. They were then walked through the Observation/Debrief elements and SASS-SIM to gather data on self-observation, and then taught the Observer/Debriefer procedures. Trainee #1 then became the Observer/Debriefer for Trainee #2 (repeating the same procedures). Trainee #2, became the Observer/Debriefer for Trainee #3, and so forth. Once Trainees were completed with cycles 1 and 2 in Rotation B, they fluidly rotated between aiding the SME (Controller) in Rotation B, and participating in Rotation A. The SIT Trainer alternated between facilitating intermittent Catalytics with Adaptives (group exercises) and HRV exercises in Rotation A, and conducting fidelity checks in the AES. Unit members were assigned 'time-keeper' roles intermittently to aid the SIT-Trainer in keeping the rotation flow.

ROTATION A: **Cognitive Catalytics (CC)** **(HRV Competitions / Games, Group Catalytics)** **0900-1300** *Cycle 1:* HRV Simulation *Cycle 2:* Group Catalytic	**ROTATION B:** **Adaptive Environmental Simulation (AES)** **(1:1 / Trainees Rotate Through SIM)** **0900-1300** *Cycle 1:* Train – Recover – Structured Debrief *Cycle 2:* Observe – Structured Debrief Application
HRV Simulation (2 player) – Tropical Heat HRV Simulation (2 player) – Dual Drive	*Trainee 1:* 0900 Observer/Debriefer = SIT Trainer + Observer/Controller *Trainee 2:* 0920 Observer/Debriefer: SIT Trainer + Observer / Controller
HRV Simulation (2 player) – Tropical Heat	*Trainee 3:* 0940 Observer/Debriefer 1: 1000
Catalytic 1 (Cognitive Skills)	*Trainee 4:* 1000 Observer/Debriefer 2: 1020
Catalytic 2 (Cognitive Skills)	*Trainee 5:* 1020 Observer/Debriefer 3: 1040
Catalytic 3 (Cognitive Skills)	*Trainee 6:* 1040 Observer/Debriefer 4: 1100
HRV Simulation (2 player) – Dual Drive	*Trainee 7:* 1100 Observer/Debriefer 5: 1120
HRV Simulation (2 player) – Tropical Heat	*Trainee 8:* 1120 Observer/Debriefer 6: 1140
Catalytic 4 (Cognitive Skills)	*Trainee 9:* 1140 Observer/Debriefer 7: 1200
Catalytic 5 (Cognitive Skills)	*Trainee 10:* 1200 Observer/Debriefer 8: 1220
1230-1300	LUNCH *scheduled, but varies to allow trainees to finish AES and break at alternate time points
1300-1400	Adaptive Environmental Simulation Review (Self-Assessment / Structured Debrief) a. Physiologic Debrief / (Goal Setting) Training Plan Adaptation (SUDS) b. Cognitive Debrief / (Goal Setting) Cognitive Training Plan Adaptation (Cognitive Skills Enhancement)
1400-1410	BREAK / HRV Baselines (Time 2)
1410-1510	Catalytic Vignette Training (*Operational Hot Wash)
1510-1520	BREAK / HRV Baselines (Time 2)
1520-1600	Wrap Up/ Debrief + Q&A, Time 2 Baseline Assessments (Post-SIT)

Achieving Evidence-Driven Human Performance Training:

Individual Level: Individual trainee's pre-to-post assessment scores on evidence-based measures of performance skills, physiological control, and cognitive skills were compiled with feedback from the Adaptive Exposure Simulation (AES) and structured debrief using the SASS-SIM. Individual training plans were generated with recommendations, and reviewed to establish goals/objectives in collaboration with the trainee.

Unit/Group Level: Aggregate group pre-to-post assessments scores on standardized measures, and AES observational feedbacks, were compiled along with trainee feedback and satisfaction ratings on individual modules, skills, and AES experiences. Recommendations from trainees, key informants, and trainers were also generated post-training and incorporated. Group level training plan recommendations were generated in collaboration with key informants/SMEs, for integration and expansion of current training practices.

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Inside this Issue:

- FEATURE ARTICLES: Prehospital Blood Transfusion
- Processionary Caterpillar as Threat in Australia
- Helicopter Simulation Video Laryngoscope
- Loading Patterns in Military Personnel With Back Pain
- Stress Inoculation Training: A Performance Training Protocol, Part 1 and Part 2
- Ultrasound for Special Operations Medics
- Hemostatic Dressings in an Extended Field Care Model
- EMS Providers Having Firearms
- Anesthesia Gas Machines During Coronavirus Pandemic
- Swine Polytrauma Model Without Fluid Resuscitation
- Overview of the Combat Medical Care (CMC) Conference 2021
- Combat Medical Care Conference 2021 Abstracts
- CASE REPORTS: Prehospital Iliac Crest IO Whole Blood Infusion
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