CALL SIGNS

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USN AEP SOCIETY

RISK: How to manage, mitigate, and succeed.

Featuring:

Modeling Human Readiness Levels

Applying Aviation Risk Management Strategies to Anesthesia and Critical Care Medicine

And more!

A Publication of the United States Naval Aerospace Experimental Psychology Society

Contents

About the USN ★ AEP Society

As military transformation continues to affect today's and tomorrow's Department of Defense and the Navy Medical Service Corps, the need to promote the role of Aerospace Experimental Psychologists as leaders and innovators in aerospace psychology continues.

Naval Aerospace Experimental Psychologists offer a unique combination of education, knowledge, skills, and experiences to address current and emerging challenges facing the Navy, joint, and coalition environments.

The U.S. Naval Aerospace Experimental Psychology Society (USNAEPS) is an organization intent on:

- Integrating science and practice to advance the operational effectiveness and safety of Naval aviation fleet operators, maintainers, and programs
- Fostering the professional development of its members and enhancing the practice of Aerospace Experimental Psychology in the Navy
- Strengthening professional relationships within the community

Message from the President

LT BRENNAN COX, AEP #142

This past January, the annual Aerospace Experimental Psychology (AEP) community meeting was held in conjunction with the United States Naval Aeromedical Conference (USNAC) at Naval Air Station, Pensacola, FL. The event was well attended, and provided an excellent forum for AEPs to gather, share stories, and learn from experts across all of the aeromedical communities. During this occasion, it was my honor to assume the role of President of the United States Aerospace Experimental Psychology Society (USNAEPS).

First and foremost, on behalf of the Society, I would like to express my sincere appreciation to LCDR Tatana Olson for her leadership as USNAEPS President over the past two years. I would also like to thank members of the Executive Committee (EXCOM) who selflessly dedicated their time and talents in service of the Society during this period. We are very fortunate to have retained the guidance and historical perspective of CAPT(r) Mike Lilienthal as our Emeritus Member at Large, as well as the tireless efforts of LT Eric Vorm as newsletter Editor and Historian. I am also pleased to announce LT Stephen Eggan as our new Vice President, LT Todd Seech as Secretary, LT Mike Natali as Treasurer, and LT Joe Mercado as Co-Editor.

In this issue of *Call Signs*, we feature a diverse set of articles on the topic of Risk. First, CDR Henry Phillips discusses the evolution of a Human Readiness Model toward development of a Human Systems Integration (HSI) Progress and Risk Summary Tool (HPRST). This HPRST will assist HSI practitioners in understanding and managing risks associated with cost, schedule, performance, and safety parameters throughout the acquisition lifecycle. Next, Dr. Keith Ruskin shares his thoughts on how application of the aviation industry's Safety Management System can assist healthcare providers in reducing errors and preventing adverse events during patient care. This article demonstrates the value in cross-talk among aeromedical communities and related areas of specialization. There exists a great variety of tools and models for enhancing safety, maximizing performance, and minimizing risk. *Call Signs* welcomes articles from outside contributors, and we sincerely appreciate Dr. Ruskin's involvement in putting together this issue.

This issue also includes notable updates from around the AEP community. CDR Jeff Grubb provides a detailed and rather complicated history on the origins of the AEP community, to include a critical examination of the AEP historical roster. Based on his review, 2016 may well mark the 75th anniversary of the AEP community – more details on this announcement to follow in our next edition of *Call Signs*. We also receive LT Stephen Eggan's first-hand account of his work in prototype testing the Tactical Assault Light Operator Suit – be sure to read his interview to learn more about his involvement with this and other programs. Also, for those who could not attend, LT Mike Natali summarizes the events that took place during this year's community meeting.

On behalf of the USNAEPS EXCOM, I hope you enjoy this issue of *Call Signs*. Thank you for your continued support of the Society!

Evolution of the Human Systems Integration Progress & Risk Summary Tool (HPRST)

CDR HENRY PHILLIPS, AEP #119

In 2014, following a presentation and call to action from the Chief Scientist of the U.S. Air Force Dr. Mica Endsley, Department of Defense Human Factors Engineering Technical Advisory Group (DoD HFE TAG) TAG Proponent and ASD(RE) Human Performance, Training and Biosystems Director Dr. Patrick Mason directed the TAG to form a working group to develop and evaluate a Human Readiness Level (HRL) model. When the original chair of that Working Group had to bow out, AEP #119 CDR Henry Phillips stepped in to replace him. The working group included 27 representatives of every TAG constituent service branch and organization, and spent considerable time and effort determining what the scope of its effort would be.

Following no small amount of storming and norming, the HRL system as designed by that group ultimately became a system of scales capturing Systems Engineering Technical Review (SETR)/Milestone (MS)-relevant requirements and Human Systems Integration (HSI) progress, intended to be scored by an HSI team lead at any point in the acquisition life cycle (ALC) to provide a quick snapshot of HSI progress as a starting point for conversations with program leadership about more granular data relating to HSI work conducted in system development.

The model was intended to reflect summary of the same SETR-relevant system development information, acquisition artifacts, and risk management processes already being used by HSI teams and program leadership. It was not designed to supplant or change any tools or processes already in place. It is intended to serve as a tool HSI/program manager (PM)/lead system engineer (LSE) team members could incorporate into their processes with minimal additional burden to be placed on the teams using it.

The original 2014 HRL system was a set of scales intended to reflect the degree to which the HSI team has exhibited adherence to process, whether all explicit and implicit HSI requirements have been taken into consideration by the HSI team and program management, and whether HSI requirements are being appropriately considered in design decisions. The scales were not intended to reflect specific achievement of any human systems performance goals or direct contributions to Total System Performance.

The 2014 HRL model consisted of nine 9-point scales. Seven of these reflect HSI progress within HSI domains (Safety & Occupational Health [SOH], Habitability [Hab], Force Protection/Survivability [FP/S], Training [T], Personnel [PS], Manpower [M], and Human Factors [HF]). An eighth scale, Domain Integration (DI), reflected the degree to which tradeoffs and tradeoff requirements across HSI domains are being appropriately recognized and implemented. Finally, a ninth called the HRL scale was defined to reflect a system-level summary of HSI progress, including process adherence by the team, appropriate HSI requirements specification, and incorporation of HSI into programmatic decisions.

The 9-point scoring continua associated with these scales were intended to reflect points along the acquisition life cycle (ALC), which would be modifiable for different program SETR maps. Note that progress along the HRL scoring continua was expected to reflect readiness for these reviews, not any reflection of the quality of HSI work.

The achievement of a specific score was driven by accomplishment of the specific achievements listed in that scale point's anchor. The text of these scale anchors was developed by the working group to reflect a summary of the requirements for SETR/MS reviews as captured in existing instructions, MILSTDs, and SETR checklists. Three principal sources were consulted in their development: the Marine Corps Systems Command (MCSC) SETR Matrix, the USAF Acquisition Guide, and the current draft of the SPAWAR HSI Framework. Each anchor was accompanied by a short list of more specific supporting questions to be considered by a rater when assigning a score to a program.

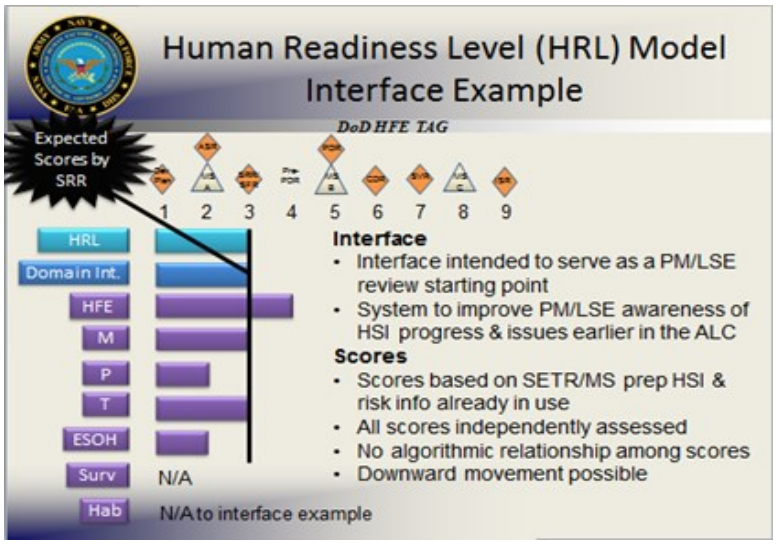

Figure 1. Notional scoring dashboard for the 2014 HRL.

The HRL Working Group included 27 members representing USN, USMC, USA, USCG, USAF, FAA, DHS, and NASA. The products developed were evaluated and edited by 12 different external reviewers with expertise across DoD service branches and HSI domains.

CHANGING SCOPE AND TARGET

In May 2015, the scale was refined at the direction of Acting ASD(RE) Mr. Al Shaffer to more directly reflect the incorporation of consolidated risk information. The outcome of this change in direction is the HSI Progress and Risk Specification Tool (HPRST), which is based on the existing foundational data of the HRL scale.

The goal of the HPRST is to provide the tools necessary for practitioners to:

- Evaluate general HSI progress requirements and activities by SETR and Milestone
- Identify the potential problems and risks linked to the failure to adequately and accurately conduct HSI domain activities by ALC timelines
- Determine potential mitigation strategies for consideration to address the identified problems and risks
- Use the general information and guidelines to develop tangible, rigorous, and defensible program-specific risks that will impact the acquisition project in terms of total cost, schedule, technical performance (both systemic and human), and safety.

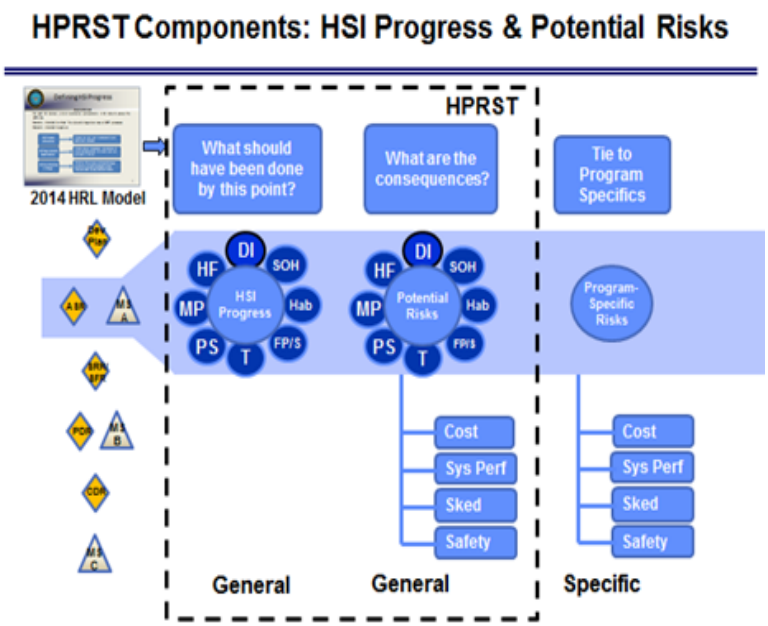

Figure 2. Conceptual Model of the HPRST

DEFINING POTENTIAL RISKS AND CONSEQUENCES

Consequences are the problems that will likely occur when the HSI processes are not adhered to properly. These potential problems, if allowed to continue festering, may adversely affect the program in terms of risks to total system performance, cost, schedule, and safety. Even if not linked directly to system performance, potential risks and their consequences may manifest their impact by extension due to decrements in human performance. Consequences lists provided in the HPRST are specific to the HSI domains as well as to the domain integration level.

MITIGATION ACTION GUIDANCE FOR POTENTIAL PROBLEMS

Mitigation actions provided in the HPRST documentation provide general guidelines for addressing the problems faced for deficient HSI progress. Problems will have different mitigation approaches and strategies based on the severity of the problem and the program's location in the ALC.

The appropriateness of specific mitigation strategies may be affected by the technical and financial priorities of the program. Individual risks may need to be absorbed based on the constraints of the program.

ARTICULATING PROGRAM-SPECIFIC RISK

HSI Practitioners, having identified for their program the failures to properly and accurately conduct HSI activities and the associated potential risks to Cost, Schedule, Performance, and Safety, now specify these risks in terms of their program. The risks are articulated in prose to show systemic ramifications (e.g., lack of training integration of government furnished equipment components could eclipse current training budget to fix). These risks are then converted onto the standard risk matrix, along continua representing Likelihood versus Consequence.

These risk/consequence lists and mitigation plans are intended to help HSI practitioners define and articulate the risks of failure to adequately and accurately conduct HSI activities in a language that acquisition program management can relate to and easily understand.

Over the years, one of the biggest challenges of HSI as a discipline as well as a barrier to HSI technical acceptance has been the lack of an ability to codify the HSI risks to an acquisition program. The HPRST tool is intended to address that issue and to help HSI practitioners better apply HSI processes, identify the repercussions of sub-optimal HSI application, and articulate justifications for rectifying shortcomings. With proper HSI and Systems Engineering community vetting, the HPRST has the potential to further entrench HSI considerations into the Systems Engineering process, saving DoD acquisition time and money across the total system lifecycle.

Applying Aviation Risk Management Strategies to Anesthesia and Critical Care Medicine

DR. KEITH RUSKIN, MD
UNIVERSITY OF CHICAGO MEDICINE

Healthcare is a complex system in which large, inter-professional teams with varying levels of training care for patients with multiple comorbidities. Seemingly insignificant errors in this setting can initiate a chain of events that may quickly become life-threatening. Although accidents and "near misses" are relatively uncommon on an individual scale, thousands of adverse events occur throughout the United States each year. *Safety Management Systems* (SMS) recognize an organization's role in the prevention of adverse incidents and is widely adopted throughout the aviation industry as "the next step in the evolution of safety in aviation".

SMS is a systematic, comprehensive process that integrates risk management, safety, and knowledge sharing into the entire organization's workflow. Under SMS, front-line operations are integrated with other areas of the organization, including such departments as finance and human resource management. This article will discuss features of SMS and how SMS practices can be integrated into medicine. The practice of anesthesia will be offered as a specific environment in which risk management using the principles of SMS may potentially improve patient outcomes.

The operating room is a complex environment in which critical events can happen without warning and seemingly insignificant errors can have potentially life-threatening consequences. Although accidents and "near misses" in the operating room are relatively uncommon on an individual scale, thousands of adverse events occur throughout the United States annually. Large, inter-professional teams with varying levels of training care for patients with multiple comorbidities while they are subjected to a range of physiologic stresses and surgical insults. Anesthesiologists who work in this setting must manage large quantities of rapidly changing information. They are frequently required to make decisions quickly, with incomplete information, in an environment that is intolerant of errors. At any time, one or more factors, including patient illness, the surgical procedure or equipment malfunction may combine to cause a life threatening condition.

Deviations from safe practice can be divided into errors, which are unintended and violations, which are deliberate. Errors can be caused by unfamiliarity with a given task, external pressures, such as production or systemic problems, such as a poor human-system interface or fatigue due to extended work hours. Errors can occur as a result of improperly formed plans (mistakes) or while implementing plans (slips of action or lapses of attention). Systemic failures or latent errors may go undetected for months or years. Latent errors include failures in equipment design and maintenance and inappropriate staffing, which are caused by conflicting goals, improper planning and organization, and from simply not having an anesthesiologist participating on the appropriate hospital committee. Improperly developed procedures (for example, a poorly developed "time out" that does not specifically address the laterality of the surgery) may seem to work when implemented, but can ultimately become the root cause of a serious adverse event.

The Aviation Integrated Safety and Risk Management Advisory Standard

Violations in the operating room are usually the result of an attempt to achieve a goal that is incompatible with safe practice. Although it is tempting to dismiss violations as the actions of "someone else," even the most dedicated physician may deviate from safe practice for a seemingly plausible reason. Skipping a few tasks on the anesthesia gas machine checkout in order to get a case started on time, for example, might please the hospital administration, but increases the risk of an equipment malfunction at a critical point in the procedure. In some cases, violation of poorly designed procedures may even be required to solve a clinical problem. Violations may be caused by inadequate supervision, workplace conflicts, poor morale, a perceived lack of concern by supervisors, and the lack of an institutional safety culture. For example, the nursing staff or surgeon may pressure the anesthesiologist to bring the patient into the operating room on time, which may in turn prevent the team from verifying that the necessary patient workup has been completed.

High reliability organizations (HROs) demonstrate remarkable levels of safety despite undertaking risky operations. HROs are preoccupied with failure and never rest on their laurels. They always attempt to find even the smallest signal that a threat to safety might be developing. HROs create an environment in which front line workers are alert to any deviation from expected performance and report these deviations to managers. HROs are *resilient*; they recognize that deviations from safe practice do occur, but take steps to mitigate the harm caused by an adverse event and prevent small errors from combining to increase the level of harm. HROs also exhibit deference to expertise: They recognize that organizational hierarchy may interfere with finding the solution to a problem and acknowledge that senior managers might not be in the best position to resolve problems on the front line. [1] Although many articles have been published on high reliability organizations, healthcare institutions seldom show the five principles of HROs.

Risk is defined as the exposure to the possibility of loss, injury or other adverse circumstance (Oxford English dictionary). The definition of risk can be further expanded to include the probability and severity of an injury that occurs in association with a given hazard. *Risk management* is a formal way to determine the probability of a given hazard and find ways to avoid the hazard, minimize the exposure to the hazard, and/or decrease the likelihood or severity of a mishap [2]. Medical risk management can ultimately identify and mitigate a problem before a patient can be harmed.

Accident and "near-miss" reporting is critical to risk mitigation. Healthcare workers are usually reluctant to report incidents, however. Many healthcare workers cite lack of feedback and doubts that their reports will result in positive actions. Completing the forms takes time that can be used to pursue activities with greater perceived value. Many clinicians also have concerns about repercussions or disciplinary actions. Voluntary reporting can, however, be used to learn about problems such as diagnostic errors and improve patient safety. [3] Closed medical malpractice claims can be used to guide the development of simulation scenarios clinical decision support systems. Using this technique, Wright *et al.* [4] were able to develop and validate clinical decision support tools that are not widely used but that might decrease the risk of malpractice lawsuits.

Most risk assessment tools used by physicians are used to estimate the probability of a patient developing a specific medical condition (e.g., a myocardial infarction after surgery) and guide treatment decisions. The risk of a given course of action is frequently evaluated informally, if at all, and few if any physicians receive any formal training in risk management. As it was originally developed, PAVE stands for Pilot, Aircraft, Environment, and External Pressures. Risk management is an important part of SMS, and healthcare-associated harm occurs in all patient care settings. Several formal risk management and risk assessment strategies have been published in the medical literature. This author has modified the PAVE tool that is widely used in aviation for use in anesthesia. In this case, the acronym was modified slightly to give anesthesiologists a simple checklist that can be used to determine potential hazards that might be associated with a clinical situation.

- Patient: Surgical illness and comorbidities.
- Anesthesiologist: Training and skills, recent experience, fatigue.
- Environment: There is the procedure (*e.g.*, operating room or remote location)? Is help available if a problem arises? Where is emergency equipment (*e.g.*, defibrillator) located?
- External pressures: Production pressure, a "VIP" patient.

Although the use of the PAVE risk assessment tool in anesthetic practice has yet to be studied, it seems logical to assume that formally assessing the risks associated with each of these factors will enhance the anesthesiologist's ability to identify and mitigate the hazards associated with a surgical procedure. [5]

CONCLUSIONS

Risk management tools can be adapted for use across a wide variety of domains. Although healthcare has not yet achieved the high reliability that is routine in aviation, clinicians and other healthcare workers are beginning to use risk mitigation strategies to improve patient safety.

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Disentangling AEP History from the AEP Historical Roster

CDR JEFF GRUBB, AEP #124 (...OR IS IT?)

The AEP Historical Roster plays an outsized role in what people know about the history of our community. According to the roster, AEP #1 is Alan D. Grinsted, whose "Date of Original Qualification" was 26 December 1941 and was a Captain "…at the time of designation." Unsurprisingly, authors tend to summarize this as, "In later portions of 1941, Navy Captain Alan Grinsted was designated as Naval Aviation Psychologist number 1," (Staal, 2014). AEPs themselves have repeated this account in forums as diverse as online bulletin boards (e.g. Arnold, 2002), conference presentations, and in the pages of *Call Signs* (Phillips, 2010; Schmorrow & Patrey, 2013; Walker & Little, 2013). Documents from the community's early history, however, indicate that this account is not strictly accurate. Given the evident pride that active AEPs take in their own placements on the roster, it is important for the community to recognize these discrepancies and understand the historical roster for what it actually represents. Our community's history is richer and more complicated than what one would infer based on the roster alone.

The common inference that the Navy designated CAPT Grinsted as its first aviation psychologist on 26 December 1941 is inaccurate in at least two significant ways. First, it is very unlikely that Grinsted was a Captain on the date in question. According to Trumbull and MacCorquodale (1951), Grinsted was a Commander when he checked into the U.S. Naval School of Aviation Medicine on 9 July 1948. A community newsletter attached to a 15 July 1952 memo from Vern Lyon lists him as a Commander assigned to the Staff of the Chief of Naval Air Training. Grinsted listed himself as a Commander in a 1953 article on aviation selection for the U.S. Naval Institute's *Proceedings*. So it appears that Grinsted did not make Captain until at least the mid-1950s.

Second, by December 1941 the Navy had already commissioned a number of psychologists to specifically perform work that modern AEPs would recognize as core and characteristic functions of the community. Ross A. McFarland, then a Ph.D. psychologist with Harvard's Fatigue Lab, accepted a commission as a Lieutenant Commander in July 1940 to facilitate his work organizing the activities of the psychologists working on the Pensacola Project, which eventually yielded the selection test that was the forerunner to the modern ASTB (Hoffman & Ritchie, 1987). Although McFarland was only in Pensacola until September and was released from active duty by April 1941, the Navy soon began commissioning some of the psychologists that he had overseen. On 27 May 1941, Robert H. Peckham accepted a commission as a Lieutenant, H-V(S) (Trumbull & MacCorquodale , 1951). The H-V(S) was a special designation created in February 1941 for non-physician officers of the volunteer reserve who had been commissioned, usually directly from civilian life, for specialist duties in support of the Medical Corps. By July 1941, the Bureau of Aeronautics (BuAer, the forerunner to NAVAIR) sent a letter to the commanding officers of the three primary aviation training stations regarding the employment of the H-V(S) officers, which were then being brought aboard at those sites (Mitcher, 15 July 1941). Per BuAer, H-V(S) officers had "…special training in personnel selection methods and research in allied fields," and were to be employed in the development and administration of selection tests and in research activities.

These commissioned psychologists who did AEP type jobs prior to Grinsted's qualification date are not the only ones who are mysteriously absent from the roster. The roster only lists two AEPs whose qualification dates are before 1945. However, according to Jenkins (1945), between the summer of 1940 and 1945, more than 100 psychologists served under the auspices of what became BUMED's Aviation Psychology Section. Among those who are conspicuously absent is John G. Jenkins, himself. Jenkins was commissioned in early 1942, but he directed the Pensacola Project from its inception, subsequently headed the Aviation Psychology Section at BUMED from its formal stand-up to 1946, and became the first psychologist to make Captain

Image 1: USS Ticonderoga (CV-21) after being hit by a kamikaze attack January 21st, 1945. LCDR Vern Lyon, a Navy aviation psychologist, was serving aboard during the ordeal. Although he is likely the only AEP to ever collect aviation psychology data in an actual sea battle, and went on to serve as the AEP specialty leader and retire as a Navy Captain, he is not listed on the AEP historical roster.

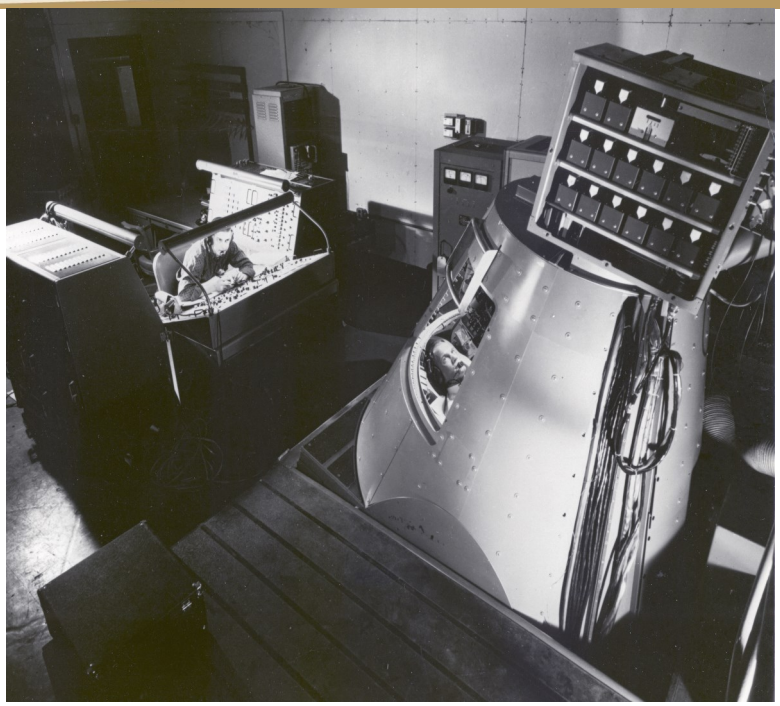

Image 2: Aviation Psychologist Robert Voas (left) works the booth while astronaut John Glenn (right) undergoes training in the Mercury Procedures Trainer. While assigned to Navy Medical Research Center, Robert Voas did the initial review and down-select of the Naval candidates for Project Mercury. He was then assigned to the Space Task Group and eventually transferred to NASA, where he held the title "Astronaut Training Officer." He, too, is not currently listed on the AEP historical roster.

(Bennett, 1948). Jenkins essentially created aviation psychology in the Navy, but is not recognized on the AEP Historical Roster. Likewise, Verne Lyon and Joe Snyder, two psychologists listed on the specialty leader's plaque (i.e. the "wooden wings") as having led the community in the early 1960s, do not appear on the roster. Lyon's absence is particularly galling. In the effort to validate aviation selection tests against fleet performance, he accompanied Air Group 80 aboard *USS Ticonderoga* (CV-14) from 13 December 1944 to 27 January 1945 and then aboard *USS Hancock* (CV-19) from 27 January to 9 March 1945 (Jenkins, Ewart, & Carrol, 1950). This means that while doing AEP work, he survived a kamikaze attack on the *Ticonderoga* that killed more than 100 sailors and then took the first opportunity to sail back into harm's way so that he could collect more data. If anyone was ever qualified for the title Naval Aerospace Experimental Psychologist, it is Verne Lyon, but he is not recognized on the AEP Historical Roster.

Psychologists who performed AEP duties after the war are also mysteriously absent from the roster. For example, in the early 1950s Robert B. Voas accepted a direct commission and reported to the Aviation Psychology Laboratory in Pensacola, FL where he worked on refinements to the aviation selection test. His next assignment took him to Naval Medical Research Center, where he was assigned to work with CAPT Norman Lee Barr on what eventually became space research. Because of his selection background and billet, Voas was tasked with reviewing the records of all Naval Test Pilots to select those that the Navy and Marine Corps would nominate for Project Mercury. He was eventually assigned to the Space Task Group, where he was a key figure in space capsule design and astronaut training for Project Mercury (Bergen & Voas, 2002; Addiction, 2012).

Thus, the AEP Historical Roster fails to account for many early uniformed experimental psychologists who worked, what we would now consider, AEP jobs. The roster also contains seemingly inconsistent data about those early psychologists for which it does account. What then does the AEP Historical Roster represent? A clue to the answer to this question is in the column headings of the roster itself. Although AEPs' ranks on the roster are "Rank at Time of Designation," the dates on which the roster indicates AEPs joined the community, and hence the bases of AEPs ordinal placements on the roster, are the "Date of Original Qualification." For modern AEPs, the distinction between qualification and designation is meaningless. Our qualification dates are the dates on which we graduate from the student AEP curriculum within the Aeromedical Officers Course, which in turn are the dates on which we receive Wings of Gold, the 1844 subspecialty code within the Medical Service Corps, and a certificate of designation as an AEP. However, to be legalistic, there is a difference between being qualified to do a job and with holding the formal regalia of that job.

Although uniformed psychologists were doing AEP work before WWII, the formal AEP regalia took almost three decades to assemble. As noted above, psychologists were being commissioned specifically to do jobs that are characteristic of AEPs as early as July 1940. The Navy created a special officer class to cover such officers by February of 1941. BUMED stood up the Aviation Psychology Section on 29 October 1942 to manage the activities of its aviation psychologists. The Medical Service Corps, and hence the 2300 designator, was created in 1947. Aviation psychologists and physiologists were granted flight status in February 1966, and we were authorized to wear wings on 12 April 1967 (Grossnick & Armstrong, 1997, p.659). Thus, there are many dates that could represent the bureaucratic stand-up of the community. Inclusion in the AEP Historical Roster seems to indicate recognition under one of these latter milestones in the community's history.

The most likely conclusion about what the roster represents is that it is a roster of winged AEPs. The specialty leader's plaque indicates that CAPT Lyon served as specialty leader from 1959 to 1962 and CAPT Snyder did so from 1964 to 1965. Since neither Lyon nor Snyder appear on the historical roster, we have to conclude either that it is possible to be the AEP specialty leader without actually being an AEP or that Lyon and Snyder had left the community prior to the critical event on which roster inclusion is based. That critical event would therefore have to have occurred after 1965. This narrows the list of candidate events to the bestowal of flight status in 1966 and the authorization of wings in 1967. If flight status itself were the key, modern AEPs' qualification dates should be the dates

that they reported to squadrons for the flight portion of the Aeromedical Officers Course rather than their graduation dates. Thus, the roster is probably based on receipt of wings.

This view explains a number of the roster's discrepancies. Aviation psychologists who left the community prior to our being authorized wings would naturally not be included on a winging roster. Thus, the roster does not contain CAPT Jenkins, who died in 1948, or Robert Voas, who left the Navy for NASA during Project Mercury. The roster lists Grinsted as a Captain because that is what he was in 1967, not what he was in 1941. CAPT Grinsted is AEP #1 because he was the senior most active aviation psychologist when we received wings, not because he was the first aviation psychologist in the Navy.

The flip side of this view is that it throws open two questions that the roster previously seemed to answer. Namely, when did the AEP community begin and who was the first AEP? The USNAEPS Executive Committee and a number of community grey beards had a long discussion in early 2016 to try and answer these questions. If the community had been created in its current form, this would have been easy. However, the community is more a product of evolution than creation. We can trace our roots back to civilian scientists working in 1939 on a project to nominally select civilian pilots. The commissioning, the expansion of duties, the formal bureaucratic recognition and organization, and the shiny Wings of Gold came gradually.

The general consensus among those in the discussion was that 1941 was a particularly important year for the community. The H-V(S) class was created, many such officers (including apparently Grinsted) were commissioned, and BuAer introduced them to the fleet with a description that is recognizably AEP. As of this writing, the earliest H-V(S) officer working in aviation psychology for which we have records is Robert H. Peckham, who commissioned on 27 May 1941. However, AEPs should recognize that even with these lines of argument, this choice is somewhat arbitrary, and arguments can be made for both earlier and later dates and people. In other words, the AEP community's history is as interesting and complex as its members.

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Tactical Assault Light Operator Suit update

LT STEPHEN EGGAN, AEP #143

INTRODUCTION

SOF AT&L's Joint Acquisition Task Force Tactical Assault Light Operator Suit (JATF-TALOS) was established in November 2013, and chartered to explore and catalyze a revolutionary integration of advanced technologies to provide comprehensive ballistic protection, peerless tactical capabilities and situational awareness advantages for the SOF Operator of the future. In FY15, JATF-TALOS continues driving toward the embodiment of that mission—: a next generation, technologically advanced combat operator suit— while pioneering innovative acquisition processes.

The current TALOS roadmap consists of incremental iterative exoskeleton prototypes with increased levels of subsystem integration leading to a first article prototype delivery by August 2018. To maintain that timeline, the priorities for JATF-TALOS in FY15 included are the development of powered exoskeleton prototypes of a combat suit and enabling technologies, accelerating technology development and transitions, pioneering innovative processes, and maintaining consistent collaboration with users and our extended TALOS network.

PRIORITY 1: COMBAT SUIT DEVELOPMENT

The development of the TALOS 2018 deliverable is the number one primary mission of the JATF, which continued to make progress with exoskeleton prototypes, an integrated armor mosaic design, novel antenna prototypes, and thermal management base layer integration.

JATF-TALOS developed the first ever tactical powered exoskeleton prototypes to offset the load of additional body armor and push the boundaries of human performance augmentation. These prototypes pursued enhanced dynamic motion capabilities for SOF Operators with a lightweight mobile system, which was used to baseline achievable performance augmentation and inform future spiral development of the integrated combat suit.

In 2015, the JATF conducted an initial user assessment on the three of these exoskeleton prototypes at the US Marshal Service Special Operations Group (SOG) in Camp Beauregard, LA. TALOS engineers, operators, and extended technical team assessed the systems and provided critical qualitative and quantitative feedback on each prototype.

The JATF team gathered operator physiological and motion data, gauging the metabolic cost of the exoskeletons to the operator and relaying the state of development of the systems. Using the lessons learned from each of these efforts, the JATF is leading the integration effort by taking the strengths of multiple vendors and subject matter experts.

A TALOS exoskeleton is necessary to support the weight of the added armor added to the suit for maximized operator survivability. This increased armor volume creates limitations to operator mobility and requires a design that strikes a balance between operator protection and mobility. Since the summer of 2015, significant progress has been made in the design of the body armor mosaic. Through the support of our extended Integrated Survivability Design Network, the TALOS Survivability team conducted the integration-focused Armor Mosaic Prototyping Series at SOFWERX in Tampa, FL as well offsite fabrication and testing laboratories. This series focused on developing weight and volume representative armor shapes and attaching

Image 1: A Navy SEAL participates in a prototype assessment as part of the TALOS development.

them to a passive exoskeleton to further explore the threat protection versus mobility trade space.

By characterizing this trade- off area, the Armored Passive Exoskeleton has informed MK V exoskeleton requirements, including initial armor design, regional payloads, and armor facilitation and attach-

ment points. Equally important was the further reinforcement of the extended TALOS Survivability Design Network and the cyclical, cross-collaborative design process that was used to develop the TALOS armor mosaic—a process that will be replicated in future integration efforts with other TALOS subsystems.

The first of those integration efforts will begin in spring of 2016, with the Base layer Integration Prototyping Series. This event will focus on integrating an initial base-layer concept with the Armored Passive Exoskeleton in order to further explore TALOS operator thermal management, physiological status monitoring, and junctional fragmentation protection. The resultant, integrated prototype will provide an improved mechanism to drive MK V system requirements based on quantitative and qualitative operator assessment data.

An element of the integrated base layer, the cooling unit, is also progressing as one of the JATF's first spin-off technologies, which feeds into the second TALOS priority—technology transitions.

PRIORITY 2: ACCELERATED TECHNOLOGY DEVELOPMENT AND TRANSITIONS

The first two years of the effort shed light on promising technology transitions for the SOF enterprise. The JATF has already passed off a novel armor material solution to PEO SOF Warrior for use on Non-Standard Commercial Vehicles, which is currently in a testing phase.

Coming out of the 2015 RPE, the JATF Team developed the Assaulter Target Acquisition System, a Small Arms-Fire Control System that provides the operator with the ability to rapidly engage targets at night with increased surgical lethality. This is being further refined and optimized as a promising technology transition. Another is the cooling system for the TALOS base layer, which uses active water cooling in combination with next-generation passive cooling textiles to help maintain the core body temperature of the wearer.

The TALOS Communications Team has three potential technologies for transition. The Future Interoperable Radio Enclosure (FIRE), which will provide the operator with current and future battle field interoperability, the Integrated Communication Element (ICE) brings four bands together into a single form factor antenna, and the Small Form Factor SATCOM Antenna leverages an advanced dipole design that is tuned for that specific band.

Image 2: a TALOS rapid prototyping event

Also, some of the SOF components are in the process of testing passive exoskeleton prototypes. JATF-TALOS continuous to make the transition and development of these and other advanced technologies a key priority in order to push these capabilities to forces today and give them unparalleled advantages on the battle field.

PRIORITY 3: PIONEERING INNOVATIVE PROCESSES

The TALOS business model and acquisition approach is unique, even within the DoD. TALOS aims to have flexible acquisition strategies and agile processes, allowing the team to discover, innovate and implement rapidly. Streamlining the overall effort allows for driving down costs while increasing the JATF's ability to meet aggressive timelines. With this new approach comes risk, but also the prospect for great rewards in technology breakthroughs. Specific processes that the JATF has used include Prize Challenges, Rapid Prototyping Events, and the use of a Partnership Intermediary Agreement.

Government organizations are increasingly using Prize Challenges to reach a broad spectrum of non-traditional solution providers and accelerate innovative problem-solving. Prize Challenges are distinct from traditional contracted efforts in many ways, including the concept of 'pay-for-performance,', where much of the investment risk is transferred to the candidate solvers.

An Armor Design challenge, which was co-sponsored by the Combatting Terrorism Technology Support Office, launched in April 2015. Unfortunately, there was limited success as the majority of submissions were focused on material solutions. The next TALOS challenge is focused on Real-Time Parallax Correction, seeking to reduce the latency in pursuit of full digital night vision capabilities.
JATF TALOS is also involved in a Wearable Sensors Challenge that is co-sponsored by the Department of Homeland Defense and seeks to demonstrate the utility of integrated wearable sensors for first responders and operators.

Rapid Prototyping Events, or RPEs, were a trademark of TALOS's first two years. They focused on solving very complex design and engineering problems through collaboration with industry, academia, and government to develop future combat suit concepts and technology feasibility assessments. Through the use of various forms of modeling, which can include foam cutting, clay, 3D printing, fiber glassing and computer-based modeling, the team was able to rapidly iterate on fundamental TALOS design ideas.

TALOS has conducted two extended duration RPEs, one in summer of 2014 and one in June 2015, but is moving toward a more steady-state rapid prototyping capability through collaboration within SOFWERX.

The SOFWERX facility is a capability provided for use by USSOCOM through a Partnership Intermediary Agreement (PIA) with the Doolittle Institute. SOFWERX provides an environment that fosters innovation and collaboration with space to freely explore problems and potential solutions, providing state-of-the-art data, communications and visualization capability. The unique meeting and collaboration areas are ideal for small teams, meetings, and forums and provide areas for participants to protect property and information. The facility is intended to create an innovative environment for bringing together the best minds to collaborate and find solutions to tough problems, making TALOS an ideal problem set to work out of SOFWERX.

In addition to providing a venue for TALOS's move toward steady-state prototyping, SOFWERX has enabled TALOS presentations to many senior leaders within the DoD, including DEPSECDEF Robert O. Work and GEN Joseph Votel. In his last TALOS update, Votel said, "this is very impressive. It's very satisfying to see how far [TALOS] has come in the past several months."

PRIORITY 4: PERSISTENT COLLABORATION

The JATF continues to maintaining an extended network that includes regular end-user engagement and relationships with relevant partners in academia, industry and government. The JATF leverages the expertise of leading minds throughout the country as no one company, university or individual has the answer to TALOS. The JATF is currently teamed with corporations, government agencies, universities and national laboratories. The use of unconventional development methods has resulted in numerous non-traditional partnerships, ranging from costume designers in Hollywood to a company that designs protective suits through biomimicry (studying insects and other creatures with hard shells).

The TALOS extended network has become essential to the team's cyclical design process. The JATF reaches out to partners and SOF components during the design process for modelling tools. The prototyping phase requires the use of fabricators and armor materials scientists from industry, and the assessment phase has been supported by organizations like NHRC. The analysis phase uses the expertise of the extended network, but is ultimately conducted by the JATF and the suit's end-user community.

Utilizing partners decreases the development costs and timelines to bringing in new technologies. This unique level of collaboration is essential to the accelerating technology development in support an August 2018 prototype deliverable.

2015 Annual AEP Meeting Recap

LT MIKE NATALI, AEP #150

Our annual Aerospace Experimental Psychologist (AEP) meeting took place from 11-15 January in the Cradle of Navy Aviation, beautiful Pensacola, FL. During this time we connected with our counterparts from across the country to discuss ideas, research, and provide mentoring. It was a unique event this year as we were able to coordinate our meeting with the United States Naval Aeromedical Conference (USNAC), presenting and discussing aeromedical issues with the Aerospace and Operational Physiologists, Flight Surgeons, and Aviation Optometrists.

For the first two and a half days, we attended USNAC where several AEPs presented research and participated in discussion panels. Some of the highlights include Specialty Leader CDR Jim Patrey presenting on re-conceptualizing mishaps from a human factors perspective; CDR Patrey and LCDR Chris Foster participating in a panel discussion on hypoxia; several Unmanned Systems presentations by LCDR Foster, LT Rolanda Findlay, LT Joseph Geeseman, and LT David Rozovski; CDR Hank Phillips presenting the case for applying aviation human factors principles to medicine; and LT Lee Sciarini discussing healthcare modeling and simulation. LT Sciarini also won "Best Poster" for the conference and was presented his award by the CO of Navy Medicine Operational Training Center, CAPT Paul Kane, MC.

The AEP annual meeting, January 2016 in Pensacola, FL. Left to right: Jeffrey Grubb, David Rosovski, Chris Foster, Joseph Cohn, Rolanda Findlay, Joe Mercado, Eric Vorm, Mike Lowe, Brennan Cox, Tatana Olson, Greg Gibson, Henry Phillips, Lee Sciarini, Mike Natali, Jim Patrey, Todd Seech, Rick Arnold

It was exciting to have such a great presence at USNAC, especially since we have not typically participated in that forum. USNAC provided opportunity to connect more with the medical side, and several doctors and AOPs were interested in our work and potential collaboration efforts. Several AEPs were approached throughout the conference for more information about our community and our work. We hope to continue the relationships we built at USNAC and create some stimulating new opportunities.

CDR Patrey provided an update on our community and there was much discussion of where we see the community headed in the future. An overview of the recent survey of AEP billets showed overall we are doing well, but there are areas we could improve such as senior leadership positions, connections to the line, and our impact on Navy Medicine. The discussion was useful and will help guide us moving forward.

After our discussion of the state of the community, we had three focal areas for our meeting: career management, updates on research and projects, and small group activities. Career management briefs covered a wide range of topics: sources of funding, Joint Professional Military Education, acquisition training, awards, Fitness Reports, and "lessons learned" from CAPT(sel) Joseph Cohn. Our newest LTs, Todd Seech and Joseph Mercado, were also given the opportunity to present a "Flag-level" brief to the group while senior leaders provided feedback. This has been a useful exercise for the new JO's coming into our community as it helps teach them, in a safe environment, how to deliver a very focused brief and how to handle potentially difficult senior military officials who may not want to hear what they have to say. Both Joe and Todd handled themselves well and look to be excellent additions to our community.

Updates on Aviation Safety, ONR, PMA-205, ASTB and SUPer filled most of the second day before an evening USNAEPS social at Lillian's Pizza. Dinner proved to be an exciting event. A new AEP patch and coin design was voted on and new executive members of USNAEPS were introduced. However, the biggest surprise was likely CDR Phillips' face when he saw the miniscule amount of food on his plate when his order arrived. Luckily, there was plenty of pizza from other orders to at least temporarily sate his appetite.

Our final day of meetings centered on two small group projects. The outputs of these groups will be disseminated to the community in the near future, but centered on which conferences AEPs should attend and areas in which AEPs make an operational impact. We also congratulated LT Rozovski on his recent acceptance into the Duel Designator program and wish him luck as he trains to be an aviator in Corpus Christi!

It was a great week for our annual meeting and we look forward to next year's gathering!

Meet an AEP: LT Stephen Eggan, AEP #143

LT ERIC S. VORM, AEP #149

Naval Aerospace Experimental Psychologists are a small, but diverse group of professionals who come from a wide variety of backgrounds and experiences. In this series, we give individuals an opportunity to share more about themselves in a one-onone interview format in order to narrow that gap, and foster relationships and collaboration across our community.

In this issue we will meet LT (LCDR-Select) Stephan Eggan. He currently works at the United States Special Operations Command (USSOCOM) Headquarters at MacDill Air Force Base in Tampa, FL as the Human Factors lead for SOF AT&L's Joint Acquisition Task Force Tactical Assault Light Operator Suit (JATF-TALOS).

WHAT IS YOUR ACADEMIC BACKGROUND?

I entered undergrad as a pre-med student at the University of Pittsburgh in 1995. Because my father worked for the university, I had six free years of tuition – and I used them all. During the first five years I completed a double major in Neuroscience and Psychology. I spent the sixth year taking interesting courses that I could not fit in while completing my majors and studying abroad for a whole semester. After completing my BS in 2001, I stayed at Pitt for graduate school. I was trained as a Translational Neuroscientist and sought to explore how certain etiological factors can unleash pathogenic mechanisms that produce pathological disturbances in the brain that characterize psychiatric disorders, and how these brain disturbances give rise to the pathophysiological processes that alter brain function and are manifest as a particular clinical syndrome. I completed my Ph.D. in 2007 with a dissertation on the relationship between the brain cannabinoid system and schizophrenia. I continued this work as a Postdoctoral fellow at University of Pittsburgh School of Medicine until 2010, during which time I also lectured as Adjunct Faculty. My course was on Drugs and Behavior – it was popular with the undergrads.

WHAT MADE YOU INTERESTED IN PURSUING A DOCTORAL DEGREE IN YOUR BACKGROUND?

Truth - I missed medical school interviews because I decided to go gallivanting around the world on a ship for a semester for a study abroad program. My mentor suggested that with the amount of lab research and data collection I completed as an undergrad I could finish a Master's in the year during which I would have to wait for next cycle of medical school applications. Neuroscience had fascinated me since my first Intro to Neuroscience course as an undergrad, it was a hot science with significant discoveries being made so it was an exciting time to be a neuroscientist, I had a great relationship with my mentor, and I met a girl who was in the Ph.D. program (my wife) – so fate had destined for me pursue a doctorate in Neuroscience at Pitt.

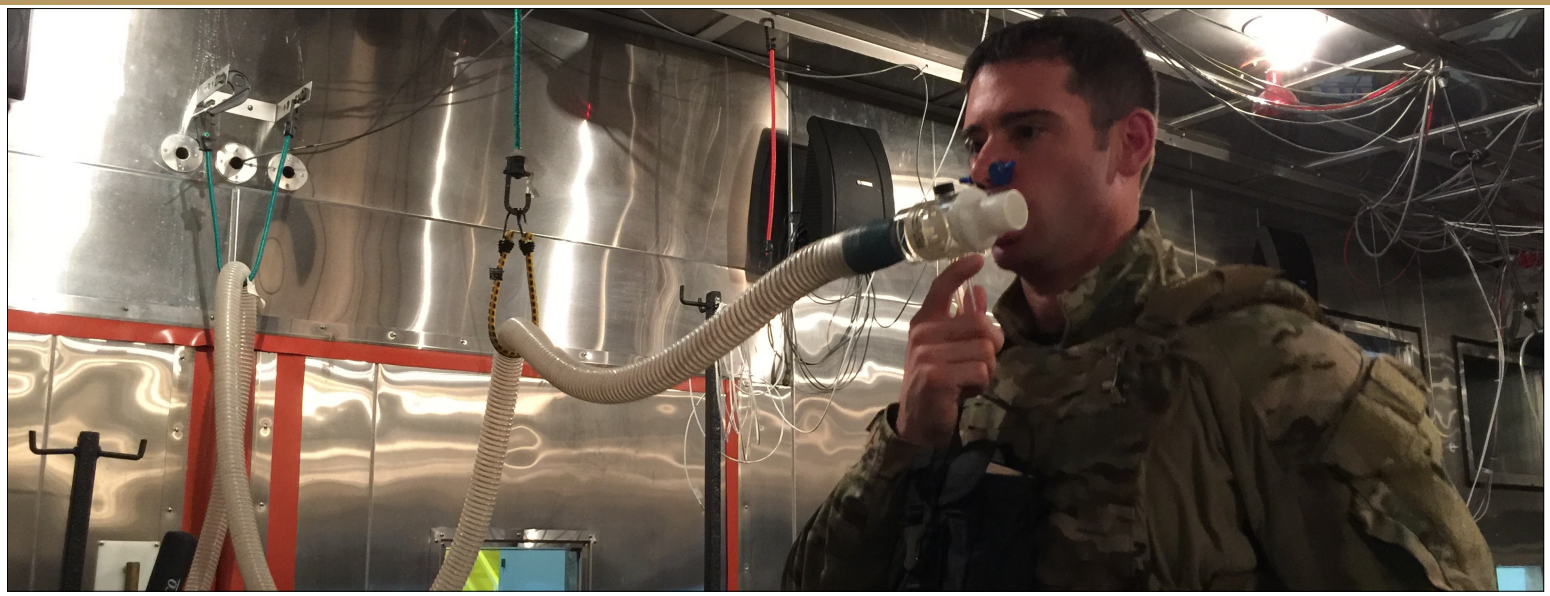
HOW DID YOU LEARN ABOUT THE AEP PROGRAM?

It all started with a fire, some beers, and a conversation with my brother. While sitting around a fire bowl one night I was contemplating a permanent career in academia and potential alternative options. I had been offered a position as an Associate Professor, but I wasn't sure that I wanted to be in academia for the rest of my life. I had been looking into careers in industry and consulting firms and that night my brother mentioned that the military has uniformed scientists. My grandfather and father both served in the Air Force (I don't hold that against them), which had instilled a desire in me to serve as well. So I got online and found the AEP program on the Navy website and called a recruiter.

Stephen Eggan at the Great Wall of China in 2001 during a semester abroad

WHAT WAS THE MOST CHALLENGING POINT OF YOUR TRAINING?

I understood military life so the transition from civilian life to the military, while intimidating at first, wasn't that difficult. Aviation Preflight Indoctrination (API) sprayed us with the information fire-hose, but I had strong background physics and other sciences that helped me with most of the courses – the API course that really challenged me was Nav. The most challenging part of training for me was bal-



LT Stephen Eggan tests a cooling vest developed by the TALOS team in the environmental chamber at the Naval Health Research Center, San Diego, CA

ancing family life with the amount of time and effort I had to devote to training. I went to Pensacola with a two year old toddler and a nine-month old baby. Then one Flight Suit Friday I came home from the O-Club to learn – very unexpectedly – that I was to expect another ankle-biter in about nine months. Shock and Awe!

WHAT WAS THE MOST MEMORABLE (OR EMBARRASING) POINT OF YOUR TRAINING?

I don't recall any really embarrassing moments from training. During my first fixed-wing fam flight we had just completed a barrel roll and I was feeling positive pressure in my mask so I looked down and to the right at my OBOGS – not smart. I didn't fill my bag, but I stopped talking and popped my mask so my IP noticed and gave me a hard time for the rest of the day. There are a lot memorable moments on the other hand – O-Club on Fridays (especially that one Friday), McGuire's outings, getting winged. One moment that stands out occurred during one of my first flights in the TH-57 when I was hovering in the box and my IP suggested I should change designators – I considered it for a minute.

WHAT IS YOUR CURRENT BILLET AND TITLE?

Currently, I am assigned to USSOCOM Headquarters at MacDill AFB in Tampa, FL as the Human Factors lead for SOF AT&L's Joint Acquisition Task Force Tactical Assault Light Operator Suit (JATF-TALOS) – see article in this edition for description of the effort and a progress update.

WHAT WORK ARE YOU INVOLVED IN NOW, AND HOW DOES/WILL IT IMPACT THE NAVY?

My major role on TALOS is to bring to bear technologies that will prolong Operator peak performance and increase awareness of Operator physiological condition while in the suit. To achieve this, I am leading the development of a novel baselayer garment that incorporates 1) an active water-based cooling system in combination with a next-generation passive cooling textile to manage thermal load; 2) integrated sensors for real-time, continuous health monitoring; and 3) the capability to transmit the data across a tactical mesh network to remotely located displays to enhance the medical triage and CASEVAC process. The TALOS team is currently conducting a five phase Rapid Prototyping Event to fabricate a working baselayer prototype. Once prototyping is complete, testing of the baselayer will be conducted in NHRC's environmental chamber to assess the effectiveness of the cooling system and validate health sensor signal output.

WHERE DO YOU SEE YOURSELF IN 10 YEARS? (LONG-TERM PROFESSIONAL GOALS)

In 10 years I hope I will be closing in on the end of a successful and fulfilling Navy career as an AEP, and will be just five years away from my goal of 20 years of service. I hope to have completed a deployment of some type, gained more operational experience, and served as the CO of a Navy unit such as NAMRU-D – non-traditional paths for an AEP. Working outside the traditional box will hopefully help pave the way for junior AEPs to do the same should they desire. I'm excited to see what my Navy career will bring, and to share those experiences with fellow AEPs.

FINAL THOUGHTS?

Stay thirsty my friends.

Bravo Zulu

LCDR Pete Walker and his colleagues received notice that their journal article, “Applications of Transductive Spectral Graph Methods in a Military Medical Concussion Database” was accepted for publication in IEEE/ACM Transactions on Computational Biology and Bioinformatics.

On 2 Dec, CDR Henry Phillips' team won the 2015 Army HSI Program Award (Technology Research & Development or Studies) for their work developing the Human Systems Integration Progress and Risk Specification Tool (HPRST). His team included Owen Seely of NSWC Dahlgren Division, Eric Stohr of Basic Commerce & Industries Ltd, and Dr. Jim Pharmer of NAWCTSD.

On 4 Feb, CDR Henry Phillips received an Army Commendation Medal for his work as Navy Lead for the Squad Overmatch Tactical Combat Casualty Care (SOvM-TC3) Pilot Study.

LCDR Brian R. Johnson (USAFA) was selected as the Outstanding Academy Educator (OAE) in the Department of Behavioral Sciences and Leadership. This award is presented annually to recognize one instructor who by personal example and performance best characterizes the principles of excellence in education. This individual is considered the best of the best in the areas of teaching skills, innovation in the classroom, curriculum and course development, publications or presentations, supervision, positive attitude/image, impact on the USAFA mission, and contributions above and beyond, including community and cadet service.

LT Brennan D. Cox, Naval Health Research Center, was awarded $746,000 by the Defense Health Program 6.7 for 2 year 4 month study entitled "Enhancing the Computer Assisted Rehabilitation Environment with a Brain-Machine-Interface." This work will incorporate a neurofeedback loop into an immersive virtual reality environment used for warfighter performance training and rehabilitation efforts.

LT Joe Mercado received notice that his journal article Intelligent Agent Transparency in Human-Agent Teaming for Multi-UxV Management will be published in the May 2016 edition of Human Factors: The Journal of the Human Factors and Ergonomic Society.

LT Joe Mercado and LT Rozovski received notice that their paper Integrating Methodology for Experimentation using Commercial Off-the-Shelf Products for Haptic Cueing was accepted for publication at the 18th International Conference on Human-Computer Interaction.

Upon his checkout from NAWCTSD on 28 Jan 2016, LT David Rozovski received a Flag LOC as well as two military awards. These included an end of tour Navy Commendation Medal for his work in multiple project areas across a three year tour, as well as a Navy Achievement Medal sent by the CO of CVN-78 in recognition of his work from September to December 2015 in developing an Augmented Reality demonstration capability. Pictured L to R: CDR Henry Phillips, Mrs. Marianne Idol, LT David Rozovski, LT Joe Mercado, and LT Rolanda Findlay.

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Calendar: Mark These Dates Down!

Aerospace Medical Association Annual Meeting

- April 24-28, Atlantic City, NJ

International Conference on Applied Human Factors and Ergonomics

- July 27-31, Orlando, FL

Human-Computer Interaction International Conference

- July 17-22, Toronto, Canada

American Psychological Association Annual Convention

- August 4-7, Denver, CO

Military Health System Research Symposium

- August 17-20, Ft. Lauderdale, FL (tentative)

Human Factors and Ergonomics Society Annual Meeting

- September 19-23, Washington, D.C.

Society for Neuroscience Annual Meeting

- November 12-16, San Diego, CA