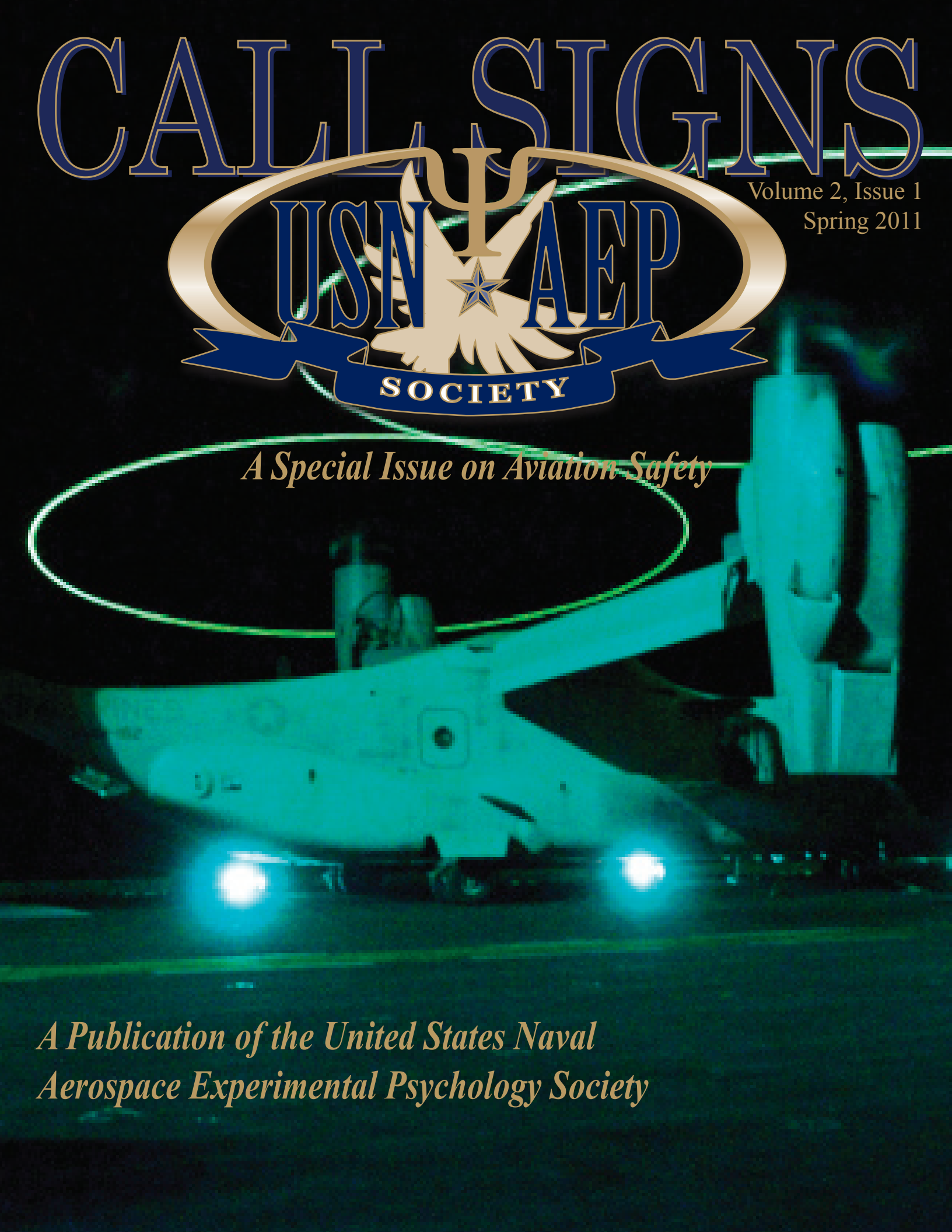
CALL SIGNS

Volume 2, Issue 1
Spring 2011

USN AEP SOCIETY

A Special Issue on Aviation Safety



A Publication of the United States Naval Aerospace Experimental Psychology Society

The Fence or The Ambulance
Joseph Malines (1894)

'Twas a dangerous cliff, as they freely confessed,
Though to walk near its crest was so pleasant:
But over its terrible edge there had slipped
A duke and many a peasant;
So the people said something would have to be done.
But their projects did not at all tally:
Some said, "Put a fence around the edge of the cliff"
Some, "An ambulance down in the valley."

But the cry for the ambulance carried the day.
For it spread to the neighboring city:
A fence may be useful or not, it is true,
But each heart became brimful of pity
For those who had slipped o'er that dangerous cliff,
And the dwellers in highway and alley
Gave pounds or gave pence, not to put up a fence,
But an ambulance down in the valley.

"For the cliff is alright if your careful," they said,
"and if folks even slip or are dropping,
it isn't the slipping that hurts them so much
as the shock down below-when they're stopping,"
So day after day when these mishaps occurred,
Quick forth would the rescuers sally
To pick up the victims who fell off the cliff,
With their ambulance down in the valley.

Then an old man remarked, "it's a marvel to me
that people give far more attention
to repairing results than to stopping the cause,
when they'd much better aim at prevention.
Let us stop at its source all this mischief, cried he.
"Come neighbors and freinds, let us rally :
If the cliff we will fence, we might almost dispense
with the ambulance down in the valley."

"Oh, he's a fanatic." the others rejoined:
"dispense with the ambulance Never!
He'd dispense with all charities, too, if he could:
no, no! We'll support them forever.
Aren't we picking up folks just as fast as they fall?"
And shall this man dictate to us? Shall he?
Why would people of sense stop to put up a fence?
While their ambulance works in the valley?"

But a sensible few who are practical too,
Will not bear with such nonsense much longer
They believe that prevention is better than cure
And their party will soon be the stronger
Encourage them, then with your purse, voice and pen
And (while other philanthropists dally)
They will scorn all pretense, and put up a stout fence
On the cliff that hangs over the valley.

Contents

1 LETTER FROM THE PRESIDENT

2 AEPS AND SAFETY

4 TRAINING AND SAFETY

6 CREW RESOURCE MANAGEMENT

8 HFACS UTILITY

10 SPATIAL DISORIENTATION

12 NEWEST AEP

13 PERSPECTIVES

16 CALENDAR

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 that will excel in the emerging joint and coalition environment.

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

• Advancing the operational effectiveness and safety of Naval aviation fleet operators, maintainers, and programs through increases in knowledge base, utilization of tools and practices of aviation psychology.
• Fostering professional development of its members and enhancing the practice of Aerospace Experimental Psychology within the Navy.
• Strengthening professional relationships within the community.

AEP Community Specialty Leader
CAPT Dylan Schmorrow
Office of Secretary of Defense
dylan.schmorrow@osd.mil

USNAEPS Executive Committee:

Society Chair
LT Pete Walker
Naval School of Aviation Safety
peter.b.walker@navy.mil

President
LCDR Joseph Cohn
Office of Naval Research
joseph.cohn@navy.mil

Vice President
LCDR Henry Phillips
Naval Aerospace Medical Institute
henry.phillips@med.navy.mil

Secretary
LT Brian Johnson
Naval Air Warfare Center Aircraft Division
brian.r.johnson@navy.mil

Treasurer
LCDR Brent Olde
Naval Air Systems Command
brent.olde@navy.nil

Historian
LCDR Jeff Grubb
Naval Air Warfare Center Training Systems Division
jeff.grubb@navy.mil

Newsletter Editor
LCDR Tatana Olson
Chief of Naval Personnel
tatana.olson@navy.mil

WELCOME

LCDR Joseph Cohn

Greetings and welcome to the third issue of the United States Naval Aerospace Experimental Psychology Society's Newsletter, Call Signs. This issue finds us all in very turbulent times – increased operations tempo (OPTEMPO) due to ongoing tensions across the globe and humanitarian crises continue to place stress on our Sailors and their families. As OPTEMPO increases, the likelihood of human error increases as well, further emphasizing the importance of the special role Aerospace Experimental Psychologists (AEPs) play in ensuring the safety of aviation personnel in the Navy and Marine Corps. This issue highlights the many contributions AEPs are making in the area of aviation safety, such as the Human Factors Analysis and Classification System (HFACS), the Military Flight Operations Quality Assurance (MFOQA) program, and Crew Resource Management. AEPs continue to lead the charge in getting the word out about aviation safety – in fact, our very own LT Pete Walker was recently selected as Instructor of the Year at the U.S. Navy and Marine Corps School of Aviation Safety

In this issue, we also bid farewell and thank you, to our inaugural Editor, LT Pete Walker. Pete has done an excellent job shepherding our newsletter from humble beginnings as a storyboard/powerpoint vision into a high-quality, professional publication, read not only by our members, but by senior military and civilian leadership as well. For many, Call Signs is their first exposure to the wide range of talent in the AEP community. As the saying goes, when one door closes, another one opens, and we are fortunate to have LCDR Tatana Olson, currently on special assignment to the staff of the Chief of Naval Operations, as our incoming newsletter editor. Tatana will no doubt provide a different perspective based on her background in aviation selection and her experience working on the Navy staff. Please join me in thanking LT Walker for all his hard work and welcoming LCDR Olson to her new position!

Lastly, we have recently experienced some turnover in our Executive Committee and will soon be soliciting nominations for the positions of Newsletter Co-Editors (two positions open) and Membership/Outreach Coordinator (one position open). Please let either LCDR Phillips or me know if you are interested in either of these exciting opportunities to help broadcast our community's successes!

AEPs Yesterday, Today, and Tomorrow

CAPT Dylan Schmorrow

Greetings and welcome again. The spring issue of Call Signs, the official newsletter of the United States Naval Aerospace Experimental Psychology Society (USNAEPS), reminds all of us how important our jobs are in supporting the science and training required to keep our warfighters effective and safe. The work the AEP community has accomplished continues to make a significant and positive impact for our forces around the world. Our community remains the vital link between the latest innovations in science and technology and naval leadership.

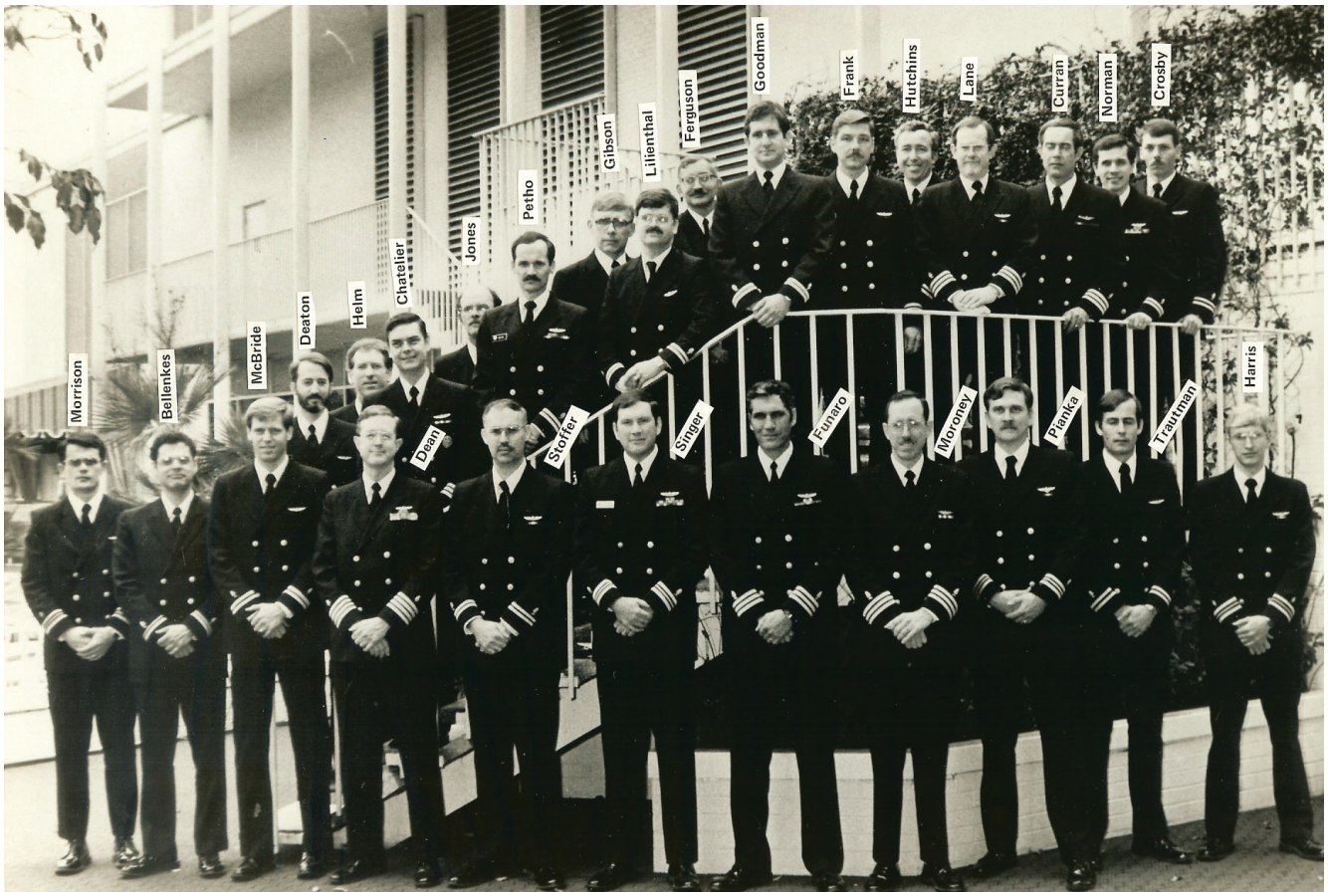
In this issue of Call Signs, we focus on Aviation Safety and highlight our accomplishments as a community over the past several years. Fiscal Year 2010 was a banner year for Aviation Safety. The mishap rate for both Naval and Marine Corps aviation reached record lows of 0.74 and 1.34 mishaps per 100,000 flight hours, respectively. In addition, several innovations and improvements in aviation safety were introduced to the fleet, including significant changes to the Crew Resource Management (CRM) program, the release of OPNAV 3750.6R Change 4, which mandated the use of the Human Factors Analysis and Classification System (HFACS) for all aviation mishaps, and the initiation of the WESS Aviation Mishaps and Hazards Reporting System (WAMHRS). The compilation of these programs was due in no small part to the contributions and successes of the AEP community over the past several years.

This is certainly not to say that AEP contributions in the safety arena represent a closed chapter. As scientists and practitioners, we must continue to seek out opportunities for research that will enable and protect our warfighters. This issue will highlight just some of the work done by members of our community in fostering cutting edge research in safety awareness. Specifically, this issue includes a discussion of the Navy and Marine Corps CRM program, a description of how HFACS can be utilized as a proactive tool for mishap prevention, and the latest research on spatial disorientation.

A challenge I have given all AEPs working in safety is to think about how to define and lead the challenges arising from the dramatic acceleration of remotely piloted vehicles and air vehicles employing varying levels of autonomy employed by naval aviation. If you think of yourself as a safety expert or you serve in one of our safety-focused billets, then please engage. AEPs serving in other core areas such as systems design, training, selection, or program management have similar roles to play with regard to this new area. We all know that more unmanned systems operators are being trained than are traditional pilots across the DoD, and that this trend will intensify. If we want to remain a relevant component of naval aviation then I believe we must demonstrate our relevance and engagement in this critical area. It is time to take action, and move beyond just talking about the implications of this shift.

We just have to look back upon our profession's beginnings to see this has long been a common thread. Technology developments in naval aviation in the first half of the twentieth century spawned naval aerospace experimental psychology as a profession, and amazing advancements in the next two decades that catapulted our profession into the mainstream of naval aviation. With the major transformation to unmanned systems underway, we face another opportunity to renew our relevance. We must all be prepared for this future. We should be at the forefront of innovative research programs and human-system integration solutions for our fleet customers, to keep naval aviation at the cutting edge.

I would like conclude by extending my gratitude to the Editorial Board of the US Naval Aerospace Experimental Psychology Society for their time, innovation, and dedication in creating and



AEP Community Meeting c1982

and supporting this society. The Society's Board will be turning over this year, and I have every confidence that the newly elected committee will continue to meet the exceedingly high standards established by the founding committee of the Society. Finally, as a contrast to all this forward thinking, I've included a couple of photos, from 1982 and 2003, that offer a small glimpse of how our community has progressed over the years. These photos not only remind us of our own rich tradition, but also help us remember that the innovations we seek to achieve today were shouldered by the colleagues of our past. In the same way that AEPs from the past provided the foundation for our current professional health and relevance, it is our responsibility to provide the bedrock upon which the AEPs of tomorrow will stand.

2003 AEP Meeting at NAS Pensacola. Pictured left to right, front row: LCDR Deborah White, CAPT Mike Lilienthal, LT Hank Phillips, LT Gisela Bahr, LT Cheryl Casey. Second row: LT Courtney Crooks, LCDR Dylan Schmorrow, LCDR Sean Biggerstaff. Third row: CDR Mike Reddix, CDR Andy Bellenkes, LT Joseph Cohn, LCDR Jim Patrey, LT Jeff Alton, CAPT David Gleisner. Rear row: CAPT(Ret.) Paul Chatelier, LT Eric Muth, CAPT John Schmidt, LT Rick Arnold, LT Brent Olde, LT Heike Rentmeister-Bryant

Danger! Danger! Training in progress!

by CDR Jim Patrey

Most of us are familiar with Hank Caruso, the undisputed king of military aviation art. I remember one of his paintings of a carrier just before the training contingent arrives – the 'orange' aircraft. As he always does, he amusingly captures the key characteristics of the event – the stress, fear, and danger that it brings to the carrier air wing. I remember as much when I was aboard the U.S.S. Enterprise during carrier qualifications. I saw the jokes about the orange aircraft posted in the squadron spaces and got to watch from an uncomfortably close distance a nugget conducting a touch-and-go, who came within just a few feet of clipping his wingtip on the jet blast deflector. A friend who was an instructor at Whiting Field summarized it best when he said that the safest way to approach training was to act as though all his students were out to kill him – there's no disputing the danger in Naval aviation training. It has often been said that landing aboard an aircraft carrier is the most difficult task a human is asked to accomplish. Such a degree of challenge will always unavoidably be accompanied by a chance of failure. This risk is unavoidable, as are the inevitable casualties that accompany it. This grim reality begs constant attention toward the nature of this training; we must consider whether Naval aviation training has slowly, insidiously, and profoundly changed.

While we are clearly flying in the safest days in the history of aviation, still there have been 100 Class A mishaps in Naval aviation since the start of FY05. Of those 100 mishaps, 14 have involved training aircraft during primary and intermediate training and only 9 occurred during OIF/OEF. In the last two years, 33% of these mishaps involved training aircraft and an estimated 80% occurred on training missions. While these numbers are tiny when viewed as proportions of all executed flight hours over the same period, they nonetheless suggest an alarming trend in which training may be failing to provide fully ready aviators. So here we are in the glory days of naval aviation dominance, equipped with precise, reliable equipment, exceptional maintenance personnel, and the most capable aircrew in our history. Why, then, are we losing the majority of our aircraft in training-related mishaps?

A fair question to ask is whether our training approach is broken or antiquated. There has arguably been little major change to our core approach to training in many decades. We are now on the brink of adoption of our next generation of fleet aircraft. Be that as it may, the core skills and controls for flying an aircraft have not appreciably changed. While our platforms are becoming increasingly complex, aviators trained to fly them must still learn basic navigation, radio work, and stick skills before being asked to tackle the advanced systems boasted by these new aircraft. We still teach these skills the same way we always have. There appear to be no obvious reasons why the aviation components of these early phases of training would suddenly have become more dangerous, except in comparison to a relative improvement in downstream safety.

Another question that has been raised is whether the increased reliance on simulation has provided unintentional negative training. Simulation is a powerful tool for generating readiness, yet it doesn't provide the full range of physiological, sensory, and cognitive cues to wholly mimic reality. Are those shortcomings responsible for inadequately or negatively preparing aviators for actual flight? This is possible, but seems unlikely given that there has not been an appreciable reduction to flight hours and flight simulators have been and mostly remain a minor part of the training continuum. However, anecdotal information has suggested that pilots are engaged in more 'heads-down' flying, possibly encouraged by the impoverished properties of the flight simulators. If it is true that current generation flight simulators still have visual fidelity limi-

Training

Continued from Page 4

tations that are generally regarded as inadequately representing the detail required for judging the distance between other aircraft in formation, we may be potentially teaching aviators to disregard visual cues that are poorly represented in flight simulation, yet key to task performance, something supported by the occurrence of five F/A-18 mid-air collisions since 2005. This possibility is certainly worth further consideration as Naval aviation training evolves to include simulation as a more significant component, though it seems to be an unlikely contributor to training-related mishaps at this point.

One other possibility that could explain an increase in aviation mishaps during training could be a fundamental shift in what needs to be trained. While the fundamentals of flying have remained mostly unchanged, the fundamentals of the military aviation mission have changed dramatically. The preponderance of new cockpit systems have progressed well past the traditional stick and rudder, and now include heads-up displays, advanced kinetic weapon programming interfaces, infra-red displays, electronic warfare packages, helmet-mounted cueing systems, etc. It very well could be that our traditional training approach is no longer adequate for our current aircraft and missions. The 'heads-down' flying that has been anecdotally reported and is consistent with the characteristics of the recent mishaps could be well explained by our increases in cockpit complexity.

While there are connotations for selection and design, the first place we must turn to address the current prevalence of training-related mishaps is undoubtedly the adequacy of our training design. We seem to be at a crossroads for training – an era in which simulation is mandated, viewed as a solution to delivering ready aviators in a financially constrained Navy, and our aircraft and missions are truly proceeding towards a new generation. But can we do this successfully using only a traditional training approach? AEPs have always been at the forefront of such challenges in training and it is beginning to look as if our unique expertise is sorely needed to help understand how to meet these new challenges as well. Understanding the cognitive demands, workload constraints, and characteristics of next generation aviation relevant to modern training will be integral to our future air dominance. So put on your flight suit, brave the orange aircraft, and meet the challenge!

Crew Resource Management in the U.S Navy

Where It Came From and Where It Might Be Going

by Paul O'Connor, Ph. D.

The aviation industry was instrumental in developing training aimed at reducing human error and increasing the effectiveness of flight crews. This training is commonly referred to as Crew Resource Management (CRM). CRM training can be defined as a set of instructional strategies designed to improve teamwork in the cockpit by applying well-tested tools (e.g., performance measures, exercises, feedback mechanisms) and appropriate training methods (e.g., simulators, lectures, videos) targeted at specific content (i.e., teamwork, knowledge, skills, and attitudes).

CRM training was first introduced in the U.S. Navy in the late 1980s. The impetus for CRM training came directly from commercial aviation. However, the early Navy CRM training was based upon civil aviation models, and was not well received by all naval aviators. Therefore, CRM training research was started by the Navy with the purpose of designing a theoretical and evidence-driven program designed specifically to meet the needs of naval aviators. As a result of this research, seven critical skills were identified for training: decision making, adaptability/ flexibility, situational awareness, mission analysis, communication, assertiveness, and leadership. Every naval aviator must receive ground training and a CRM evaluation during an actual or simulated flight, by a CRM instructor, or facilitator, once a year.

Unlike commercial aviation, the U.S. Navy considers CRM training to be an operational training program, as opposed to a safety training course. However, with more than 80% of naval aviation mishaps attributed to human error, if CRM's goal of reducing preventable crew errors by minimizing crew preventable errors, maximizing crew coordination, and optimizing risk management is achieved, improvements in safety would also be an inevitable outcome of CRM training.

The Navy's CRM program is governed by a Chief of Naval Operations (CNO) Instruction – OPNAVINST 1542.7C. The CNO instruction outlines a rudimentary foundation of CRM program academics and the behaviors the program aims to achieve. This instruction also sets out how the CRM program must be implemented by each aviation squadron. The U.S Navy's CRM program is centrally controlled, but each aviation community is given the latitude to administer its own CRM program tailored for its particular aircraft and mission. In a sense, the Navy and Marine Corps have 48 separate, but closely related, CRM programs (one for each type model aircraft the Navy and Marine Corps flies). Each program is inspected to ensure

CRM

Continued from Page 6

that it is in compliance with the CNO instruction, and that the academic literature is consistent with the U.S Navy's CRM curriculum. Although there have been minor updates, the basic CRM instruction in naval aviation has not changed greatly in the last decade. The last systematic update of the training curriculum was in 1999.

Evaluations of the Navy's CRM carried out in the 1990s were promising. It was found that participants liked the training, were more knowledgeable as a result of the training, there was generally a positive shift in attitudes toward the CRM concepts, and the training resulted in improved team coordination. However, whether there was an effect on the mishap rate of the training was inconclusive. A more recent evaluation found that naval aviators believe that CRM training has a positive effect on safety and performance, something that TACAIR aviators (particularly senior officers) did not agree with as strongly in the early 2000s as compared to the late 2000s. Naval aviators who fly different aircraft and of different ranks were generally knowledgeable of, and display positive attitudes towards, the concepts addressed in CRM training. However, there was a lack of a significant effect of CRM on the mishap rate. The lack of an effect on the mishap rate is not entirely unsurprising given that it is clearly affected by many factors other than CRM training.

Despite the fact that CRM training has been used in the U.S. Navy for almost two decades, there has been no systematic effort to expand the training to communities beyond naval aviators beyond a few limited applications. Bridge Resource Management (BRM) was introduced into the curriculum of the Surface Warfare Officers School about four years ago. However, there would appear to be no empirical foundation for BRM (in the Navy or the maritime industry more generally) beyond research that was originally conducted in the formation of aviation CRM courses. A recent evaluation of the impact of the Navy's BRM training on knowledge and attitudes found that it is below that which is typical of the CRM training reported in the literature. Therefore, it would appear that more developmental work is required for the Navy's BRM program to reach its potential. The only other isolated examples of the use of CRM training by non-aviation personnel are Navy medicine and Navy diving.

Outside the military, CRM training is being applied in a wide range of high-reliability industries. Those industries that adopted it first were, unsurprisingly, involved in the aviation business. However, CRM training has also begun to be used in a number of other high-reliability industries unrelated to aviation. Civilian applications of CRM training that directly related to the roles of U.S. Navy personnel include: aviation maintenance, air traffic control, nuclear power generation, commercial shipping, and medicine. However, if naval aviation CRM is to be adapted for other military domains, the training materials must be customized. As in the example of naval aviation, this effort must be fully supported at all levels from the deckplates to the Chief of Naval Operations.

There is no doubt that naval aviators will continue to receive CRM training for a long time to come. However, CRM training will have to adapt to address the automation issues associated with the new advanced aircraft. As with military hardware, a training program must not remain stagnant or it is in danger of becoming obsolete and ineffective. It is suggested that the Navy should continue to revisit its CRM training programs, and reassess where the training continues to be effective, and where it needs to be changed. This will take time and money. However, when one considers both the price of modern military hardware, and the cost of training someone to use it, an effective CRM training program is a cost effective method for improving for both safety and mission performance.

DoD HFACS

Forget Validity, Let's Talk Utility!

by LT Peter B. Walker and LCDR Jeff Alton

Historically, the most common underlying causal factor to aviation mishaps has been human error. In fact, it has been estimated that as high as 80% of all military aviation mishaps can be traced to a human causal factor. Yet, it was not until the signing of a joint memorandum of agreement between the military services in 2005 that Human Factors was even the primary focus of most accident investigations. However, a recent agreement among the military services has initiated the use of a common methodology, the Human Factors Analysis and Classification System (HFACS), to investigate and report human factors causes of mishaps.

HFACS attempts to provide a rigorous hierarchical structure to identify the levels at which an error might occur within an organization. Specifically, layers within the HFACS model are used to represent the original unsafe act that was committed by the operator (aviator, maintainer, ATC, etc.) and the preceding latent failures that produced a set of preconditions that allowed the unsafe act to occur. However, the Department of Defense version of HFACS called for an additional layer of specificity that included various nanocodes that may be used as identifiers for each of a number of different causal factors. Specifically, each DoD-HFACS category has between one and 16 associated nanocodes.

While there has been a great deal of research focusing on the validity (or lack thereof) of HFACS in reporting the human causal factors to a mishap, there has been much less of a focus on the utility of the HFACS model as preventative tool for accident analysis. Currently, we are seeking to develop an approach to assess the utility of HFACS through the application of association rule learning methodology. This approach can be used to identify common links between nanocodes of the HFACS model.

Using conditional probability, we can assess the extent to which the probability of reporting one causal factor (e.g., Checklist Error) is dependent upon the reporting of another causal factor (e.g., Failed to provide proper training). Stated in probability terms, the question is to determine the conditional probability of C, given A:

$$p(C|A).$$

In addition, the independence of reporting HFACS can be assessed by:

$$p(C|A) = p(C).$$

The example used above could thus address the question of whether the majority of causal factors (Checklist Errors) were at all influenced by command supervision not providing proper training.

Finally, we can calculate the lifted probability of the relationship between two HFACS codes by

$$p(C|A)/p(C).$$

The lifted probability of the relationship between two HFACS codes represents the facilitatory or inhibitory relationship between two variables. Specifically, if the ratio is equal to 1, we can infer that the probabilities of reporting condition A and C are independent of one another. This statement must be true because the conditional probabilities of the two nanocodes are equal to the a priori probability of one nanocode. However, if the probability of a single nanocode is affected by the occurrence of the other probability, the lifted probability will be greater or less than 1.

We recently calculated the a priori probability for human causal factors for 487 Class A and B avi-

HFACS

Continued from Page 8

	Frequency	Probability
Skill-Based Errors	**(286)**	**(.587)**
AE 101 (Inadvertent Operation)	11	.0226
AE 102 (Checklist Error)	22	.0452
AE 103 (Procedural Error)	93	.191
AE 104 (Overcontrol/Undercontrol)	91	.1869
AE 105 (Breakdown in Visual Scan)	65	.1335
AE 106 (Inadequate Anti-G Straining)	4	.0082
Judgment/ Decision Making Errors	**(145)**	**(.298)**
AE 201 (Inadequate Risk Assessment)	77	.1581
AE 202 (Task Prioritization)	11	.0226
AE 203 (Rushed Necessary Action)	3	.0062
AE 204 (Delayed Necessary Action)	16	.0329
AE 205 (Caution/Warning Ignored)	3	.0062
AE 206 (Decision Making During Op.)	35	.0719
Perception Errors	**(12)**	**(.025)**
AE 301 (Error due to Misperception)	12	.0246
Violations	**(61)**	**(.125)**
AV 001 (Violation – Risk Assessment)	6	.0123
AV 002 (Violation – Routine/Widespread)	25	.0513
AV 003 (Violation – Lack of Discipline)	30	.062

ation mishaps from Fiscal Year 1999 through Fiscal Year 2009.

As can be seen from the table above, the a priori probability of reporting specific causal factors is quite low. For example, for skill-based errors the most commonly reported causal factor was Overcontrolled/Undercontrolled the Aircraft (AE 104) with only 19% of all causal factors reporting this condition. Therefore, it would be tremendously difficult to develop any sort of preventative safety program based around such high level descriptive data.

Therefore, we calculated the lifted probability of each human causal factor as a function of preceding factors (Preconditions, Supervisory and Organizational Factors). Obviously, the number of lifted associations that can be observed is quite large. Therefore, we only focused on those causal factors that received the greatest lift from an item at the precondition level. As can be seen from the data below, several interesting observations can be seen from this analysis.

The strongest relationship with regards to skill-based errors was observed for AE 105 (Breakdown in Visual Scan). This causal factor was strongly influenced by PC 102 (Channelized Attention). In other words, a Breakdown in Visual Scan was reported three times more likely to occur when there was also a report of Channelized Attention. Similarly, a strong relationship was observed between AE 205 (Ignored a Caution or Warning) and PC 307 (Mental Fatigue).

	Association Rule	Conditional Prob	Lifted Prob
Skilled Based Error			
AE 105	PC 102 Channelized Att	.42	3.14
Judgment/ Decision Making Errors			
AE 205	PC 307 Mental Fatigue	.083	13.44
Perception Errors			
AE 301	PE 102 Restricted Vision	.243	9.89
Violations			
AV 002	PC 208 Complacency	.148	2.88

In this instance, the reporting of an Ignored Caution or Warning was thirteen times more likely when there was also a reporting of Mental Fatigue. Not surprisingly, we also observed a strong relationship between Misperception Errors and Restricted Vision.

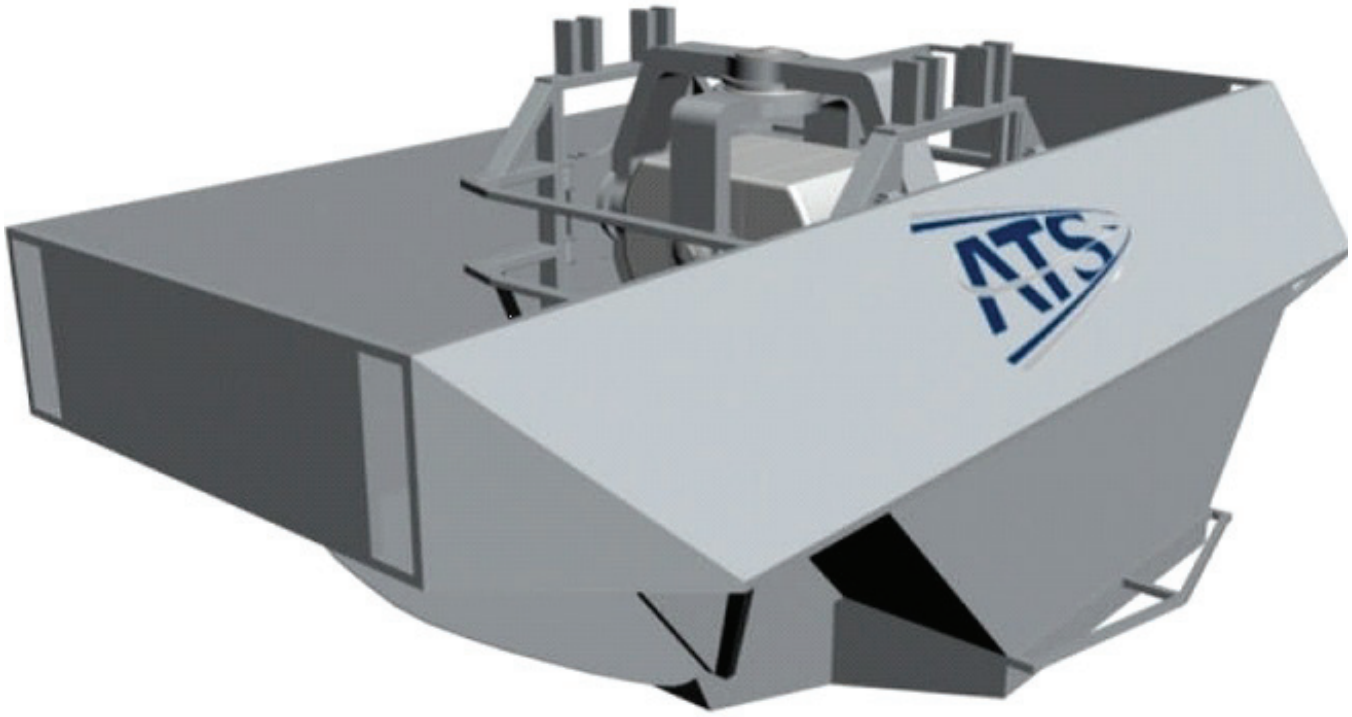
The scope of this paper was to merely highlight a novel approach for assessing the utility of HFACS. However, one can easily imagine several promising preventative approaches that can be developed from the preceding analytical approach. For example, the data presented above suggests that further education regarding the flying into IMC conditions might lead to a reduction in errors of misperception for aircrews.

The discussion above represents a limited case in which the work of AEPs have further contributed to the development of robust tools for accident reporting and investigation. In addition, we have argued that this approach can be formalized to help generate mishap prevention programs targeted at specific trends that have been identified using HFACS.

NAMRL and NAMRU-D Pursue Solutions to Pilot Spatial Disorientation

by LCDR Phil Fatolitis

In June of 2010, Dr. Fred Patterson, retired AEP and current Naval Aerospace Medical Research Laboratory (NAMRL) researcher, presented ground-breaking safety information related to loss of in-flight spatial awareness to a large audience of Training Wing 6 (TW-6) crewmembers at a safety stand-down. Headquartered at Sherman Field aboard NAS Pensacola, TW-6 conducts primary, intermediate, and advanced Naval Flight Officer and Navigator training for the U.S. Navy, Marine Corps, Air Force, and select international students. The safety stand-down was conducted in response to recent spatial disorientation (SD) incidents and mishaps involving TW-6 aircraft. The safety stand-down coordinators requested that NAMRL provide updated information and training on how to recognize and avoid this serious cognitive threat. NAMRL has been actively engaged in new research efforts related to SD, and utilized this opportunity to present its latest Enhanced Spatial Disorientation Training package to TW-6 instructors and students. Dr. Patterson provided flight crews with innovative information related to the methods by which pilots create and utilize multiple spatial strategies during various phases of flight. One of the main points stressed for prevention of SD was the importance of recognizing how primary spatial cues created by outside horizon references interact with secondary



Artist's rendering of NAMRU-D's Disorientation Research Device-Hercules.

Spatial Disorientation

Continued from Page 10

spatial cues generated from peripherally viewed cockpit images. Analysis of several recent aircraft accidents, including a recent Blue Angels mishap, was used to demonstrate how direct application of the theories and conclusions presented in the training package could be used to improve situational awareness in flight operations.

The training was extremely well received and was another example of NAMRL's transition of bench science to the Fleet. As NAMRL transitions to Wright Patterson AFB this year to become Naval Medical Research Unit-Dayton (NAMRU-D), the laboratory's SD expertise will be applied to "next generation" research utilizing new state-of-the-science SD research facilities and devices.

Future SD work will be enhanced by the laboratory's newest research acquisition, the Disorientation Research Device (DRD)-Hercules. The DRD capabilities include the integration of a precisely controlled, dynamically changing acceleration environment providing six independent degrees of freedom with reconfigurable visual displays and data collection capabilities, including physiological monitoring and telemetry; simultaneous yaw, pitch and roll movement; sustained acceleration to 3g; and off-center rotation. The capsule has a total of 32 cubic feet of "payload space," which can accommodate physiologic monitoring equipment to support fatigue, respiratory, and cardiovascular research in unusual acceleration environments. In addition, the payload area is large enough to mount reduced oxygen breathing devices (ROBDs) and associated air tanks in order to support hypoxia research. Of keen interest is the unique "cockpit" design which allows for man-in-the-loop mode in which the research participant ("pilot") controls movements of the device from within the capsule. These controls can be linked with a flight simulator so that the "pilot" is presented with the forces that he/she would feel in the actual flight environment while flying the simulator. The cockpit affords researchers the choice of seating only one subject centered in the capsule or two subjects side to side. With a seemingly endless list of capabilities, the Navy's one-of-a-kind research device will undoubtedly be a cornerstone of research in the new Joint Center of Excellence for Aerospace Research, Training, and Education at Wright-Patt. The device will assist researchers in addressing fleet aeromedical problems that include, but are not limited to, spatial disorientation, cockpit design, motion sickness and associated interventions, and visual and other sensory and acceleration issues. Innumerable collaborative efforts are anticipated as the synergies afforded by the new Center of Excellence become a reality. The matchless capabilities and research resources will be a magnet for research in general, but especially for aeromedical research for the services.

Welcome our Newest Student AEP

Our newest SNAEP, LT Kirsten Carlson, was commissioned on 28 January 2011 at her parents' home in New York. LT Carlson reported to Officer Development School in Newport RI on 6 March, and will be reporting to NAMI in Pensacola to join Aeromedical Officer Class 2012-01 following her ODS graduation scheduled for 8 April. She is expected to earn her wings in February 2012.

LT Carlson earned her doctorate in Biopsychology and Behavioral Neuroscience from Rutgers in 2006, and worked as a postdoctoral scholar at the University of Pittsburgh's Neurology Department following graduation. She has worked as Associate Director of Research Programs for the Michael J. Fox Foundation for Parkinson's Research since 2008, where she served as scientific lead and manager of a $30M portfolio encompassing over 100 grants. She is also an accomplished distance runner. We congratulate her on joining the AEP community, the Medical Service Corps, and the world's finest Navy!

LT Kirsten Carlson, center, at her commissioning ceremony, pictured with her recruiter, LT Kruse, left.

Perspectives From Fore and Aft

LT Rolanda Findlay and CAPT John K. Schmidt

Over the course of 30 years in uniform, CAPT John Schmidt made a mark in aviation safety while serving on the Naval Safety Center (NSC) staff, Naval Postgraduate School (NPS) Aviation Safety faculty, and Columbia Accident Investigation Board as an investigator. At the writing of this article he has rejoined the NPS faculty and is now engaged in developing a human systems solution to help combat a $1Billion corrosion problem plaguing Naval Aviation.

I had the opportunity to interview CAPT Schmidt, delving beyond his bio and resume, to learn more about the opportunities and events that paved the way for his accomplishments in safety, as an AEP, and as a Naval Officer. Whether you are new to our community or a well-seasoned AEP, I believe you will find his insights valuable and enlightening.

Q. How did you get involved in the field of Aviation Safety?

R. During graduate school I was heavily engaged in supporting safety at local petrochemical plants. Consequently, I took related industrial engineering classes and eventually completed a thesis and dissertation tied to occupational safety. So I have always had an interest in safety, but it was not until our training at the Naval Aerospace Medical Institute (NAMI) when a NSC team provided an overview of their mission that I found a way to combine my interest in safety with a career as an AEP.

Q. What experiences were most critical in preparing you for the responsibilities you have had in Aviation Safety?

R. The first step was completing the Aviation Safety Officer (ASO) Course at the NPS School of Aviation Safety (SAS). It was a rigorous combination of classroom-based and practical hands-on training designed to provide ASOs a background to manage safety programs, investigate and report mishaps, conduct local training, and promote safety efforts. I found the course coupled with my human factors training and past aviation research, development, training, and education experience provided insight into the challenges to reduce mishaps. I strongly suggest all AEPs given the opportunity take the ASO Course.

Q. Out of all of your accomplishments in the field of aviation safety, what do you consider to be your most profound contribution/accomplishment? Why?

R. In turning over with Andy Bellenkes at the NSC, I had a sense leadership was open to initiatives to address Fleet issues. After the Nashville F-14 mishap, Naval Aviation looked to NSC and SAS to address the human factors involved in 80% of Class A Flight Mishaps. Our small NSC Aeromedical Group became the focal point with SAS for a CNO directed effort to develop and execute a comprehensive plan to reduce human error. Fortunately a forward leaning effort by two AEPs, Scott Shappel at Naval Air Forces U.S. Atlantic Fleet, and Doug Weigmann at the Naval Aerospace Medical Research Laboratory, to employ Reason's "Swiss Cheese" Model was underway. For the next year, I worked with Scott to support the Human Factors Quality Management Board (HFQMB) by conducting post-hoc analyses of Class A Flight Mishaps for a 10-year period. Our efforts led to many insights, changes, and interventions that helped drive down Naval Aviation's mishap rate. It is gratifying to have played a part in this team effort that put much needed attention on the central role of human factors in causing mishaps.

Q. What are some of the best practices and major lessons learned in each of the roles you have held within the realm of Aviation Safety?

Perspectives

Continued from Page 13

R. At SAS's request (& AEP SL Mike Lilienthal's direction) I PCSed to Monterey to teach and support the HFQMB. At the time, I thought I'd return to acquisition, but the needs of the Navy came first (besides who ever heard of turning down orders to Monterey, CA). Given NSC pressed with Human Factors Analysis and Classification System (HFACS) in studying pilot error and SAS was implementing an aircrew climate assessment, I decided to take a new direction and address maintenance error. I partnered with Naval Air Forces U.S. Pacific Fleet's #3 Maintenance Officer (a future Flag named Mike Hardee) and with the support of my SAS colleagues Bob Figlock, Don Lawson, and Doc Bank as well as over 20 NPS thesis students (including a junior AEP named Schmorrow) we developed an array of safety products for the Fleet. Among them were a HFACS derivative to study maintainer errors, an on-line survey to capture maintenance safety climate, a program for wings to identify human factors maintenance issues and develop interventions, and maintenance resource management for flightline and hangar operations. In our 2nd year, the National Transportation Safety Board (NTSB) endorsed our work and we were jointly funded by NASA and the FAA for the next five years, with many of our products being leveraged by the commercial aviation. My takeaways from this experience was that in every billet you can make a difference, partnering is a force multiplier, networking opens up untold opportunities, and as my hero President Ronald Reagan stated "There is no limit to what you can accomplish if you don't care who gets the credit".

.Q. You have certainly had a powerful impact and left your mark on the field of Aviation Safety. What advice can you give to fellow members of the AEP community to distinguish themselves as valuable contributors to the field of Aviation Safety?

R. I would not say I left an indelible mark on aviation safety, for the hazards and associated risks are constantly changing. This requires a perpetual effort to reassess threats, develop tailored interventions, and find support for implementation. If this is not done we not only find the emergence of new challenges that come with advanced technology, mission changes, etc., we also see reemergence of the old ones. This means anyone looking to impact safety does not have to look far to see the many opportunities that exist whether it is in supporting mishap investigations, providing squadron level training, conducting safety surveys, analyzing mishaps, HAZREPs, and survey data, and developing controls. The experience gained from such activities lays a firm foundation, and coupling it with professional reading of safety efforts in other industries, keeping abreast of safety related system acquisition, and networking with other services can lead to innovation.

Q. In your opinion, what are the current challenges facing Naval Aviation Safety? What do you foresee are the future/imminent issues within Naval Aviation Safety? How can AEPs contribute?

R. In my view we have three challenges moving forward: 1) Providing for safety in legacy systems as they are upgraded/retrofitted with new technology, this entails solid human system integration and systems engineering, 2) Enhancing maintainer effectiveness and avoiding maintenance error, especially as the number of manned systems decreases and there is pressure to reduce personnel, and 3) As most squadrons become comprised of Unmanned Aerial Vehicles, we will see some of the same safety issues witnessed with increased automation in manned aircraft as well as a host of new ones. As AEPs our acquired knowledge of the operational environment, mission requirements, various platforms, acquisition process, systems engineer-

Perspectives

Continued from Page 14

ing, test & evaluation, crew resource management, and selection & training offers a unique skill set to address safety issues of both the present and the future.

Q. How would you advise individuals in the AEP community, not directly assigned to an Aviation Safety billet, to get involved and engaged in Aviation Safety?

R. As AEPs we fly regularly with local squadrons to maintain proficiency and awareness. Often these units have little safety support for Safety Standdowns, Crew Resource Management (CRM) training, etc., and can really use our professional expertise. If you are able to attend the ASO and CRM courses now offered at Aviation Schools Command, you can add another dimension in that you can offer to also support mandatory annual CRM training, help out with a human factors council, consult on a mishap case, help write a hazard report, and even assist in a mishap investigation as part of an Aviation Mishap Board. I have been fortunate to have had many such opportunities over my career, and through them was viewed as a squadron member and not a flight time rider.

I would like to personally thank CAPT Schmidt for allowing me to conduct this interview. It was an honor and pleasure to learn more about his work, career, and experiences as an AEP. As a junior AEP just beginning my career, I look forward to implementing the advice shared and modeling the example he has set.

Calendar: Mark These Dates Down!

Mar 28-30, 2011
AEP Community meeting to be held in Washington DC. We hope to see you all there!

Apr 14-16, 2011
26th Annual Meeting for the Society for Industrial & Organizational Psycholgoy (SIOP) to be held in Chicago, IL
http://www.siop.org/conferences/default.aspx

May 2-5, 2011
International Symposium of Aviation Psychology will be held at Wright State University in Dayton OH. http://www.wright.edu/isap/

May 2-5, 2011
DoD Human Factors Engineering Technical Advisory Group-65 will be held in Natick, MA. http://www.hfetag.com/

May 8-12, 2011
2011 Meeting of the Aerospace Medical Association (AsMA) to be held in Anchorage, AK. http://www.asma.org

Jul 9-14, 2011
HCI International will be held in Orlando FL. www.hcii2011.org

Sep 19-23, 2011
HFES will be held in Las Vegas NV. www.hfes.org

Call Signs is published three times annually on behalf of the United States Naval Aerospace Experimental Psychology Society.
Postmaster: LT Peter B. Walker
Naval School of Aviation Safety
181 Chambers Ave. Ste C.
Pensacola FL 32508
Send articles to the address above or
via email to the editor, peter.b.walker@navy.mil.