

# The Safety Sigma

## From the Director—Naval Aviation SMS: What Does SA Mean?

What is SA? For most Naval Aviators it is one of the 7 critical skills of CRM: situational awareness. It has been beat into our heads since FAM 1. How many times have you heard “you need to pull your head out of your \_ss” by your instructors? Actually I have said it a few times, but never actually heard it, maybe because I had such poor SA at the time! So why is maintaining SA so important? Good SA contributes directly to good decision making in the cockpit. Without good SA one cannot predict the future, thus described by Boyd’s OODA loop. (Continued on next page)

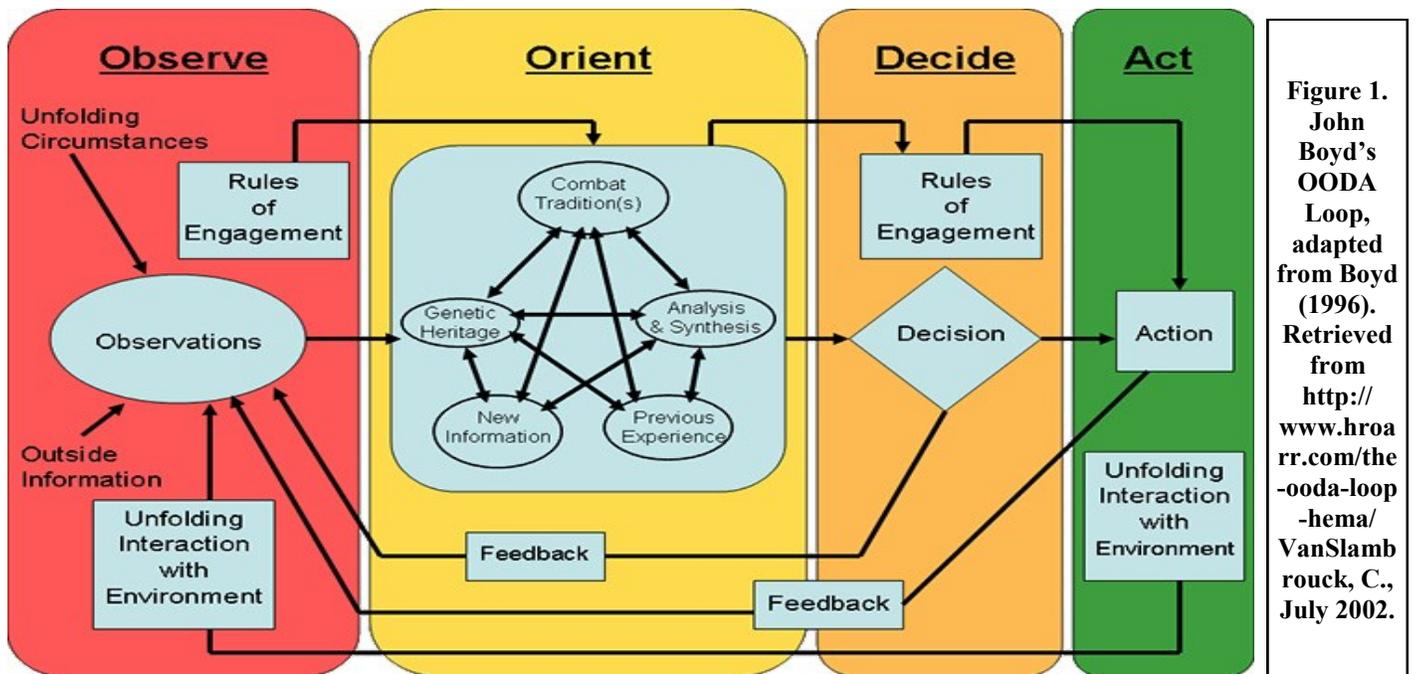


Figure 1. John Boyd's OODA Loop, adapted from Boyd (1996). Retrieved from <http://www.hroarr.com/the-ooda-loop-hema/VanSlambrouck, C., July 2002.>

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## Naval Aviation SMS: What Does SA Mean? (continued)

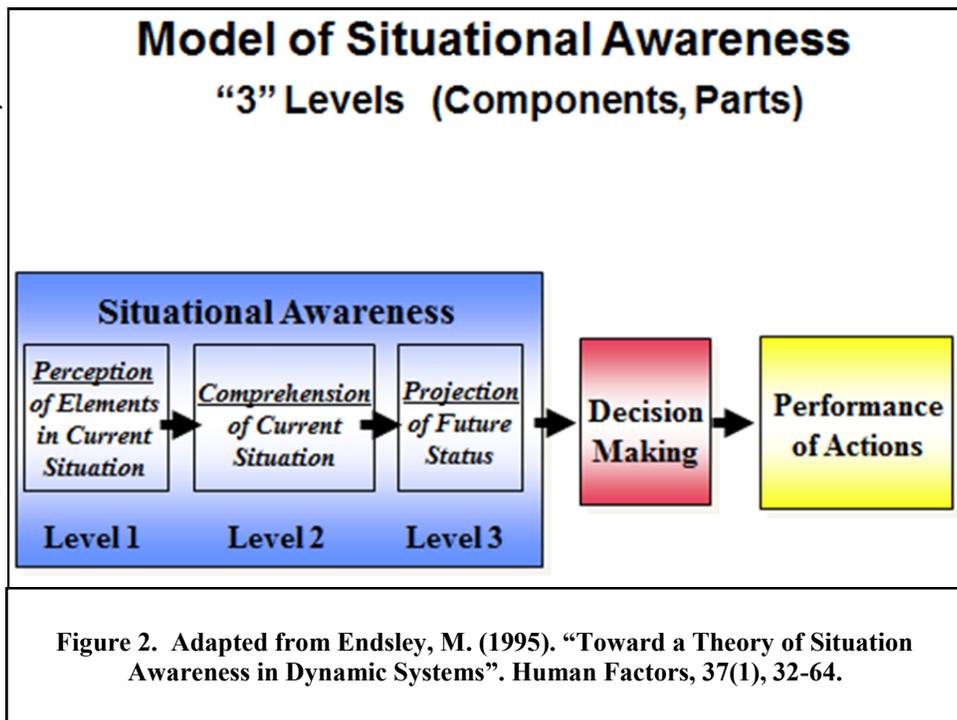
One must observe and orient before deciding and acting. Or one must gain SA. SA is defined as “the perception of the elements in the environment within a volume of time and space, the comprehension of their meaning and the projection of their status in the near future” Endsley (1995).

But SA also has another meaning, safety assurance, and is defined by the ICAO and FAA SMS as one of the four pillars/elements to any Safety Management System. I have been asked to speak at the International Society of Air Safety Investigators Southeast Region Chapter's annual meeting at the end of March. The topic they want me to discuss is SMS. So as I got my brief together I did a deep dive into both the ICAO SMS and the FAA SMS. Both are similar, both rely on 4 pillars/elements (safety policy, safety risk management, safety assurance and safety promotion). These 4 pillars provide a stable platform to a com-

mand's SMS, and one thing I found very interesting is that FAA circular 120-2B states, “SMS is a decision making system.” So why is safety assurance so important to SMS? The purpose of SA in SMS is to assist in decision making, very similar to the relationship of situational awareness to the 7 skills of CRM.

It is interesting how the SA from SMS plays a very similar role as situational awareness plays in flight decision making. SMS is based on fundamental, proven best practices across aviation safety. In SMS, your risk management is only as good as your safety assurance. Or as you might say, “you get what you inspect” and/or “trust but verify” (Figure 3).

So this begs the question, how robust is safety assurance within Naval Aviation? And who is responsible for safety assurance, the chain of command (COC) or the Naval Safety Center? If you read the Summer 2014 Safety Sigma you know how I feel. I believe it is not the safety department's responsibility to assure safety processes are being enforced within a unit. Based on the FAA definition of SMS they would agree. The FAA SMS states safety assurance is the responsibility of the “accountable executive.” The accountable executive is defined as an individual who: is final authority over operations, controls the financial resources, controls the human resources, and retains the ultimate responsibility for safety performance. That sounds a lot like “train, man and equip” to me. For the Navy then to have a fully functional SMS, the TYCOM must be responsible for safety assurance through the type wings commanders to the squadron commanders. Bottom line, an outside entity cannot be responsible for safety assurance. It is directly tied to the commanders and the chain of command. (next page)



## Naval Aviation SMS: What Does SA Mean? (continued)

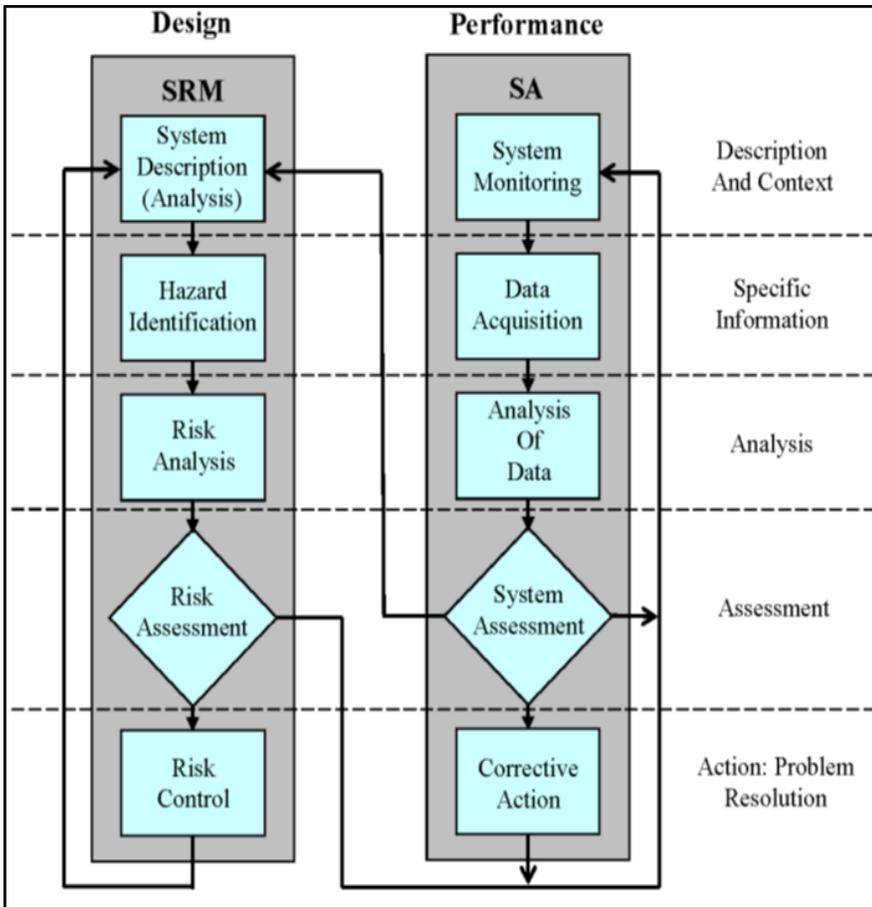


Figure 3. Adapted from "SMS for Aviation Service Providers." AC-120-92B. January 8, 2015.

### SMS Safety Assurance Components

MFOQA, ASAP, AnyMouse, Cultural Workshop, Safety Survey, CSA, MCAS, MPA, AMI, AMCI, Investigations, Reporting, SSWG, ORM, CRM, Fatigue Management, HFCs and HFBS

Figure 4. Naval Aviation SMS Safety Assurance Components as taught at the Naval School of Aviation Safety

Let's look at the new 3750 (Naval Aviation SMS policy) in regard to Naval Aviation SA (Figure 4).

The safety assurance pillar in Naval Aviation has numerous processes and numerous process owners. Flag-level aviation commands and squadron commanders all own pieces and requirements of safety assurance. Under the FAA SMS model, SA is the responsibility of the type commander and COC. Is it really their responsibility in our current Naval Aviation SMS? Is there a gap? Before I answer that let's take a look at some of the other pillars of the Naval Aviation SMS.

**Safety Policy.** It is interesting that in accordance with FAA SMS safety policy (Figure 5), the "3 Rs" of safety management are defined: roles, responsibilities and relationships. How are the roles, responsibilities and relationships of Safety Assurance defined within our current Naval Aviation SMS? And whose responsibility is it to define these? IAW FAA SMS that again is the responsibility of the "accountable executive" to define these roles, responsibilities and relationships. Have we defined the roles of Wing ASO, Base ASO, or TYCOM ASO?

**Safety Promotion.** The School of Aviation Safety (SAS) turns 50 this year. For 50 years the school has trained squadron ASOs in the 3 R's of squadron safety management, how to identify hazards, manage risk, and how to investigate and report mishaps. Additionally, squadron commanders have been trained how to manage their safety programs within their organization. SAS education and training has stopped there, at the unit level. Is that (next page)

## Naval Aviation SMS: What Does SA Mean? (continued)

a gap in Naval Aviation SMS safety promotion? I would say yes.

In the Navy, Type Wing Commanders and Type Commanders need to gain situational awareness as to the effectiveness of risk management within their organizations. They need to ensure robust safety assurance. How do we best do that? I would put forth that Naval Aviation needs to close the gaps at the wing level when it comes to safety assurance by defining the roles, responsibilities and relationships of Wing and Base ASOs and educate them to create standardization in safety assurance across Naval Aviation. Figure 6 Is an initial draft of a 5-day course that is in development here for Aviation Safety Managers.

### Course Overview

The course will include the following units of instruction:

-Introduction and Course Overview

-Safety Management Systems

-Reporting

-Agents and Tools

-Other Topics and Related Disciplines

Dr. "Opus" Hahn, our Associate Director of Academics, has been working with Base and Wings ASOs to develop this curriculum, both because we saw a need at the school house and a demand signal for follow-on education into the roles and responsibilities was received from Base/Wing ASOs. The course is designed as a follow-on to the ASO course for officers designated to serve in base, wing, or staff ASO positions. The target date for piloting

### FAA SMS Safety Policy Components

1. Importance of Top Management Involvement
2. Three R's of Safety Management
  - Roles
  - Responsibilities
  - Relationships
3. Procedures and Controls
4. Safety and Quality

**Figure 5. FAA SMS Safety Policy Components as taught at the Naval School of Aviation Safety**

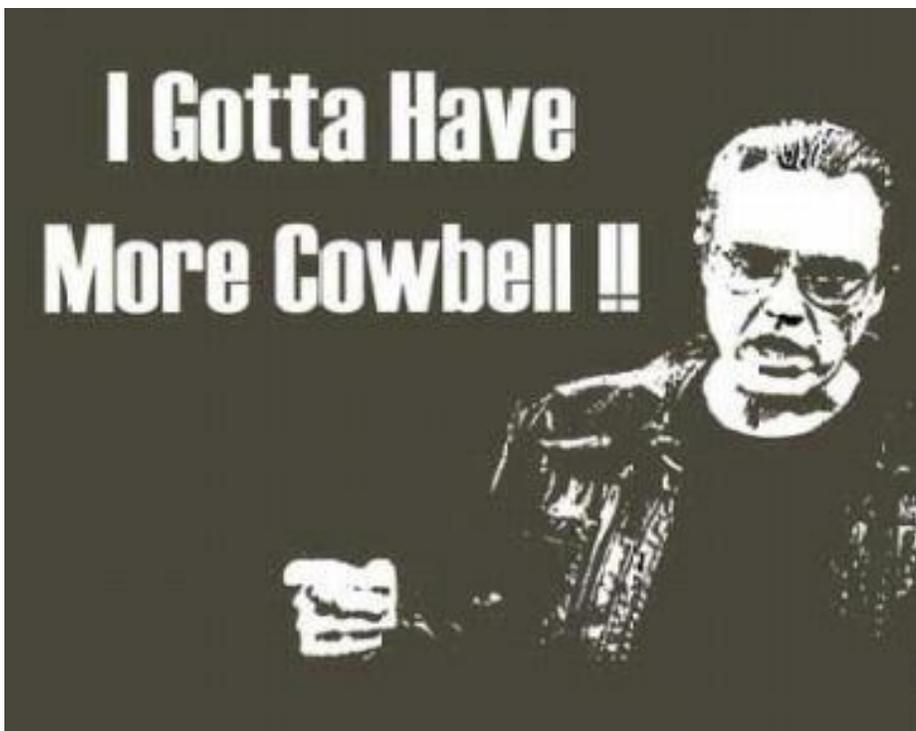
	Mon	Tue	Wed	Thur	Fri
0800	Course Intro	Agents I	Agents II	ASAP	HAZREPS/ BASH
0900	SMS Overview	Endorsements	Fall Protect	Pulse+/ MFOQA	Misc Topics
1000	Reporting	Inspections	Agents III	ESAMS	Safety Ldrship
1100	Reporting	Safety Surveys	Agents IV Bash & USDA	ASAP Lab	<b>Figure 6. Proposed ASM Course daily schedule.</b>
1300	ORM	CSA/MCAS	Mishap Resp Plans	Agents V Mtgs & ASC	
1400	CRM	5102	Aeromed	Endorse Lab	
1500	Safety Awards	5102	DoDHFACS	Endorse Lab	
1600	WESS/ WAMHRS	Endorse Exercise	Endorse Exercise	Endorse Review	

## Naval Aviation SMS: What Does SA Mean? (continued)

(from previous) this course is summer of 2015. The ultimate goal is having the course available for the fleet in FY16.

This course is a start in filling the current gap in the Naval Aviation SMS SA pillar. It will not only assist the chain of command in acquiring situational awareness of the effectiveness of their risk management processes but will greatly assist in safety process improvement as we continue down the road to a more proactive safety culture.

Finally, I say farewell. I am off to Atsugi, Japan to be the Deputy Commander of Fleet Air Forward flying C-12s and generally loving life. The family wanted one last great Navy adventure before we closed the chapter as a Navy family, so off we go. To the COs who have gone through the course in the last couple of years it has been a real pleasure to work with you. I look forward to seeing you out in the fleet. To the ASOs who have come through as well, if you want to fly C-12s overseas drop me a line. I can never have too many ASOs nearby. I am very happy I had the opportunity to be Director of SAS, and during my tenure I think we have moved the ball forward: realigning under the Naval Safety Center, becoming more responsive to the fleet, helping draft the Naval Aviation SMS, and developing the Aviation Safety Manager Course for Wing and Base ASOs. I thank my entire staff. What great people we have here at SAS! They truly have made this place the Blue Threat Weapons School!



**On behalf of the SAS staff and the hundreds of former students over the last 3 years, we salute Captain Jody Bridges for boldly and energetically leading the percussion section of the Naval Aviation safety band, inspiring aviation leaders to constantly improve and promote the best things of a healthy safety culture, ie, “More Cowbell!”**

## How Many Hellcats in a Lightning II? Or...do we need to update our Cost-Benefit Calculations?

Our 1945 cost per unit for the Grumman F6F Hellcat was an estimated \$50,000.<sup>1</sup> In 2014 dollars, that comes to around \$655,000.<sup>2</sup> In comparison, the Navy's newest strike fighter, the F-35 Lightning II, is costing us, for argument's sake as sources disagree, an estimated \$145 million per copy.<sup>3</sup> That's the equivalent of 221 Hellcats, a little more than two and a half times Big E's complement back then!

Let's put it in terms of mishap rates. In 1945, the USN Class A Flight Mishap rate was estimated at 87 per 100,000 flight hours. Divide that rate by 221 (assuming the Hellcat mishap rate was about the same as the overall rate) equals .4, the mishap rate we would need to achieve in the F-35 to match the materiel cost of the Navy's worst annual mishap rate during WWII. Keep in mind, that was a time of total warfare and complete national industrial mobilization.

This comparison, while

perhaps a bit simplistic, suggests that we have a lot of room for improvement, considering the FY2002-2014 rate of 1.32, and a strike-fighter rate approximately double that. The question that comes to mind is "have we changed anything?" We're flying aircraft with hefty price tags, yet when was the last time we lowered our threshold of acceptable risk to account for the severity of losing one of those aircraft? We're not just talking dollars here either. The higher the price tag, the lower the density of the asset, so the impact to mission capability with the loss of just one aircraft becomes magnified.

There is one change in progress. That's the implementation of SMS throughout the Navy. Many organizations have had astounding successes with SMS. These companies have saved hundreds of millions of dollars in mishap costs (accidents and incidents in the civilian world) and, in one spe-

cific case, a second order effect of heavily discounted insurance premiums due to reductions in risk. As part of the Navy's SMS, the heart of which is risk management, what else will we change? What about our weather criteria? I wonder if anyone currently flying Navy aircraft remembers when those were last updated. What about limiting the mission set or simplifying missions based on flight hour thresholds and recent flight time? If a strike-fighter crew has only been flying once a week for the last month, is a 4 v. unknown self-escort strike with surface-to-air threats and a full-up engagement off target the way to go?

In either case, you can manage your risk at the squadron level by taking the more conservative approach. Weather at mins with diverts sketchy – wait for a better opportunity. Highly complex mission coupled with low proficiency – eliminate some of the complexities and actively supervise the plan-

ning and execution. Is the risk assumed always worth the lives of the aviators or the loss of a costly, capable mission asset?

—LCDR Mike "Spock" Chenoweth, USN; SAS SMS Instructor



F-35 Integrated Test Force pilot Dan Canin flies F-35C test aircraft CF-2 in the Atlantic Test Ranges July 8, 2013. Photo courtesy of Lockheed Martin.

<sup>1</sup> warbirdsandairshows.com

<sup>2</sup> dollartimes.com

<sup>3</sup> Derived from multiple sources

## A Brief Review of our Concept of Privilege

Aviation Safety Officers know that while conducting an aviation mishap investigation they are able to employ the invaluable tool of safety privilege. "Military and Federal Courts grant protection from public release and non-safety uses under executive privilege to information given under promises of confidentiality, and to the analysis, conclusions and recommendations of the AMB and endorses" (OPNAV 3750 1-28). As the command's subject matter expert, the ASO must have a firm understanding of the concept of safety privilege.

Legal definitions of executive privilege offer insight to the concept such as, "the privilege that allows the president and other high officials of the executive branch to keep certain communications private if disclosing those communications would disrupt the functions or decision-making processes of the executive branch" (Law.edu, 2014). In 1792, George Washing-

ton laid early groundwork for how we apply the concept today. After General St. Clair's failed military expedition in the Northwest Territory, there was a congressional inquiry demanding records and testimony from the presidential staff familiar with the event. Washington convened his cabinet and ultimately decided to release the requested materials because the secrecy did not serve public interest. But Washington also made it clear to Congress that he has the authority to deny information to Congress if it is exercised in the public interest (Rozell, 2012).

Nowhere in the constitution is executive privilege mentioned. Rather, it is an implied power recognized through the courts and this legal interpretation establishes the precedent and guidelines for what information the highest level of government is allowed to withhold from public scrutiny. Similarly, civil and military courts allow military aviation accident investigators to use privilege

as we conduct our investigations because it serves the public interest. The public pays tax for a strong defense. Lives, and aircraft lost, weaken our ability to defend. The goal of mishap reporting is mishap prevention and is therefore executed on behalf of public interest. The concept of safety privilege is critical to this execution. The following three cases were influential on how we report as mishap investigators in the modern era.

Consider the case of *Machin v. Zuckert* in the early 1960s. Machin was a lone surviving crew-member of a B-25 crash. Zuckert was the Secretary of the Air Force. Machin attempted to gain full access to the Aircraft Accident Investigation Report (the Air Force Equivalent to our Safety Investigation Report) as he pursued legal action against the manufacturer of the aircraft. US Court of Appeals ruled that requiring the Air Force to disclose the entirety of the investigation would impair our national

security by weakening a branch of our military. However, the court also ruled that it was not up to Secretary Zuckert to decide what part of the mechanic's report was privileged versus not privileged. The court ultimately decided that confidential statements made to investigators were privileged and exempt from disclosure. However, the factual findings of the Air Force mechanics would be disclosed. The court also ruled that the distinction of releasable portions would be determined by the courts, and not by the Air Force (*Machin v. M Zuckert* 316 F.2d 336). This was an early example of the courts agreeing that the military can use the concept of privilege, but cannot abuse the privilege.

In the 1975 case of *Cooper v. US Navy*, the courts initially protected the concept of privilege as it applies to mishap investigations. Cooper was an attorney representing bereaved family members of the aircrew involved in a fatal Sikorsky helicopter crash in the Mediterranean Sea. Cooper demanded the release

## A Brief Review of Our Concept of Privilege (continued)

of both the JAGMAN investigation and the Aviation Accident Report (AAR). A Louisiana District Court Judge agreed with the US Navy contention that "oftentimes employees of manufacturers will give statements which are adverse to the manufacturers but which result in the Navy Department being able to improve the safety of future aircraft. It is the opinion of the Navy officials that if this assurance were not given, the information necessary to a continued improvement in air safety would be difficult if not impossible to obtain" (Cooper v. Department of United States Navy, 396 F. Supp. 1040). The judge ruled that the JAGMAN contents would be released but the entire AAR would not be released and deemed the entire AAR privileged. However, Cooper later discovered that Sikorsky was given access to part of the investigation and re-opened the case with the US Court of Appeals in 1979 (Cooper v. Department of United States Navy-594 F. 2d 484). In this case, the court found the Navy was not following its own regulations because it released part of the investigation to Sikorsky but not to Cooper. Consequently, the court ordered that the same information provided to Sikorsky shall be released to Cooper. The court also warned that if the Navy did not protect privileged information in the future, the entire 'privilege' could be lost (AFSC/JA, 2000). Because of rulings like Cooper, US Navy requires AMBs to separate privileged safety information and non-privileged safety information within our reports. Keep in mind, however, that Naval Safety Center makes the final determination of what information will be redacted prior to public release. The requirement to separate privileged safety information also stems from the court ruling of Badhwar v. US Air Force.

In 1987, Badhwar represented journalists seeking more disclosure of investigation reports, thereby disagreeing with previous court interpretations of safety privilege. Badhwar argued that there is a need "to distinguish between those government employees whose statements are not privileged (e.g., nonimplicated mechanics reporting on the wreckage) and those whose candor depends on the assurance of non-disclosure" (Badhwar v. United States Department of Air Force-829 F. 2d 182 ). A DC Circuit Court ruled that factual portions of contractor and autopsy reports could be disclosed from the investigation report. The court also ruled that material obtained through promise of confidentiality, material reflecting deliberation, and material reflecting recommendations from the board would be privileged and exempt from disclosure (Badhwar v. United States Department of Air Force-829 F. 2d 182 ).

These three court cases provide ASOs some insight as to how and why the AMB controls privileged safety information. The Naval Safety Center is the "final authority" (OPNAV 3750 1-28) on what information will be deemed privileged. However, the AMB must be educated with certain fundamental principles as the SIR is generated.

Designate information gained under the promise of confidentiality privileged. AMBs cannot place interviewees under oath so the information is given voluntarily. Interviewees must have confidence that their information will only be used for safety purposes or their willingness to divulge will be eroded. Cooper II served as a stern warning from the courts. Information generated from AMB deliberation, conclusion or recommendation is also privileged. The Badhwar case re-affirmed the obligation mishap investigators and their services have to keep this information separate from factual information.

As a Reporting Instructor at SAS, I encourage all ASOs and leaders to study and continually gain a deeper understanding of the history and purpose of our concept of privilege. As part of the US military, we must use it correctly or lose it. If ever in doubt, call the experts at NSC or contact SAS.

—LCDR Dan 'Dauber' Kelly, USN; *SAS Reporting Instructor*

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## Safety Cultures: *Alive or just Described?*

As of August 2015, the Coast Guard's Safety and Environmental Health Manual (COMDTINST 5100.47A) describes the five elements of a positive safety culture: a reporting culture, a learning culture, a just culture, an informed culture, and a flexible culture. Our FSOs and COs know and understand the definitions, but what is that next step? How do you ensure the new direction our policy describes actually comes alive at your air station and in our Coast Guard? I have heard of a couple of air stations where stand-down and stand-up periods have included discussions on these cultural topics, led by the Commanding Officer. Awesome! There is no one at the air station better equipped to do this. The CO has the closing comments on the mishap reports which are the most visible outputs of our reporting culture. They are the ones, along with leaders who work for them, who "draw the line between acceptable and unacceptable behavior" that a just culture demands. They have the vision, experience, judgment, and authority to drive change when adjustments are needed (flexible culture). It's encouraging to see these cultures discussed in recent revisions to air station CO's written safety policies. More importantly though, the cultures have to jump off the paper and be alive in what we do. Discussions must continue until all hands understand that:

- A discussion with the FSO is not the first step toward punishment or embarrassment
- Voluntary self-reporting is an honorable thing and should not be used against the member.
- Human errors can be trapped and mitigated but never eradicated. Leaders will respond appropriately to errors.
- The conscious acceptance of unwarranted risk may result in unappealing consequences, with or without a mishap.
- Our healthy reporting culture helps us avoid the more major mishaps. All hands need to be ready and equipped to participate in this reporting process when called.
- We need not be content with less than ideal conditions (insufficient manning, an ailing facility, an unreliable aircraft system, etc). We gather evidence, involve SMEs, and write recommendations for improvements.

Leaders have the heavy task of communicating these cultures and reinforcing them with the decisions they make each day. FSOs need to be ready to help them do just this. —LT Jim Bates, USCG; *SAS USCG Instructor*

## Communication: An Absolutely Important CRM Skill

As Naval Aviators, you are aware of the importance of Crew Resource Management (CRM) in safe (and therefore effective) mission execution. Many of you are also aware of the central role that communication plays in CRM. However, you may not be aware of some important details (the devil's always in the details) with respect to communication as a causal factor in Naval Aviation mishaps. CRM is prominent among human factors (HF) mishap causes in USN/USMC Class A aviation mishaps. Table 1 shows subcategories of the Coordination/Communication/Planning category and provides evidence that communication-related HF problems are prominent among the CRM skills that DoD HFACS identifies.

Although the nanocodes shown in Table 1 are intended to address unique HF mishap causal factors, it is evident that some different nanocodes can share characteristics. Of particular interest here are nanocodes that share a communication component. For example, "PP 102 Failure to cross-check/back-up" does not explicitly identify communication as a causal element. However, communication could be implicit in some of the mishaps where PP 102 was a causal factor.

Other nanocodes such as "PP 106 Critical information not communicated," for example, explicitly address the communication component. Based on these findings, it is clear that communication errors constitute a rich area for application of mitigation practices.

**Table 1 - Nanocode Frequencies in "Coordination/Communication/Planning" DoD HFACS Category (FY 2000-2009)**

<i>Coordination/Communication/Planning Factors (Crew-Resource Management)</i>	
PP 101 Failure of crew/team leadership .....	41
PP 102 Failure to cross-check/back-up.....	61
PP 103 Inadequate task delegation .....	15
PP 104 Rank/position intimidation.....	7
PP 105 Lack of assertiveness.....	13
PP 106 Critical information not communicated.....	27
PP 107 Standard/proper terminology not used .....	4
PP 108 Failure to ensure communicated intentions/actions was understood and followed .....	15
PP 109 Mission planning inadequate.....	35
PP 110 Mission briefing inadequate .....	22
PP 111 Failure to re-assess risk and adjust to changing circumstances.....	20
PP 112 Information is misinterpreted or disregarded .....	8

Effective communication is critical for the establishment and maintenance of situational awareness (SA). It is worth mentioning here that SA itself is a central component of the OODA Loop, and poor SA can threaten both safety and mission completion/effectiveness. So what are the threats to effective communication? There are two fundamental ways that communication can fail: lack of communication and poor communication. For example, in terms used by DoD HFACS in Table 1, lack of communication could be observed in instances where the nanocodes PP 102, 106 and 108 are found to be causal and poor communication could be observed in instances where PP 107, PP 108, PP 110 and PP112 are

## Communication: An Absolutely Important CRM Skill (cont)

found to be causal.

More insidious are the times during communication when crewmembers make erroneous assumptions. For example, the “sender” of a message may assume that the “receiver” understands. In an error-laden instance, the receiver may assume that the message means one thing when, in fact, the sender intended something completely different. Assumptions can be based on a number of things, including biases, experience, context and expectations. Errors associated with assumptions can be mitigated if ambiguity in the message is reduced and if a conscious effort is made to engage in active two-way communication, where feedback is an integral component.

Some simple mitigation “best practices” to enhance communication include: redundancy- active listening & assertive feedback; precision- awareness of imprecision in natural communication should drive effort to make communications more precise; fatigue- awareness that fatigue can degrade effective communication; vigilance- keep an eye out for errors during the entire communication process.

—LCDR Phil “Dr. Phil” Fatolitis & CDR (ret.) Bill “Pop” Little, USN; *SAS Human Factors Instructors*

## CRM: The Program Management Lecture

The Program Management (IMMs) conduct on an 18 month cycle. The CNAF 1542.7A was signed by Vice Admiral David Buss on 12 March 2014 and it was promulgated on 10 April 2014. The “A” is full of fleet driven changes derived from frequently asked questions as well as direct input from many PMs. Two of the main changes are the CRM Facilitator (CRMF) Evaluation Under Instruction and the Community Model Manager (CMM) Type/Model (T/M) CRMI Des-

ignation Letter.

The Facilitator training shall cover an abbreviated CRM ground course. In addition, the potential Facilitator will conduct a flight/simulator evaluation under the instruction of a CRMI. The reason behind the under instruction evaluation flight/simulator is to align CRM with NATOPS due to the eventual inclusion of CRM into the OPNAV 3710. In response, many Type/Model/Series (T/M/S) PMs have overlaid this requirement

on an existing check ride. For instance, all instructor pilots in the HSM community are trained as CRMFs. Therefore, all potential Instructor Pilots (IPs) conduct an evaluation under instruction during their pre-existing IUT-4X. The HSM community developed a simple way to annotate the training as well. In the “Remarks” section of SHARP they annotate who the CRMI was (i.e. "Conducted a CRM evaluation under instruction of LT XXXX, CRMI") and log the event as a 2L5 (Stan Evalua-

## CRM: The Program Management Lecture (continued)

tion). They also ensure the CRMF designation letter includes that it was done IAW CNAFINST 1542.7A and documented in Section II.C of the NATOPS Jacket. CRMF ground training is then logged in Section III.A. We consider this type of instruction implementation a "Best Practice" and is not governed by CNAF 1542.7A because each community may have different methods of training and annotation.

Another "Best Practice" is the T/M/S community review. Upon request and before the end of the four day CRMI course, the IMMs will review the archived Assist Visit reports with the PMs and Unit Level Managers (ULMs). This allows the incoming

Managers to see the CRM status of their community before assuming their new position. The IMM will also schedule the next visit with the PMs and make recommendations for improvement. This method sets up the new Managers for success and assists them in the job transition.

The Assist Visit checklist is the PMs and ULMs key to an excellent CRM program. We recommend that once designated as a manager the member perform a self-assessment using the Assist Visit checklists dated August 2014. This action will give the manager excellent situational awareness on the current state of their program. It contains two sections: PM and Training. The PMs will find the entire check-

list helpful. Whereas the ULMs will find the training section more applicable to their needs. The checklist is provided to all CRMI graduates on a student disk. Once our website has fully migrated to the Naval Safety Center it will be hung there for mass consumption.

The CRMI designation is typically for one T/M/S. However, under the new instruction the T/M/S CMM has the discretion to write a Type/Model (T/M) designation letter. This was written to alleviate the administrative burden caused by multiple designation letters for similar aircraft (i.e. HH-60H/SH-60F/MH-60S).

The CRMI PM lecture is considered the first part of

a two part series. Upon squadron check-in, the second part will be given to the new CRMIs by their current PMs. The PM will explain how the program works for their T/M/S, the PM's responsibilities, and the new CRMI's responsibilities.

The T/M/S PMs are the fleet ULM's primary CRM point of contact. However, our office is always available for the fleet's CRM needs. The CRM office conducts 12 classes per year in Pensacola and has the ability to conduct 8-10 Mobile Training Teams per fiscal year. In FY13 we trained a total of 311 CRMIs and FY14 produced 395. FY15 projected numbers show that approximately 420 CRMIs will be trained.

—LCDR Al "Judge Red" Tony, USN; *SAS CRM Director*

**An MV-22B Osprey assigned to Marine Medium Tiltrotor Squadron 365 (Reinforced) takes off from the flight deck of the amphibious transport dock ship USS New York (LPD 21). New York, part of the Iwo Jima Amphibious Ready Group, is deployed in support of maritime security operations and theater security cooperation efforts in the U.S. 5th Fleet area of responsibility. (U.S. Navy photo by Mass Communication Specialist 3rd Class Jonathan B. Trejo/Released)**



## Rotor Disk Loading

Early in their careers, likely no later than the Fleet Replacement Squadron, Naval Aviators piloting any rotor-equipped aircraft are made aware of the sometimes negative effects of the downwash produced by their aircraft. It's likely that some amongst us have personal stories related to this downwash and errant portable toilets, tents, or covers ("hats," for USCG). Unfortunately, the downwash from rotorcraft can have far less comical results, such as broken bones and damaged aircraft. Damage to lighter civilian aircraft is usually taken into consideration by military aircrew transiting civilian fields, but how often is consideration made for damage to other military aircraft and equipment?

The disruption of airflow around and behind aircraft has been previously discussed in the Sigma ("Caution Wake Turbulence," SAS Safety Sigma 12-3), but let's briefly refresh the idea and the factors which contribute to the strength of that turbulent air, particularly for rotorcraft. We all know that lift is produced by our airfoils. This action is sometimes related to Newton's Third Law, with the end result being that air is accelerated downward since

that would be the opposite direction of the force applied to the wing (assuming we're flying in a non-inverted manner). Take a step back and think about where need for this downward flowing wind originated lift. Thus, if our aircraft is heavier than normal, then we need more lift, and to get more lift the air will need to be accelerated a greater amount. This also relates to a term known in rotorcraft circles as disk loading.

Disk loading is simply the ratio of rotor thrust to rotor disk area. For an ideal rotor in a hover, it is also proportional to the square of induced velocity.<sup>1</sup> For an aircraft at a higher gross weight, the downwash beneath the hovering aircraft will be significantly increased. This is where we can get into trouble. That higher velocity of downwash leads to higher dynamic pressure on any object in close proximity to the hovering aircraft. The resulting force across people, structures, equipment, wings, or other rotors may be excessive and ultimately lead to a reduction in mission capability!

In mitigating the negative effects of downwash we can look toward reducing the disk loading, possibly by reducing the weight of the aircraft. Of course there are limits to how much we can reduce that weight. Further-

more, there are times when rotorcraft aircraft will be in a relatively heavy condition due to mission demands. So how can we mitigate the negative effects of that downwash? As is often the case, detailed and specific education for everyone operating in this situation is one of the first and best solutions. This means not only educating the aircrews of these aircraft to 'be careful where you fly,' but everyone on the ground/ship to understand the implications of the changing conditions which cause a greater or lesser amount of downwash than which they are accustomed. That includes aircrew and maintenance personnel of different T/M/S aircraft in the vicinity who may have a degree of complacency towards downwash. Should panels be closed? Gear moved further from the flight ops? Gear tied down with extra straps? Personnel take a knee? Remember, understanding the changing aerodynamic conditions is necessary for effective hazard identification in our risk management processes.

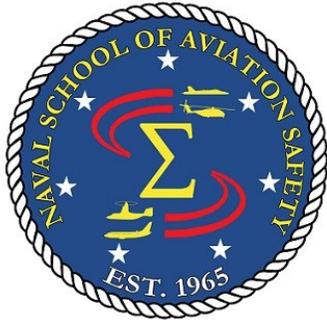
—LtCol Stephen "Bender" Dickerson, USMC; *SAS Rotary-wing Aerodynamics Instructor*

Ref: Leishman, J. G., *Principles of Helicopter Aerodynamics*, Cambridge University Press, 2nd Edition, New York, 2009

## Naval School of Aviation Safety's Quarterly Newsletter

Naval School of Aviation Safety  
181 Chambers Ave. Suite A.  
Pensacola, FL 32508-5271

Phone: 850-452-3181



*Feel free to contact the contributors to this issue of the Safety Sigma newsletter at the email addresses below:*

Director: [jody.g.bridges@navy.mil](mailto:jody.g.bridges@navy.mil)

SMS Instructor: [michael.chenoweth@navy.mil](mailto:michael.chenoweth@navy.mil)

Reporting Instructor: [daniel.j.kelly1@navy.mil](mailto:daniel.j.kelly1@navy.mil)

Coast Guard Instructor: [james.a.bates3@navy.mil](mailto:james.a.bates3@navy.mil)

Human Factors Instructor: [philip.fatolitis@navy.mil](mailto:philip.fatolitis@navy.mil)

CRM Instructor: [alvin.d.toney@navy.mil](mailto:alvin.d.toney@navy.mil)

RW Aerodynamics Instructor: [stephen.m.dickerson1@navy.mil](mailto:stephen.m.dickerson1@navy.mil)



## Fair Winds and Following Seas

We wish the best to Major Rob "Tattoo" Orr, USMC, SAS Investigations Instructor, who retires this month after 20 years of service to his country. He leaves a void (literally, his replacement is not here yet!) that will be difficult to fill. He provided expert, credible instruction while consistently feeding our hard-working students' need for humor and excitement during the long academic days here at the school. None of us ever knew how applicable the Urban Dictionary and seemingly unrelated YouTube videos could be to the pursuit making Aviation Safety Officers. On behalf of the hundreds of students you taught during your time here at SAS, we thank you and wish you the best in your next career.

—SAS Staff

