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SAFETY SAGE

Risk *Mitigation*

This month's issue has a smattering of everything. We've got the perennial favorite "there I was" stories full of excitement, advice and instruction from the top ORM experts in our Air Force, and some great information on new initiatives and programs to give you some ideas. There's something for everyone, because *safety is everyone's business!*

"How Many Steps To Safety" discusses the future of AF ORM. (See page 8.)

Articles by Lt Col Dillinger (See page 21.) and Lt Col Nunn (See page 26.) at the AF Safety Center provide insight on the OSA and SAT processes – great tools for improving safety. You might want to sign up for one.

"Aviation ORM Takes Off" discusses a large-scale ORM initiative implemented by AMC. (See page 18.)

Of course, the most entertaining stories are about when ORM was misapplied … so enjoy and learn from someone else's misfortune. Remember, "The driving force behind a safety program is the cost of not having one." (See page 4.)

Keep reading FSM! Make sure you mailed in your Annual Mailing List Verification form that arrived with the December issue, or go to http://afsafety.af.mil/SEMM/annualveri.shtml for details. We need to receive it by 1 Apr 2007 or you will be dropped from our mailing list. Next month we'll focus on leadership…and you won't want to miss it.

DEPARTMENT OF THE AIR FORCE — THE CHIEF OF SAFETY, USAF

PURPOSE — *Flying Safety* is published monthly to promote aircraft mishap prevention. Facts, testimony, and conclusions of aircraft mishaps printed herein may not be construed as incriminating under Article 31 of the Uniform Code of Military Justice. The contents of this magazine are not directive and should not be construed as instructions, technical orders, or directives unless so stated. SUBSCRIPTIONS — For sale by the Superintendent of Documents, PO Box 371954, Pittsburgh PA 15250-7954. REPRINTS — Air Force organizations may reprint articles from *Flying Safety* without further authorization. Non-Air Force organizations must advise the Managing Editor of the intended use of the material prior to reprinting. Such action will ensure complete accuracy of material amended in light of most recent developments.

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How Safe Is Safe Enough?

"The driving force behind a safety program is the cost of not having one."
Greg Alston, 2003

MR. GREG ALSTON
HQ AFSC/CD

Organizational Climate Excerpt from "How Safe Is Safe Enough?"
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HQ AFSC Photo / Photo Illustration by Dan Harman

Organizational climate differs from culture in its lack of permanence and stability. The safety climate in particular, is a 'snapshot' of employees' perceptions of a current environment or prevailing conditions, which impact upon safety (Mearns et al., 2000). Based on common themes in various definitions of safety climate … Wiegmann et al. (2002) derived the following definition of safety climate:

> *Safety climate is the temporal state measure of safety culture, subject to commonalities among individual perceptions of the organization. It is therefore situationally based, refers to the perceived state of safety at a particular place at a particular time, is relatively unstable, and subject to change depending on features of the current environment or prevailing conditions.*

Safety professionals and organizational leaders cannot overlook the importance of safety climate within their organization. The safety climate can fluctuate with real-time influences, such as new leadership, organizational changes, and environmental impacts. Safety managers, and corporate managers in general, must be vigilant for climate changes, realizing the constant fluctuation. Through diligence and effort, the climate can possibly be controlled with incentives, training, and participative process.

At the beginning of this chapter, the quote from General Eberhart pointed out that *risk* is inherent to an organization; the safety challenge is to identify hazards, eliminate or mitigate risks, and make smart decisions on what risks we will and will not accept. This applies to everyone and every activity, and determines if we are *safe enough*. Risk management requires prevention methodology: identify hazards, report them to appropriate people, assess the risks, choose the best solution, and monitor. Sometimes we must accept risk, but must accept it at the right level—strategically, operationally or individually. In management's effort to win the risk game, sound organizational structure and solid corporate processes that achieve prevention methodology will, in the end, effectively manage organizational risks, and provide a comforting answer to the question, *"Are we safe enough?"*

Lip Service...Or An Effective Tool?

HQ AFSC Photo / Photo Illustration by Dan Harman

Anonymous

Operational Risk Management (ORM): Is it lip service or an effective tool being utilized by today's Air Force aviators and leadership? As we briefly explore ORM and its principles, we will form an understanding of how it should play into both the leadership and aircrew decision-making process. We will then evaluate these understandings against a scenario, forming a conclusion of whether or not the crew and leadership applied proper ORM principles while executing the missions. To answer these questions, one must first have an understanding of what ORM was designed to do and the levels at which it was designed to work.

Understanding ORM is more than knowing the six steps (which we will cover later). It's knowing the principles that govern all the actions associated with the decision-making process in the risk management business. There are four principles that control decision making:

1. *Accept no unnecessary risks.* This tells us that, yes, there is risk in every mission we fly. However there are different levels to those risks, and the determination of acceptability of those risks need to occur for each situation.

2. *Make risk decisions at the appropriate level*. Making decisions is directly related to accountability. If you can not be held accountable for the success or failure of a mission, then you probably do not have the stakes to give input.

3. *Accept risk when benefits outweigh the costs.* This is simple economics. If the real or perceived benefits outweigh the real or perceived costs, then the mission has a significant impact and should be executed.

4. *Integrate ORM into operations and planning at all levels*. These levels should include the Commander, Deputy Commander, and most importantly the aircrew. This is where "the rubber meets the road" and the ability to see fluid risks will **always** be most apparent. Now that we have a brief description of four principles of the ORM process, let's explore the six steps that we should apply using the ORM matrix.

ORM is comprised of six steps which all count upon the previous step being followed to completion. These steps are defined by the pocket guide to USAF ORM:

1. *Identify the hazards.* The purpose of this step is to identify all hazards, real or perceived, that may cause mission degradation.

2. *Assess the risks, or assess the exposure, probability*

and severity of a loss to the above hazards.

3. *Analyze risk control measures*. Investigate specific tools and strategies that can reduce, mitigate or eliminate, avoid, delay, transfer, etc., the risks.

4. *Make control decisions*. After controls have been chosen to eliminate the hazards or reduce the risks, determine the leftover risk for the mission tasking. If they are acceptable, continue. If not, reevaluate or pass the decision process to a higher level.

5. *Implement risk controls*. To do this, assets need to be made available for the mission, and the people in the system, (aircrew) should be informed of the risk management process and subsequent decisions.

6. *Supervise and review* is the step in which monitoring the operation occurs to ensure that the control measures remain in place and are being effective. If they are not, reevaluation would be necessary. It is also the part we should review after our assets are expended to control risks and answer whether the mission was *really* balanced against the four driving principles.

Now, that we have completed an overview of both the four driving principles of ORM and the six steps in the execution of the ORM process, let's examine a scenario and evaluate how the crew and leadership measured up in applying the ORM process.

In this scenario, the mission is to fly a C-21A from Randolph AFB, TX to Scott AFB, IL to pick up a wing commander who has been selected to be on a Chief's promotion board at Air Force Personnel Center, Randolph AFB. Crew complement is a new aircraft commander (less than 500 hrs C-21A), and new copilot (less than 100 hrs C-21A).

It is mid-December and the crew shows on a Sunday at 0700 for a 1000 local takeoff for an out-and-back; no passenger mission line. At about one hour into the planning phase, the flight commander arrives in the office and tells the crew that they need to go to Scott AFB. They need to pick up a wing commander because all the international airports are shut down due to a severe winter storm covering the St Louis area.

All other flights in and out of the region had been cancelled. So, you are probably asking the same question as the crew, "Why can't the squadron located at Scott AFB do the mission?" "They're already there and have more experience dealing with icy conditions?" Well, the answer was they had already notified their crews and cancelled all flights for the day due to the winter conditions—leaving only the Randolph crew available for the mission. Since there was no other option and the operations group commander insisted the mission be done, the crew and the commander began crunching away at the planning phase of this new mission.

The conditions were overcast at 500 feet AGL with severe icing and heavy snow over the field at Scott AFB. The RCR was being reported as four and the taxiway's braking action less than poor. All of these conditions were outside of the performance and limits of the C-21A. The weather at Randolph was skies clear and a temperature of more than 50 degrees (normal), and weather for the route of flight was not a factor.

The crew completed all mission planning tasks and briefed the commander on their intended actions and talked to Scott AFB ops. The crew coordinated for Scott to start plowing the runway and all taxiways required to reach the de-icing area and aux passenger terminal on the civilian side of the field. The crew took off with enough gas to hold for an extended period of time to catch a break in the weather at Scott. Scott Weather reported that they expected a 30-minute window where the icing would go from severe to moderate.

The plan was to hit this window, land, quick turn acquiring minimum gas, mission plan for departure, load passengers and luggage, de-ice, taxi and take-off all within a 30-minute window. All this would be done with no concurrent servicing allowed in the C-21A. If it sounds like a goat rope, it was. The flight commander called the Operations Group Commander one last time and advised him of the conditions and risks involved. His guidance was to continue with the mission.

The wing commander needed to be at Randolph AFB, for a promotion board that started Monday morning. With this guidance, the flight commander instructed the crew to continue with the mission.

The crew stepped to the aircraft, did all pre-flight inspections and departed for Scott AFB. At cruise, the crew contacted Little Rock AFB weather and requested an update on Scott AFB conditions. The weather was reported as overcast at 300 feet and one-half mile visibility with mixed snow and sleet, and severe icing. The aircrew asked them to contact base ops and get the runway condition. The report was an RCR of four and braking action less than poor on the taxiways.

The crew elected to continue overhead Scott AFB and enter holding as planned to see if the break in weather would occur. After five minutes of holding and monitoring ATIS, the crew contacted the Weather Shop to confirm the severe icing conditions and RCR that ATIS was reporting. Then they contacted base ops at Scott and asked for an update on the runway conditions because ATIS and Weather were reporting severe conditions. Base ops reported an RCR of six which is the minimum for the C-21A, and icing was moderate, also falling within operating range.

The crew decided with the conflicting information that they should contact the Weather Shop one last time. The Weather Shop continued to report an RCR four and severe icing. The crew then queried base ops again. Base Ops told the crew to stand by. After a prolonged pause, base ops came back on frequency and told the crew to contact Weather.

USAF Photos
Photo Illustration by Dan Harman

USAF Photo by Ken Hackman

The crew switched frequency and contacted Weather, this time the RCR was being reported as six and the icing was now moderate. With all the conditions within limits, the crew turned all the anti-ice systems on and prepared for a decent through the weather.

The approach and landing were executed without incident with the crew breaking out of the weather at minimums and an uneventful landing on a runway with a braking action of poor, and crosswinds within one knot of limits.

The crew followed the plow truck as a "follow me" as it plowed the way to the loading and de-icing area. On the post flight walk around, the aircrew noticed icing on the trailing edge of the wing and icing on the conical spinner of the engine, which was not suppose to be able to accumulate ice.

The wing commander arrived as the crew was rushing through the post/preflight checks, and preceded to drive the staff car behind the jet where it slid into a snowbank and became stuck in the critical exhaust area.

In order to be able to start engines, the aircraft commander instructed the copilot to dig the car out of the snowbank with a shovel from the de-icing truck while the aircraft commander finished the mission planning. The copilot was able to get the car moved and the wing commander loaded into the jet as the aircraft commander started engines, and called for the de-icing truck.

All this went as planned and the crew was ready to depart. It had been 49 minutes since the crew landed. The crew checked the weather one last time and departed. The takeoff went uneventful with the aircraft performing normally. On climb out at about 1500 feet and two miles from the field, tower called "Scott AFB icing severe contact departure."

The crew contacted departure and continued to Randolph AFB uneventfully to a full stop—mission complete. Though this mission was a success (in the fact that the mission was completed with no loss of assets or life) was it a success in the realm of ORM?

To answer this, let's compare the sequence of events to what we learned earlier about the ORM process and principles. We'll review the four driving principles of the ORM process and see if we can find errors in this scenario:

1. *Accept no unnecessary risk*. Is the risk of a C-21A at the cost of 3.3 million dollars, two crewmembers, and the wing commander of an AMC wing, worth the risk of transporting personnel to a Chief's promotion board?

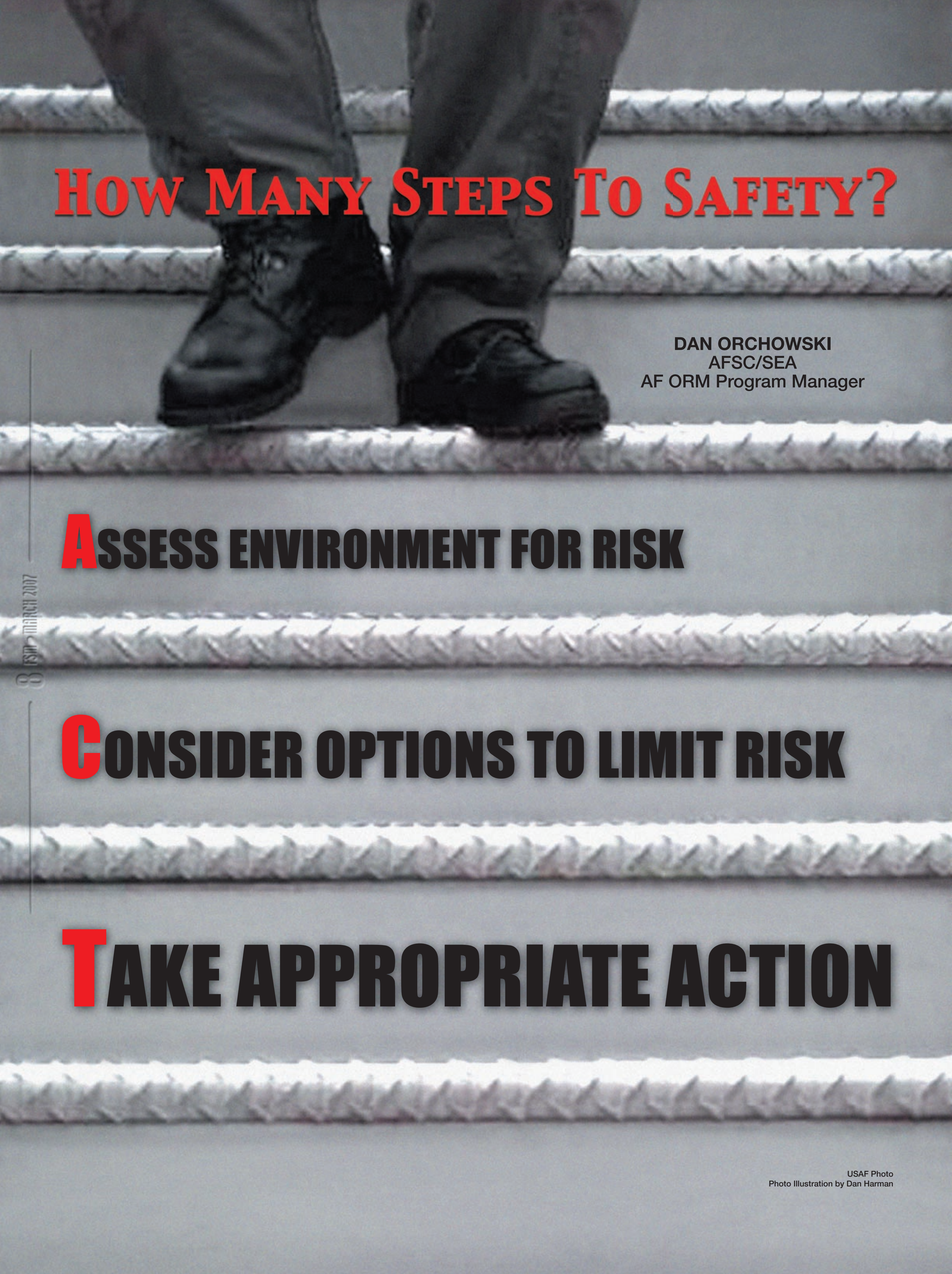
2. *Make risk decisions at the appropriate level*. All members who had a stake in the failure or success of this mission were accounted for.

3. *Accept risks when benefits outweigh the costs.* The benefit of this mission is the wing commander arrives on time to the board, instead of showing a half day late on Monday, at the possible loss or damage to aircraft and personnel.

4. *Integrate ORM into operations and planning at all levels*. This action was partially met. All individuals were involved and both the crew and commanders integrated most of the ORM principles. However, knowing what we know about these principles it is clear that one or two of these is not adequate. All four need to be evaluated and met. In this scenario, the four principles were not addressed completely and correctly.

It seems the individuals involved let these driving principles fall out of their crosscheck, or were influenced by other motives. Though the six steps of ORM were applied and properly used, the driving principles were not met. *Accept no unnecessary risks* comes to my mind.

The crew was at the "point" of the mission, in the fluid motion where all the hazards are most visible. Just because the ORM was met before departure, it does not relieve the crew of their duties to make sure the principles are being applied through the entire mission. If it comes to a point where you feel the risk is not worth the benefits, ask yourself "is the risk I am about to take worth the price of the aircraft, the life of the passengers, or the wings on your chest?" Do not let the perceived pressure of getting the mission done be a factor that makes you part of a mishap.



How Many Steps To Safety?

DAN ORCHOWSKI
AFSC/SEA
AF ORM Program Manager

ASSESS ENVIRONMENT FOR RISK

CONSIDER OPTIONS TO LIMIT RISK

TAKE APPROPRIATE ACTION

USAF Photo
Photo Illustration by Dan Harman

The AF ORM program is currently under complete review. In conjunction with the other services, we are taking a look at the program from a user perspective. Of particular interest is the actual **use** of the process. The Army, Navy, and Marines use a five-step process. The Coast Guard uses a seven-step process, while we in the Air Force use six-steps.

During a series of Staff Assistant Visits, we have asked AF personnel to identify the six steps of the ORM process. The vast majority were unable to come up with all six. In fact, only about five percent could identify the six steps. The implication here is: if they don't know the six steps, how could they be using the process both on and off duty? The other obvious question is "does the process really work for our personnel?"

The basic principles of ORM are sound. Take no unnecessary risks, only take risks when the benefit outweighs the cost, and make risk decisions at the appropriate level. You can readily see the value of the basic tenets of embracing risk management. It's hard to disagree with the basic principles. The problem is getting our people to use ORM routinely, both on and off duty. The use of ORM has the potential to systematically reduce the amount of risk AF personnel accept. However, the process must be easy to use, and viewed as beneficial in order for our personnel to exercise it.

During the last year we conducted a joint ORM conference with the other services and an AF ORM conference with MAJCOM ORM Program Managers here at the Air Force Safety Center. At the joint conference, we decided the five-step process was being utilized by a majority of services and would work best as the DoD standard. The decision of that group has not yet been staffed or officially adopted by DoD at this point. If adopted, the AF would combine steps four and five of our six-step process (not really a change in procedure, just the number of steps.)

A hot topic at the joint conference was time critical ORM. Basically, a process that would involve only a few steps, so our personnel could use it quickly to identify risk, mitigate where possible, and execute their task. We showed them the AF "**ACT**" three-step process: **A**ssess environment for risk, **C**onsider options to limit risk, **T**ake appropriate action. The group was very interested in **ACT**. Unanimously, the joint group felt personnel get bogged down in the five-, six- or seven-step processes, where a shorter process would be easier to use, and more likely to be embraced. The idea is not to eliminate ORM in the *planning* process. The five-step process would be retained and used for planning functions, but for impromptu tasks and missions, the three-step process offers potential. We found that although the services' missions are vastly different, there are some basic risk principles we share. We all take risks to accomplish our mission, we recognize that risk is inherent in our business, and we all want to mitigate that risk as much as possible to protect our personnel and equipment. The basic desire common to all of the services was to have personnel assess the risk prior to accomplishing the task or mission. Finally, the joint group recommended having a joint ORM fundamentals course for DoD personnel.

During the AF ORM conference, the group agreed that the five-step process would work for the AF. We also revised AFI 90-901 and AFPAM 90-902. The jist of the discussions at the AF group meeting was to find a way to encourage AF personnel to use ORM - both on and off duty.

The three-step **ACT** process was also discussed at the AF meeting. The consensus was the three-step process had merit, and that our people may be more apt to use it due to its brevity. The bottom line is that we are willing to adopt or use any strategy that will lead to AF personnel assessing and mitigating risk. The ORM process has to be one that is viewed as a help, not a hindrance to mission accomplishment.

If they don't know the six steps, how could they be using the process?

The aviation community has done an outstanding job with ORM. Of the AF disciplines, aviation has taken the most systematic approach to ORM. In many instances ORM is integrated into the mission planning process to the point where it is not thought of as a separate program, but part of the mission. The question now is "how do we make it better?"

What do you think? That is of paramount importance to the direction of the AF ORM program. It's time to breathe some life into the program. We want the next iteration of ORM to make sense, be effective, and actually work for you. If it's just another administrative burden for you, we have failed. If you have an idea, we would love to hear from you. If you have a way to make the program better, it will be given serious consideration. Tell us what you really think of the AF ORM program and the aviation ORM program. I will *personally* guarantee that your name will not be passed to anyone no matter what you say about the program. Our email address is rmis@kirtland.af.mil.

The Only American Lives We're Going To Save Tonight Are Our Own

USAF Photo by SSgt Chuck Reger
Photo Illustration by Dan Harman

CAPT JUSTIN HOFFMAN
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… It was a popular phrase I'd heard in the squadron (this article was written in 2004). Most often used as an overriding theme while discussing ORM assessments for tactical training mission briefings. As catchy as the phrase is, I've never really cared much for it. In my mind it's nothing more than a cool cliché, and it detracts from the true value of risk recognition and mitigation efforts.

The intention was to remind aircrews that we were in a training environment; for the first time in almost three years, we weren't deployed to the AOR. However, as much as it highlights that it's acceptable to throttle back, it also promotes a far more troublesome attitude. Simply put, it asserts that it is OK to throw risk mitigation efforts out the window once we are actually engaged in combat operations. If other customers and operators are involved in our mission, then we are cleared hot to throw caution to the wind. It implies there are situations when we, as an aircrew, have the sole authority to intentionally put our aircraft (and ourselves) in compromising or dangerous positions—high-risk situations where our actions could cause destruction of the machine or loss of life. As much as we all want to be heroes, decisions that grave should *only* be made on a deliberate basis by competent authorities—people with more rank than the average crewmember.

We can all recall stories, some maybe about ourselves, when aircrews have performed with extreme valor in spite of overwhelming odds. Their actions may have been heroic, but suicidal they certainly were not. For when we kill ourselves or ball up our machine, the mission doesn't get accomplished. And when the mission doesn't get accomplished, the commanders' objective isn't met and battlefield successes aren't realized. Ultimately, our ability to fight and win wars hinges upon our ability to employ our combat assets effectively. The tool the Air Force equips us with to ensure effectively employment is ORM.

The value of effective ORM *application* was highlighted during one action-packed night in March of 2003. My crew's mission on that particular night involved flying a night vision goggle and terrain following low-level to insert troops and war fighting equipment into an austere, blacked-out landing zone in northern Iraq. After performing our litany of planning, rehearsal, briefings and preflight and actions, my crew of eight fearless aviators departed our deployed location for the lengthy flight in-country. After level-off, we settled into our standard routine of mid-level airway flight with our senses tweaked by the smell of the much-anticipated MREs cooking in the galley. After feasting on something resembling a ham slice, my mind began to run through the sequence of events that would make up the remainder of the flight. Approximately one hour prior to crossing "the fence", I led the crew through of our low-level and objective area in-flight briefings. This was our last chance to go through "what-ifs." Approaching the border, we coordinated with command and control and started our descent into the low-level structure. Beginning our tactical profile, we used terrain following radar to pick our way through the high mountains. We performed all appropriate checklists, and things appeared to be going smoothly … for the time being. That would prove to be the last moments of calm and order for the next four hours.

Approaching the combat entry point, the flight engineer started to depressurize the aircraft when the loadmaster smelled fuel fumes in the cargo compartment. The loadmaster spotted fuel spilling out of the fill spout on a diesel generator trailer. Fuel quickly covered the cargo compartment floor. He immediately notified me while the other loadmaster attempted to stop the leak. Climbing to a safer altitude a few hundred feet higher, the navigator searched his charts for an escape route as the engineer scanned all systems for any abnormal indications. I initiated the smoke and fume elimination checklist (calling for everyone to get their oxygen on and hatches be opened) in an attempt to alleviate the hazardous condition. The loadmaster called again and reported the fumes were getting stronger and massive amounts of fuel were now pooling in the rear of the aircraft. Realizing the danger, the loadmasters moved troops and equipment away from the worst contamination, and attempted to vent the pooling gas by manually opening the cargo ramp. During this process, windblast caught a stream of fuel and blew it up into the loadmaster's eyes. Air rushing into the aircraft from open hatches and doors compounded the situation. Needless to say, communication was difficult at best.

With a disabled crewmember and a potentially explosive situation on our hands, we fell back on the fundamentals of ORM to determine our next course of action. Without referencing any type of worksheet or formal manual, our training and familiarity took over as we initiated what were, in effect, the first few steps of the ORM process. As we identified hazards and assessed the risk, we formulated control measures leading to our next course of action. With our closest available alternate over two hours away, I decided to continue low-level despite the emergency. Although more than an hour of low level in hostile territory remained, this was the quickest avenue for getting the aircraft on the ground so we could reassess the situation in the relative stability of zero airspeed. We continued on the low-level while breathing 100 percent oxygen, trying to secure charts from the rush of air, scanning for threats and trying to stay on our terrain avoidance profile with limited communication capability. After an uneventful NVG landing at our objective, the loadmaster unloaded the equipment while the flight engineer inspected the aircraft.

We assessed the situation and used the ORM process again to decide our next action. After carefully evaluating the status of the malfunction, injuries, threats and terrain, I decided to take off low-level toward an alternate that was two hours closer than our staging base. Four hours after the beginning of the emergency, with the loadmaster suffering from the pain and effects of temporary blindness, we safely landed at our divert base where we were able to get medical and maintenance attention. While we successfully completed the mission, a couple of lessons were reinforced that night:

First, ORM doesn't end after the worksheets are completed. In fact, it's during execution when ORM becomes most important; hardly ever does a mission play itself out exactly as planned. The elements of the 5-M Model are dynamic; they are constantly changing and the crew must be able to react accordingly. Crewmembers must be able to re-identify, re-assess and re-analyze so appropriate decisions and implementation actions can be made.

Second, whether in training or combat, the goal of the ORM process is to preserve combat power so the mission can be successfully accomplished. Just because you are flying a combat mission, you do not have carte blanche justification to put yourself and your aircraft at unnecessary risk.

Instead of becoming obsessed with catchy phrases, we need to get ourselves in the habit of adopting sound ORM practices during all operations. When you stop to think about it, risk management is nothing more than stacking the odds in our favor so we can successfully accomplish the mission. Whether we are in training or in combat, successful mission accomplishment is the underlying purpose of our existence in the Air Force. Mission success requires that ORM must become ingrained into the culture of our flying units. Aircrews must appreciate the usefulness of risk management in both training and contingency operations. Risk management can't get thrown out the window as soon as we deploy to the AOR. And, when we finally redeploy back to home station, we just can't disguise it with cute clichés …

… But when I stop to think about it, with all the action and drama that unfolded that night, the only American lives we saved that night were our own.

Is This The Smartest Thing You've Ever Done?

MAJ DANIEL D. TOLLY
732 AS
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"Is this the smartest thing you've ever done?" These words were ringing in my head as I found myself standing in the assistant Ops officer's office. I was busy racking my brain over which of the myriad of offenses I had committed over the past month (while at the same time trying to slip into my best post-Academy strict position of attention) when the AF Form 781 came sliding across the desk. "Ah ... that was what his Major-ship was talking about." Perhaps, I should start at the beginning.

I was at base operations planning my return trip to the home-drome at Mather Air-patch. Unfortunately, I had lost my fellow instructor pilot on this T-3 cross-country a few days earlier. He suffered a severe ear block while descending into Luke AFB, but that's a safety story for another day. On this morning, however, it would have been nice to have another brain to run my plans through.

The weather between Colorado Springs and the west coast was "severe clear." I checked the NOTAMs for all possible en route stops and any likely divert fields. Everything looked good as I filled out the DD Form 175 for my three hops home in the mighty Cessna T-37B Tweet. The most direct route was to go from Peterson Field to Hill AFB in Utah. Sure, it seemed like a long way, but it was well within the range of the T-37. I had made the reverse flight twice before with no problems. And besides, the weather was great and my aircraft *was* about 300 pounds lighter since I had gotten rid of the other pilot.

While doing my pre-flight, I noticed an Air Force T-43 taxiing out for takeoff. I smiled to myself thinking how the cadets on board would spend the next couple of hours. They would be droning around, plotting their positions and figuring out the airplane's ground speed, while I was in command of my own fully acrobatic jet trainer. I couldn't have been happier to have my Academy days behind me and be part of the "Real Air Force." Nope, there was no amount of money that would make me want to change places with one of those cadets.

As the T-43 climbed into the Colorado sky, they started a slight turn to the northwest. I began to taxi as I got my flight clearance. Ground control switched me over to tower frequency and the J-69s in my T-37 started to jet down the runway on my way to Utah and eventually home. The tower controller handed me off to departure control and I was cleared to turn right and pick up a southeasterly heading. "Wait a minute . . . that can't be right. I need to turn north and get headed toward Utah." A quick call to the center provided my answer. The T-43 was operating in the Military Operating Area (MOA) directly northwest of the airport. I would have to continue my climb to the southeast until proper separation could be achieved. Whoops, I hadn't counted on this, but I was sure it wouldn't be for too long. Ten miles later I wasn't so positive. Twenty miles later I really began to get concerned. Round trip, this was an extra 40 miles added to my

Photo by JOC Mchugh

flight. Not too far in a heavy aircraft, but that was about ten percent of the range of my Tweet. Plus, this was already an abnormally long trip. Finally, I reached 25,000 feet (the Tweet's max altitude) and was cleared to turn northwest. I had already gone into fuel conservation mode.

With the airplane's heating system in vent (an old Tweet IP trick to save fuel) I began to calculate the distance to Hill and the time it would take me to get there. I could make it, but it was going to be a long trip, and I would be cutting it thin. With the fuel being so close and no one to talk to, I was checking my time and fuel every five minutes. I wasn't very happy with the results. Something else wasn't going right. A quick check of my whiz-wheel (everyone carries those right?) and a confirmation from Denver Center provided me with another problem. The winds were hitting me right in the nose and were about twice as strong as forecast. Big surprise, right? My ground speed was at least 20 knots below what I had planned. Things were not getting better, in fact, just the opposite.

Quickly, I began scanning my high chart for a suitable airport between my position and Hill. The only one I could find was Salt Lake City International, but I didn't really think that extra 25 miles was gonna help much. With the temperature in my cockpit rapidly falling toward zero, it was hard to believe how much I was sweating. I quickly figured out my turn around point where I would be forced to continue or head back to C-Springs. I was also contemplating having to land on one of the few highways I saw beneath me (luckily I had remembered to bring along my VFR charts.) We've all heard the rumors about pilots having to use their own credit cards to buy fuel for their jets, but I wasn't anxious to add my name to this urban legend—and on a mountain highway no less! All of a sudden being on that T-43, close to the field, with lots of extra gas was looking better and better.

About the time I was seriously considering declaring myself "minimum fuel" the first bit of luck came my way. Denver Center handed me off to Salt Lake Control. I had been requesting vectors direct to Hill ever since ATC had allowed me to turn north, but was denied each time. This new controller must have heard the urgency in my radio transmission, or perhaps he wanted to steer me away from Salt Lake's very busy airspace. At any rate, things began to turn my way. I was cleared directly to Hill's overhead, and during my descent, I was able to get a little heat into my now freezing cockpit. With no traffic in Hill's Sunday pattern, I was number one for landing. Never had "one to a full stop" felt so good. After a very brisk taxi and a sprint for the nearest latrine, I sat down with the 781s and realized I was logging a 2.2-hour sortie!

Safely on the ground, it was time to do a little reflecting on how lucky I had been. Even before my ADO had posed his question, I knew I had gotten away with something foolish. My "sky-hop" to Hill had been predicated on everything going right. But, what if something went wrong? What if I didn't get the most direct routing? What if something happened with the weather or the winds weren't as forecast? What if I'd had an ATC delay at Colorado Springs? What would I have done if I couldn't land at Hill due to an emergency on their runway? The point is I hadn't really built any "pad" into my flight plan. Using the vernacular of the poker craze sweeping the nation—"I hadn't left myself any outs." Everything in my plan had to go my way in order for it to work: weather as forecast (how often does that happen?), direct routing, no deviations and no contingencies. After discussing it with my assistant Ops Officer we agreed it was a very poor plan. It's always a good idea to give yourself options. Have a fallback plan. Give yourself room to maneuver.

Years later as a C-141 Instructor Pilot, I found myself planning a stressful mission from Germany back to our home base on the east coast. Our load was very heavy, the weather was lousy and the large crew was very anxious to get home after a long trip. While quizzing the weather forecaster for the best possible divert locations and en route fuel stops, the hair on the back of my neck went up when I heard one of the younger crewmembers say, "Hey, is this really the smartest plan we have?" "No," I answered. "You're right, let's give this a little more thought."

So There I Was...
(B-52 Out Of Diego)

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It started out as a normal OEF sortie out of Diego Garcia. The five of us were scheduled to fly a standard fourteen-hour B-52 sortie into Afghanistan to perform Close Air Support (CAS) and Time Sensitive Targeting (TST). Everything went smooth through takeoff and our first airborne refueling.

About 20 minutes after air refueling with the KC-135, we were at flight level 310 when the pilot came over the interphone and, in a freaked-out voice said "Everyone go on oxygen." The navigator and I scurried to put on our helmets and reported up to the pilot, followed shortly by the Electronic Warfare Officer (EWO). When everyone reported in, the pilot informed us that there had been a loud pop, a hiss and foul-smelling dark smoke coming from the copilot's area. We quickly ascertained that there was no danger to the aircraft - the smoke was just the condensed vapor that escaped from the copilot's pressurized ejection seat. Apparently, when the copilot had reached around behind his seat to get his pubs bag, the strap got tangled and pulled loose the initiator tubing.

First thing we did was to get the copilot out of the seat until we could ascertain the status of the ejection system. The next order of business was to get the smoke and fumes out of the cockpit. We accomplished this by opening the sextant port. It's a small hole in the top of the aircraft about an inch-and-a-half in diameter - big enough to let the smoke and fumes out, but small enough to keep us pressurized. Once that was accomplished, the crew (except for the pilot at the controls) removed our masks.

The next decision was pretty much obvious: we were going to turn around. We contacted command post to inform them of our situation and get maintenance and egress working on some answers. None of us had ever seen any thing like this before. Our big question was if the seat was safe or not. Had it actually been activated?

After we got the go-ahead to turn around, we got our Dash-1s out to see if we could figure out what to tell the maintainers. From our descriptions the Operations Supervisor informed us that maintenance was sure the seat was safe to sit in during normal cruise, provided the pins were in, but under no circumstances was the copilot to rely on it for egress. The seat was totally useless for ejection, and any attempt to rely on it would be fatal.

With that, the copilot resumed his station. After all, it does require a pilot team to effectively fly the large bomber. He began to balance fuel and catch up on his duties. When we returned to the local area we were still too heavy to land, so we entered holding off the island until we were within limits.

Now the big ORM debate started. There was no way we could fix the seat and there was no way for the copilot to strap in for landing - his seatbelt had come undone. We know from experience the most hazardous time for an aircraft is takeoff and landing. So do we: (1) put the copilot in an obviously unsafe place for landing where he can reach the controls? (2) put him in the IP seat where he can strap in and monitor the pilot and the instruments? or (3) use the old Gunners seat next to the EWO? The B-52

USAF Photo by SSGT Alex R. Taningco

does, after all, have six working ejection seats and only five crewmembers.

By now the Group Commander (OG) had heard of our dilemma, and it seemed as though everyone wanted a vote. The OG wanted the safest possible solution. The Duty IP thought the Co should be in the seat. As a crew, we were confident in our pilot, but left the decision up to the Co—after all it was his neck.

Instead of being hasty about it, we looked at all the variables (as any good crew would). The pilot was a young aircraft commander who hadn't been in the left seat more then a few months; however, he was very competent and had landed the plane many times from the left seat at this field. It was only five hours after takeoff and not the end of a long combat sortie, but it was night with a slight mist of rain at the field and we were still loaded with our internal and external weapons.

The copilot's decision (and we all agreed) was to sit in the IP seat where he could strap in and still monitor the pilot's actions, the instruments and outside the jet. He was also able to reach the throttle quadrant and the radios. If anything should happen, he would be in the most helpful and safest position available. He could also get back into the copilot seat if he needed to. We also decided to retain the weapons.

When we were ready to shoot the approach, we informed everyone and got our clearance. The tower had fire trucks and maintenance on standby. The copilot set up the fuel panel and got the jet balanced out before moving to the IP seat. They gave us a long straight-in, and the pilot flew a perfect approach monitored closely by the crew. We landed uneventfully and got a good chute. When it was safe the copilot hopped back into the copilot's seat. We ended up stopping on the runway for about ten minutes while the maintainers looked us over and pinned the weapons. We taxied back to parking and shut down the jet normally.

This may not seem like such a big deal now (and it probably wasn't), but it was a good exercise in CRM/ORM. We utilized all of our resources and made a well informed, well thought out decision based on the positives and negatives of the situation, as well as a number of outside experts and experienced crewmembers … after all, we did take about three hours to come up with a final decision.

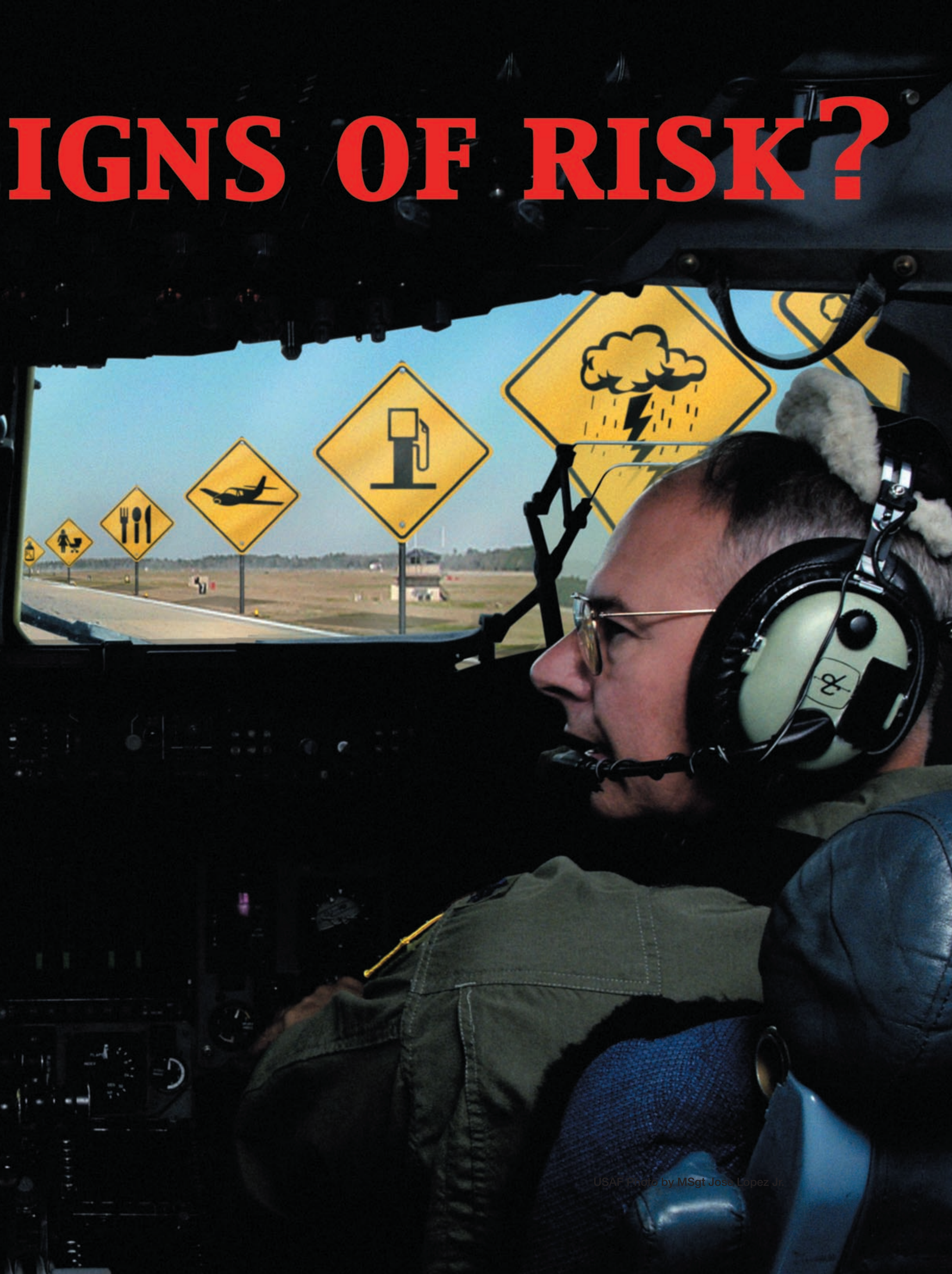
At the end of the day there weren't any changes made to tech orders or checklists. It was chalked up as a fluke accident that could happen to anyone. It just happened to us first. Hopefully, if a situation like that ever comes up again, we'll have a head start on how to handle it. Write it up as a good experience. The ejection seat was fixed in a few days without much effort.

Ironically enough, the only major thing wrong with the jet when we landed was that (probably in our hours of holding with the gear down) one of the wingtip gear doors must have gotten loose somehow and is now sitting on the bottom of the Indian Ocean.

LOOKING FOR S

USAF Photos / Photo Illustration by Dan Harman

IGNS OF RISK?



USAF Photo by MSgt Jose Lopez Jr.

LT COL MARK HALE
AMC/SEF
Aviation ORM Program Manager
(Reprinted from the Mobility Forum)

USAF Photo by SrA Jerry Morrison
Photo Illustration by Dan Harman

In the May/June 2006 edition of *The Mobility Forum,* there was an article introducing you to the idea of Aviation Operational Risk Management, more commonly referred to as "ORM." After defining what exactly Aviation ORM is, the article went on to describe both where we were then as a command and where we were headed. The key points in "The Way Ahead" section of the article were (1) It Must Be Standardized, (2) It Must Be Understood, (3) It Must Be Supported, and (4) The Acceptance of Risk Must Be Shared, and all of this is still true if a new command-wide ORM program is to be successful. Eight months later, I am happy to report we are making progress in all four of these areas and Aviation ORM in AMC is already making a difference.

In early FY06, a Tiger Team convened at HQ AMC with representation from Active Duty, Air National Guard (ANG) and Air Force Reserve Command (AFRC) and all AMC airframes. Their task was to develop a single standardized, end-to-end Aviation ORM program. One of the first requirements for the team was to identify who are the key players in this new ORM process. They concluded that the list should include the Tanker/Airlift Control Center (TACC), where all operational missions are born, and specifically TACC/XOC (i.e., the "Floor"). Next, it has to include operational leadership at the wing, group and squadron levels. Of course, the personnel in current operations and unit mission planners who schedule and plan the mission play a key role. And finally, it must have the aircrew, who will ultimately make it all work in the end. By reaching well beyond what has historically been done only at the unit level, the team was articulating ORM as a responsibility of personnel at every tier of leadership and not just with the crew out there at the tip of the spear.

AMC began to execute and institutionalize the program in June 2006 for TACC-tasked missions. We chose a phased-in approach as the optimal solution to ramping up all players from the command level down to the unit/crew level. This course of action ensured forward progress while also allowing adjustments to benefit subsequent units. The initial volunteer units were Charleston, Travis, Fairchild and the 816/817 EAS in the Area of Responsibility (AOR). In the first phase, the manual process was refined to make it as simple a process as possible, using the draft AMCI 90-903 and worksheet that came out of the Tiger Team deliberations.

Shortly thereafter, with the continued strong support of Gen McNabb, AMC hired Cyintech Corporation to assist in outlining the key benchmarks to successfully achieving a standardized ORM process. As some of you may remember, this same company previously helped AMC establish the TACC flight dispatch program about eight years ago. Bringing this experience to the table, Cyintech was able to quickly grasp the concepts and challenges we faced in making the new program a reality. For several months now, Cyintech and AMC Safety have worked in concert to develop a training package for the new manual process and plan for the much anticipated program automation. The current process requires a TACC mission planner to take the numbers from a hand-scored sheet and enter them manually in the "Remarks" section on the Form 59 with the approving authority's name. The concept for automation is to have this program accessible to all the players through the Global Decision Support System (GDSSII) and/or Consolidated Air Mobility Planning System (CAMPS)…without any additional log-ins! Once automated, the ability to compile and interpret large amounts of data will be at our fingertips and enable us toward our goal of predictive risk management. This is the desired end state-where we plan for success by eliminating as much risk as possible to a mission up front and identify those specific other areas to the entire chain of planners and decision makers.

An advantage not often mentioned with a standardized ORM program is the power of a common language. Here are a few examples to illustrate my point. A KC-135 crew on a SAAM mission is talking to a C-5 pilot working the SAAM desk at TACC. One is a tanker and one is an airlifter—two different cultures with their own set of paradigms. Another example is the deployed commander who has a KC-10 background and is now commanding C-17 and KC-135 units. It will be nice to be able to talk about levels of risk to a mission from a common reference point. This is where the power of a standardized program benefits all the players. With the new process, everyone will have a common frame of reference; between TACC and the unit, unit to unit, commander to commander, aircrew to TACC, etc.

Considering today's intense global operations, we must do everything possible to protect our personnel and material resources while we accomplish the mission. Anything we can do to lower the mishap rate and increase our odds of a successful mission is a force multiplier. The impact of losing an aircrew and/or aircraft, whether temporarily or permanently, is far reaching and will only further stress an already stretched pool of mobility resources. Moreover, we should never forget, most of these resources are irreplaceable!

So, where are we today as we bring the Commander's vision forward? The TACC completed training and began full ORM implementation for all active duty TACC controlled missions in Dec 06. Training for the new ORM program at the unit level is a bigger challenge considering the number of personnel on the road at any one time. However, all active duty AMC units and associate units will be on board by Jan 07. The last units will be the stand-alone ANG and AFRC units.

USAF Photo by TSgt Edward D. Holzapfel

Part of the plan to "operationalize" the ORM program involves transitioning responsibility for standardizing and enforcing the AMCI to AMC/A3 since they are the lead for all USAF mobility weapon systems. AMC Safety will continue in its role as the staff ORM advocate and, for the time being, will retain responsibility for the worksheet. Another key component to the success of this program will be an active, responsive Change Review Board (CRB). This group will periodically review the AMCI, the software (once it is developed), and the worksheet to ensure proposed changes are incorporated as we move forward. AMC Flight Safety will gather feedback from the field through a Change Request Form submitted by the individual Wing Safety offices. (All forms are available on the AMC Safety web site at *https://private.amc.af.mil/se/SEHome.htm*.) After the board approves any changes, the chair will task AMCI changes to the A3 and worksheet changes to Safety. The CRB provides an avenue for the program to remain viable by adapting to changes in operational needs, improvements in automation and a better understanding of human factors.

Now that you have been drinking from the ORM fire hose for the past 10 minutes, I'll close with a few personal observations. Having previously been active duty and now in the Illinois ANG, I appreciate the value of a program that reaches across some of the historic boundaries to standardize this crucial mishap prevention tool. The energy from everyone in this ORM evolution effort has been incredible. In my first few weeks working on this program, I wondered how we would ever be able to institute a program of this size throughout AMC on all TACC-controlled missions including the ANG and AFRC. I'm starting to see light at the end of the tunnel. I have listened in on discussions between TACC controllers and the units on ORM scoring. I recently received an analysis from the TACC evaluating all of their missions and reviewing ways to reduce scores wherever they can. This in many ways validates what we are doing since the original intent from the beginning was to capture all of the impacts on a mission's risk. What we have found is much of the risk is built into a mission in the planning, long before it ever reaches the crew.

I know this has been said before, but I'll say it again. AMC's new Aviation ORM program is not intended to ever undermine the aircraft commander's authority to call "Safety of Flight." However, when it works as advertised, it will inherently lower the number of times an aircraft commander would ever even have to consider that option. A standardized Aviation ORM program will significantly reduce the burden on aircraft commanders by involving leadership at all command levels in risk mitigation to ensure full mission success.

OSAs

Organizational Safety Assessments

LT COL TRACY DILLINGER
HQ AFSC/SEO

HQ AFSC Photo and Photo Illustration by Dan Harman

OSAs, or Organizational Safety Assessments, are conducted by HQ AFSC. You might have heard of them and wondered: What are they? What's their purpose? Who might consider requesting one?

Well, here's how they work: A wing commander is usually the official requestor. Leadership involvement and support is absolutely critical—climate and culture change rarely occur without leadership involvement—and, usually, the wing Chief of Safety (COS) is the POC. The COS and HQ AFSC/SEO (Safety Assessment Division) work out details including surveys, team composition, site visit and briefing dates.

Yes, surveys—part one of the OSA. While not everyone's favorite pastime, they provide important feedback to the commander. A minimum 70 percent return on the surveys is required in order to develop a valid picture. AFSC mails hard copy surveys to the POC, who returns the completed surveys about one month before the site visit.

The OSA team conducts an eight-day visit. The team is multi-disciplinary and is composed of AFSC personnel and augmentees who offer specialized knowledge and skills pertinent to the organization being visited.

First, the wing briefs their mission and organization. Then the OSA team in-briefs the CC addressing initial survey results. The team emphasizes the stress, strain, coping mechanisms, and safety attitudes, beliefs, and practices found in the wing.

Next, the interview process begins. The first day is usually one-on-one interviews with commanders, chiefs and other key players in one-deep positions. Group interviews follow, usually organized by squadron/organization and rank. For example: field grade officers from a particular organization would be interviewed together, then CGOs, senior NCOs, junior NCOs, Airmen, and civilians. The OSA team continues throughout the wing in this manner. Operations, maintenance, air traffic control, security forces or any other group can be targeted based on initial survey results, or the wing commander's request. Grouping the interviews helps to breakout the perceptions of various rank structures and career fields within the wing.

Two days are spent putting data and interview feedback (subjective and objective data) together. The team identifies findings and, when appropriate, recommendations. The CC decides who attends the briefings—it's the commander's mishap prevention tool. Some commanders invite their staff; some involve all commanders, or top three, etc. It's up to them based on their assessment of current events, and how they intend to use the results.

From the OSA team perspective, the entire process is a white hat function—they're there as the CC's experts to identify risks and offer mitigation strategies. Most of the time, about 75 percent of what we find is known—a validation of sorts. This can be used to push concerns up the chain. About 25 percent of what we find is previously unknown. Organizations are busy and with AEF cycles and other operational needs, even smart, caring, involved commanders are often unaware of important practices or attitudes—an OSA is one way of raising their awareness.

There is one thing an OSA is NOT—it is not a crisis response effort. The OSA team wants to see an organization under "normal" circumstances. They already have a clear picture of what a group of people will look like after they've lost peers, or experienced a traumatic event. In the case of a Class A, especially one involving fatalities, we usually give the organization a year to recover and return to normality.

So, it's a two-tiered process, it takes about three months to spin up, the goal is mishap prevention, and any wing commander (or above) can call to discuss the feasibility of an OSA. AFSC conducts about one OSA a month, balancing our desire to get to each MAJCOM with the level of potential significant concerns and needs. AFSC is currently booked through June of 2007.

The letter of request needs to be signed by the wing commander and include a fund site. AFSC pays for testing and analysis, and the wing pays for team site visit costs. A typical two-squadron wing, with three maintenance squadrons, requires a team of eight people.

You can find more information about the process on the website: http://afsafety.af.mil. Go to the Assessment Division and check it out. Stay tuned—AFSC just finalized a second tool—especially designed for squadron commanders. This one, called AFCAST (Air Force Culture Assessment Safety Tool), is simple, short, web-based, and completely funded by AFSC. Check it out at AFCAST.org, and call if you're interested. AFSC will be presenting more information on AFCAST via MAJCOM safety offices, and at the upcoming aviation training seminar.

Risk Assessment In The Buff

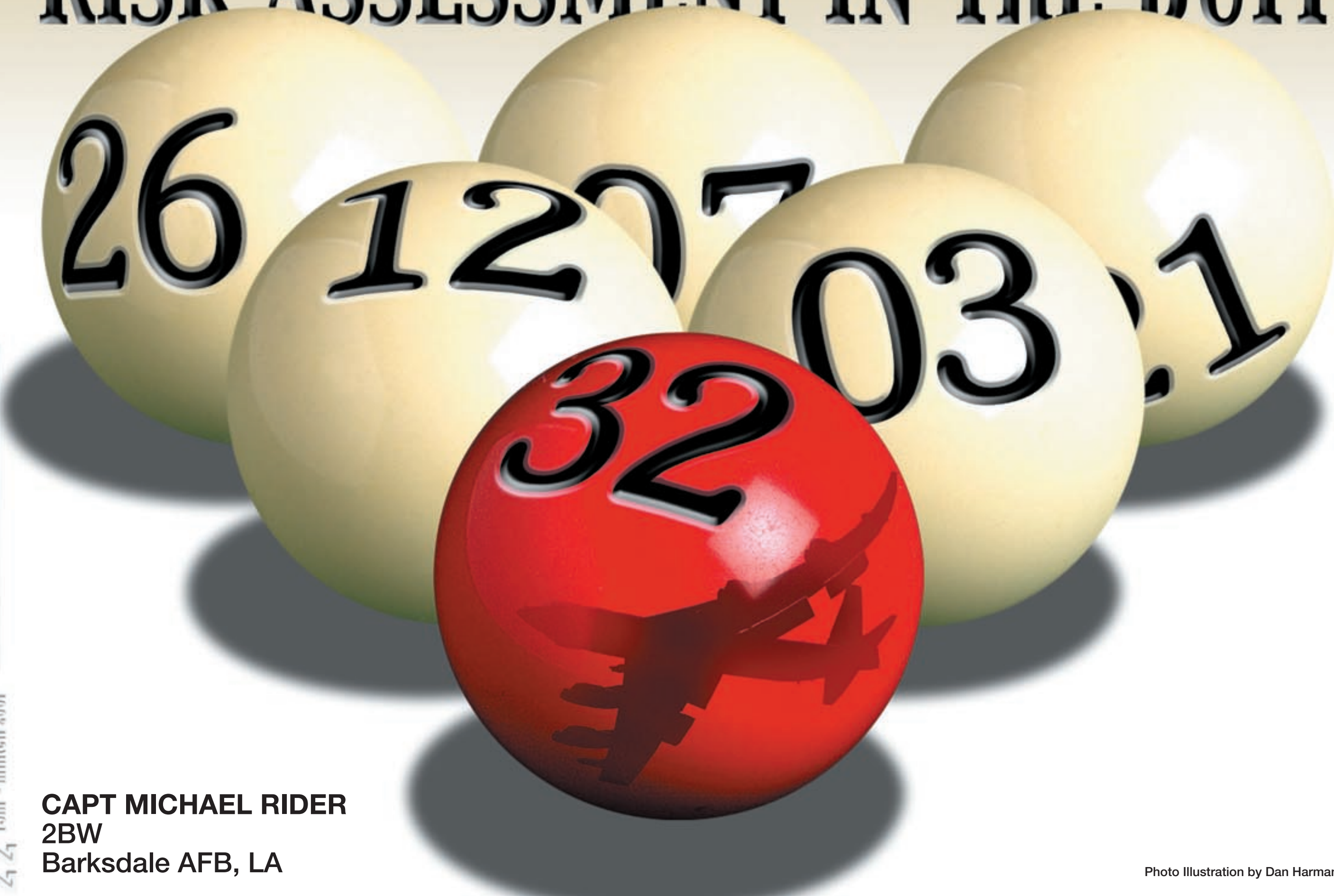


Photo Illustration by Dan Harman

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In my experience, the first two steps in Operational Risk Management (ORM) are the most critical. Analysis of what exactly constitutes a hazard and then determining the risk it presents is the foundation on which all other decisions and control measures are made. I submit that there are no new or different hazards that are missed in a given mishap—only how they were perceived or calculated.

Risk assessment can be a very tedious process, but most of us do it every day without thinking about it. We may normally speed on the highway despite the risk of accidents or tickets. Heavy rain keeps few of us from driving on the highway, but if it is raining heavily, we are less likely to speed because of the combined factors.

Risk assessment begins when all the hazards have been identified. The ORM model calls for us to assess the exposure, severity and probability of any given hazard. Most of the time the hazards are a given. The mantra of the safety-man may be, "We haven't invented any new ways to crash an airplane," but maybe another way of saying it is "All the stories have been told. All the scenarios have been played out somewhere, in some theatre. We all know and have seen what can happen when there is grave human error—either in aviation, maintenance, or engineering." What we can't do is predict how likely these errors are to affect a crew and their aircraft on a particular day, given a particular set of special circumstances. You can't surprise anyone telling them how a mishap occurred. But the mishap's probability and severity were obviously miscalculated since we don't plan accidents.

Some units have gone to a point system of assessing risk. A young crew may get more points than an experienced crew (let's hope the all-field-grade crew also gets more points). Bad weather gets a few points. Maintenance delays get a couple of points. Add the points up and if the sum is greater than X, we mitigate the risk by adding an IP, or shortening the duration, or reducing the events planned on the sortie. That is a control decision made after identification of several hazards put together. But what about elements of the mission that combine to make any hazard more probable?

Certainly we've seen sorties on the flying schedule or ATO where we knew there had not been a sufficient assessment of risk when assembling the plan. Usually, it's not just the probability of a single hazard that got your attention - it was when you put all the players together to make a single hazard more probable. You see, multiple hazards put together *can* add on to the matrix number—perhaps even more risk than just the number solution derived from the risk matrix.

Remember, in assessing final probabilities of a series of events, the separate elements may **multiply** the likelihood of a particular outcome. We can refer to the 32 numbers in the powerball lottery. They don't add up to 1/160th chance of winning when you have five placeholders—they multiply out to a 1/33.5 million chance of winning. Unlike the lottery, the aviation "lottery" is not one anyone wants to win, and we do know the odds of losing to be about one for every 100,000 hours of flying. But there is a problem with our probability of that risk. We are thinking of the accident in terms of a single event rather than the series of events that it always is! If you think of it that way, then combining those hazards may actually multiply the probability of the undesired outcome. Let's put it another way.

The young pilot team gives you three points on the risk matrix. The young navigator team gives you four points. An idea of managing the risk is to never put the crews together because you assess that risk as a seven. But if you play the odds of when a violation might occur should the two teams be combined, you would be more correct to assess the risk at twelve. You didn't just add to the probability of a hazard occurring, you **multiplied** it out.

I am not a math wizard, but what brought me to this idea wasn't the actual adding of the numbers on the matrix. It was the so-called "fixes." I see great decisions made every day in order to reduce, or manage the risk. The DO has the tough job of saying when enough is enough. He may put an IP with a weak pilot team, or maybe the weak student nav gets paired with the veteran radar nav. On the surface, this seemed correct, and everyone was happy. But what about that particular IP or that particular radar? I saw instances where the fix (that was by most measures logical) seemed to add to the risk.

A young pilot team may get crewed with an old IP, but what if it's well-known that the IP sleeps for much of his flights? A timid navigator who is weak on systems knowledge is teamed with an "old-head" who taught at the FTU, but what if that old-head uses fear and intimidation as a technique? (Yes, there are a few SAC-o-sauruses left.) What if that nav team is on the same crew as the young pilot crew and sleepy IP? On paper the risk management seemed to take care of what had been assessed. But what if the original assessment was wrong? Incorrectly assessing the risk cannot lead to good risk management.

In reality, these "fixes" added to the probability of poor CRM on that particular mission - and therefore a violation (or worse). These exact scenarios led me to understand the fallacy of adding all the elements up (rather than multiplying certain factors) to get a number. The weak pilot team didn't get better with a sleepy IP—they got worse. On the same crew, the nav came close to "student shutdown," and getting "violated" seems like a welcome thing compared to what could occur during pattern work. Please don't interpret me as second-guessing any decisions made in mitigating risk—these just happen to be anomalies that illustrated the overall point. (I'd defend any of the risk-management decisions I've seen made by the DOs at the schoolhouse.)

Some events can certainly be added: a weak radar-nav doesn't interact with, or multiply, maintenance problems. The assessment of those two events can be added to the overall number—say, two points for a weak radar nav and one point per hour of maintenance delay. But the weak radar nav coupled with bad weather actually multiplies the overall risk of the mission; maybe two points times three points. To my knowledge, no B-52 ORM matrix addresses that anomaly.

I mentioned in the beginning of this article that the human error occurs in aviation and engineering. Our engineering friends have long since identified this when they build a part with an expected or known failure rate. When a series of these parts are used in sequence, they know that the probability of failure is the product of two factors—not the sum. (Remember the O-rings!)

It is time to reassess the ORM worksheets. The identification of the hazards seems to be a given. We've read the safety reports. We know the things that can kill us, now let's look at the assessment of these risks in combination. Is one hazard's probability of causing a problem irrespective of another hazard causing a problem? More likely, the hazard interacts with other very specific hazards in a combinatory effect. Just like the series of events that lead up to a mishap, the probability of those events occurring should be calculated by multiplying to get the final risk. Then, once a firm foundation is laid, we can attack the control decisions effectively.

AFSC/SEF note:

If you have an IP that sleeps and a Nav with an attitude problem, then I suggest you have a Stan/Eval and leadership problem!!

The fictional scenarios used by the author highlight an even greater ORM challenge to squadron, Stan/Eval, and wing leadership: why the "sleepy" IP and "badgering" Nav were ever allowed into supervisory positions to begin with, and once identified as such, allowed to remain there?

The ORM "loop" is not closed until the final step "supervise and review" is accomplished. Be a supervisor and leader and make the tough call!!

When Is ORM Over?
Not With Mission Planning

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Does ORM end at mission planning, or do you continue to use it in combination with CRM after you step to the jet? Risk can change as the mission moves along or changes. Today you are waiting to see the squadron commander, and answer questions about why you declared an emergency on your last flight and damaged the aircraft. As you, the aircraft commander, sit in the squadron commander's office, you replay yesterday's flight in your head.

It started normally with mission planning. The day of the flight you, a new aircraft commander, show with the rest of your crew: a young copilot, a navigator about to upgrade to instructor and an experienced instructor boom operator. The flight is a KC-135 staging leg for a coronet from Kadena AB to Misawa AB, Japan. You have gone over everything to include the ORM, which is acceptable. With the mission briefed, the flight plan filed and a last minute check on the winter weather at Misawa you're off to the jet.

Nothing unusual with the preflight, taxi, or takeoff, and the en route portion of the flight to your staging base is uneventful. During the flight to Misawa you got an update on the weather, and the only problem was the runway needed to be cleared of snow. Misawa was aware you were on the way and were supposedly clearing the runway for your arrival. Upon arrival however, the runway had not yet been cleared so you went into holding. Periodic checks were made on the progress of the runway, with one final check as you neared your divert fuel. The response was "they are still working on getting the runway cleared." As the aircraft commander you decided to divert back to home station for fuel. The copilot worked a clearance for the routing your navigator supplied and off you went.

As you started for home, a discussion began in the cockpit: should you make a fuel stop at one of the suitable alternates you were going to pass along your way home, or just press on? The discussion centered on the issue of how "much fuel is required upon arriving at home station?" The local regulation states you must arrive at any of the preferred diversion recovery bases' IAF with at least 14,000 pounds of fuel. At this time, you were going to arrive at the IAF right at the required amount of fuel. On your way home however, you were going to pass up at least three suitable alternates where you could get fuel. The boom operator and navigator were both pushing to stop at one of the alternates. Thinking about it now the boom brought up a good question, "since you are diverting for fuel, should you pass up suitable

USA Photo by TSgt Michael Morford
Photo Illustration by Dan Harman

alternates where you can *get* fuel then arrive back home with just above minimum fuel?" As the aircraft commander you were intent on returning home, and accused the boom and navigator of just wanting to go TDY. The navigator went through the timing of the duty day and explained how the crew had the duty day to stop, get gas and then continue on to home station. Being the all-powerful and all-knowing aircraft commander you still elect to continue on to home station. The navigator, continuing to push for stopping at one of the alternates, brought up the fact that on the first half of the flight up to the Misawa AB you had an 80 to 90-knot tailwind. Then he brought to your attention how the tailwind on the way up would be a headwind for the last half of the flight home. How would that affect the amount of fuel upon arrival at Kadena? You liked the argument, but being the all-knowing new aircraft commander, you had made your decision and home station was the divert location. So, on you pressed.

After passing up all suitable diverts locations you hit the aforementioned headwinds. Checking your expected fuel upon arriving at the IAF now showed around 12,000 pounds which would require you do declare an emergency. You start to think "maybe I should have listened to the boom and nav and stopped at one of the suitable alternates for fuel."

Everything would have been fine, even with declaring an emergency, except the weather had moved in over Okinawa. The only option you had was to hold and hope the weather cleared before you ran out of fuel … because you didn't have enough fuel to divert anywhere else. As you continued to hold and burn down the remaining fuel, the crew got ready to bail out.

Your luck was improving though, the weather had cleared enough for you to land but you only had enough fuel for one approach. Everything looked good all the way down; even with a 20 knot crosswind, but as you touched down you drug an engine pod.

OK, so that's not how it really happened. The crew actually stopped at one of the suitable alternates for fuel before continuing home to Kadena. When the actual sortie arrived at Kadena it took three approaches to land the aircraft. At least the aircraft commander didn't have to stand in front of the squadron commander to explain an emergency or damaged aircraft. ORM and CRM both played a role throughout the mission. Evaluating the risk of pushing all the way back to Kadena played into stopping for fuel. CRM was also at work with ideas on what to do, and the reasons why, being shared by all crewmembers.

USAF Photo

The Air Force Safety Analysis Team (SAT) Process

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In this day and age of increased wartime readiness and limited resources, risk mitigation and mishap prevention is essential to preserving lives and combat capability. Historically, commanders and the Air Force have invested resources towards implementing mishap recommendations based upon single mishap events. This approach, although beneficial to solving a specific problem has failed to address the most prevalent hazards encountered across Air Force operations as a whole. In the last couple of years, the Air Force Safety Center (AFSC) has moved toward becoming even more proactive. AFSC is conducting Operational Safety Assessments (OSAs) to assess the climate and personnel issues of Air Force operational units in relation to safety, implementing the beginnings of the Military Flight Operations Quality Assurance (MFOQA) program to collect and analyze flight data for mishap prevention, and developing the Air Force Safety Analysis Team (SAT) process to analyze past mishaps to identify trends and provide leadership with qualified and quantified options to reduce risk and mishaps. Among these programs, the SAT process is unique in that it mixes analysis of past mishaps with Subject Matter Expert (SMEs) experience to identify hazards and risk mitigation strategies to meet the hazards. The SAT then conducts a mathematical analysis of the feasibility to implement the mitigation strategies based on real-world constraints. The result of this analysis provides leadership with a comprehensive, rank ordered list of risk mitigation strategies for implementation that fit within the needs of the MAJCOM. But, how does the process work? This article will provide a step-by-step look at how the SAT process is conducted by the Analysis and Integration Branch of the Air Force Safety Center (HQ AFSC/SEAI).

A. Define Scope of Study

As in any analysis, the first step to the SAT process is to define the scope of study. This is normally set by the person or convening authority (i.e., MAJCOM commander, safety office, etc.). The scope sets the expectations for what is to be analyzed and what the expected outputs will be. Typically the scope is limited to a specific type of data or area such as aviation or ground mishaps. Once the scope is set, the next step is to select the dataset for analysis.

B. Select Mishap Dataset

Selecting the dataset is important because it establishes the basis for subsequent analysis. The scope of the dataset is again determined by the SAT convening authority. This dataset must be large enough to ensure data validity, but small enough to allow for the meaningful, focused assessment of the issues at hand. The dataset is normally limited to the type/class of mishaps to be reviewed and to approximately a three-to-five year look-back: i.e. all Aviation Class A and B mishaps over the last five fiscal years for a particular MAJCOM.

C. Select Team Members

When establishing a SAT, it is important to define the expertise that will make up the analysis team. The selected MAJCOM SMEs should include personnel familiar with the involved weapon systems, missions, etc., and who are knowledgeable in human factors, engineering, maintenance, operations, and safety. (Note: AFSC provides personnel who act as SAT facilitators and computer/database support). Although the team membership can vary from the recommended expertise, the convening authority is more likely to accept the results of the study if experts from their command are fully incorporated into the team.

D. Review Dataset Mishap Reports

Once the team is established, and proper safety privilege guidance is given, each team member is provided with a copy of a mishap or incident report. The entire team reviews the report, and each member individually makes notes pertaining to potential hazards in a given sequence of events to facilitate hazard statement development.

E. Identify Hazards and Write Hazard Statements

Hazards, according to MIL-STD-882, are any real or potential condition that can cause injury, illness, or death to personnel; damage to or loss of a system, equipment or property; or damage to the environment. The SAT process attempts to focus on **all** hazards within a mishap that contributed to the event regardless of causality. SAT members identify hazards present in the mishap and categorize them with previously developed hazard statements from AFSC or write new ones to capture the hazard.

F. Score Hazard Statements

After all hazards are identified, the SMEs score them individually based on their influence in the mishap using a zero to six "Likert" scale (e.g., "strongly agree" to "strongly disagree"). Once all hazards are identified and scored, the total hazard influence for each hazard statement can be determined across the dataset.

G. Identify Control Measures and write actionable Control Measure Statements

From here, the team develops unconstrained (i.e., "perfect world") control measures that address all of the hazards within the dataset. The control measures are considered from a global perspective rather than from a single mishap perspective. Control measures are strategies designed to mitigate the risk of a given hazard and are initially developed without considering real-world feasibility (this is considered later).

H. Score Control Measure Statements

Once all control measures are identified, they are scored by the SMEs on their ability to mitigate a specific hazard on a global basis. The System Safety Design Order of Precedence (DOP) is considered in control measure scoring, with a zero to six Likert scale used to weight the effectiveness of the proposed control measures based on the DOP categories:

Design to Eliminate/Reduce Hazard
Provide Safety Device
Provide Warning Device
Provide Special Training or Procedures

I. Calculate Risk Reduction Potential

Once all of the control measures are scored against their effectiveness to reduce a hazard, the SAT combines all of the hazards experienced across the entire dataset to determine how influential each hazard is. Additionally, each risk mitigation strategy is examined to see how influential it may be in mitigating the various hazards. This approach provides an overview of the prevalence of hazards and the overall effectiveness of the recommended control measures. The key is that the risk reduction potential for a single control measure is the sum of the control effectiveness scores for all hazards (see figure 1):

Overall Control Effectiveness

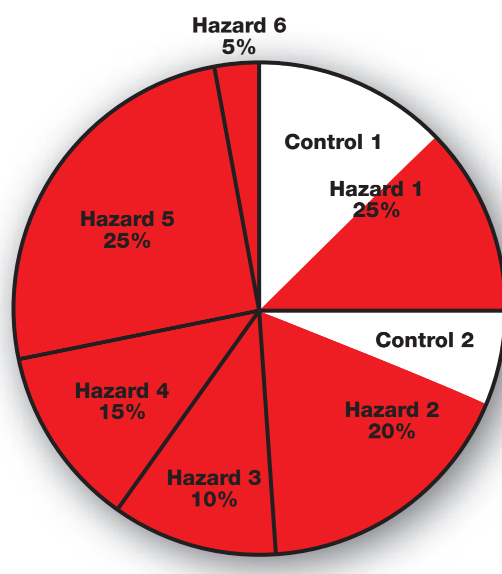

Figure 1

SHAPE * MERGE FORMAT

Implementing a control measure will mitigate a hazard by some amount. Control measure 1 may mitigate hazard 1 by 40% and hazard 2 by 30%.

Risk reduction potential for a single control measure is the sum of the control effectiveness scores for all hazards it mitigates (40% x 25% plus 30% x 20%, etc.)

J. Apply Feasibility Factors

Rating control measures for feasibility allows a decision maker to make more informed decisions by bringing the "ideally rated" control measures into the realm of real-world limitations and constraints. The SAT considers five feasibility factors (Dollar cost, Time to Implement, Availability of Technology, Organizational Impact, and Mission Impact) to determine the overall feasibility of a control measure. These factors focus on the negative impact of implementing a control measure while the benefit of that implementation is captured in the effectiveness scores. A three-tiered color scale/band is utilized to differentiate the thresholds within the feasibility factors for implementation. The thresholds for the green, yellow and red scale/bands are determined through discussions with leadership and MAJCOM representatives so that the thresholds realistically meet the command's expectations and constraints. Here is an example of a possible scale/band:

Factor 1—Dollar Cost:
- Green : Control cost < $10M
- Yellow: Control cost between $10M and $100M
- Red: Control cost > $100M

Factor 2—Time to Implement:
- Green: Control implementation time <1 year
- Yellow: Control implementation time between 1 and 6 years
- Red: Control implementation time > 6 years

Factor 3—Availability of Technology:
- Green: Technology exists/control currently available
- Yellow: Modification or minor research required
- Red: Extensive research or invention required

Factor 4—Organizational Impact:
- Green: No impact
- Yellow: Reorganization required using existing resources
- Red: New organization required requiring new resources

Factor 5—Mission Impact:
- Green: No impact
- Yellow: Degraded mission capability
- Red: Unable to accomplish required mission

Figure 2 illustrates how the scale/band is used to rank order controls. This chart assumes each feasibility factor is equally weighted and can be adjusted based on a commander's input. The concept behind this scoring method is that a red value means the control is undesirable for that factor. Thus, even if four of the factors score a green value, and the fifth is red, the feasibility score will be lower than a control with all five factors scoring a yellow.

Feasibility Factor Scores
All Factors Equally Weighed

Figure 2

K. Optimize Control Measure Selection

The last step in the SAT process is to optimize the list of control measures for implementation to effectively strike a balance between the risk reduction potential and feasibility. To optimize this balance, it is necessary to understand that the risk mitigation potential of a control measure may change based on implementation of other control measures. HQ AFSC/SEA developed a MATLAB® routine to automatically optimize a list of controls based upon this relationship. This routine also allows the user to weight each of the five feasibility factors individually to match the decision maker's goals. For example, if effectiveness and cost are the only important factors, the other four factors can be given a weight of zero, and the program will optimize the controls based on these inputs. Figure 3 illustrates this concept.

The whole circle represents 100% of the insufficiently mitigated risk of hazard 1. Each white section represents the risk reduction potential of each control as applied to hazard 1.

Control Risk Reduction
Potential Scores for hazard 1

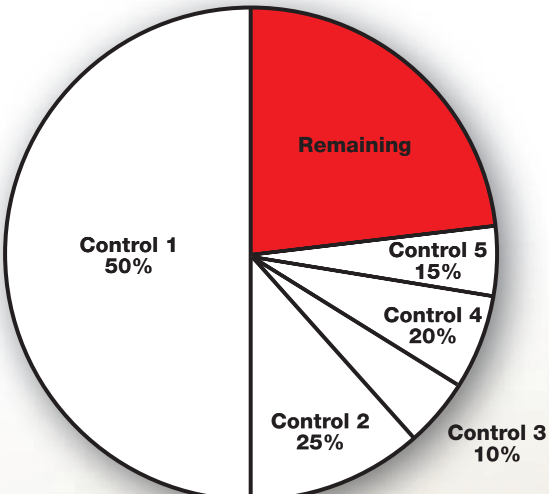

Figure 3

Implementing a control will mitigate the risk of a hazard by some amount based on effectiveness scores. Control 1 may mitigate the risk of hazard 1 by 50%. Implementing a second control will mitigate the **remaining** risk by its percentage. Control 2 will mitigate 25% of the **remaining** risk of hazard 1. As the remaining control measures are implemented, the risk continues to be reduced. Unless a single control measure is 100% effective this process never allows 100% of the risk to be mitigated.

In summary, the SAT process is a new and innovative way of analyzing mishap data to enhance the ability of our leaders to make timely and effective risk mitigation decisions based on known real-world limitations/constraints. If utilized to its full potential, the SAT process will allow each MAJCOM to individually tailor SAT assessments to their various weapon systems, identify the top hazards and provide these commands with specific risk mitigation strategies to meet the hazards. Ultimately this will allow for more in-depth mission planning, risk assessment, and aircrew situational awareness on the potential risks and hazards associated with specific missions. Proactive safety, in near real-time, will save lives, preserve resources and ensure the preservation of future combat capability for the Air Force.

HQ AFSC Photo by 1Lt Calvin Bradshaw

USAF CLASS A FLIGHT MISHAPS

FY07 Aviation Mishaps
(Oct 06-Feb 07)

5 Class A Mishaps (5 Flight)
0 Fatalities
3 Aircraft Destroyed

FY06 Aviation Mishaps
(Oct 05-Feb 06)

12 Class A Mishaps (7 Flight)
0 Fatalities
2 Aircraft Destroyed

02 Oct	✈	A C-21 departed runway near approach end and caught fire.
02 Oct		An F-15E had multiple bird strikes; damage to # 2 engine and left wing.
26 Oct		An F-16C caught fire on takeoff; pilot aborted.
27 Nov	✈	An F-16C CFIT (IAW CSAF guidance; currently a non-reportable loss under DoDI 6055.7)
04 Dec	✈	An F-16D experienced engine failure.
18 Jan	✈	A T-38C had multiple bird strikes; pilot ejected.

- A Class A mishap is defined as one where there is loss of life, injury resulting in permanent total disability, destruction of an AF aircraft, and/or property damage/loss exceeding $1 million.
- These Class A mishap descriptions have been sanitized to protect privilege.
- Unless otherwise stated, all crewmembers successfully ejected/egressed from their aircraft.
- Reflects all fatalities associated with USAF Aviation category mishaps.
- "✈" Denotes a destroyed aircraft.
- "✶" Denotes a Class A mishap that is not in the "Flight" category. Other Aviation categories are "Aircraft Flight-Related," "Unmanned Aerial Vehicle," and "Aircraft Ground Operations".
- Air Force safety statistics are updated frequently and may be viewed at the following web address: http://afsafety.af.mil/stats/f_stats.asp
- **Data includes only mishaps that have been finalized as of 09 Mar 07**.

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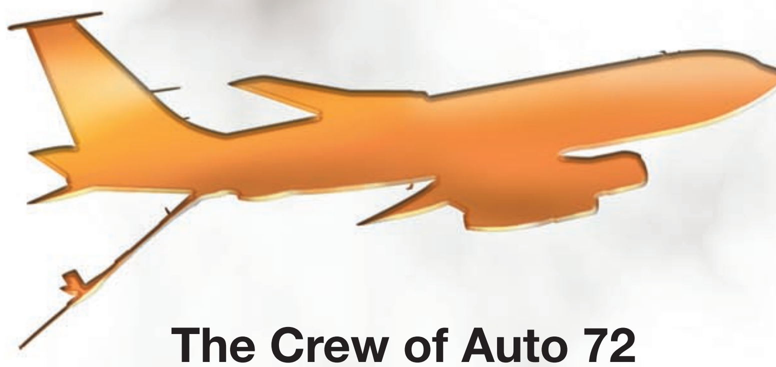
The Aviation Well Done Award is presented for outstanding airmanship and professional performance during a hazardous situation and for a significant contribution to the United States Air Force Mishap Prevention Program.



The Crew of Auto 72

927 ARW
Selfridge ANGB, MI

The Crew of Auto 72 was awarded the Aviation Safety Well Done Award in recognition of their exceptional contribution to aviation safety. On 24 June 2006, during a two-hour mission, the Crew of Auto 72 prevented a potential Class A aviation mishap when they experienced an in-flight emergency involving failure of the left hydraulic system on their KC-135R. The hydraulic failure coupled with a second malfunction of the nose gear might have resulted in a gear-up landing emergency. The crew used their expertise and all available resources to extend the nose gear ensuring a safe recovery of the crew, passengers, and aircraft. The crew's swift actions, innovative skills, superior airmanship and ability to perform under extreme circumstances were directly responsible for the safe recovery of a multi-million dollar asset.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