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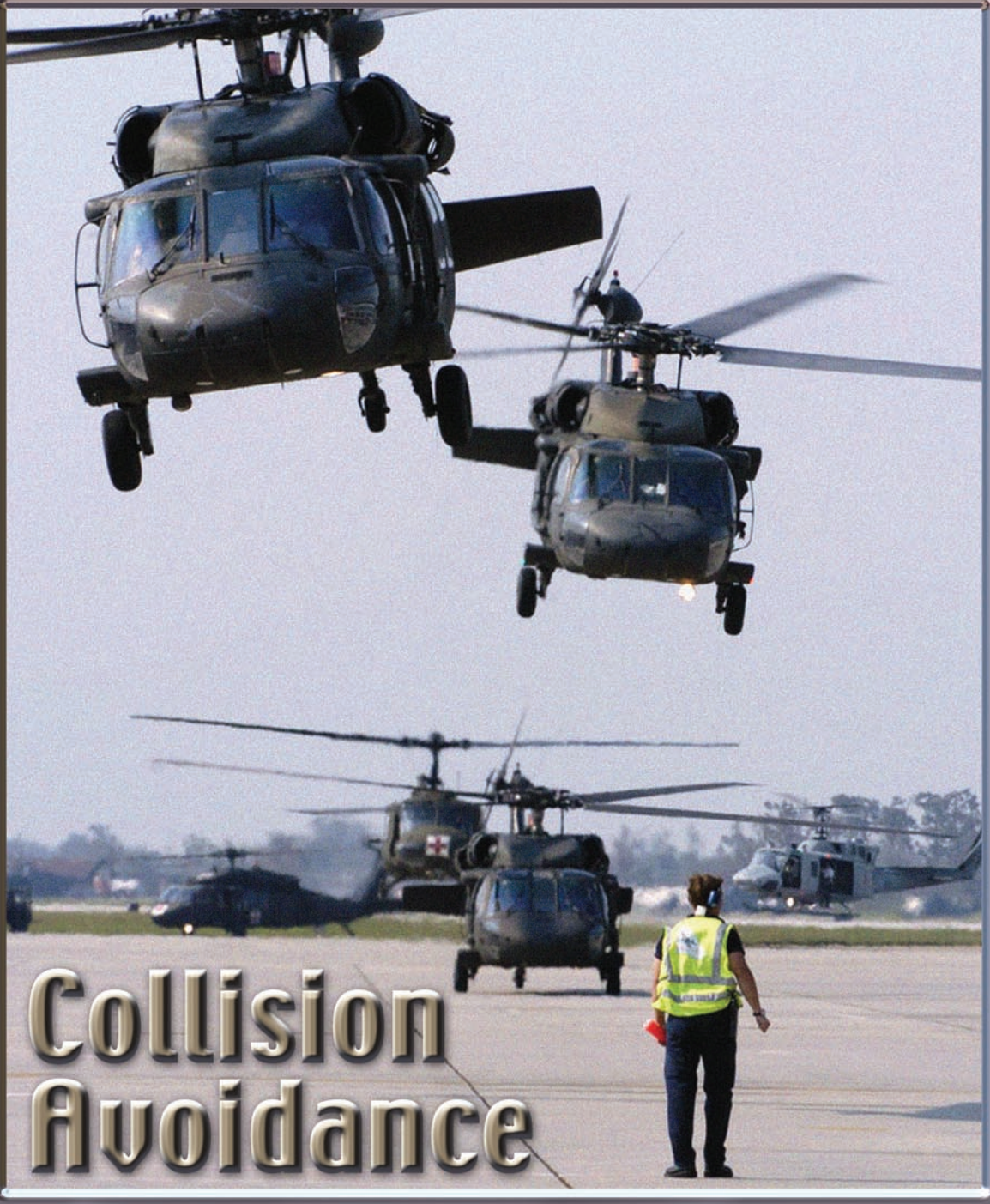

Collision Avoidance

FSM
FLYING SAFETY MAGAZINE

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Rear Cover: USAF photo by SSgt Jacob Bailey

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The articles in this edition of ***Flying Safety Magazine*** all discuss this month's theme of collision avoidance. In addition to the nuggets contained in these articles, the faa.gov website highlights significant findings of recent NTSB studies of mid-air collisions.

Here are a few tips from the FAA site on how **you** can reduce the odds of becoming involved in a mid-air collision:

1. Practice the "see and avoid" concept at all times regardless of whether the operation is conducted under Instrument (IFR) or Visual (VFR) Flight Rules.

2. Under IFR control, don't always count on ATC to keep you away from other aircraft. They're human and can make mistakes.

3. Understand the limitations of your eyes and use proper visual scanning techniques. Remember, if another aircraft appears to have no relative motion, but is increasing in size, it is likely to be on a collision course with you.

4. Be aware of the type airspace in which you intend to operate in and comply with the applicable rules.

5. Traffic advisories should be requested and used when available to assist the pilot's own visual scanning.

6. If not practical to initiate radio contact for traffic information, at least monitor the appropriate frequency.

7. ABOVE ALL, AVOID COMPLACENCY—SEE AND AVOID!

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

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Don't Hit Me!

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As a general aviation pilot, I fly through Military Operating Areas (MOAs). And since I use my GPS moving map display, I can fly right along the border of a restricted area. My Mode C sometimes doesn't work, and I tend to turn my radio off for most of the flight. I rarely call ATC because I hate being vectored—too inconvenient. I've even flown from Oshkosh, Wisc., to West Palm Beach, Fla. without talking to a soul. I fly direct to save time and gas, and yes, I'm 100 percent legal. You might be thinking I am a cowboy aviator, but you're wrong—I fly and maintain my aircraft well within Federal Aviation Regulations, using airmanship skills developed and honed as a USAF fighter pilot. Because of this, I'm more likely to go above and beyond what a typical general aviation pilot would do to stay out of your way.

Actually, the question should be directed at you, the military aviator: Are you looking for me as we share the skies safely? I know a lot about you since I'm also a military aviator, but do you know much about me, the civilian aviator in a light aircraft? I fly an experimental aircraft with a 23-foot wingspan at 150 knots. My aircraft is difficult to see, both visually and on your radar. Sometimes I fly in formation with several aircraft—from fingertip to 6,000-9,000 feet line abreast with an altitude split, or I'm single-ship doing aerobatics. I hope you're visually looking for me and not just depending on your radar to find me and my friends. I'm usually flying between 3,000 and 10,000 feet as I fly across the country—I would expect other light singles to be around the same altitudes, following roads and at speeds between 100 and 250 mph, too. For light twins, expect them to be in the mid-teens. I would also plan on civilians not observing the existence of your MOA (as I have had them blast right through the middle of my "4 v X" engagements in the past). You may never even see them since you are focused on air-to-air tactics versus visually searching for a "bug-smasher."

However, regardless of your ability to find me and your situational awareness (SA), I'm looking for you! When available, I utilize flight following with ATC. I fly below your air-to-air floor, and I check the SeeAndAvoid.org, AirNav.com, and AeroPlanner.com flight planning web sites for any information in regard to your airspace. If the FAA publishes a VHF common safety frequency for your MOA, I monitor that frequency to make sure I get out of your way so you can conduct your training. But not all civilian aviators are looking for you! A high percentage of civilian pilots are not aware of MOA/military airspace information for a variety of reasons—lack of training, lack of information available, attitudes toward military airspace, ineffective MACA (Mid-Air Collision Avoidance) programs at your base, etc.

USAF photo by TSgt Lance Cheung

HOW TO SEE AND AVOID

1. Clear your flight path.

a. If heads-down, ensure your wingman is looking for threats—traffic in your MOA or AAA in the AOR. Sounds like common sense, but it's easy to get a "helmet fire" and spend more time looking in than out, especially with all the new gadgets in modern cockpits. Most debriefs are centered on your video tape critiquing your radar/targeting pod work and not your visual search pattern. This tends to force most wingmen to spend more time focused inside the cockpit.

b. Be extra vigilant near uncontrolled/private airfields, along major highways and in your MOA, especially on the weekends when the weather is great.

c. Below 10,000 feet and/or anywhere near an Air Traffic Area, your cranium should be a swivel—never focused inside the cockpit unless you have someone clearing for you!

2. Utilize flight following when cross-country or RTBing from the range or MOA—but don't count on ATC to save you. You should be the one with the most SA.

3. Plan on civilians blasting through your MOA as a general rule of thumb, and have a plan for your knock-it-off (KIO).

4. Don't intercept civilian aircraft unless specifically directed. I know it's tempting—but don't. Besides alarming the other pilot, you're most likely violating your own training rules.

5. Speaking of training rules: AFI 11-214, *Air Operations Rules and Procedures*, states to KIO if "an unbriefed or unscheduled flight enters the working area and is detrimental to the safe conduct of the mission." This does not clear you to intercept the aircraft, dust him off, fly across his nose and/or expend flares. My recommendation is to stay outside one nautical mile. The unbriefed aircraft is a nuisance to your flight, but believe it or not that aircraft has just as much right to the airspace as you do. You own the airspace only between you and other military aircraft.

6. Utilize sectional charts for your mission planning. Sectional charts are useful references for actual boundaries of airfields, accurate special use airspace and boundaries of Class B, C and D airspace. In addition, these charts have accurate information with regard to obstructions (e.g., towers that are not displayed on military charts).

7. Comply with the Federal Aviation Regulations (FARs)—speed and airspace restrictions. Don't go blasting through Class B airspace after cancelling IFR as you enter a low-level route.

8. Book your VR low-level route and make your entry time.

9. Keep your SA high! Know where you are at all times. Six years ago a fighter pilot had a mid-air with a Cessna. Why? The pilot had no SA on where he was and blasted right through the Class B airspace of a major international airport.

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USAF photo by TSgt Ben Bloker

Photo provided by Brett Kappenman

see MACA information. While MACA pamphlets are required to be in place in accordance with safety AFIs, a large poster depicting the local military airspace and aircraft information is a greater asset for your program. Pamphlets disappear quickly, and not everyone has the opportunity or the time to read them. However, a well-displayed poster (e.g., hanging over the weather computer) would tend not to disappear, and it would remind all aviators of what is happening in the local area.

2. Utilize sectional charts for your MACA products so you're speaking their language—a black and white "stick diagram" of your MOA and local airspace doesn't mean much to your average civilian pilot.

3. Web site: You probably have a MACA web page on the public web site for your base. Great! But do you think the average civilian pilot is accessing your information? A more effective way for folks to find your site would be a link from one of the frequently used flight planning web sites such as ***"http://www.airnav.com," "http://www.aeroplanner.com,"*** or ***"http://www.aopa.org."*** You could also include the location of your web site on the poster mentioned above!

Some recommendations for your flight planning room: Make sectional charts available for pilots. The new AF flight planning software has the ability to choose a variety of charts. I recommend using a sectional chart for any phase of flight where you'll be flying below 18,000 feet.

I know what it's like to be on both ends of a close encounter. With experience in fighters, experimental aircraft and airliners, I've seen a lot of near-misses with other aircraft, and in most cases everyone was legal. The bottom line—be vigilant as you share the skies safely with everyone. Your best friend could be the guy in the other aircraft.

10. Report all close encounters via a Hazardous Air Traffic Report (HATR) form. In order for our system to better accommodate civilian and military traffic, there needs to be data to substantiate the agenda to push for safety related issues. I'm positive there are many close encounters which are never reported.

RECOMMENDATIONS

FOR YOU FLIGHT SAFETY OFFICERS out there looking to get promoted: How effective is your MACA program? I've flown throughout the U.S., not only as a light aircraft (experimental) pilot, but as an airline pilot as well, and I have yet to see any MACA information displayed that warns me about your local flying area. Just because you have a MACA program and a pamphlet doesn't necessarily mean the average civilian pilot has your information. Near-misses, mid-air collisions, and TCAS alerts continue to be part of the safety database from Class A mishaps to HATRs. I believe many of these mishaps/incidents could have been prevented with a more effective and robust MACA program.

Here are some recommendations to improve your MACA program:

1. Put up a poster. I have yet to visit a civilian field and

A Mid-Air With An Unmanned Aerial Vehicle (UAV) Is Not A BASH Event!

MAJ DANIEL MURRAY
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Eglin AFB FL

UAVs are the newest players in the potential for mid-air collisions involving military aircraft. However, let me assure you that going beak-to-beak with a Predator will do more than FOD out your engine! Our Ops Tempo is high and our GWOT mission is demanding across the entire USAF and DoD. Still, flying safety can not be left in the briefing room. We are in a sustainment mode overseas and while we have to accomplish the "mish," the other goal is to bring the plane, and our butts, back safely. Yes, this is another "There I was…" story but my story involves someone else's goof-up. Let me start with the big picture.

The Chief of Staff's 2004 Sight Picture was to reduce our aviation mishaps by 50% this year [since this article was written, the Sight Picture has increased to 75% by FY08], with an ultimate goal of reducing our mishaps to zero. Obviously, in order to "reduce" we have to prevent. There are many ways to have a mishap in an aircraft, and the best way to prevent is to track "near" mishaps and correct them before they become actual mishaps. That is the entire purpose of our Class E program of reporting mishaps. There are several types of class E's, but let's talk about one in particular--the Hazardous Air Traffic Report (HATR), and the sub-category, near mid-air collisions (NMAC).

Traditionally, the majority of our NMACs (or actual MACs) were in two areas, and we still see them happen in these areas. The first is nearly having very close contact with tankers on the AR tracks. The second is specific to the fighter world where, simply by the nature of their mission, pilots must be in very close proximity to wingmen or opposing force jets at high rates of speed and closure. During our deployments, we see many tanker NMACs, but then the fighters aren't doing much dog-fighting in theater. Currently, the biggest NMAC threat on our deployments is the huge number of USAF aircraft we put into a relatively small amount of airspace.

The US and Coalition military aviation world has become adept at managing that airspace over the years. We do this by creating the airspace

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USAF photo by Chad Bellay

control order (ACO) and most of you are aware of how it works. For instance, if a restricted operating zone (ROZ) is in use, you don't fly through its boundaries or altitude. A big piece of the deconfliction also depends on the aircraft using the ROZ staying ***inside*** the boundaries. We're used to avoiding refueling ops or "kill-boxes," but there is a newer NMAC threat.

The advent of the Unmanned Aerial Vehicle (UAV) has posed many challenges for the Air Force, not the least of which is putting them into combat in and around manned aircraft and ensuring deconfliction. Unfortunately, we are not deconflicting manned and unmanned aircraft as well as we could in theater.

Here comes the story, although it isn't a "there I was" tale, it is a "there my crew was" tale. As deployed mission commander, I had an MC-130P crew flying "in-country." We are AFSOC birds, so flying on NVGs is our bread and butter. They were transiting from one objective to another and leveled off at an intermediate cruise altitude. Having stepped to the plane with the ACO, they knew that a UAV ROZ was active to the south of them. While they were flying within the UAV altitude window, they remained well clear of the ROZ. Due to an overcast deck above them they couldn't get higher and remain VFR/"see and avoid." Of course they did not intend to get within 20NM of that ROZ and they were under ATC control to boot.

About 50NM north of the ROZ they saw a UAV pass co-altitude, within 150 feet of their left wing. They were on NVGs, but because the UAV was operating with its lights off for tactical reasons, they never saw it until it could have been too late, and certainly too late to maneuver. ATC never provided an advisory. In addition, most AFSOC aircraft still don't have TCAS, so there was no warning whatsoever. Unfortunately, they did not query ATC at the time, so the tapes were not marked for investigation. They reported the incident to me upon landing, and I walked them through the HATR reporting system.

Of the seven reported UAV NMACs in theater, happening in different control areas (one was actually a runway incursion during a C-130 takeoff), all are similar in one area—somehow, ATC lost track of the UAV. There are several reasons for this, and while we, as flyers, are often quick to blame the controller, in fact they are at a great disadvantage when having to deal with UAVs. Keep in mind that no matter who is to blame, it would be the pilot and/or crew of the manned aircraft who would be killed in a mid-air collision, not the ATC controller or UAV operator. We have to understand UAVs to avoid them.

The UAV world is still operating with some serious shortcomings that lend to "losing" them in the air. They have only one UHF radio, and not only is it weak, but the operator has to uplink to the bird and then the call is transmitted. Most times they have no radio contact with the controller, so their requests and information are passed to the controllers via e-chat (mIRC). The problem here is that the manned aircraft up on frequency never hear the coordination. Next, the radar cross section of UAVs is small enough so that often the radar contact is intermittent, so if the UAV isn't squawking, there is no radar contact. They are also very slow, flying 60-80 knots, so they don't have the maneuverability to miss us, and they are easy to overrun (contrary to popular belief, C-130s and A-10s can overrun UAVs!).

USAF photo by MSgt Jonathan Doti

Another set of problems arise from the UAV search mission. In the previous story, why the heck was the UAV out of its ROZ? The bad guys they are tasked to recon aren't necessarily going to stay in the ROZ, so the UAV has to follow them. If the coordination has been done via mIRC, and the controller clears them to "remain VFR and use see-and-avoid," the rest of us don't know that the UAV is now a threat. In addition, if the UAV is blacked out for operations, there is nothing to see for the manned aircraft to clear. This all leads to the final problem of controllers treating UAVs as "see-and-avoid" aircraft. The UAV operators spend the majority of their time looking down at the ground. Their nose camera has a narrow field of view and while limited during daytime ops, is nearly useless for clearing at night. So the manned aircraft is still see-and-avoid, but the UAV is not really able to clear.

What does this mean to you? I DO NOT believe that any UAV operator or ATC controller would consciously be flippant about having a mid-air collision occur because they are on the ground and would be perfectly healthy afterwards. Honestly, though, that is why we built and fly UAVs in the first place. We can crash one or have one shot down, and we haven't lost a human being…that is the entire idea. But as long as we're still flying manned aircraft, the onus is ultimately on the person in the cockpit to avoid a mid-air for their own and their crew's sakes.

What can you do to prevent a mid-air with a UAV? First and foremost, be wary. We have always sanity-checked our clearances from ATC to ensure they aren't flying us into a mountain. That is just part of being an aviator. Do the same thing with unmanned aircraft. If you know there are UAVs out there, sanity-check your environment. For instance, if there is a cloud deck at the published UAV operating altitude, count on the fact that they will be lower than the deck so they can see, so don't fly right underneath a ROZ altitude block. Be aware that they may have to deviate from the ACO, so don't skirt the edges of a ROZ. Pimp the controller for updates rather than awaiting them. The theater controllers are heavily task-saturated. Help them help you.

Also, don't get complacent. It is always nice to be mission complete, on a climb out of the threat environment, and ready to RTB. But remember that your mid-air threat is usually at cruise altitudes, whether it be a UAV or a tanker operation.

Lastly, honor your TCAS. Three of the seven UAV NMACs were avoided because the TCAS alerted the crew. UAV operators are squawking out there and even if the controller loses them, hopefully your TCAS will not. For those of us without TCAS, the Air Force is working on it. The more valuable we show that TCAS is to accomplishing the mission, the faster we'll all get it. One way to do this is to file a HATR when it worked for you or when the lack of TCAS let you get too close to someone else. If all that prevention fails and you are involved in any NMAC, remember that you need to do several things without delay:

1. Let Air Traffic Control know immediately. If the controller is not aware of the mistake/event, it will call the event to their attention and highlight it on tape for prevention investigation.

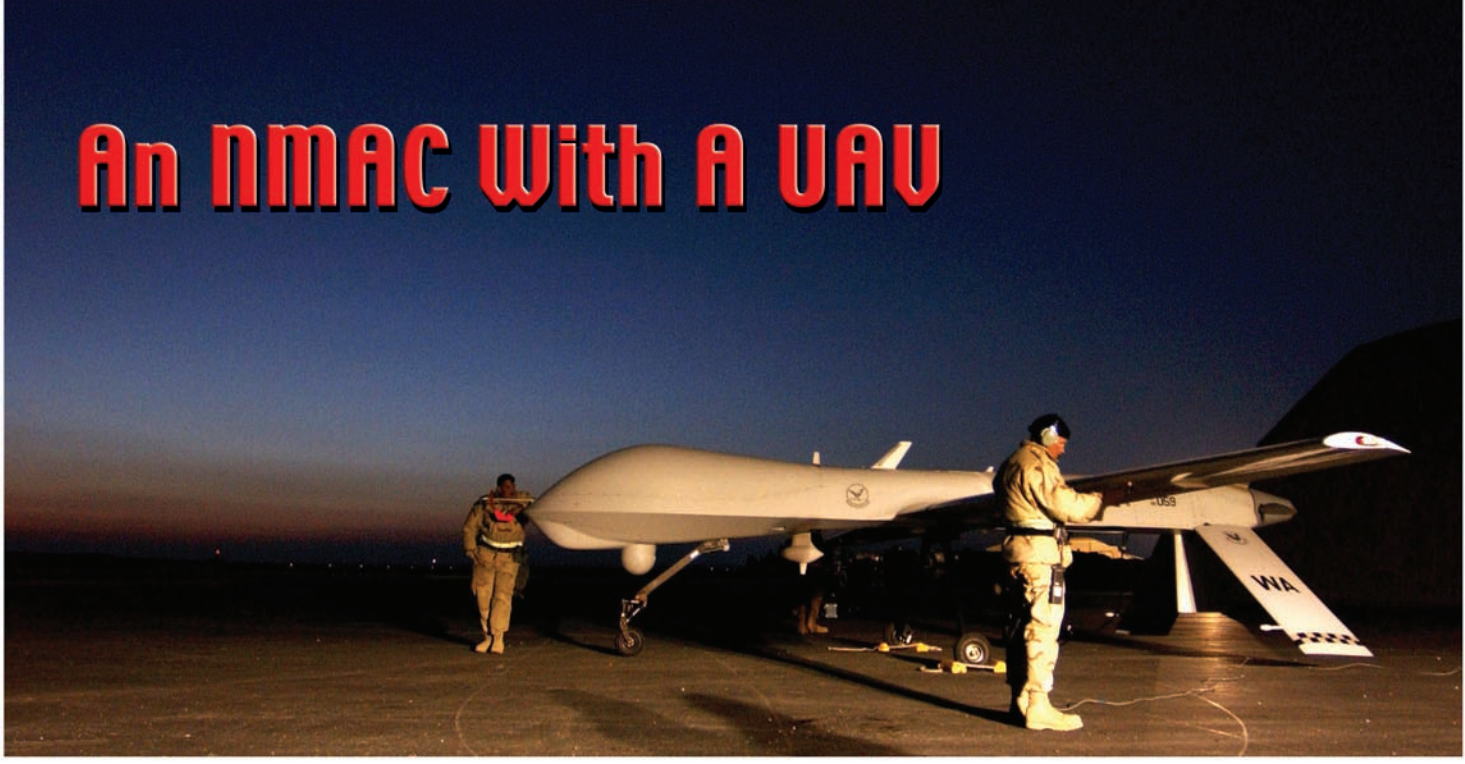
2. File a HATR as soon as possible to start the prevention investigation. Remember that HATRs are non-retribution. Even if you blew it, as long as you file in a timely manner, and there was no criminal act committed, they are treated as information for mishap prevention.

3. Spread the word throughout your unit and personal sphere of influence. Unfortunately, many of our folks don't file because they aren't clear on the program. They feel it is a waste of time, or that they will get a "hear" about it if they were at fault. None of these are good reasons not to file a HATR.

As we continue to deploy and sustain, the worst thing we can do is kill or injure each other out there. Fly safe and keep clearing.

USAF photo by Dennis Rogers

An NMAC With A UAV



USAF Photo by SSgt Jeremy T. Lock

CAPT KEITH J. BUTLER
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It's one month into Air Expeditionary Force (AEF) 7 now, and the squadron is getting comfortable with the pace of Operation Iraqi Freedom. Today's sortie is fragged as a three-hour vul (vulnerability period) for convoy security along Highway 1 in the southern Baghdad area. The two of us are executing detached mutual support in the mighty Block 40 Viper. In other words, we've placed a Be-No line halfway down the Line of Communication (LOC) so both of us can focus on watching over the 30-mile-long convoy instead of watching out for each other. We're also hitting the tanker as singletons in order to provide maximum coverage to our bros on the ground. Ground Control Intercept (GCI) has cleared us the block 5,000 to FL200 and told us we're the only show in town. Up to speed yet? Good, because here's where I start "shooting my wristwatch."

I'm at 15K MSL in a five-mile wheel with a sweet targeting pod lock on a pickup truck that's stopped on the side of the highway. While making sure this guy isn't planting an improvised explosive device (IED), I catch some movement off the right wing. I look out and find myself staring in disbelief at an unmanned aerial vehicle (UAV) two miles away at 14K MSL on a northwestern track. You can imagine my frustration, because now I have to split my attention between the truck on the ground, this slow-speed "cheerleader," and the convoy itself. I call out the traffic to Lead, and ping GCI to figure out what this guy is doing here. GCI's response is something to the effect of "XX flight, we show no traffic in your area." I then proceed to point out to GCI the traffic, which bears an uncanny resemblance to a Predator and is now on a vector toward Lead's area. Lead acknowledges the call and climbs above 16K MSL for avoidance. GCI say they will look into the situation and get back to us. For the rest of the sortie, I cap myself from FL150-200 to minimize my chances of flying home with a hood ornament. Both Lead and I get intermittent tallies on our visitor, but never get a call back from GCI.

During the debrief, Lead and I discussed the incident and felt the run-in was a one-time occurrence, chalking it up to our good friend Clausewitz and the "fog of war." Unfortunately, this was my first of three sorties during our deployment where the UAV arrived on scene with no advisory calls from GCI. This isn't to say that GCI never warned us. There were sorties where we received numerous calls that a Predator was in the area, and were forced to cap our operating altitudes. Combine this restriction with weather in the area and requests from ground troops under fire to perform low passes or employ weapons, and you can see how our ability to effectively execute our fragged mission could easily be hampered. I started asking around the squadron to see if anyone else was having these problems. Over half the pilots said they had similar situations at least once during a sortie. I received comparable responses from our Strike Eagle bubbas who were downrange the same time we were.

Armed with the knowledge that this was not an unusual occurrence, I started wondering to

USAF Photo by Capt John Sheets

myself, "Self, how do you reduce the risk of a midair with a UAV?" I was trying to find a more profound answer than "Don't hit 'em, you moron." Then one night, as I was drinking my ration card's worth of beer at the newly built pavilion and watching camel spiders get chased by SERE (survival, evasion, resistance, escape) instructors (by the way, hasn't anyone ever told those guys not to play with their food?), it hit me like a cold can of Guinness upside the cranium: Why not be the proverbial SERE instructor and chase down the source of the problem?

The next day I tracked down GCI's phone number and got in touch with one of their controllers. After asking what the procedures are for tracking the pesky Predators, he said that about every fifteen minutes they get a position report over MIRChat (Military Internet Relay Chat) from the UAV rep on the Combined Air Operations Center (CAOC) floor who in turn is talking with the pilot at the controls back in Indian Springs, Nevada. Based on the positional information they receive, they update a grease pencil mark on the radar scope and make traffic calls to all aircraft operating in that area! I know, I was thinking the same thing when I heard it, too. In effect, this controller was telling me we're still using 1960s techniques to deal with today's technology.

So what's the bottom line? Right now there is no real-time ability to effectively track all UAVs above the AOR's coordination altitude where manned aircraft fly. This means it is absolutely imperative that each pilot and/or aircrew uses all available resources to detect a UAV while they still have time to deconflict flight paths. Most of us already incorporate this while flying in the AOR, i.e., scanning for SAMs, RPGs and AAA. Take the extra time in your search pattern to look for the traffic that can take you out just as easily as a MANPAD. Staying within our assigned kill container will not insulate us. Relying on traffic calls from GCI will not save us.

By the way, did you know that a Predator is 27 feet long and 48 feet wide? If you ever thought the Predator was a "no-factor" when it comes to traffic, think again.

Official USAF photo

(Author's PostScript/Disclaimer: I originally wrote this article in the summer of '04, shortly after our return from downrange. Since then, I've learned some interesting facts worth sharing. During that period, Air Force Predator ops were listed in the Air Tasking Order (ATO), although their operating areas changed constantly. However, I was told by several Air Control Squadron (ACS) controllers that the U.S. Army and Other Governmental Agencies (OGAs) were also conducting Predator operations that were not on the ATO, nor did they maintain the same altitude blocks as the Air Force UAVs. Things may have changed since then, but some things never do. At the end of the day, the Pilot In Command (PIC)/Aircraft Commander (AC) is ultimately responsible for avoiding all unintentional contact with other objects in the wild blue yonder as well as cumulogranite. You're no good to the troops if you're a smokin' hole [so to speak] in the ground.)

Flying Safely In The Combat Zone

LT COL BILL ADELMANN
729 AS
March ARB CA

You are on your way into the Area of Responsibility (AOR). This is your first time flying into a combat zone, or maybe you've been there several times this past year. Regardless, you listened intently during the Intel briefing. You noted the latest weapons the bad guys have been using or are suspected of possessing, their tactics, the current airway procedures, today's code words, and you even memorized the search-and-rescue code phrases. You know everyone flying with you knows their job and is ready to fly today. The Combat Entry Checklist went smoothly, everyone has their body armor on, and the survival equipment is readily available. The aircraft defensive systems have been checked and are armed. You are ready. Or are you?

How much thought have you given to the actual airway procedures in the AOR? How about clearances to deviate from the briefed procedures when necessary for weather? Are you responsible for de-conflicting with other traffic, or is the military controller going to keep you safe from all the high-speed shooters and small UAVs crowding the night sky? Many of us are accustomed to air traffic control (ATC) keeping us separated from all other traffic, both IFR and VFR. But in the AOR that is not always possible, as the controllers don't have direct control over all present traffic.

On this particular evening, we were flying the C-141C into Baghdad on an airevac mission. The weather was good, with little cloud cover. Moon illumination was low, but we didn't consider it a factor since we were not qualified to use night vision devices. I was the aircraft commander and I was flying with two sharp first pilots (left-seat qualified co-pilots). Since I had never flown into this airfield, I asked the one pilot who had flown in there before to fly the approach. The airfield lighting was described as poor to nearly non-existent, and he would be the most likely pilot to spot the field. This would allow me to work the ATC radio, monitor the approach parameters, and keep good situational awareness (SA) during the entire descent, approach, and landing. The third

USAF photo by SSgt Tony R. Tolley

USAF photo by SSgt Tony R. Tolley

pilot would work the defensive systems, handle the other radios, and be the safety observer. This served as the foundation of our approach plan, and from there we worked on putting it all together.

We picked the descent profile that would lead us into our tactical approach, and discussed the plan. Most C-141 pilots do not routinely fly tactical approaches, and there is no tactical currency to maintain. The co-pilots had never flown this type of approach, but had seen it before, flying on other missions. Since re-qualification in this airplane, I had not flown this approach either. But I was proficient in this maneuver in my previous assignment, and therefore felt comfortable teaching the co-pilots. We spent a significant amount of time discussing the maneuver, and then we programmed the entire route into our navigational computer to help our SA. This gave us a virtual precision approach to an airfield without navigational aids (navaids).

Furthermore, it showed our route of flight on the map display. Then I emphasized the whole point of the tactical approach was to get us to a normal final for a safe landing. Regardless of how effective our tactical maneuvering was in defeating the potential threat, it would be for nothing if we plowed the airplane into the ground. Neither did we want to make a go-around and give the bad guys a second chance at us. We also briefed what we would do if we had to abort the landing, and our reactions to ground fire. That was it. Lots of stuff discussed. The extra time discussing made everyone feel much more confident. The descent checklist was completed. We were ready for anything—or so we thought.

ATC cleared us for the approach and we began our descent. We did not spot the airfield until we were nearly on top of it. Shortly thereafter, we overflew the landing runway and began the maneuvering. Right after this, our navigational computer decided we had arrived and no longer needed to provide us any information. Unfortunately, Murphy's Law kicked in soon thereafter, and the pilot flying lost sight of the runway. Because of the airfield position and the aircraft maneuvering, I was unable to see the airfield from my side. I therefore, directed the pilot to continue the approach while he looked for the runway and the third pilot automatically went to that window to help find it.

Since I knew the other pilots were primarily looking outside, I concentrated on the instruments and quickly programmed a false navaid on the

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airfield, so the computer would give us a simple relative position to it. As I called out an updated position to the airfield, the two other pilots spotted the runway lights again. I looked up to where I thought the lights would be, and didn't see them. The other pilots talked me to the lights, and I soon spotted them myself. Something immediately didn't feel right, but at this point we were all task-saturated and we needed to complete checklists and get ready to land. The most important goal, as we had briefed before, was to safely line up on final and land. This is what we concentrated on now.

As we commenced our turn to final, I had a chance to do a quick sanity check. That's when it hit me: we were turning 180 degrees from the direction of the planned landing runway! Obviously, we were going to land on the wrong runway. Normally, the textbook solution is to initiate a go-around and do it right the second time. But as we had discussed before, the thought of giving the bad guys one more shot at us was loathsome. Since we knew there were no restrictions to landing on this runway, we went ahead and landed. Afterwards I apologized to tower for messing up their pattern and doing the unexpected. I was thankful that they took it all in stride and were very patient with us.

Afterward, as we sat parked on the ramp, we discussed at length what we could have done differently. Besides the more obvious corrections, we could have entered the false navaid (waypoint) for a constant relative position and distance to it—regardless of the programmed route status. Also, my personal technique had always been to put the HSI captain's bar on the landing runway heading when I flew the approach. But since I was not flying this time, I did not pay attention to its setting. Now, I will. Finally, flying the approach exactly as planned would have put the airplane near the desired final approach point. But because we were concentrating on finding the runway, and lacked tactical approach proficiency, the ground track was not the desired one. We definitely need to practice these approaches more often.

One final event on this same mission made us look over our shoulders for ol' Mr. Murphy. After executing a high-speed tactical departure, we were leveling at our initial altitude at a low speed. Two near targets appeared on our TCAS (Traffic Collision Avoidance System) scope. One indicated above, which immediately turned into a resolution advisory (RA) and commanded an immediate descent. At the same time, a second target appeared directly below as a traffic advisory (TA). Trapped between these two unidentified targets and with very little maneuvering energy, we immediately

turned our strobes on in hope they could see us. Nothing was visible to us outside and ATC informed us that they had no information on the traffic. About as fast as they appeared, both targets disappeared. We never did find out if the targets were false or some other real aircraft.

Flying in the AOR is not like flying anywhere else. Not only do we have to comply with the AOR-specific rules, such as Rules of Engagement and Special Instructions, but we also have to apply

USAF photo by SSgt Tony R. Tolley

the procedures that apply in the normal world. Furthermore, we have to consider the interaction between the two and how to operate in the middle area. What we learned that night was that we have to be as prepared as possible, but always be ready for the unexpected. Sometimes the right answer is not clearly delineated, but experience and a good discussion beforehand of various possibilities goes a long way in helping make time-critical decisions.

Lt Col Adelmann is transitioning to the C-17, and has more than, 6000 flying hours in the C-141, C-130, and C-27. He has participated in Operations Desert Shield/Desert Storm, Restore Hope (Somalia), Support Hope (Rwanda), Allied Force (Bosnia), Enduring Freedom, Infinite Justice, Iraqi Freedom, and the counter-drug war in South America.

Collision Avoidance

USAF Photo by MSgt Kenneth Page
Photo Illustration by Felicia Moreland

"It Ain't Over, Till It's Over"

ANONYMOUS

Undoubtedly, all of you sports fans have heard these famous words uttered by Yogi Berra, the legendary New York Yankee catcher. As you'll see from this "There I Was" chronicle, this simple phrase also rings loud and clear in our unpredictable world of aviation.

On a typical night, after flying a typical sortie, from a typical deployed location, my crew and I were taxiing our KC-135 back to the park to finish up another evening of airlift support. Takeoff, air refueling, and landing were as routine as it gets. The entire sortie lasted a mere 3.0, and we were anxious to make it back for midnight chow. This mission had become so standard that we could calculate the time it took from landing to the chow hall to within five minutes. Unfortunately, on this night, we didn't make midnight chow. In fact, when it was all said and done, we barely made the following day's breakfast.

Upon reaching our parking spot, we were expeditiously greeted by our crew chiefs, eager to push us back into our spot. We shut down the engines, finished up the checklist, and began to pack up for the night. As we proceeded, so did our crew chiefs. They quickly hooked up the tow bar, put their four wing-walkers, tow driver, and tow supervisor in place, and waited for me to release brakes and commence the tow. After

USAF photo by MSgt Lance Cheung

being verbally instructed by the tow supervisor to release brakes, the tow began.

This particular parking spot was notorious at the airfield. Night lighting was marginal, as was the distance between adjacent KC-135s. Less than a year before, two airplanes were towed into one another in this exact spot. However, multiple maintenance, aircrew, and base rotations had caused this vital airfield information to be lost in the shuffle.

We proceeded backward, and I instructed my co-pilot to look out the right window and monitor the tow as best as he could, despite the marginal nighttime lighting. As he watched, we began a sharp, accelerating turn. In the time it takes to blink an eye, we heard a loud "WOO!!" coming from outside, and immediately came to an abrupt halt. You guessed it—our base X aircraft had been towed by a base Y maintenance crew into a base Z aircraft. Three bases and two MAJCOMs were immediately affected.

Our right wingtip had sliced across the nose of the adjacent KC-135 and struck the windshield, totaling our wingtip, and damaging the stationary tanker's radome and windshield wiper system. The sharpness of turn, speed of the tow, and the lack of immediate supervision brought "Murphy" to life.

How and why could something like this happen? With every mishap, there's the infamous "error chain," and this incident was no exception.

1. Information on the dangers of this parking area was not passed from deployment to deployment. Whatever procedures, if any, put into place following the first incident were lost.

USAF photo by MSgt Scott Wagers

2. The adjacent parked aircraft had been moved forward 30 feet. This was a new "verbal" policy, implemented to protect fuel pits from engine blast during taxi-out. Unfortunately, after that aircraft's sortie was cancelled, it was never pushed back to its original spot, as the new policy instructed. This move made it virtually impossible to fit our aircraft into the spot.

3. Despite six personnel on the ground, supervision was such that the tow driver could not hear instructions during push back.

OK, we now know what happened and why this incident occurred. Now, how can you and your crew prevent this from happening at your base X? Just a few suggestions:

1. Make sure you get a thorough ground briefing from the tow supervisor. This will give you the warm fuzzy you need to ensure you are handing the jet over to a competent ground crew.

2. Always know your surroundings. It's true we were still on the jet and it was night. However, we taxied out of the same spot we were to be towed into after the sortie. Had I done a thorough inspection of the parking area before taxiing out, I might have had enough information to give the tow supervisor a heads up on the hazards of this particular parking spot.

3. Take complete responsibility for your crew and your jet at all times. Empower your crew and take ownership of it! If something goes wrong, it's your fault. If you don't want something to go wrong, fix it before it happens.

4. Recognize the dangers of complacency. Although you may be flying the exact same mission over and over, and can predict what's going to happen light years before it does, try this. What can happen? Think outside the jet (box). Hope for the best, but be prepared for the worst. The more experience you have in the jet, the farther outside the box you will need to look.

5. Never, ever stop learning. Study the mistakes of others and keep them in your clue bag when the time comes to prevent a mishap.

The causes of this mishap were no different than many, many mishaps we've all seen or heard about in the past. You'll probably recognize these mishap buzz words: Complacency, failure to follow established procedures, lack of checklist discipline, loss of situational awareness, task saturation, and task prioritization. All of these were causal factors in this mishap and could have been prevented had any of these been identified and expeditiously corrected.

Heed these words, put them in your clue bag, and pass this information on to your aircrew mates. Good luck and fly safe.

Can You See?
A Near Miss With The Navy

ANONYMOUS

We were on a standard refueling mission in the AOR, scheduled to give fuel to two F-18s, among a long list of other receivers—or at least as standard as a mission can get during hostilities. Due to the environment, there were very strict rules about where to fly and at what altitudes–with the primary safety backup always calling for the receivers to enter the refueling track 1000 feet below the tankers. We had briefed as usual and were feeling pretty good about the sortie. This was our 15th mission of the operation with the same crew, and we were very familiar with the routes and rules. As a bonus, it was daytime and we were actually going to get a chance to see everything!

The sortie was uneventful leading up to entering the refueling track. For the operation, there were specific lanes to follow both into and out of the refueling areas, and we were established on a "driveway" leading us to the entry point of the refueling area. As we were getting ready to refuel, everything seemed normal (standard lead-in to numerous incidents), so I decided to take advantage of the lull and hit the lavatory one last time. As I stepped back onto the flight deck, I stared in stunned silence as I saw two F-18s come out of nowhere and fly directly past our nose left to right. Before I could even open my mouth, we felt the unmistakable "thump, thump" of their wake turbulence. I swear (and my flight crew agreed) that it had been less than two seconds before we hit their wake. At 420 KTAS that's about .2 miles (yes, as in POINT two). A near miss? Hmm, co-altitude and 0.2 miles? I would say so. We had no warning—just an impromptu fly-by. I never missed TCAS more (for the combat ops, receivers had TCAS transmitters off).

We got a call shortly thereafter from our F-18s, and the rest of the sortie was uneventful. Was it our receivers who passed off our nose? We'll never know for sure. What I do know is that two F-18s were not where they were supposed to be, and came close to making our flight a whole lot more eventful. I've often wondered about that incident. Unfortunately, we never filed a HATR, but we did report it to our DO and the Intel folks. Of course, this

U.S. Navy photo by Photographer's Mate 1st Class Spike Call

led to the questions, "Are we all flying from the same rulebook?"

To me, this incident highlighted the need for close coordination with not only the Navy but with the Air Force receivers, as well. I can't help but think that a one-minute conversation between the F-18s—something along the lines of,"OK, the tanker will be at 25,000 feet, so we need to come in at 24,000 feet"—would have prevented this near-miss. Of course I am not naive enough to think that fighter pilots have all this extra time on their hands and have nice, uneventful missions in the combat zone, then come leisurely out to the refueling box to get some more fuel, so they can go back to their boring, uneventful combat patrols.

I realize fighters have a million and one things to worry about, and probably the last thing on their mind when they come to get gas is remembering all the nit-noid little rules about how they're supposed to join the tanker. I know that fighter pilots probably think–"I'll never run into a heavy." I know it seems very unlikely that a highly-trained F-18 pilot would fail to see a KC-10 in broad daylight–I don't think I would call the KC-10 a "small" airplane (I would say we're slightly bigger than a Cessna 172). But there I was that bright sunny day over the sand–watching speechless as we got our very own extreme close-up air show. All the success in the world "in the fight" isn't going to matter one bit if a fighter collides with its tanker and doesn't make it home. I can't think of anything more tragic—especially since it probably wouldn't do too much for the tanker's aerodynamic properties, either.

This all leads to the question, "What can be done to prevent this from happening again?" I think a good start would be closer communication between tanker and receiver units. I don't know if we ever communicated in person with the other units—just everyone flying their mission according to what our "rulebook" stated. I now wish I had called the Navy unit myself, to talk about our procedures and what they expected from us. It seems readily apparent to any tanker pilot who's had a close call with a receiver, but maybe we were not all on the same page. And we have become very dependent on TCAS to keep us safe—or at least those of us lucky enough to have TCAS. But what do we do when TCAS doesn't help? Sometimes we, as pilots, can become overdependent on our technology to keep us safe. I remember many times thinking "We don't really have to look outside much—TCAS will keep us out of trouble." Of course TCAS doesn't pick up any planes that have turned off all their emitters (this is also the case flying around airfields with a lot of civilian traffic that may or may not be squawking–another area with high mid-air collision potential).

Even if we were 100 per cent right and the F-18s 100 per cent wrong, the Air Force would still be down one tanker and more tragically the Department of Defense would still be short at least four highly-trained aircrew. There would be no winners. So, the next time you're flying into a combat zone, take an extra minute to think about how you're going to get your gas—and more importantly, how you're going to get it safely.

USAF photo by SSgt David W. Richards

Mid-Air Collision Avoidance

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63 FS
Luke AFB AZ

Since the first aircraft was flown, aviation mishaps have occurred time and time again from the same basic causes. Controlled flight into terrain, mechanical failures, spatial disorientation, bird strikes, and mid-air collisions have comprised the bulk of aircraft accidents since we started flying airplanes. The purpose of this article is to refocus attention toward the avoidance of mid-air collisions. Mid-air and near mid-air collisions tend to occur during three phases of flight: during mission operations, on departure and recovery, and in the traffic pattern.

During mission operations, our situational awareness usually starts out fairly high, but gets degraded as the engagement progresses. Most conflicts occur between members of the same formation, followed by near mid-airs with others involved in the engagement, such as Red Air. Much more seldom are close passes with civilian aircraft transiting MOAs. Decreased experience levels, such as at an RTU or during an upgrade sortie, will obviously increase the likelihood of reduced situational awareness (SA) and possibly the chance for a mid-air. Large force employments (Red Flag, Maple Flag, etc.) are also the source of increased risk. This stems primarily from the fact that there is such a large number of aircraft in a confined airspace. Also, since units do not participate in LFEs as often as we'd probably like, experience levels in these situations tends to be lower.

To help out in avoiding conflicts, we follow the training rules (TRs). The TRs are inherently necessary to keep "order" in what could be an

USAF photo by SSgt Jacob Bailey

otherwise chaotic environment. It is vital to a successful mission that TRs are briefed to the lowest experience level in the formation. Things usually stressed in a flight briefing, especially to inexperienced members of the flight, are block adherence and bubble avoidance, as well as minimum gun and missile ranges.

In addition to just reading the TRs, talk about "what do you do if?" What do you do if you're in a BFM engagement and lose visual? What do you do if you're converting on someone during an intercept and lose your lock? What do you do if you go blind on your flight lead? How about when you're going for guns … what about closure? A rapid cross-check is vital to avoid excessive closure while in pure/lead pursuit. Even though you may be experienced and have done it a hundred times before, you're still vulnerable to lapses in judgment or SA. When in doubt … Knock It Off!

Of course, fighter operations aren't the only potential mid-airs that happen during missions. Heavy mishaps have occurred during tanker ops or in the air refueling track—once again between aircraft that should be flying in relatively close formation with a set of rules already established for deconfliction. Boom operations and tanker track deconfliction is something that should be briefed each flight, again to the lowest experience level, even though there is a set of standard rules. Here again, when in doubt … use the radio, or breakaway while on the boom.

Another time to be extra concerned about the potential for mid-airs is during departure and recovery. As expected, there are usually lots of aircraft converging on the same point in space, at the same altitude. This is especially apparent at UPT/RTU bases with a high traffic count. Also, at joint-use fields, many civilian aircraft will be thrown into the mix; some very slow-moving. In areas such as Luke AFB, many surrounding airfields are always active. One way to avoid conflicts is to stick with the published/stereo departures and recoveries. In most cases, the flow to and from an airfield has been built around the outlying airfields, and ATC controllers (especially those in training) can have difficulty keeping track of and helping you avoid all the other traffic, like non-participating VFR traffic. ATC is not required to give you separation from VFR traffic, although they will if they have time. If you do not see the traffic and think they may be a factor, keep getting updates from ATC until you pick them up visual. If you still have no luck, just ask for an avoidance vector. This works well at Luke; it will usually keep you safe and not cause too much pain.

The third high-density environment is the traffic pattern. This is true at all bases, but especially UPT and RTU bases. Not only do you have lots of traffic there, but many of the pilots are very inexperienced. The best way to keep your SA high and avoid all conflicts is to keep your eyes outside and listen to the radios. Many times pilots will get task-saturated and forget to listen. This is common at UPT bases. Often times the best way to get info on those around you is just to listen to their calls. At the same time, the more standard calls you make, the better others will be able to keep track of you. Like in all the other situations, when advised of traffic and still unsure, keep asking for point-outs. If you're still unsure, break out of the pattern if able.

The closest I've come to a mid-air in the pattern was as No. 3 of a four-ship in 2+2 formation. We were 90 degrees out from the run-in heading, and flying directly to initial for fuel reasons. Tower advised us of another three-ship, in 2+1 formation, already on initial. I was not visual of the three-ship, but assumed No. 1 was. He was visual of what he thought to be the last member of the 3-ship, but what was really the first element, and we continued to initial. As soon as we rolled out on initial, a plane appeared 1,000 feet right in front of me. I didn't see him until he called "breaking out" and started to climb. We quickly descended to deconflict, and then continued into the break without any more problems. My wingman never saw him, and was just flying off of me. This is an example where it would have been better to get a point out to the three-ship from my flight lead. My asking over interflight may have let him know that I didn't see anyone, and maybe we would have gained visual on all three aircraft, and not rolled out right in the middle of their formation. Tower was not visual with players and did not see anything until it was too late.

One common theme to all these situations is that a drop in SA at any point in flight can be dangerous, especially when you have multiple aircraft all flying in a small piece of sky. This may be an all-too-obvious statement, but it's what keeps killing people and wrecking airplanes, so we need to keep briefing it and pointing out when (and where) the breakdowns are most likely to occur. TCAS is a great tool to use--a huge SA builder--but not all aircraft are equipped with it (like fighters or light aircraft). Ultimately it is the pilot's responsibility to avoid other aircraft, and he/she must do what is necessary for safety of flight. Plus, TCAS is a great tool to use (for those who have it), but may not always give you full SA on everyone around you. Stick to procedures, brief the rules, and listen to the radio. When in doubt, talk on the radio. Basic skills like this will keep you safe from most mid-airs and potential mishaps.

Big Sky???
(Near miss between a T-38 and a T-6)

ANONYMOUS

Low-level planning and flying is never easy. Combine that with being a student pilot always bogged down with minute details, and you can easily become overwhelmed.

Such was this day in Pilot Instructor Training at Randolph AFB in San Antonio, Texas. I had returned to the T-38 after a short tour in the B-1B, and was finally in my element: low-level flying. My single-ship low-level missions were fairly uneventful, and now we were progressing to two-ship low-levels. This was my first two-ship low-level, and I was leading my wingman through VR-143, a fairly wide visual route north of San Antonio. All the normal preflight planning was accomplished. I checked the bird condition and weather, scheduled the route, and assembled the briefing. I asked my wingman to call the crossing

USAF photos by TSgt Jeffrey Allen and MSgt Lance Cheung

route agencies to deconflict our time on route with all other routes. He returned with the statement that there would be no crossing traffic for us at any time. So, upon finishing a thorough preflight briefing, including Traffic Collision Avoidance System (TCAS) settings and threat calls, we set out to fly.

The preflight through the route entry went uneventfully, and soon we were in the midst of flying the route. Both aircraft set their TCAS to Resolution Advisory (RA), allowing us both to clear for other aircraft en route. The only disadvantage to this is that occasionally you can have advisories from the other aircraft, but this is far outweighed by the clearing capabilities. I was focused on making appropriate threat calls as per my brief—directive, then descriptive—and therefore was not paying close attention to my altitude. I was varying between 700 and 1000 feet when I needed to be at 500 feet. As my wingman was flying a good position, my instructor thought it would be the perfect time to interject some instruction.

My instructor, as another former B-1B pilot, also knew the importance of staying low, out of the threat envelope. So he took control of the aircraft and began a long speech about how the American pilot flies low-level better than those of any other nation in the world due to our extensive training. It was nearly eye-watering, and when he finished I was more focused on doing what it took to maintain my altitude.

This is when it happened. He had passed a turn point from IP to target and went "heads-down" to set his heading bug and check his fuel. As soon as he looked down I saw over his shoulder a glimpse of light that soon became an aircraft, and it was bearing down on us quickly. Despite my briefing and practice on my threat calls, all I could say was, "Traffic," as he looked up and banked left to avoid the other aircraft. The aircraft flew in between us and our wingman, within a couple hundred feet of us.

The movement of our aircraft was not enough to avoid the collision; we just weren't at the exact point in space as the other aircraft at the time. As the aircraft passed, it was easy for us to identify it as a T-6. We made a radio call to identify its call sign and originating base. We exited the route and returned to Randolph for a normal landing pattern.

We immediately reported the incident to our duty desk, and our Top 3 representative made a few calls on our behalf. The other aircraft was stationed at another Air Force base and was flying on SR-282. A slow route that flies exactly opposite VR-143. Apparently both of our routes share a common point—the point where we met.

They had scheduled the route with knowledge of us, and thought the times would work out where we would never see each other We knew nothing about their entry time, and from our post flight interaction, they rescheduled their time after we had already launched.

This sortie taught me several lessons about flying low-altitude in a high-traffic environment such as San Antonio, Texas. First, deconfliction should be one of your highest priorities in sortie preparation. If this near-miss could happen to two Air Force aircraft, which have regulations and directives to avoid such mishaps, just think what could happen with your low-time civilian pilot who is just out sightseeing.

Second, nothing takes the place of clearing with your eyes out in front of the aircraft. We have TCAS in T-38 aircraft, and the T-6 has a similar system. However, not <u>one</u> of the three systems ever made us aware of the impending danger.

Finally, we all know that math in public is bad, but when it comes to timing aircraft moving over the same point in space from opposite directions, you need to allow some padding. If unable to do this, providing insight to other aircraft via any means possible (radio, ATC controllers, phone calls) is not only necessary, but lives depend on it.

Fortunately, all three aircraft are safely flying today. We could easily have lost not only two aircraft, but also up to four Air Force pilots. Sure, many of us believe in the "Big Sky" theory of flight, but sometimes it is easy for two pilots to both want that same piece. As Air Force pilots, we use lessons learned to expand our procedures and techniques, and this opportunity has provided me the chance to prevent other pilots from having the same experience.

Photo Illustration by Felicia Moreland

MACA In The Threat-Permissive Environment

USAF photo by MSgt Jason Tudor

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On June 17, 2005, at approximately 1612Z, Python 01, a flight of two AV-8B Harriers, scrambles on alert from Khandahar, Afghanistan, to respond to a possible "troops in contact." While proceeding en route, the crew searches with onboard air-to-air radar to ensure there is no traffic between them and the target area. Additionally, GCI indicates the picture is clean. Once within communication range of the endangered friendly ground party, Python 01 leaves GCI frequency and pushes to the ground party's strike frequency. After checking in and authenticating on the strike frequency, Python 01 is passed an AO update, followed quickly by the first nine line. With this information in hand, Python 01 quickly and adeptly finds and fixes the enemy location, while also gaining visual contact with friendly forces.

Python 01 assesses the tactical problem and then passes the attack formation, role, ordnance, and timing interval to his wingman, Python 02, for the ensuing employment. Python 01 maneuvers his aircraft to a proper base position, with his wingman 30 seconds in trail, and then rolls in for the attack. As 01 rolls out on final, tracking toward the target, Python 02, over strike frequency, loudly calls **"Abort, abort, abort."** Python 01 quickly recovers the aircraft without expending and requests a reason for the abort. An out-of-breath and noticeably nervous young wingman states he saw a small aircraft pass underneath his flight lead as he was rolling out on final. Python 01 acknowledges the possible trespasser and immediately begins looking outside the cockpit for possible traffic. Sure enough, his wingman saved the day; now one mile to the north of the target area, Python 01 sees a UAV.

Is this story factual? No; but the situation depicted is not unrealistic. Given the current state of military operations, the preponderance of strike missions within the AOR are pop-ups that fall most likely into the mission classification of close air support (CAS); such as the scenario depicted. With that in mind, the potential for mid-air collisions significantly rises.

First, unlike strike missions, where detailed planning in the ATO provides positive procedural deconfliction, CAS missions, including scrambled alerts, can respond anywhere and at any time. This is true even if other assets (i.e., C-130 troop transport, commercial passenger traffic from Amman to Baghdad, or UAV reconnaissance) have pre-coordinated to use that airspace at a specific time.

Second, unlike flying in the CONUS, radar coverage can be extremely limited or non-existent for a variety of reasons in the AORs (i.e., radar facility force protection or line of sight due to terrain). Therefore, radar traffic call-outs will often

Desert Hawk UAV patrols Tallil

TALLIL AIR BASE, Iraq—SSgt James Ellis adjusts the camera in a Desert Hawk. The Desert Hawk is a miniature unmanned aerial vehicle used by security forces to see beyond base perimeters providing a rapid assessment of threats.

Official USAF photo

not be available unless you are operating in the vicinity of the major cities, or AWACS is on station.

Third, the Traffic Collision Avoidance System (TCAS) is not the be-all and end-all for mid-air collision avoidance. Ask yourself: Do aircraft operating in the above-mentioned AORs have TCAS onboard their aircraft? If your answer is yes, try again.

For one reason, certain aircraft in combat environments will not be squawking for tactical considerations. Therefore, aircrew relying solely on TCAS to provide their air picture are potentially placing themselves and the non-squawkers in a hazardous situation.

Next, the current areas that we are operating in are not restricted solely to military aircraft. With the onset and progression of more stability and peace in Afghanistan and Iraq, we can expect to see a logical drawdown of military aircraft, and an increase in commercial and private aircraft. However, unlike the United States, where air carriers are mandated to be TCAS equipped, the Iraq and Afghanistan governments cannot mandate this upon air carriers entering their country. This may be due to limited financial resources that some of these third-world air carriers pool from.

Finally, most fighter aircraft are not TCAS-equipped. For this reason, many pilots might make the argument that their onboard air-to-air radars provide them with enough situational awareness to mitigate mid-air collisions. The fallacy in this argument takes several forms. First, not all fighter aircraft have air-to-air radars, e.g. the A-10. Second, many air-to-air radars struggle to acquire aircraft that have small radar cross-sections and/or have negligible open or closing velocities, such as many of the currently fielded UAVs. Therefore, their radars are not always as useful as some might think.

Most importantly, close air support is in most respects a mission that is either won or lost through visual acquisition of friendly and enemy forces, aided greatly by recent improvements and fielding of advanced targeting pods and EO/IR sensors. The point being made here is that this mission is not fought with our craniums down in the radar

Official USAF photo by SrA Christina D. Ponte

searching for air threats, but instead focused on the battlefield below, as viewed through MFDs, TVMs, binoculars, or the tried-and-true "Mark I Eyeball."

So, now that we have established that there truly is a high potential for mid-air collisions in the threat-permissive combat environments we so commonly operate in today, how can we mitigate this risk?

There are several ways to approach this situation, ranging from engineering solutions to control solutions, and finally to personnel solutions. However, due to the nature of certain missions and even economic factors, undoubtedly all of these prevention mechanisms should be implemented in order to effect a noticeable and safer change.

For engineering solutions, AF-wide implementation of TCAS could be an answer. Or better yet, Link 16 with integrated TCAS. This way, every aircraft squawking would be displayed, in addition to selected radar points. Also, audio would be provided for collision avoidance with the integration. Aircrew attention may be outside the cockpit for an extended time, such as in a "troops in contact" situation; TCAS would alert the pilot of an impending mid-air collision.

For control solution, the answer lies back in the basics. For areas where ground-based radar coverage is limited, VFR reporting points must be created, and more importantly used by pilots, in concert with ground tracking and monitoring stations. These ground stations would then apply procedural control measures to help build a mental air picture for aircraft flying into those areas. While such measures might already exist, we need to rethink our training programs so that they are better and more fully implemented and used.

Lastly, we can apply personal control measures by increasing overall MDS awareness. Aircrew should increase efforts to know the altitudes at which other aircraft operate, their common route of flights, and the ways to communicate with these other aircraft (i.e., radio types). Then pilots will have a better idea of when and where to focus their visual search.

In conclusion, we see that through a variety of mitigation measures, the potential for mid-air collisions can be greatly reduced in our current combat environments. So, in the future, the Python 01s won't hear **"Abort, abort, abort,"** but instead **"SHACK, GOOD HIT!"**

Mid-Air Collision Avoidance (MACA) For Fighters

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How many times have you sat in a flight briefing and tuned out the flight lead as he or she briefed mid-air collision avoidance? How about when the training rules are briefed? I've heard the mentality firsthand: "I know this stuff … I've heard it a hundred times." If that's the case, why do we still run aircraft together?

I submit that there are two human factor elements that at least contribute to, if not cause, almost every mid-air collision: task misprioritization and misperception. There are other elements that play a factor in some mid-air collisions, but I believe if we combat task misprioritization and misperception, we can break the chain of events that cause mid-air collisions.

In addition, consider where the biggest threat of a mid-air collision exists. In the last four years [this article written in 2004], 17 out of 18 non-air refueling–related mid-air collisions in the Air Force occurred within our own formation or briefed fight. Finally, while this article focuses on MACA from a fighter standpoint, some of the ideas are transferable to our heavy and helicopter brethren.

The mid-air–collision potential outside our own formations is as high as ever. While we have only had one recent instance of a civilian and Air Force aircraft colliding, the negative publicity from this type of incident is unacceptable. Also, the "Big Sky" theory is unreasonable, considering the level of air traffic today.

There is a lot of technology available to prevent mid-air collisions, but for it to be effective, we have to use it, and not over-rely on it. For example, in fighters with air-to-air radar, we always brief that we're going to bracket our altitude with radar coverage and call out factor traffic. This is a great example of using technology, but that doesn't mean we should be craniums-down, staring at the radarscope. There is no substitute for the Mark I eyeball using a good clearing scan pattern, so don't misprioritize your tasks and forget to look outside. Air Traffic Control is another important tool we use to stay clear of traffic, but if we depend on controllers exclusively, we are not using everything available to avoid a mid-air collision. Not using ATC service can be a problem as well. The potential problem I see here is flying back from the working area VFR and not requesting flight following because "it's a pain." Obviously, ATC service only works if you use it.

Because of the lack of ATC service and high amounts of VFR traffic, low-level sorties provide one of the greatest potentials for mid-air collisions. We have good procedures for clearing our flight path on low-levels that work ***if we execute them.*** Too often in the F-15E, I see crews overusing the air-to-ground radar when they should have the air-to-air radar out looking for threats (traffic). Also, don't forget that avoiding traffic on low-level goes back to the brief. Briefing low-level crossing routes, civilian airfields, and areas of high potential for traffic allows us to anticipate conflicts. So, listen up during the low-level brief and keep traffic clearance a high priority, especially in those briefed areas of interest.

As I suggested, the ongoing trend in the Air Force is mid-air collisions within our own formations. Make no mistake about it, training-rule violations are the main reason we have mid-air collisions in our own formations. If we never violated the training rules, we could eliminate practically all of our mid-air collisions. Assuming that we are not flagrantly disregarding training rules, I believe task misprioritization and misperception are what lead to training-rule violations, in most cases. For the purposes of this article, I am including all the aircraft in a briefed training event, such as an air-to-air fight, as part of the formation.

USAF photo by A1C Veronica Pierce

We have all been guilty of task misprioritization at one time or another, and we will probably all be guilty of it again. I would be willing to bet that everyone reading this can think of an instance when they were focusing on the wrong thing at the wrong time and narrowly avoided a mishap, or maybe some of us were not so lucky. When we fly close formation, the priority task is very obvious—don't hit lead! That said, there are documented incidents where pilots in fingertip thought the priority task was to change the radio frequency and as they were doing so proceeded to hit their flight lead or wingman. This goes to show we are susceptible even while doing the most basic things, so imagine when things start to get more complex.

There's no doubt that multi-aircraft Air-to-Air and Surface Attack Tactics (SAT) missions can be some of the most complex missions we fly, but remember even Basic Fighter Maneuvers (BFM) or a benign surface-attack range ride can be task-saturating, depending on who's in your flight. Generally, the mission-planning stage is the first time at the operator level that we can begin mitigating the risk of a mid-air collision. Always start by considering the experience level, proficiency, and currency of everyone in the flight. If we don't over-task flight members, they are less likely to find themselves in a situation where they misprioritize their tasks. That being said, there is only so much we can do in the planning and briefing stage of the flight. During execution, no matter how simple we make the mission, there is always the opportunity for task misprioritization. For example, I have been in a basic 2v2 fight with a wingman who almost hit me because he was concentrating so hard on running the radar he forgot to fly formation. Consider also that he and I were both in two-place aircraft. That means four sets of eyeballs didn't notice a problem until it was almost too late. With the advent of more sensors and the increasing availability of information, it is very easy to get lured into the trap of not looking outside.

The other reason I believe we run aircraft together is misperception. Like task misprioritization, misperception can also occur anywhere at anytime. There are definitely times when we are more susceptible to misperception. Environmentals such as the sun, visibility, and weather can present the biggest problems. If you are looking at your wingman with the sun in the background, oftentimes it is much harder to tell what his aircraft is doing.

Another important contributing factor to misperception is expectation. Meaning: Sometimes we can talk ourselves into seeing something based on what we expect to see. For example, if a flight lead briefs that all rejoins from tactical formation will be turning away and in the air he rocks his wings and turns into the wingman, the wingman

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USAF photo by TSgt Ben Bloker

might misperceive which direction flight lead is turning based on an expectation from the brief. The example probably won't end up in a mid-air collision, but if there were more going on, such as in an Air Combat Maneuvering (ACM) engagement, the potential for a mid-air collision due to misperception based on expectations is considerably higher.

Misperception of closure is something we continue to have a problem with, as well. I know most of us have at least seen HUD tape where failure to control closure created a bad day for someone and their buddy. The first way to avoid this is not to fixate on one spot on the other aircraft. By scanning the other aircraft and keeping the big picture, we prevent the loss of the visual cues we need to assess closure. Closure problems can also be avoided by always using available cockpit tools, such as the air-to-air radar and air-to-air TACAN.

I know none of the points I have brought up here are cosmic. That is because MACA is very much a "back to the basics" topic. If we prioritize our tasks properly and are aware of the potential for misperceptions, we can reduce our number of mid-air and near–mid-air collisions. Finally, don't forget the most basic thing of all—Check Six!

USAF photo by MSgt Kevin J. Gruenwald

FY07 Aviation Mishaps (Oct-Nov 06)

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

FY06 Aviation Mishaps (Oct-Nov 05)

4 Class A Mishaps (4 Flight)
0 Fatalities
0 Aircraft Destroyed

02 Oct ✈ A C-21 departed runway near approach end and caught fire; crew egressed safely.

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 and egressed safely.

- 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 16 Dec 06**.

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