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Inadvertent Instrument Meteorological Conditions (IIMC)

Training Day 56 of the Initial Entry Rotary Wing (IERW) training program is the 10th day into the Basic Instrument phase. The daily student briefing slide presentation on this training day lists three important facts. The first: "The #1 cause of Army Aviation mishaps is human factors (pilot error), NOT hostile fire or mechanical problems!"; second: "The two biggest killers of Soldiers in Army aircraft, in peacetime or war, are inadvertent instrument meteorological conditions (IIMC) and controlled flight into terrain (CFIT)"; and third: "According to accident data, seven seconds is the average amount of time it takes a crew to lose control of the aircraft when they encounter IIMC."

Each aircraft aircrew training manual (ATM) provides training tasks to respond to IIMC. They go something like this:

1. Crew actions.

a. The pilot on the controls will announce "Inadvertent IMC," transition to the instruments, and immediately initiate a climb while establishing aircraft control. The pilot on the controls will immediately announce if they become disoriented.

b. The pilot not on the controls will announce "Inadvertent IMC" and monitor the cockpit instruments to assist in recovery. The pilot not on the controls will announce when the aircraft is in a positive climb, the altitude and altitude climbing to, and the aircraft heading (and desired heading when required for obstacle avoidance and multi-ship operations). He will adjust the transponder to emergency, tune navigation radios as appropriate, and make the appropriate radio calls. The pilot not on the controls will perform any other tasks as directed by the pilot on the controls and remain prepared to take the controls should the pilot on the controls become disoriented.

c. The non-rated crewmember (NRCM) will focus primarily outside the aircraft to provide adequate warning for avoiding terrain or obstacles and will announce if visual meteorological conditions (VMC) are encountered. The NRCM will perform any other crew tasks as directed by either of the pilots.

2. Procedures.

The crew should consider establishing (during the crew mission briefing) a torque/power setting and airspeed appropriate for the mission environment to use in the event of encountering IIMC. This can help eliminate confusion during the actual emergency. The most important action upon encountering IIMC is to immediately begin climbing while establishing aircraft control via the instruments. Immediately establishing a climb does not necessarily mean immediately increasing the collective, if the aircraft is in a turn and nose low, for example, increasing the collective before setting the correct attitude may be fatal. Once aircraft control is accomplished, the transponder should be set to emergency to alert air traffic control (ATC). Tuning navigational radios or making radio calls will be determined by ATC directives and local procedures. The crew should contact ATC on guard and allow ATC to assign an appropriate altitude and heading/course, and, if necessary, an appropriate frequency. If radio contact cannot be established first, the crew must ensure that navigational radios are tuned as quickly as possible to determine the aircraft's position and appropriate course for recovery.

Procedural versus Behavioral

We have a good ATM procedural layout for crew actions and procedures for an IIMC event, but you have to remember, it is an unexpected, undesirable encounter and we're behaviorally averse to transitioning from VMC flight to instrument flight. With sight providing 80 percent of our sensory input (depending on the source information) this transition can be overwhelming. Effective communication is essential in a smooth, successful transition to instrument flight. What do I mean? Above all else we have to fly the aircraft, the pilot not on the controls (P) is the safety pilot ensuring the pilot on the controls (P*) is actually doing what they think they're doing. In order for that to happen the P* should be talking through his actions, i.e., leveling the aircraft pitch and roll, adjusting for climb power, slowing or accelerating for the desired airspeed, etc. With this verbalization, the P can effectively back up the P* either with vocal inputs or minor flight control input to help him achieve his desired settings, make sure the aircraft is in stable flight, then move on to setting transponders, tuning navigational and communication radios, and contacting ATC.

IIMC Considerations

When it comes to making that IIMC call and committing to IMC flight there are a multitude of factors to consider: mission; mission planning; weather in terms of icing; terrain; operating area; aircraft capabilities; pilot proficiency; and command climate.

A majority of our rotary-wing aircraft missions are visual flight rules (VFR) missions and the crew focus/desire to achieve that mission can cause them to push their limits. In regard to mission planning, if detailed IIMC planning is completed to include safe altitudes and headings, identification of appropriate ATC agencies and frequencies along the planned route, then the IIMC call will most likely be made in a more timely fashion if the situation calls for it, rather than waiting until everything is past falling apart.

A timely organized call for IIMC is more critical with multi-ship formations. Obviously, poor weather is the primary cause of an IIMC event, but how will icing affect your aircraft? If icing is forecast or reported to be greater than the limitations of your aircraft anti-icing and de-ice systems, your mission planning should have included landing, modifying or a return to base (RTB) criteria before encountering an IIMC event. Terrain and area of operation considerations are also critical. Operating in mountainous areas with no means to avoid terrain may eliminate the option of going IIMC, requiring again more clear-cut abort/turn back criteria.

Pilot currency does not always equate to pilot proficiency. Even when you're proficient in instrument skills, being thrust into IMC from a VMC flight can be startling! This is particularly true if you've not given IIMC its due diligence during mission planning and it isn't covered during the mission brief. If you didn't plan for it, brief actions if encountered, then you and your crew are not prepared for it. Command climate aversion to IIMC, whether perceived or actual, can play a role in the planning and decision to recognize and take actions if you inadvertently fly into IMC during a VMC mission. Whether actual or not, if you perceive the command climate on going IIMC is a failure on the pilots part in some way, then pilots will be less likely to take the appropriate actions if or when they do encounter it, leading to higher risk and unsafe actions.

IIMC Canvassing

Interview responses of a large number of senior aviators from units throughout the Army referring to command climate as it pertains to IIMC events, whether perceived or actual, provided a wide range of answers. Response examples were: "Regardless of the amount planning and preparation, the risks associated with the type of flying we do may put us in an IIMC situation"; "The timely and proper execution of IIMC procedures is critical and a reality of our business"; "Views/position a crew that has pushed its mission to an IIMC event has in some way failed in mission planning and execution".

Getting Personal

With over 31 years of military service, I've experienced four IIMC events. The first was on the Antarctic Continent while navigating a narrow valley leading to an opening in a glacier. The weather, unknown to me, was closing in behind us. As I reached the glacier, it was obvious the weather was rapidly coming down and the crew quickly realized the weather closed our back door. Since the aircraft could not handle the icing, we would pick up in the clouds the only option was to land. With a quick recon, a site was selected and approach begun. At 130 feet from the ground, we were over taken by blowing snow, completely IMC as ceilings above rapidly decreased. Understanding my aircraft, its limits and capabilities, I set a landing attitude that would provide for an appropriate airspeed deceleration to the ground, adjusted the rate of decent within touch down parameters for the aircraft, and safely landed with a 12-foot slide (skis were installed on the aircraft). Eighteen hours later, when the weather cleared we returned to base.

The second and third events occurred during the same mission night. We were navigating to a mishap site at approximately 0200 hours. While conducting the rescue operation over coastal marshland south of New Orleans, LA, we encountered low clouds. We were under night vision goggles (NVG) with no visible ambient light. We used visible marsh grass patches below us to provide surface visual reference along our intended route. On the first two attempts, we ran out of visual reference points and were IIMC, so we quickly executed the ATM task for IIMC and contacted ATC, with an instrument approach into Navy New Orleans. The mission was successfully completed on the third attempt.

The fourth IIMC event was in southeast Alaska, while traversing a narrow mountain pass a snow storm quickly rolled in on us and with no place to land. By the time we slowed down to turn around, we were in a heavy snow squall dropping visibility down to a few hundred feet. Even if the aircraft could handle the icing, getting to a safe altitude without flying into the side of a mountain was not probable. I came to a stop, found a tall tree and parked my chin bubble on the top of it, at about 110 feet above ground. We had five and a half hours of fuel to come up with a plan "B". The snow squall passed after about 30 minutes and we continued on our way.

IIMC, Have a Plan

At the end of the day, what's the answer? It's not simple. Unless part of your current mission profile provides flying instrument flights in IMC conditions on a regular basis, an IIMC event is going to push you to your limits. When I say flying instrument flights, I mean in IMC conditions, not in VMC, it's a different set of tools when you're in the clouds and have no visible horizon.

I have been told of units that only allow instrument training under VMC as a risk management tool. I use this crew coordination technique when our aircraft encounters IIMC. I am not quick to take the controls if the flying pilot is having problems with the transition. If they're having problems and you're not certain how useful they would be as the P when you become the P*, then maybe the best technique is to back them up on the controls and with aircraft orientation while keeping a good scan going. With that said, you must take the controls before allowing them to put the aircraft in an unrecoverable situation.

When/if the P* is not responding to verbal commands, the two challenge rule should apply and take appropriate actions. Remember it isn't a "three" challenge rule. I've listened to black box recordings where the P gave verbal commands three, four, even five times that the P* is doing something that's placing the aircraft in a perilous situation with no response or corrective action from the P*, resulting in aircraft and crew being lost. Perhaps one of those times the P should have, instead of telling the P* what they're doing wrong, tell them what they need to do in order to correct the problem, i.e., increase power/lower the nose, etc.

Effective communication is critical during an IIMC event, once again as mentioned previously, if I know what the P* intention is through their vocalization, then the P can assist them with appropriate corrective inputs both vocal and physical if needed. At that point, it's a team event. In pre-mission briefings, if the flying conditions warrant it, you need to do more than just state as per the standard operating procedures for the IIMC portion of your brief. You should discuss headings, altitudes, ATC frequencies, etc. Discuss/decide during the brief what flight limits frame the decision points for modifying, canceling or returning to base (RTB). Options should always be discussed and rehearsed such as landing on a safe area, transitioning to instruments or aborting the mission and RTB. Don't forget to use dynamic risk management and continually assess the risk and take control measures.

Be Ready for IIMC

When your crew is executing the mission, if you're thinking about a hazard, it's time to start thinking out loud and use effective crew coordination. Bad situations don't get better with time or silence. For training, go beyond simply regurgitating the IIMC task, discuss and rehearse critical decision points and actions on contact with IIMC. Verbalize and communicate your thoughts about what you might be thinking in those seconds before you have that IIMC event or the minutes before that as you struggle to maintain visual references. Oh, and by the way, your boss wants to get to that field site even if the weather is bad…what will you do? ■

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When It Wasn't Written-Up in the Logbook

How many times have you completed a job or conducted troubleshooting on a manned or unmanned aircraft and didn't feel there was sufficient time to make the appropriate aircraft logbook entries? In accordance with (IAW) Department of the Army (DA) Pamphlet (PAM) 738-751, The Functional User's Manual for the Army Maintenance Management System – Aviation, all work requires an entry on the required forms.

Some would say not making the write-ups is cutting corners, while others see making write-ups as a hindrance to executing the mission due to time and operational constraints. In both instances, if you failed to enter a write-up or have been the one in charge directing maintainers not to write it up, you're causing a major circumvention of Army directed procedures. These procedures are in place to annotate discrepancies, generate a historical record, provide the details of work performed, and ensures the airworthiness of the aircraft.

Are Write-Ups Really That Important

Is making the write-up really that important for every minor discrepancy? Let's look at a hypothetical situation to shed some light on just how important that simple annotation in the logbook is to airworthiness and the safety of flight of the aircraft.

For our situation, a forward deployed UH-60L aircraft is preparing to launch on a routine mission. As the crew is running up the aircraft, the stabilator fails the stabilator test. This is a grounding condition, so the pilot in command (PC) calls flight operations and the maintenance avionics team responds. They test the system and make a few checks of some canon plugs for security. The pilots start the test again and the stabilator passes the test.

One of the Soldiers makes a decision to not write-up the stabilator discrepancy in the logbook so the crew can make their takeoff timeline. We all know this should have been written-up, but we all know that over our careers in Army aviation, sometimes we believe we are good-to-go without making the write-up. We convince ourselves bypassing this critical step prevents the mission abort, reduces aircraft operational readiness down time reporting and reduces stress on the command. Whatever the reason, our hypothetical crew departs and completes the mission.

Several days later, another crew is flying the aircraft for the same daily mission. While this crew is in mission profile, they begin to experience stabilator auto mode failures. They remember some other pilots mentioning the aircraft stabilator auto mode fails often, but that the maintainers and maintenance test pilots never received a duplicate fault. The pilot in command (PC) decides to continue the mission and instructs the pilot (PI) to use the manual mode to slew the stabilator to full down below 40 knots and to zero once above 40 knots.

The mission continues and the crew is on their final leg and are departing the final landing zone en route to their home base. They pull pitch and are using an airspeed over altitude technique as they descend off a pinnacle to remain in terrain flight mode. As the crew takes a breath after a long mission day and continues to accelerate, they fail to remember to adjust the stabilator manually to zero degrees once above 40 knots. As the aircraft continues its acceleration, once at 100 knots the nose begins to tuck without control input by the PC. Suddenly the PC loses complete control of the longitudinal pitch axis and the aircraft crashes into the terrain. A complete aircraft loss and all aircrew fatalities.

"These procedures are in place to annotate discrepancies, generate a historical record, provide the details of work performed, and ensures the airworthiness of the aircraft."

Oh Yeah, That Write-Up That Wasn't Made

In this hypothetical situation, a tragedy occurred. What if the write-up had been made and the aircraft maintainers and maintenance test pilots had a historical record of the aircraft stabilator auto mode failures? What if each time an aircrew flew the aircraft and it encountered a failure of the stabilator automatic system requiring manual mode to complete the flight, the crews would have made the write-up?

In this scenario, since no write-ups were made over a period of time, no in-depth inspections and stabilator test procedures were performed on the aircraft. One could believe that each time a failure occurred, it was with a different crew, and without making the write-up, the history of the failing stabilator ended with each mission and the entry of "Flight X OK" in the aircraft logbook. Had the write-up been made, the aircraft would have been grounded and eventually, with proper maintenance procedures and troubleshooting, the problem with the aircraft stabilator would have been resolved and the aircraft would have been fully mission capable.

What Will You Do

After reading through this hypothetical situation and having a better understanding of the importance of making the write-up, what will you do the next time you have a maintenance issue with your aircraft? Will you tell the maintainers, if they can't duplicate a failure or they wiggle some wires and the system begins working, that they don't need to write it up? Maybe the unit has an unwritten policy and crews and maintainers don't red X the aircraft status symbol if they are about to depart on a mission and what was inoperative is now working.

The list could go on and on of reasons why the write-ups aren't made. Unfortunately, the loss of the historical record of discrepancies, especially ones that recur in flight systems, doesn't allow the maintenance system and personnel to be able to trace the problem and resolve it. Just as if the quality control section doesn't maintain historical records of parts that have time limits between overhaul, not making the write-up of faults that didn't duplicate or for some reason started working again, you lose the record of an intermittent failure of a system or piece of equipment. The write-up provides a record and gives visibility to maintainers, maintenance test pilots, and production control of the further degradation of an aircraft system and the need for more in-depth maintenance or pass-back to a higher-level maintenance facility.

In our hypothetical situation, several factors resulted in a catastrophic mishap. Not making the write-ups was one of the major factors. Just think about that the next time you are told not to make the write-up, or as a leader, you think about telling a subordinate not to make the write-up or as a pilot when you have a discrepancy and are thinking of just signing off the flight as "OK." Remember, the next crew flying that aircraft may not make it home because others thought the write-ups weren't necessary. ■

Aviation Division
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Emergency Procedures: *Fly the Aircraft First*

During the Army transition from the UH-1/AH-1 to the Black Hawk and Apache aircraft, numerous experienced single-engine pilots were introduced to the nuances of multiple engines, backup systems and enhanced pilot assist which required a change in their mindset on how to respond to different aircraft emergencies.

An example: On the first flight in the UH-60 aircraft qualification course (AQC), the instructor pilot (IP) was demonstrating several basic flight maneuvers to the rated student pilot (RSP). Hovering work, normal takeoff and landings as well as roll-on landings were performed. The RSP was then given the opportunity to repeat the maneuvers. On the third or fourth takeoff, just prior to the turn to cross wind, the IP reached up and retarded the No. 1 engine power control lever (PCL) imitating an engine failure. The No. 2 engine picked up most of the power requirements from the reduced No. 1 engine output but not enough to prevent a reduction in main rotor RPM and annunciation of the low rotor audio. The RSP continued the upwind with no significant change in the flight controls. After several seconds, the IP queried "Aren't you going to do anything?" in reference to the steady tone in his helmet and the desire to have the RSP adjust the collective downward to allow the rotor to regain RPM. "Nope," replied the RSP as the turn to crosswind was initiated, "it's flying just fine. I'll deal with it in a moment." Although not the book response dictated in the aircraft operator's manual, the RSP had completed a quick analysis of the situation and decided to fly the aircraft first before initiating actions that were unfamiliar due to inexperience and lack of knowledge.

The above situation, relatively benign in nature based on the flight profile, becomes more critical with changes in the environment. In terrain flight or mountainous areas new hazards are presented in the aircraft flight profile which must be included in the crew analysis and response to an emergency

situation. Responding with memorized steps may not be enough to encompass the total response to the emergency. Example: While conducting a night air movement security mission in mountainous terrain at 1,500 feet above ground level (AGL), the AH-64's No. 1 engine oil pressure low caution message annunciated with a corresponding reduction in engine oil pressure. The pilot in command (PC) reduced the No. 1 engine power lever to the idle position, but there was not enough power available to execute a safe approach and landing to the ground. The aircraft could not maintain altitude and impacted the ground. The PC and the pilot (PI) both knew the appropriate emergency procedures; however, they did not apply the appropriate crew coordinating actions to ensure a successful approach and landing. The PC focused on the low oil pressure warning without acknowledging a lack of single engine capability. This was counter to the caveat of "when conditions permit." Reducing the No. 1 engine power lever to the idle position resulted in excessive decay of rotor rpm, which diminished the capability to arrest the aircraft's rate of descent. The aircraft had adequate power to land with both engine power levers to the fly position but was not considered in the final response. Fly the aircraft first.

Published changes to emergency procedures may occur based on review of performance history of aircraft systems, malfunctions, required responses, mishaps and the need or ability to reduce risk in the performance of the procedure. One such example occurred numerous years ago prompting an in-depth study and subsequent changes to procedures and training. On a clear night, two UH-60s were flying overwater at 700 feet AGL at 140 knots along a coastline. About 15 minutes into the flight, the crew of the trail aircraft radioed Chalk 1 to alert them that Chalk 1's No. 2 engine was on fire. They received no reply but watched as Chalk 1 immediately turned toward shore. Shortly thereafter, Chalk 1, in a descent, hit the water at 214 knots and sank. All four crewmembers perished. The mishap was the result of the crew's mistaken reaction to a single-engine emergency. The No. 2 engine had failed due to a gas-generator turbine failure. The aircraft had single-engine flight capability. Their mistake? During their response to the emergency, the crew shut down the wrong engine (No. 1 engine). A subsequent study (The Wrong-Engine Study) conducted by the United States Army Aeromedical Research Laboratory (USAARL) identified recommended changes associated with engine emergency failures. These changes included 1) increased aircrew coordination training, 2) expanded school training on correct engine malfunction analysis and emergency procedures, 3) increased simulator training, 4) revisions to checklist emergency procedures to stress control of the aircraft and time allowed for reaction, 5) increase individual aviator proficiency training (See Flightfax June 1997 issue). Although more than 25 years ago, the lessons learned are worth reviewing as a more recent mishap investigation identified similar circumstances and findings.

Recently, the United States Army Aviation Center of Excellence (USAACE) introduced the Emergency Response Methodology (ERM), a refined approach on how crewmembers respond to aircraft emergencies. It provides a formal, trainable response process for crews to follow and teaches crews to respond to aircraft emergencies in context to the aircraft's flight profile. In all instances, crews must fly the aircraft first (See Flightfax Special Edition No. 2). ■

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Crew Selection: *Beyond the Aviator*

Typically, when Army aviation personnel hear the term "crew selection" their mind flashes to images of aviators and how much experience they have or their readiness to execute a mission set. Just relying on the aviator and crew information to manage crew selection proves a false model. Crew selection requires leaders to think beyond the aviator and crew. To select the best crew for a mission requires trained and informed leaders that look critically at each of these elements: the crew, the mission, the mission briefing, and the risk level. Many times, based on mishap data, the leader critical look is a missing link.

A Case Study, Six Fatalities

During support of a counter-drug mission a crew encountered spatial disorientation (SD). The mission was to support the Department of Justice (DOJ) in carrying out the culmination of a counter-drug mission in a Caribbean island location. The mission support consisted of three UH-60s, one UH-72, and one OH-58. The mission was a night vision goggle (NVG) over water flight. During the mission, a UH-72A aircraft crashed into the sea and resulted in six fatalities and the loss of an aircraft. We will look at this as a case study of crew selection and the importance of leader critical looks at each of the key elements provides. In this case study, unfortunately, the critical looks did not occur.

THE ELEMENTS

Element 1: The Crew

The crew selected for the UH-72 required two aviators who were NVG trained and current. The aviator crew selection for the mission consisted of a pilot in command (PC) with 410 hours in series and 1,750 total hours and a pilot (PI) with 403 hours in series and 2,567 total hours. At first glance, this crew looks right for the mission. But had a critical look at just this element been conducted by leaders, they would have determined that the PC was not NVG current in the UH-72A and had not flown the aircraft in 161 days (yes, that's 161 days) and the PI had not flown NVGs in 52 days and had not flown any aircraft in 40 days. Of note, the PC failed to notify leadership of this and additionally misrepresented the crew was current and had recency on the risk assessment worksheet (RAW).

Element 2: The Mission

The mission was in support of the DOJ and was conducted by an Army National Guard (ARNG) aviation unit. The aviation leadership, the state Army aviation officer (SAAO), and crews performing the mission were not briefed on the mission and scope until the day of the mission. The DOJ mission briefing consisted of a hasty 20-minute briefing to the SAAO and crews.

There was no assigned air mission commander (AMC) for the Army crews, nor detailed planning conducted by the crews due to the DOJ short timeline from brief to execution of the mission. Based on the short fuse mission and apparent secrecy, the ARNG leadership involved had no knowledge of the large scope of the mission and failed to direct the appropriate planning time and rehearsal requirements necessary based on Army Regulation (AR) 95-1, Flight Regulations, and the military organizations standard operating procedures (SOP). The leadership failed to look critically at the mission elements and take action to ensure that Army aircrews could accomplish the mission within regulations and SOP.

Element 3: The Mission Briefing

The mission was briefed by the DOJ followed by crews executing their hasty planning and functions for the mission. The crews completed four separate flight plans and four separate RAWs. The RAW was assessed as low risk for the UH-72. The crew of the UH-72 was mission briefed by the PC of the OH-58 who was the detachment standardization instructor pilot (SP). The OH-58 and the UH-60 mission briefing were accomplished by one leader, while the UH-72 briefing

officer was by a different briefer, the OH-58 SP. The SAAO was the final mission approval authority for the UH-72 and the UH-60 crews while the OH-58 crew was approved by the assistant state adjutant general due to a high risk on the RAW for a single-engine aircraft overwater.

Upon arrival at the staging site, the aircrews put in a request for weather (approximately 1600 hours) but received no Department of Defense (DD) 175-1, Flight Weather Briefing, from the supporting military weather squadron, nor prior to mission did they follow-up on the request. They decided to use the terminal area forecast, which based on their mission, was in contravention with the unit SOP. The leadership briefing the mission failed to look critically at the mission briefing elements and ensure they were in accordance (IAW) with AR 95-1 and the unit SOP.

Element 4: The Risk Level

Based on the short notice mission notification and no preparatory mission information to accomplish basic mission planning, the ARNG aviation crews were unable to address the scope and complexity of the mission and implement controls. Leaders failed to look critically at what the DOJ had planned for the aircrews and to address risk levels adequately resulting in failed controls being implemented or no controls implemented. Aircrew risk levels were beyond low for more than just the OH-58 aircraft but were not addressed on the completed RAWs. Had the critical look been executed by the ARNG mission briefing officers, they would have been able to address the deflated risk, just in observing that no DD 175-1 for the mission was on file. This would be followed by addressing the fact that the UH-72 mishap aircraft aircrew was not current in NVGs or recency.

Conclusion

Numerous flags were present leading up to this loss of six personnel and an aircraft, yet due to a failure of leaders to take a critical look beyond crew experience, no leader took action. They relied on the RAW and were overconfident that their aircrew members could make the mission happen, no matter how complex. Unfortunately, the mission was never completed and three aircrew members and three passengers became fatalities.

To preclude these devastating consequences for aviation units, leaders must look beyond the crew experience and take an active role in critically looking at each part of the mission process elements:

- The crew- Currency, recency, experience for the mission scope and complexity. Take crew dynamics into consideration, personalities and personal conflicts between crew members.
- The mission- Proper planning time available based on scope and complexity ("This mission has multiple stopovers, is over water, and under NVG. We can't support this mission without time to properly plan it, rehearse it, and implement controls or adjust the risk level and have it approved at the proper command level."); requirements for weather and equipment can meet parameters IAW AR 95-1 and local SOP.
- The mission briefing- Trained and ready mission briefing officers; briefing officers look in-depth at each critical element and ask leading questions requiring aircrews to provide direct responses with facts ("Where is your DD 175-1 print out?").
- The risk level- Proper application of the 5-Step Risk Management process IAW Army Techniques Publication 5-19, Risk Management; Properly address the RAW with accurate information and verify aircrew entries ("How is your risk low when you can't produce a DD 175-1?"), ("I am subjectively increasing this risk level to high based on a lack of planning time and mission complexity, so the CG will be the approving authority").

Leaders you are responsible for the mission (commander, platoon leader, mission briefers, approval authorities, AMC, SP, and PC). Use a critical look at the elements to gain the information you need to make an informed decision and implement controls as necessary or push the mission approval to higher levels of responsibility. ■

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Army Flight Test & Risk Management

Operational Army aviators with specialized technical training, Experimental Test Pilots (XPs), help bridge the gap between the Warfighter and the integration of future technologies. Ensuring dominance against near-peer threats requires that Army aviators and engineers regularly participate in flight testing associated with supporting Science & Technology (S&T) and Developmental Flight Testing. In addition to developing technical and operational capabilities, this testing also assesses system-level hazards, ensuring robust human systems integration, and enabling the operational aviator to focus on mission accomplishment and safety of flight. Experimental flight test operations are broadly defined in terms of support to S&T and Developmental Testing (DT). Army Futures Command (AFC) XPs support S&T research, where test pilots explore and mature new technologies in pre-production configurations. Army Test and Evaluation Command (ATEC) XPs perform DT, where test pilots verify technical performance and determine potential hazards for prototypes and production systems to be fielded – at the component, system, and system-of-systems levels.

As you can imagine, the risks associated with the various types of flight testing run the gamut from lower risk (new EGI or Doppler/GPS software) to higher risk (first flight of prototype/demonstrator aircraft). It is important to note that Army XPs use the normal Army Risk Management process to identify, mitigate, and accept risk, however the unique nature of experimental aviation operations requires specialized expertise, training, and rigorously detailed preparation. At the U.S. Army Redstone Test Center, XPs and flight test engineers (FTEs) identify test-specific risks during the test planning process in working groups that develop a Test Specific Risk Assessment (TSRA). These are risks that are specifically associated with the flight test regime of the system under test and may include hazards due to test instrumentation or operations outside of the typical envelope of the aircraft. The TSRA must have Command approval prior to flight test execution. Additionally, a Technical Committee, comprised of Senior XPs and FTEs, provides input and recommendations into flight test techniques prior to execution.

Army XPs are specially trained technical experts, with a strong operational background, who conduct this flight testing to collect, validate and verify data on behalf of the Army to inform technical and safety related decisions for the materiel developer. While aircraft/system manufacturers regularly conduct extensive testing themselves, active duty and Department of the Army Civilian (DAC) XPs are the independent testers for the Army's decision-makers, providing conclusions and recommendations based on the technical data and their Army Aviation mission experience. Army XPs use their operational experience to ensure testing is relevant, appropriately conducted for the aircraft's intended mission, and supports Army Aviation system safety efforts. U.S. Army XPs, commissioned and warrant officer aviators, are graduates of the United States Naval Test Pilot School. The Army sends nine test pilot candidates a year to this

rigorous 11 month course. Test hazard identification, mitigation, acceptance, and system safety are integral components of every aspect of the flight test curriculum taught at the school.

Flight Testing and System Safety Integration during the Test Planning Process

Identifying the risks and hazards associated with flight testing is a detailed process that begins with a comprehensive test plan outlining every maneuver to be conducted along with all of the associated parameters (gross weight, CG, airspeed, pressure altitude, etc.). If it's not in the test plan, you can't fly it! Next, the test team looks at every maneuver/condition to determine if any additional test risk outside of normal flight operations should be discussed and mitigated by the test team. Additional test risks could be related to aircraft configuration/flight regime (operating outside of the approved gross weight/CG envelope), conducting specific non-ATM maneuvers (tethered hover, structural demonstrations), or because the new aircraft structure/systems have known problems or haven't completed initial testing. Those additional test risks and hazards are incorporated into either the test plan or TSRA to be reviewed and approved by a committee of senior XPs and engineers before being accepted by the chain of command at the appropriate level. Prior to infrequent or higher risk testing (flight loads survey, minimum controllable airspeed single-engine, rejected takeoff, touchdown autorotation, etc.), specialized training tailored to the specific aircraft and test is required to be completed. For example, prior to stall or minimum controllable airspeed single-engine testing in fixed wing aircraft, Redstone Test Center XPs are required to conduct a tailored stall, extreme unusual attitude, departures, and out-of-control training flight in the Army T-6D aircraft with an IP to prepare them for a worst-case aircraft condition. Throughout testing, system safety is assessed and all hazards are well documented, categorized IAW MIL-STD-882E, and include any applicable warnings or cautions.

Supporting Army Aviation Efforts

Army XPs have been involved with testing all of the current Army Aviation systems, aircraft, and modifications and are postured to continue to inform the materiel development of FVL aircraft in preparation for future flight testing. XPs have a tangible impact on materiel and equipment used on the battlefield by the Warfighter. From full acquisition programs, to rapid fielding initiatives, to finding solutions to critical issues in the field — XPs are a key member of the team.

Summary

Flight test risk management has unique flight regimes and conditions that must be identified, mitigated, and accepted in a detailed, deliberate manner to ensure the safety of the crew and test article. The additional specialized schooling and training, combined with technical expertise and operational experience, allows Army XPs to precisely and safely execute experimental flights under the most demanding conditions. Truth in Testing! ■

**Note: Army aviators interested in applying to become an Experimental Test Pilot should see the current HRC MILPER message 21-002 (https://www.hrc.army.mil/Milper/21-002) for a list of requirements and application information. Deadline to apply is 22 Feb 2021. For more information about what Army XPs do and/or the application process, please contact the recruiting team at: usarmy.redstone.atec.list.rtc-xp-recruiting@mail.mil.*

MAJ Thomas Boehm

DAC Phil Catoire

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Experimental Test Pilots
Aviation Flight Test Directorate,
US Army Redstone Test Center

Flight-line Driving

Every flight-line has unforeseen hazards and Army aviation strives every day to mitigate them. These hazards pose a threat to our aircraft, equipment, and Soldiers when they are not identified. Identifying these hazards is the responsibility of each and every individual that steps foot within the gates of the airfield. One of these hazards is the vehicles that operate on the airfield and the individuals that may or may not be licensed to operate them. Let us take a look at the flight-line credentialing and licensing process.

Flight-line Driver Training Program

Army Regulation (AR) 95-2, Air Traffic Control, Airfield/Heliport, and Airspace Operations, provides guidance for safe ground vehicle operations and pedestrian control on Army airfields (AAF)/ Army heliports (AHP). Flight-line driver training prevents runway incursions, property damage, and personnel injury. Federal Aviation Administration (FAA) Advisory Circular (AC) 150/5210–20A may be used as a guide in developing this program. The airfield division chiefs will designate a flight-line driving training program manager and outline responsibilities. The unit's master driver is encouraged to coordinate with the airfield division chief to schedule and track unit personnel required to operate vehicles on the flight-line. This includes anyone operating a fuel truck, forklift, crane, tug, gator, tractor, or other military vehicle. Contractors that operate on the flight-line are also required to obtain a license. Here are a few items the flight-line driving training will address, at minimum:

(1) Definitions and descriptions of local movement and safety areas.

(2) Procedures for entering and exiting movement and safety areas.

(3) Two-way radio communications with control tower and approved phraseology.

(4) Runway incursion prevention.

(5) Airfield signs, lighting, and markings.

(6) Speed limits.

(7) Vehicle lighting and marking requirements.

(8) Air Traffic Control (ATC) light gun signals.

(9) Vehicle operations in the vicinity of aircraft.

(10) Foreign object debris (FOD) prevention.

(11) Obstacle clearances.

(12) Rotor wash, jet blast, or wake turbulence hazards.

The flight-line driving training program manager will provide training for all personnel who operate vehicles on the AAF/AHP as well as maintain training records and exams for personnel who have completed the training for the duration of their assignment. The flight-line driving training manager will develop and implement a certification exam, issue a locally developed certificate or license to authorized drivers, and provide annual refresher training for authorized drivers.

Training Circular (TC) 3-04.16, Airfield Operations, also provides guidance for drivers training and establishes speeds to obey while driving on the flight-line. The maximum speed limit for all vehicles on the flight-line is 15 mph (excluding emergencies). The maximum speed limit for all vehicles operating within 25 feet of an aircraft is 5 mph, however, the speed of vehicles will not exceed 3 mph (walking speed) when within 10 feet of the aircraft, to include movement inside the aircraft rotor system. Drivers of vehicles that operate on ramps, taxiways, or runways will have, on file, evidence of satisfactorily passing a written examination. The examination will include clearance requirements between aircraft and vehicles, light signals, and radio procedures if vehicles are so equipped. All drivers for the airfield services branch should possess the appropriate military driver's license and special authority to operate on the airfield movement area.

Army Regulation 600-55, The Army Driver and Operator Standardization Program, mandates drivers' qualifications and states that all Army Service members and Department of the Army (DA) Civilian drivers must have a U.S. Government Motor Vehicle Operator's Identification Card (OF 346) or DA Form 5984 – E, Operator's Permit Record, and demonstrate their proficiency in order to operate the equipment listed in Army Regulation 600-55, paragraph 7-1. Unit master drivers will issue the appropriate license once the training is successfully completed.

Mishap Summary:

After reviewing the last five years, there have been 15 accidents ranging from Class A-D as a result of operations in and around aircraft. This has led to the reduction of combat power and the support to the warfighters depending on these assets. Please take the opportunity to review these accidents and relate them to your everyday operations and think of how you could mitigate these mishaps in your formation. ■

Summary:

The first line of defense is the individual. If you do not have a current operator's license and endorsements, DO NOT assume the risk of operating the vehicle. Do the right thing and find someone that is properly licensed to drive the vehicle. Then, I encourage you to ask the next person you see driving on the flight-line if they have a flight-line permit.

References:

AR 95-2 Air Traffic Control, Airfield/Heliport, and Airspace Operations

AR 600-55 The Army Driver and Operator Standardization Program (Selection, Training, Testing, and Licensing)

TC 3-04.16 Airfield Operations

CW4 Robert Moran
Aviation Accident Investigator
Aviation Division
Directorate of Assessments and Prevention
United States Army Combat Readiness Center

	Years	Vehicle	Class	Results
G	2014	UH-60M	C	SCAMP
G	2015	B737	D	LMTV struck wing
A	2015	MH-47G	C	Special vehicle training during loading caused dmg
G	2016		C	HMMWV blade dmg
G	2016	AH-64	C	HMETT refueler
A	2017	CH-47F	C	Forklift struck aircraft during download of pallet
G	2017	MQ-1C	A	UA struck by vehicle while parked on taxiway
G	2017	AH-64	C	HMETT refueler
G	2017		D	Gator struck stabilator
G	2018	UH-60	C	Kubota struck aircraft
G	2018	UH-60	C	HMETT refuel struck blade
G	2018		D	Aircraft collided with Tug
A	2019	UH-60M	C	Struck by ground vehicle
A	2019	CH-47F	C	HMMV trailer disconnected during off load
G	2019	AH-64E	C	Aircraft struck by AGPU
A = recorded as aviation case				
G = recorded as non-aviation ground case				

Mishap Review: *AH-64D Engine Failure*

During climb out of a ground effect hover, the AH-64D Apache helicopter experienced a No. 2 engine failure. The aircraft weight and environmental conditions precluded single engine flight. As a result, crewmembers were unable to maintain the rotor speed above 101 percent revolutions per minute, causing the aircraft to descend rapidly and crash. The aircraft sustained severe damage and there were no injuries.

History

The mission was to conduct live-fire training with 30mm cannon and aerial rockets. Mishap crewmembers conducted run-up, performed communication checks, hover checks, and departed the airfield. Crewmembers arrived at a range for prep to conduct 30mm and M274 rocket training. The aircraft was loaded with 360 rounds of 30mm training rounds and 10 M274 training rockets (five on each side). Before leaving the arming and refueling pad, the crew conducted hover power checks and departed for their assigned firing point. After arriving at the firing point, the aircraft landed and conducted a firing pad brief and forced landing plan review. Crewmembers brought the aircraft to a hover with the pilot (PI) on the controls in preparation to conduct live-fire training at a pre-planned height of 160 feet above ground level. During the climbing hover, the mishap aircraft abruptly stopped ascending, then rapidly descended and crashed into the ground on the firing pad.

Crew

The instructor pilot (IP) had 231 hours in MTDS and 998 hours total time. The PI had 47 hours in MTDS and 915 hours total time.

Commentary

The No. 2 engine failure was caused by a fracture in a compressor blade on the Stage 2 compressor bladed disc. The fractured blade separated, resulting in catastrophic downstream compressor damage. High cycle fatigue is the most likely cause of the blade fracture and the result of the engine failure. Mechanical failures can occur during Army aviation operations, whether training or during support of combat operations. Crews must be prepared to execute the appropriate emergency procedures based on the emergency condition or system failure which has occurred. Crews, during the mission planning process, should identify the critical points where aircraft performance will be at the upper margins. This can assist the aircrew with understanding the implications of an engine power loss or engine failure while at these critical points. It can assist in providing the crew the rehearsal time to rehearse their actions in the event of an engine failure or power loss when their aircraft does not have the power available to maintain a hover or continue flight. While this mishap was specific to an AH-64 mission, the application of determining critical performance points is applicable to all aircraft MDS and their mission sets.

Take the time necessary to identify your aircraft critical performance points and rehearse actions if you lose engine power or suffer an engine loss while operating at these upper performance limits. If you don't have time to rehearse it before the mission, you set the conditions necessary for a catastrophic event. ■

Class A - C Mishap Tables

	Manned Aircraft Class A – C Mishap Table									as of 20 Jan 21
	Month	FY 20					FY 21			
		Class A Mishaps	Class B Mishaps	Class C Mishaps	Fatalities		Class A Mishaps	Class B Mishaps	Class C Mishaps	Fatalities
1st Qtr	October	2	2	3	0		0	0	9	0
	November	1	0	2	2		2	3	6	7
	December	1	1	2	3		0	1	6	0
2nd Qtr	January	0	0	5	0		1	0	3	3
	February	1	0	5	0					
	March	0	2	4	0					
3rd Qtr	April	0	1	1	0					
	May	0	0	6	0					
	June	0	0	6	0					
4th Qtr	July	0	2	8	0					
	August	1	2	6	2					
	September	0	2	7	0					
	Total for Year	6	12	55	7	Year to Date	3	4	24	10
	Class A Flight Mishap rate per 100,000 Flight Hours									
	5 Yr Avg: 0.94	3 Yr Avg: 0.99		FY 20: 0.63			Current FY: 1.44			

UAS Class A – C Mishap Table									as of 20 Jan 21
	FY 19					FY 20			
	Class A Mishaps	Class B Mishaps	Class C Mishaps	Total		Class A Mishaps	Class B Mishaps	Class C Mishaps	Total
MQ-1	5	2	3	10	W/GE	3		1	4
MQ-5	0	0	0	0	Hunter				
RQ-7	0	14	21	35	Shadow		1	3	4
RQ-11	0	0	1	1	Raven				
RQ-20	0	0	1	1	Puma				
SUAV	0	0	0	0	SUAV				
Other	0	0	1	1	Other				
UAS	5	16	27	48	UAS	3	1	4	8
Aerostat	3	0	0	3	Aerostat	0	0	0	0
Total for Year	8	16	27	51	Year to Date	3	1	4	8
UAS Flight Mishap rate per 100,000 Flight Hours									
MQ-1C Class A	5 Yr Avg: 8.40		3 Yr Avg: 5.71		FY 20: 4.82		Current FY: 13.93		
RQ-7B Class B-C	5 Yr Avg: 67.23		3 Yr Avg: 78.53		FY 20: 107.19		Current FY: 76.80		

Forum

Op-ed, Opinions, Ideas, and Information

(Views expressed are to generate professional discussion and are not U.S. Army or USACRC policy)

Air Traffic Control Training Integration

A lack of air traffic control (ATC) and air traffic services (ATS) integration into Army aviation training exercises presents a problem in achieving habitual relationships and standardized operating procedures (SOP). Most of the evidence to support integrating ATC into aviation operations involves lagging indicators such as traffic congestion, near misses, and other safety events. Of course, if aviation units operate without ATC and incidents, the general opinion forms that ATC is not required. Alternatively, conjecture implies that lack of ATC contributes to aviation incidents: especially in congested and complex environments.

Aviation task forces tend to encounter such complex environments at forward operating bases (FOB) and joint operational airfields. These complex multi-use aviation environments support not only rotary-wing aircraft but also other stakeholders (such as range operations.) Often the terminal airspace will host unmanned aircraft system (UAS) platforms in various sizes, fixed-wing aircraft, and airborne surveillance systems. The inclusion of those different systems significantly increases the need to maintain separation between participants. The topic of why ATC is not integrated becomes a hot button discussion point when after action reviews have identified the lack of integrated training as a potential reason for problems during operational exercises or deployments.

The number of traffic congestion incidents and communication challenges increases the argument for ATC and ATS inclusion. Training Circular (TC) 3-04.6, Air Traffic Services Operations, articulates a wide spectrum requirement for aviation and ATS integration. Paragraph 4-2 of the publication states,

"Aviation operations require worldwide strategic and tactical mobility. As a fully integrated member of the combined arms team, aviation forces conduct a wide range of tasks across the spectrum of conflict and during stability operations. ATS units enable aviation to operate in complex surroundings and are key to the mitigation of risk often present within hazardous operating environments. Integrating ATS teams with other aviation units within the brigade is critical in ensuring ATS assets are exercised and trained to meet wartime task proficiency."

Furthermore, TCs 3-04.15, Air Traffic Control Facility Operations, Training, Maintenance, And Standardization, and 3-04.16, Airfield Operations, provide guidance on the implementation and responsibilities of ATC units. As an example, TC 3-04.16, Chapter 1, paragraph 1-19 summaries some of the ATC support responsibilities:

"The coordination of ATC procedures and establishment of ATS is the responsibility of the terminal services and airspace information services platoons. These elements provide detailed planning for terminal and airspace information services in and out of the area of responsibility (AOR) by developing aviation flight procedures and incorporating them into the theater airspace plan."

In other words, the ATC units specialize in the development of local airfield and landing zone procedures. The larger ATS requirement encompasses other functions such as development of the crash grid map, airfield diagram, and assists in the development of the aviation planning guide (APG). Therefore, it is logical to use ATC/ATS to mitigate risk for aviation operations.

Stakeholders' feedback

A recent information request about operations in complex airspace to the ATS community yielded a wide range of results. Many respondents indicated positive relationships between aviation units and the ATS community. Fortunately, that means many aviation stakeholders have incorporated some form of ATS into their planning matrix. However, a few responses and reports depict situations where aviation activity lacked ATS integration. Conversely, if we focus on those "need improvement responses," a few common themes appear pertaining to combat training center (CTC) and Regionally Aligned Forces (RAF) rotations.

- Some combat aviation brigades (CABs) have not established a habitual relationship with ATC units to support them at the CTC rotations.
- CABs do not train with ATC units more often because of limited space at home station and infrequent full CAB operations.
- If organizations do not train together, they tend to misunderstand what each can provide.
- Due to the lack of dedicated collective training and habitual relationships, units encounter issues and unnecessary growing pains during the initial deployment phase.

Bridging the Training Integration Gap

In general, training integration of ATC/ATS units rarely proceeds beyond the novice level and is a gap. Aviation task forces achieve proficiency based on standards and other training metrics. Individual units accumulate thousands of hours of rehearsals, training, iterations, and analysis to achieve deployment validation. The units develop competencies and practices to prepare for complex environments. Unfortunately, organizing by task force often does not allow habitual relationships to develop and requires units to train individually versus collectively as a task force: thus, generating the expectation of downrange integration as a cornerstone for success. The need to achieve downrange integration as soon as possible represents both a challenge and problem. Inherently, the effort to integrate increases the risk during the forming-storming phase of the deployment, driving risk higher. A better way to resolve the gap involves conducting more integration training prior to deployment providing opportunities to develop habitual relationships, which reduces risk to force and mission.

To bridge the training integration gap and reduce risks, units must establish habitual working relationships to improve coordination, establish shared visions, and establish roles and responsibilities to reduce the friction points, growing pains, and issues associated with melding units together. The melding process starts at the action officer level. Often action officers can take weeks or months to work out issues and resolve problems because of conflicting schedules, different priorities, and geographically dispersed operations. Add to the situation, the reality of task saturation upon arrival at the new location. However, planners should address concerns prior to deployment. Logically, planners should resolve the issues during joint training opportunities. During those training opportunities, air traffic services leaders should establish the relationships that will facilitate increased awareness of ATS capabilities and form bonds to include ATS in aviation operations.

Reducing the Risk

Moreover, ensuring that ATS is not a burden also relies on leadership touting the safety aspect and mitigation into the planning mixture. ATS leaders must continue making the concerted effort to announce the capabilities and benefits of the service to the aviation community. The ATS portfolio should help protect and manage assets while improving efficiencies in large-scale combat operations and training opportunities. Failure to integrate ATS into the task force training plan reduces mitigation capability and increases the time necessary to achieve operational proficiency between the aviation units and aviation support units. If we do not train together, we will never achieve the journeymen and master level proficiencies.

Aviation operations involve ample amounts of risk and by its nature is a risky and unforgiving business. Failing to incorporate ATC and ATS into aviation mission training plans significantly increase risks. The reasons are evident: first, the primary training venues have difficulty replicating the complex aviation environments of African and Central Command areas of responsibility. Second, unit training incorporating multifunctional aviation task forces remain rare. For the most part, units train at the platoon level. Third, some aviation planners do not understand the full range of capabilities resident with ATS units. Often, planners incorporate only the Tactical Terminal Control System (TTCS) into some training activities. However, the full complement of ATC/ATS teams and systems who deploy suffer from a lack of integrated training opportunities. This reflects higher risk periods during deployments and training exercises.

At some point, the ATS leadership has to sell the advantages of utilizing ATS and its portfolio of different capabilities. ATS is not just a TTCS; instead, it offers a full spectrum of competencies including terminal approaches, airspace management, airspace de-confliction, and flight following, while enhancing search and rescue operations. Foremost, ATS integration improves the safe and expeditious flow of air traffic in congested areas, provides timely air route information, traffic updates, adjust landing direction that can save fuel, and reduce flight times. In other words, ATS can bring many efficiencies to the chaotic situations associated with congested airspace.

How can we start to resolve these challenges?

Resolving the challenges requires focusing on the common theme of a congested downrange environment. Ideally, units can reduce the higher risk periods through dedicated combined training events and establishing habitual relationships within the planning cells. Exercising the ATS during aviation unit home station training builds the naturally occurring holistic effects units experience only during real-time live training. You cannot replicate this training with any other training mechanism.

Additionally, the focus allows the aviation unit and the ATS unit to design and standardize procedures for the field environment (SOP development), identify/mitigate potential problem areas, and reduces initial deployment confusion. For example, have the planners develop and conduct situational training exercises, which focus on operating in a congested battle space, requiring airspace management due to loitering UAS and low-level transition routes. Training scenarios should replicate downrange aviation complex operations, which require planners to request and include the various capabilities of the ATS to help manage the airspace. Training should exercise the full range of ATS skill sets based on supporting deployed aviation units during combat operations, some of these are: contingency airfield and airspace management, terminal RADAR recovery, and flight following.

Trainers should incorporate these capabilities into training designs to facilitate mixing the various assets (rotary and fixed-wing aircraft, UAS, and range activities) and provide learning opportunities for all the stakeholders. Finally, communicate to ATS units the requirement for on-the-move operations. As CABs are less likely to base from an airfield during a large-scale combat operation, ATS units will need to hone their skills to quickly install, operate, and prepare their systems for movement in order to keep pace with actions during conflict. Eventually, such activity builds a foundation of expectation and improves the shared knowledge of the community.

Conclusion

A lack of training integration of ATC and ATS units with their supported aviation units produces a higher risk to mission and force. To reduce the risk, CABs should integrate ATC and ATS units into the CAB training plan and programmed to deploy as an element with their formations during training events. This integration will produce the necessary habitual relationships with mission planners, the CAB staff sections, and flight units while building SOPs and developing tactics, techniques and procedures to enhance operations before deployment into a combat environment, whether for training or actual deployment.

Training together as a team cannot be underestimated. The ability to experience real-time ATC/ATS supporting aviation operations in a complex training environment builds the interoperability and resiliency necessary to drive down the risk associated with the unforgiving combat environment. ■

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Blast From The Past: *Articles from the archives of past **Flightfax** issues*

Vol. 5, No. 9, 1 December 1976

Since 1971, 12 T53-L-13B-powered helicopters have had P1 multiplier connector failures. Six of these resulted in accidents. Emergency procedures for low-side governor failure, where altitude and time were available, would have given the pilot power for a controlled safe landing.

The P1 multiplier bellows senses pressure/altitude changes and automatically adjusts engine fuel flow. When the P1multiplier fails, the pressure compensating linkage moves toward the minimum flow position and fuel flow is reduced. The resultant fuel flow may be enough to sustain engine operation, but it will not provide the required power to maintain flight.

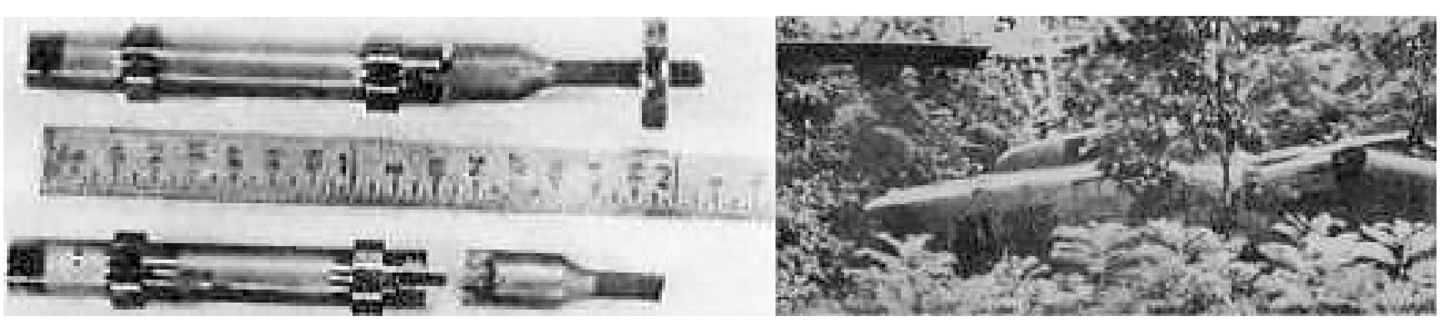
Stabilized power settings reported after P1 multiplier failures have been different. However, one thing remains constant, and that is a sudden loss of power with accompanying yaw as the initial indication of failure.

Successful emergency procedures for P1 multiplier failure require almost instantaneous and accurate evaluation of the situation. The emergency governor procedures contained in the operator's manual are correct and should be followed. The only difference between an under-speeding N2 governor (low rpm) and P1 multiplier failure is the point at which the N1 (compressor) speed may stabilize. In several cases, the N1 has decreased to as low as 25 percent. If positive manual throttle control is not obtained before N1 speed decreases below 40 percent, it is highly unlikely the pilot will be able to recover usable compressor speed without exceeding exhaust gas temperature limits.

All fuel controls received at Corpus Christi Army Depot (CCAD) are being modified with an improved P1 multiplier assembly which is designed to preclude this type failure. (Fuel controls which have been modified with the improved P1 multiplier are identified as an A-7 in the data plate.)

So, until all T53-L-13 fuel controls are modified, if you are faced with a failure of this type, follow the procedure in the dash 10 for under-speeding N2 governor (low rpm.) However, don't expect N1 speed to stabilize at approximately 50 percent. Positive manual throttle control should be achieved as soon as possible. Most important of all, once a course of action has been selected, stick to it until the landing is completed. ■

**Editor's Note: Application of the principles of FADEC-F would have provided the aircrew in this example with the ability to make the right decisions, Fly the aircraft-maintain rotor rpm as the first part of the methodology would have led the crew to initiation of the proper control inputs of collective and throttle to regain rotor rpm and engine rpm.*



Failure of this P1 multiplier valve connector caused this.

Mishap Briefs #98

Information based on preliminary reports of aircraft mishaps reported in January.

ROTARY WING

Cargo

H-47

F Model

- While turning the rotor system to align the lower pitch control (PC) links to connect the rotating swashplate, the forward red blade P/C link lower end became pinched between the attachment horn on the rotating swashplate. The upper dual boost actuator attachment horn caused gouges beyond limitations in each component. (Class C)

G Model

- While configuring the aircraft to perform cargo compartment extended range fuel system operations the vent line hose was incorrectly installed. The incorrectly installed hose led to the tank being unable to vent air resulting in over-pressurization in the fuel system. (Class C)

Utility

H-60

L Model

- The aircraft crashed during the conduct of readiness level progression flight training. Three fatalities. (Class A)

FIXED WING

C-37

A Model

- The crew was on a training flight and descending from altitude when lightning struck the aircraft. The aircraft safely returned to home station where the lighting damage was discovered. The aircraft sustained damage to the nose cone, main fuselage (fused rivets), and static wicks. (Class C)

Visit the U.S. Army Combat Readiness Aviation Division at: https://safety.army.mil/ON-DUTY/Aviation

Flightfax

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Now that PS Magazine is a fully online platform, it's easier than ever to share your maintenance and supply tips and ideas with us. In turn, we can share these tips and ideas with a wider audience by turning them into PS Magazine articles.

You may not be aware, but in addition to submissions from the field, PS Magazine generates articles from sources such as other authorized Army websites, newsletters, TDYs, online publications, and life cycle management command requests. Over the years, PS writers have regularly visited units to talk to Soldiers about their vehicles, equipment and supply processes. These discussions lead to a large number of PS Magazine articles. With Covid-19 currently limiting travel, you don't have to wait for a visit from PS Magazine to give your input. You can send in your maintenance, logistics and supply management tips and ideas now.

Do you have a maintenance or supply tip, a better way to accomplish a task, a newly created tool or a process that's helpful in performing maintenance and supply duties? If so, we want to hear about it.

Be aware that all ideas must be reviewed by the appropriate LCMC, such as the Aviation and Missile Command, the Tank-Automotive & Armaments Command or Communications-Electronics Command, for technical relevance and accuracy. Sometimes ideas submitted from the field aren't supported by an LCMC. In these cases, PS will always provide an explanation for why the tip, idea or tool cannot be adopted. For more information, visit: https://psmagazine.army.afpims.mil/Submit-Questions-and-Ideas/

So put on your thinking caps and send in your helpful maintenance and logistics ideas so we can share those that truly enhance unit readiness Army-wide. With your help, PS Magazine will continue to be the Army's premier source for readiness information.

EMERGENCY PROCEDURES REQUIRE THOUGHT

Emergency procedures, as we know, aren't so cut and dry when you actually have to address one while in a location or situation that isn't conducive to affording the crew the opportunity to land as soon as possible or to land as soon as practicable. Maybe your aircraft has a malfunction and the procedure is to land as soon as possible but you are over water and won't make landfall for 30 minutes or you have a "land as soon as practicable" malfunction but have one hour till mission completion.

In each of these situations, you have to put thought into figuring out the application of the emergency procedure and the best course of action. The implementation of FADEC-F assists pilots encountering an emergency situation by providing the tools necessary to successfully work through and think through an emergency situation in the aircraft. Being conscious of the FADEC-F methodology and understanding the capabilities during mission profile of your aircraft will provide aviation crews the right method and the right outcomes when confronted with an in-flight emergency, no matter the location or situation.

FADEC-F

What is FADEC-F methodology?

- F- Fly the aircraft.
- A- Alert the crew to the problem.
- D- Diagnose the emergency condition or system malfunction.
- E- Execute the emergency procedure.
- C- Communicate.
- F- Fly the aircraft.

Think

FADEC-F methodology requires a crew to think through the emergency condition or system malfunction. Part of the thought process is knowing your emergency procedures and also knowing your aircraft mission profile, i.e., performance planning numbers…do you have single engine capability, what is your max gross weight, what are your hover torques, what is your torque number at cruise airspeed? All these factors prepare aviation crews to execute the mission and provide vital information to be able to execute FADEC-F. Knowing your aircraft performance characteristics for the mission and for that specific time period is instrumental in accomplishing the mission and makes thinking through an emergency condition or system malfunction much easier. Utilize your aircrew training manual (ATM) and the FADEC-F Task 1070, Respond to Emergencies training support package to build your capability to successfully respond to emergency conditions or system malfunctions.

5 Questions

1. What is FADEC-F?
2. FADEC-F only requires rote memory to negotiate an emergency condition or system malfunction. True/False?
3. What task in the ATM is associated with FADEC-F?
4. Is rotor speed a major concern in FADEC-F?
5. You are flying the same mission you flew yesterday, you don't need to do another PPC. True/False?


EMERGENCY PROCEDURES
The time to get it right isn't after the emergency condition occurs or system fails!
• Instructor pilots train hard to integrate Task 1070
• Pilots and crewmember proficiency on Task 1070
• Don't forget the night or night vision goggle considerations
• Selecting the wrong switch or engine power lever is an aviation killer
TASK 1070
Respond to Emergencies
CONDITIONS: In a rotary wing aircraft, you encounter a specific emergency, warning, caution, or advisory.
STANDARDS: Appropriate common standards and the following additions/modifications:
1. RCM.
a. Conduct the emergency response method (fly, alert, diagnose, execute, communicate-fly [FADEC-F]) upon recognition of an emergency.
b. Identify the emergency condition or system malfunction.
c. Conduct the emergency procedure.
d. Select a suitable landing area, if required.
2. NRCM (if applicable).
a. Assist in identifying the emergency condition or system malfunction.
b. Assist in the conduct of the emergency response method.
NIGHT OR NIGHT VISION GOGGLES CONSIDERATIONS: Take special precautions to identify the correct switches/levers when performing EPs at night or while wearing NVD.
TRAINING AND EVALUATION REQUIREMENTS:
1. Training will be conducted in the helicopter, TFPS, SFTS or FS, and academically.
2. Evaluation will be conducted in the helicopter, TFPS, SFTS or FS, and academically.
3. During the conduct of annual standardization evaluations, NVG evaluations, and PFE's a crewmember must respond to a minimum of three (3) emergency procedure scenarios in the helicopter, (or if authorized) TFPS, SFTS or FS. Emphasis should be placed on selecting critical emergencies that require immediate and instinctive action by the pilot such situations involving the loss of NR, loss of engine(s), and fires.
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