June, July, August 2015

Flightfax® ISSUE 50

Online newsletter of Army aircraft mishap prevention information

Although the summer months are firmly in the rearview mirror, it does not mean hot, dusty, and/or high density altitude environments with their associated hazards have disappeared. Deployed locations, as well as our own desert/mountain training areas, offer challenges to the aviation force. This, coupled with the normal changeover in experienced aircrew members, makes it important for units and aircrews to review the requirements for operating aircraft in these environments. Increased emphasis on performance planning, the effects of higher ambient temperatures and density altitude are a must. Dry conditions increase the exposure to dust landings. No less a concern is the weather. With a change in seasons so come changes in the weather patterns.

Do you have an upcoming NTC rotation? Training center rotations always provide a challenging environment to operate. CW4 Martinez's article 'New Challenges with Decisive Action Rotations from a Safety Perspective' found in the October 2014 issue of *Flighfax* reviews some of the hazards associated with DA rotations and is worth a second look. A concerted effort to fly trained, disciplined, and informed crews should lead you in your aviation accident prevention effort.

In this newsletter we play a little catchup from our summer hiatus with some mishap reviews from some recent incidents as well as our standard selected mishap briefs. DES addresses IIMC and the BFTP reaches back to 1981 and density altitude. Currently, the Class A flight accident rate is holding about the same as last year. Next issue we'll take a closer look at FY 2015 and the trends that have emerged.

This issue also marks the 50th newsletter produced since *Flightfax* was re-introduced in May 2011. While not enough to qualify for series syndication, it has enough history to use in your unit's accident prevention effort. Information, articles and mishaps found in this newsletter make a great addition to your safety training/meetings. If you have the opportunity, take time to research archived issues. Not just from the past few years but from as far back as the mid-1970s. You will find that the lessons learned in the earlier years are as pertinent today as they were back then. Past issues can be found at the following site:

https://safety.army.mil/ON-DUTY/Aviation/Flightfax/Archives.aspx

Until next time fly, safe and manage your risk levels!

Aviation Directorate, Future Operations
U.S. Army Combat Readiness Center
334-255-3530 DSN 558-3530

TSAS – Tactile Situation Awareness System: A Survey

Background. The Tactile Situation Awareness System (TSAS) uses the sense of touch to provide situation awareness information to pilots. It presents information, including aircraft position, attitude, altitude, acceleration and velocity through the use of tactile stimulators distributed on the torso. The potential safety benefits of TSAS include reduced spatial disorientation mishaps, improved situational awareness, improved pilot control, and reduced pilot workload during critical flight maneuvers such as hovering in zero visibility, flight transitions, approach and landing. TSAS reduces pilot workload, increases situational awareness and mission effectiveness allowing pilots to devote more time to other tasks requiring visual attention. (U.S. Army Aeromedical Research Laboratory system description.)

The Purpose. The purpose of the survey was to determine the potential effectiveness of TSAS in relation to past recorded Army mishaps. The Aviation Directorate, U.S. Army Combat Readiness Center, conducted a survey using trained accident investigators, familiarized with TSAS, to review past mishaps and score the effectiveness of the system as a mitigation measure to the mishap.

Survey participants. Five experienced aircraft mishap investigators from the USACRC were asked to evaluate all Class A and B rotary-wing mishaps from 1992 through 2011 (20 year period) to determine whether the mishap could have been prevented if the accident pilots had been wearing TSAS. All the participants had a minimum of 2,500 (median 3,200) hours of flight time and a minimum of 1,000 hours of night vision goggle/night vision system time with a self-reported moderate to significant level of experience in degraded visual environment (DVE) operations.

The method. Prior to the survey, each investigator viewed an instructional video on TSAS abilities and application followed by a hands on demonstration/orientation in a H-60 motion based simulator wearing a TSAS garment.

In reviewing the mishaps from the 20 year period, investigators were first asked (A), to rate whether they would classify the mishap as controlled flight into terrain (CFIT). Second (B), whether degraded visual environment (DVE) was a condition and contributor to the accident. Investigators were then requested (C) to rate whether they felt TSAS would have prevented the accident. Ratings were recorded using a seven point Likert scale with strongly disagree receiving a score of (1) and strongly agree scoring out at (7).

Based on the ratings, cases were divided into three categories: agree, disagree and neutral. These categories indicated whether, on average, the raters felt that the mishap could have been prevented by TSAS (agree), could not have been prevented by TSAS (disagree), or indicated no significant feelings one way or the other (neutral).

The results. There were 330 Class A mishaps rated for the selected 20 year period. Based on analysis of the data by USAARL, the investigators determined that 23.9% (79) of the Class A mishaps could have been prevented by use of the TSAS. There were 63 fatalities associated with the mishaps and a total cost of over $700 million.

For the latter ten year period of 2002 - 2011, there were 204 Class A mishaps reviewed. 21.6% (44) fell into the category of those that could have been prevented by TSAS, representing 34 fatalities and accidents costing over $500 million.

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Additional information. In-depth analysis of the survey results as well as additional information on the Tactile Situation Awareness System may be found in the conference paper: *A Materiel Solution to Aircraft Upset* authored by Amanda M. Kelly, Richard L. Newman, Ben D. Lawson and Angus H. Rupert.

SUBJECT: Tactile Situation Awareness System (TSAS) Survey.

Instructions: You have been asked to participate in a study designed to collect information on the potential effectiveness of the Tactile Situation Awareness System (TSAS). You should have completed a simulator demonstration of the TSAS with USAARL. Additionally, prior to starting the survey, please review the video at the below link: http://www.pentagonchannel.mil/recon/ Search: Game Changer (Jun 4, 2012)

Prior to starting the survey, familiarize yourself with the below listed definitions for CFIT and DVE:

Controlled Flight into Terrain (CFIT): A mishap where an airworthy aircraft, under pilot control, inadvertently flies into terrain, water, or an object. This does not include incidents where there is intent to land, object/wire strikes, or the aircraft departs controlled flight.

Degraded Visual Environment (DVE): A mishap where an airworthy aircraft, encounters reduced visibility of potentially varying degree, wherein situational awareness and aircraft control cannot be maintained as comprehensively as they are in normal visual meteorological conditions and can potentially be lost. Brownout is the predominant contributor, but DVE includes all conditions (i.e. brownout, whiteout, blowing sand, dust, smoke, fog, heavy rain, salt spray, low contrast conditions) that partially or completely reduce aircrew visibility.
You are being asked to review each of the enclosed mishaps provided with a Summary and Findings. From the information presented, indicate if you feel the mishap was CFIT related (column C); if you believe DVE was a condition and contributor to the mishap (column D); and if TSAS would have prevented the mishap (column S). An example is shown below. *(Put your answers on the score sheet supplied – not the test sheet)*

Please enter an 'x' for each mishap in the associated column.

C. Based on the above definitions, how would you classify this mishap?

(x) CFIT (No response if you do not feel this is a CFIT mishap)

D. Was DVE a condition of the accident?

(x) Yes – DVE was a condition and contributor to the accident? (No response for non-DVE)

S. TSAS would have prevented the reviewed mishap. (respond to each mishap regardless of type)

(1) Strongly Disagree **(2)** Disagree **(3)** Somewhat Disagree **(4)** Neither Agree nor Disagree **(5)** Somewhat Agree **(6)** Agree **(7)** Strongly Agree **(0)** Not enough information

Example:

#	Type Acft	Period of Day	Summary	Findings	C	D	S 1 2 3 4 5 6 7 0
2	UH 1H	Night	DURING A FORMAL COURSE OF INSTRUCTION FOR NVG REFRESHER/MISSION TRAINING, A FLIGHT OF FOUR UH-1 AIRCRAFT DEPARTED FORBES FIELD IN TOPEKA, KANSAS, FOR A NIGHT VISION GOGGLE NAVIGATION AND FORMATION TRAINING FLIGHT. THE FLIGHT WAS UNEVENTFUL AND THE AIRCRAFT LANDED AT MARSHALL ARMY AIRFIELD, FORT RILEY, KANSAS, FOR REFUEL AS A LIGHT RAIN BEGAN TO FALL. THE AIRCRAFT WERE REFUELED WHILE THE PILOTS UPDATED THE WEATHER. BECAUSE OF DETERIORATING WEATHER CONDITIONS ALONG THE PLANNED ROUTE, THE AIR MISSION COMMANDER CANCELLED THE REMAINING TRAINING. HE PLANNED TO RETURN TO FORBES FIELD BY A DIRECT ROUTE ALONG I-70 AT 500 FEET AGL. THE FLIGHT DEPARTED MARSHALL ARMY AIRFIELD AT 2105 AND AT APPROXIMATELY SIX (6) MILES TO THE EAST, THE TRAIL AIRCRAFT IMPACTED THE GROUND IN A LEVEL ATTITUDE. ALL THREE CREWMEMBERS EXITED THE AIRCRAFT WITH MINOR TO MAJOR INJURIES.	FINDING 1: (PRESENT AND CONTRIBUTING: HUMAN ERROR - INDIVIDUAL/LEADER FAILURE): DURING A NIGHT VISION GOGGLE (NVG) FORMATION TRAINING FLIGHT, AT AN ALTITUDE OF APPROXIMATELY 200 FEET ABOVE GROUND LEVEL (AGL), THE PILOT-IN-COMMAND (PIC) OF THE TRAIL AIRCRAFT, FUNCTIONING AS A UNIT TRAINER (UT), FAILED TO FOLLOW WRITTEN PROCEDURES. WHEN OUTSIDE VISUAL REFERENCE WAS LOST DUE TO WEATHER CONDITIONS, THE UT LEVELED THE AIRCRAFT, BUT FAILED TO ADD POWER TO ESTABLISH A CLIMB AS PRESCRIBED IN TC 1-211, TASK 1083 (VERTICAL HELICOPTER INSTRUMENT RECOVERY PROCEDURES (VHIRP)). AS A RESULT, THE AIRCRAFT WAS ALLOWED TO DESCEND INTO THE TERRAIN RESULTING IN TOTAL LOSS OF THE AIRCRAFT AND INJURIES TO THE CREW. THE UT'S FAILURE WAS DUE TO A COMBINATION OF INADEQUATE PROFICIENCY, TRAINING, AND SUPERVISION. THE UT'S PROFICIENCY WAS INADEQUATE IN THAT HE WAS NOT CURRENT WITH NVG'S NOR HAD HE FLOWN NIGHT FORMATION RECENTLY. THE UT'S UNIT TRAINING WAS INADEQUATE IN THAT HE WAS NOT UNIT MISSION TRAINED NOR QUALIFIED AS AN NVG UNIT TRAILER	x	x	o o o o o X o o

I wish I had a blue chip to spend . . .

We don't usually get favors (blue chips) to cash in. They do occasionally happen. Your career manager calls you up and asks if you would take a short-fuse relocation to a less than optimum location or job. If you will do this, you'll get your choice of return locations or a school or something you desire. It's a fair exchange. Sometimes units do a little horse trading - parts or people for a player or a favor to be named later. It might not make the world go around but it provides an assist.

My 'blue chip' is a little more grandiose. More along the lines of the movie 'Clear and Present Danger.' The scene where the president is talking to the Harrison Ford character about covering up the illegal activities the government was involved with in a foreign country in countering the drug war. In particular, the part where the president tells him "we'll keep this quiet and you can tuck this chip in your shirt pocket and pull it out at a later time when you need something." Probably not the exact wording but I wasn't going to watch the movie again just to get it verbatim. I don't have the ear of the president or a congressman or general officer, but that is the kind of chip I would spend right now.

So what could be so important that a blue chip is required? It's TSAS – the tactile situation awareness system that was developed within the military and currently under the auspices of the USAARL at Fort Rucker. It is a system that uses tactile cues to expand situational awareness to an aircrew. It is effective in degraded visual environments (DVE) as well as other situations that may incur loss of situation awareness. Bottom line - it is a system that gives a crew cueing information without eating up precious visual bandwidth that can sometimes become oversaturated in information displays which can lead to a loss of situational awareness. It's scanning without using your eyes.

TSAS has been addressed several times in *Flightfax* the last few years. An article is included in this issue. As a risk mitigation measure for operating in the degraded visual environment, it makes the list of potential buy items but is not far enough up the list to actually fund. To be sure, there are several high-speed low-drag systems being developed to be the see-all end-all system to operate an aircraft under any and all conditions. The cost will be high, both in dollars and flash to bang time. The acquisition train moves slowly.

TSAS does not have all the gee-whiz components as envisioned in future systems. But it does have the potential to be in the aircraft much sooner and at a much lower cost. Would it prevent all the accidents that a whiz-bang system 15 years in the future will prevent? Absolutely not. Will it help prevent some of them? Absolutely yes, and not 15 years from now. It would be an effective part in a bridging strategy to utilize until the newer technologies mature. I look at it in terms of giving me the 70% solution now instead of the 100% solution too late. **Jon Dickinson, Aviation Directorate**

TSAS on YouTube (copy exactly even if it looks funny): http://youtu.be/5MCtv5WDU5U

Be Prepared for the Unexpected

CW5 Richard E. Arnold
Directorate of Evaluation and Standardization
U.S. Army Aviation Center of Excellence
Fort Rucker, Ala.
H60 Assault Branch Chief

Our aviation enterprise has recently experienced a rash of accidents related to Inadvertent Instrument Meteorological Conditions (IIMC) and a failure of aviation crew members to recover from the subsequent unusual attitude as required by the ATM.

Think about your preflight procedures. You have obtained a legal weather brief from the appropriate agency. You have conducted a thorough crew brief. All preflight requirements are complete including filing your flight plan and you are ready to go. You had a great night's sleep. Your weather brief is good, but the potential for decreasing weather conditions exist. You conduct a text book run up in accordance with the checklist and you are ready to go. You take off and everything is going exactly as planned. As you continue flying, weather starts to deteriorate. You slow down and realize you may have to land. Upon reaching that decision, you are suddenly engulfed by clouds and you can't see the ground. You have done everything right, but weather gets a vote and it has decided you are now IIMC.

In those first few seconds, you are disoriented, concerned that you are now in the clouds with no instrument flight plan. Your crew becomes quiet and you think back to your training. As you begin to focus on your instruments, you are already in a serious bank and losing altitude. Your mind is trying to register where you are in relation to the earth's surface. Your inner ear is trying to convince you that you are straight and level. At this point, your proprioceptive and vestibular system is not giving you accurate information and your bodily senses have been taken out of the recovery equation. You finally calm down and focus harder on the instruments and begin talking with your crew. Your training takes over and you ignore the overwhelming disorientation. You level the wings and begin a climb. Now everything starts to make sense. This scenario depicts a successful recovery; many time the opposite result happens.

The above scenario does happen all too often, and proper recovery is paramount. Our aviation crews are completing demanding missions all over the world safely and efficiently. Unfortunately, improper recovery and spatial disorientation has caused horrific accidents which have claimed many lives of our aircrews and passengers.

So what is the key to a successful recovery?

Our standardization sections conduct evaluations with each aviator on an annual basis which includes IIMC procedures and unusual attitude recovery. But think about that for a second: that is an evaluation and only happens once a year. The frequency at which these evaluations occur may be insufficient to provide proficiency oversight in these critical tasks.

So what's the answer?

The Army spends millions of dollars on state-of-the-art flight simulators. These important devices allow training at all times on every critical task, including tasks that may only be performed with an IP/IE in the aircraft. Trainers must take the time to design relevant, instrument focused scenarios that truly challenge our aircrew members. Conducting unusual attitudes that are serious but recoverable is important. Trainers should take the time to practice multiple recoveries until our aircrew members are comfortable in an uncomfortable situation. Our chains of command must

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enforce strict adherence to flight simulator scheduling and make sure that even one hour does not go unutilized.

Standardization trainers should also make the best use of the aircraft for training IIMC and unusual attitudes. Don't be tempted to "check the block" for an unusual attitude. While the trainer maintains absolute control of the aircraft, provide pilots the opportunity to recover from various forms of spatial disorientation. Another important facet of the unusual attitude is that it can occur in any flight environment. By selecting an open field under NVGs, a trainer can induce an unusual attitude and train the pilot to recover even under this usually stable flight mode. Also, don't forget the usefulness of our advanced aircraft. Utilizing the flight director when available will help to control the aircraft because "an ounce of prevention is better than a pound of cure".

Finally, ensure our aircrew members are conducting instrument flight IAW AR 95-1. Our flight regulations specifically state when an instrument flight will be conducted. The old adage that "practice makes perfect" is applicable to instrument flight and proficiency will be improved. Enforcing the requirement to conduct instrument training upon our crew members is vitally important, not just to complete three hours (as an example) required by the commander, but to truly become comfortable with instrument flight. Recent Directorate of Evaluation and Standardization visits identify the fact that many aircrew members are not completing semi-annual requirements. This fact coupled with less instrument training is a recipe for disaster when confronted with an IIMC and unusual attitude recovery.

Our aviation crew members are the best in the world. Losing even one more to a senseless accident due to spatial disorientation or IIMC is unacceptable. As a team, we can overcome this trend and save the lives of our fellow soldiers through training and utilizing the technology that is provided to us.

--CW5 Richard E. Arnold, DES H60 Assault Branch Chief, may be contacted at (334) 255-1441, DSN 558.

UAS Class A – C Mishap Table as of 8 Oct 15

	FY 14					FY 15			
	Class A Mishaps	Class B Mishaps	Class C Mishaps	Total		Class A Mishaps	Class B Mishaps	Class C Mishaps	Total
MQ-1	6		3	9	W/GE	3	2		5
MQ-5	1	1		2	Hunter	1		1	2
RQ-7		12	11	23	Shadow		5	8	13
RQ-11			1	1	Raven			1	1
RQ-20			1	1	Puma				
YMQ-18									
SUAV					SUAV				
UAS	7	13	16	36	UAS	4	7	10	21
Aerostat	3	2	3	8	Aerostat	1	0	0	1
Total for Year	10	15	19	44	Year to Date	5	7	10	22

Mishap Review: MD530F

During the conduct of a day VMC approach to an unimproved landing site, the MD530F began an un-commanded right yaw at approximate 15 feet AGL. The aircraft did not respond to the aircrews attempt to control the heading, descended and impacted the ground. The aircraft sustained major damage with no injuries to the crew.

History of flight

The mission of the accident crew was basic pilot skills training which included terrain flight and visual meteorological conditions (VMC) approaches and departures. The IP met his pilot at the AAF flight training building at 1230L to conduct academic flight training, pre-mission planning, and their mission brief. The training being conducted by the accident crew was low risk. At 1300L, the accident crew moved to the aircraft and conducted a crew brief and preflight inspection of the aircraft, finding no faults. Weather at the time of the mishap was winds 090 at 15-20, visibility was unrestricted, temperature 23 degrees Celsius, and density altitude 8893 feet.

The aircraft departed the airport at 1345L as a flight of three and proceeded toward the training area. At 1355 the accident aircraft separated the formation to conduct an aerial recon where the crew intended to conduct training. Upon locating a suitable location, the IP initiated a demonstration of a VMC approach to a hover from 200 feet AGL and 60 knots airspeed. When the aircraft reached 15 feet AGL it started an un-commanded right yaw which increased as the IP attempted to initiate a missed approach. The aircraft did not respond to the IP's attempts to control the heading before impacting the ground. The aircraft sustained major damage with no significant injuries to the crew.

Crewmember experience

The IP, sitting in the left seat, had 3,200 hours of total time, 158 in the MD530, 2,500 combat and 880 as an IP. The PI, operating from the right seat, had 200 hours of total time, 53 hours in the MD530 and 53 hours combat.

Commentary

Investigation determined the aircraft would not provide sufficient tail rotor authority during an approach to a hover at the density altitude and weight at which it was operating. The aircraft's flight manual provided only one chart indicating less than 10% control authority at DA greater than 5,000 feet at a heavier gross weight. This fact was not adequately addressed by written warnings or in the limitations section of the flight manual. Additionally, the IP's aircraft qualification training did not teach the performance limits of the aircraft at high gross weights and/or high density altitude.

Mishap Review: UH-60 Microburst

While hovering to parking, the UH-60L encountered a strong force of wind and rain which induced a sudden left yaw and rapid descent of the aircraft and ground impact. The aircraft was severely damaged with no injuries to the crew.

History of flight

The mission was scheduled pilot flight training. Tasks included formation flight, emergency procedure training and terrain flight. The crew consisted of an instructor pilot with two additional pilots that divided their time between two training periods. The aircrew conducted a mission rehearsal at 1000L and pilot daily brief at 1130L followed by aircraft preflight. Mission risk was briefed as low. Weather briefed before takeoff was 7 miles visibility with rain, clouds few at 5,000 feet, temp 37 degrees Celsius, pressure altitude +140 and wind 230 degrees at 7 knots. A weather watch was issued prior to departure for lightning within 15 nautical miles valid 1400 – 1900L.

The accident crew departed as a flight of five aircraft at 1356L, conducting formation and terrain flight training within the local flying area. At approximately 1500L the aircraft refueled and swapped pilots. After refuel, the flight departed to return to home base. While en route, a weather warning was issued at 1542L for moderate thunderstorms in the area with a maximum wind of 38 knots valid from 1630 to 1830L.

The flight landed at 1615L and separated for further flight training or termination. The accident crew contacted tower and requested to reposition to the hover training area to continue training. While in the HTA conducting training, the aircraft landed due to heavy rain from a passing cell. After the rain passed, the crew decided to terminate training and requested to reposition to parking. Estimated winds were 360 degrees at 18 knots gusting to 28 knots.

While hover taxiing to parking, a 44-knot gust of wind from 340 degrees impacted the left side of the aircraft coupled with an extreme downdraft that impacted the top of the aircraft. The combined force of the wind and rain induced a sudden left yaw and rapid descent of the aircraft. The aircraft pitched down with the main rotor blades striking the ground followed by impact on its right main landing gear with separation of the tail rotor pylon and rolling on its left side. The aircraft was severely damaged with no injuries to the crew. Another unoccupied parked aircraft was rolled on its side during the severe weather.

Crewmember experience

The IP, sitting in the left seat, had 6,900 hours of total time, 5,400 in the UH-60, and 4,600 hours of IP time. The pilot in the right seat had 97 hours total time with 14 in the UH-60.

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Commentary

The investigation determined the aircraft encountered an un-forecasted sudden wet microburst with a severe downdraft wind. Wet microbursts are environmental events that cannot be seen or forecasted with present meteorological measuring equipment, nor are they visible to aircraft crewmembers. They are a rare phenomenon associated with thunderstorms. Two thunderstorm cells merged and collided with an outflow boundary (the remnants of a previous thunderstorm) to form a wet microburst. This event also created a rapid intensification of the thunderstorms as they moved across the heliport and the local flying area.

	Manned Aircraft Class A – C Mishap Table									as of 8 Oct 15
	Month	FY 14					FY 15			
		Class A Mishaps	Class B Mishaps	Class C Mishaps	Fatalities		Class A Mishaps	Class B Mishaps	Class C Mishaps	Fatalities
1st Qtr	October	0	0	2	0		0	1	3	0
	November	3	0	5	0		2	0	2	2
	December	1	0	4	0		1	1	3	0
2nd Qtr	January	2	2	4	4		2	0	6	0
	February	1	0	3	0		0	0	0	0
	March	0	3	0	0		2	1	9	11
3rd Qtr	April	1	1	7	0		0	1	0	0
	May	4	0	3	2		1	3	3	0
	June	2	1	7	0		1	0	8	0
4th Qtr	July	2	0	5	0		1	3	7	0
	August	0	0	1	0		2	2	2	0
	September	0	1	5	0		1	1	3	0
	Total for Year	16	8	46	6	Year to Date	13	13	46	13
	Class A Flight Accident rate per 100,000 Flight Hours									
	5 Yr Avg: 1.33		3 Yr Avg: 1.28			FY 14: 1.52			Current FY: 1.52	

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https://safety.army.mil/ON-DUTY/Aviation.aspx

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Mishap Review: AH-64D Engine Failure

During the conduct of aerial gunnery training, the AH-64D descended rapidly from a climbing high hover and landed hard on the firing pad. The aircraft sustained serious damage. There were no injuries.

History of flight

The mission was scheduled training as part of an aircraft qualification course. Tasks included terrain flight, emergency procedure training and live fire training at the aerial gunnery range. The crew consisted of an instructor pilot and a PI/student pilot. Mission risk was briefed as low. The aircrew show time was 1100L for a daily brief followed by aircraft preflight and runup. Weather was few clouds at 4,100 feet, scattered clouds at 5,000 feet and 10 miles visibility. The temperature was +32 degrees Celsius with winds variable at 2 knots.

The aircraft departed home station at 1310L and flew to the aerial gunnery range to load ammunition. At 1351 the aircraft occupied the firing pad where they conducted a firing pad brief which included verification of the firing pad range limits and the training to be conducted. The crew also discussed required actions in the event of an emergency over the pad to include the possibility of the loss of an engine and the subsequent actions to be taken to accomplish a safe landing if it occurred. With the PI on the controls, the accident aircraft began a slow hover upward to assume a pre-planned altitude of 160’ AGL. At approximately 66’ AGL, both crewmembers heard a sharp noise, described as a loud bang, which came from the right side of the aircraft, followed by a ‘rotor RPM low’ audio annunciation. The IP immediately took the controls and executed the emergency procedure for an engine failure while hovering OGE. The aircraft impacted in the center of the firing pad with damage to the main landing struts, tail landing gear strut and the cannon weapons system. There were no injuries.

Crewmember experience

The IP, sitting in the front seat had 1,000 hours of total time, 231 in the AH-64 and 142 hours as an IP. The PI, operating from the back seat, had 915 hours of total time with 47 hours in the AH-64D.

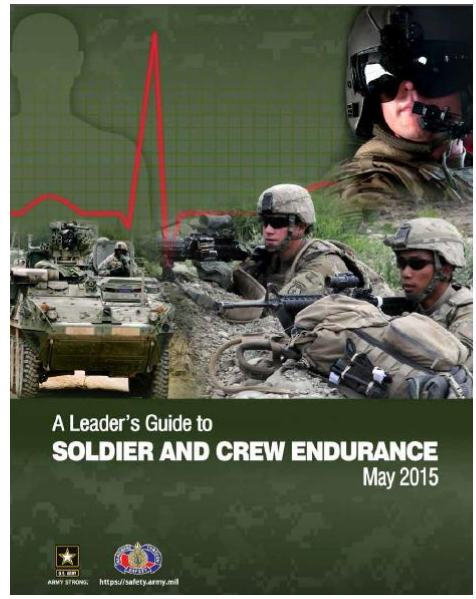
Commentary

Investigation determined the aircraft experienced an engine failure of the No. 2 engine. The aircraft weight and environmental conditions precluded single-engine flight resulting in decreasing rotor RPM and a rapid descent to a hard landing.

The No. 2 engine failure was attributed to a fracture and separation of a compression blade on the stage 2 compressor blade disc. The separated disc resulted in downstream compressor engine object damage, high cycle fatigue to the engine compressor and subsequent, abrupt engine failure with catastrophic internal engine damage.

NEW!

A Leader's Guide to SOLDIER AND CREW ENDURANCE - available on line.



The fundamental purpose of this guide is to provide leaders with information and tools for effectively managing crew endurance hazards. It focuses on the need for minimizing fatigue, sleep deprivation, environmental extremes and stress, and problems resulting from circadian rhythm disruptions caused by jet lag and shift lag. It also provides guidelines for managing the hazards associated with these stressors when they cannot be eliminated entirely.

Originally developed in 1997 to address crew endurance issues experienced by aviators, the revised Leader's Guide to Soldier and Crew Endurance includes the current medically-supported strategies for managing fatigue in an operational environment for both air and ground assets. It provides specific information and tools to help leaders eliminate or mitigate the hazards associated with fatigue.

Fatigue has always been a pervasive problem in the military. With multiple root causes, it is exacerbated by still more elements commonplace in an operational environment. The result has been compromised missions and senseless loss of life, both directly and indirectly attributable to fatigue. Every leader, and in fact, every Soldier, has a responsibility to protect against the dire impact of fatigue by realizing the true hazard it represents to safety and operational effectiveness. The information provided in this guide will help leaders effectively mitigate crew endurance hazards.

It can be accessed with the following link:

https://safety.army.mil/LinkClick.aspx?fileticket=HpiP2FnXMdQ%3d   (AKO Login Required)

Army Safe is Army Strong!

A whale swims all day, only eats fish and drinks lots of water, but is still fat. A rabbit runs, hops and jumps all day, but only lives for 15 years. A tortoise doesn't run and does mostly nothing, yet it lives for 150 years. And you tell me to exercise? I don't think so.

Accident findings: From the archives for your review

FINDING 1: (Present and Contributing: Human Error - Individual and Leader Failure): While conducting a daytime approach to a tactical landing zone, the PC failed to detect hazards. That is, the PC failed to update the aircraft performance data in flight and identify that the aircraft performance was going out of limits for the landing conditions.

As a result, both engines reached the temperature and power limit, the main rotor rpm drooped, and the aircraft experienced a hard landing causing significant airframe damage to the underside of the transition section and the tail rotor pylon, and catastrophic failure of the intermediate gearbox output flange.

The PC's failure to identify that the aircraft performance was going out of acceptable limits was a result of his overconfidence and improper supervision by the unit command. The PC contributed to the error by assigning the Performance Planning Card (PPC) task to the PI without verifying that the task was done to standard. He did not compute his performance limitations again in flight, with current conditions, even though his maximum gross weight OGE was within 300 pounds of his arrival weight on his PPC. He also did not compute his zero weight again, even though his hover power check was 3% over the PPC value. The PI relied on the company SP to fill out the data for the PPC program without verifying the data reflected the current weather brief. The company SP contributed to the error by allowing the crew, and potentially other crewmembers, to have the perception that it was acceptable not to conduct dynamic recalculation of power requirements in flight.

An interesting read on a hazard to shipboard operations:

http://www.militarytimes.com/story/military/2015/06/28/lawrence-helicopter-tragedy-accident-ddg-investigation-hazrep/29162991/

It's not hard to meet expenses. . . They're everywhere.

Fixed facts of life

It is common knowledge that most any aircraft can usually take more punishment than the handbook recommends if the occasion seems to demand it. That doesn't mean that an aircraft, fixed or rotary wing, should be pushed past the red line. Sometimes, when the density altitude (DA) has soared out of sight, an aircraft can be pushed too far. It will cling to the ground with a grip of steel. You just might be able to coax it into the air by using spurs and horsewhips. You are not going to coax it very high or very far.

Just the same, the temptation is there for a pilot who doesn't know or fully respect his operators manual. The temptation to forget the limitations. To overlook them. Or, what is probably the case 99 times out of a hundred, to gamble. Gambling can be great sport, if you can afford to lose.

There are several interesting ways pilots gamble with weight and balance with Army aircraft, particularly helicopters. You may well win for a while, too, but don't worry. The odds will surely catch up with you in the end.

- You can grossly overload an aircraft under the simple theory that it will obligingly haul upstairs anything you can cram into It. This is known in gambling circles as the Beginner's Approach and is not recommended by old hands.
- You can make a hasty estimate of the weight and balance situation rather than arrive at an exact figure. This is the mark of the born gambler. All born gamblers are due to die broke.
- You can forget about the whole thing, ignore the odds. People like this aren't even allowed at the tables at Vegas. They make the other players nervous.
- You can look at one aspect of the situation and forget the other. In gambling circles this is referred to as Blind Man's Bluff and nobody will argue that it isn't as exciting as all get-out-as long as it lasts, which probably won't be too long.

One long-shot way of gambling is to tinker with density altitude.

Most aviators associate high DA with summertime flying and have an almost intuitive feeling that it reduces aircraft performance. What is not fully understood are the factors that make up density altitude and their direct application to mission planning and execution. Mishap files are full of cases in which the aviator did not fully understand the concepts involved or attempted to substitute "technique" for sound planning.

A UH-1 H, loaded with crew, three passengers, 21 mermite cans, 18 cases of soft drinks, and other food items was making an approach to a tactical landing site in mountainous terrain. On final approach, an excessive rate of descent developed. A go-around was initiated with a right turn. During the turn, the aircraft struck trees, the main rotor hit the ground and separated, and the aircraft came to rest in an inverted position and was destroyed by fire. The aircraft was over gross and out of C.G.

A UH-1 H with crew of three and nine combat-equipped troops took off across a shallow gully. Just after takeoff, cyclic feedback occurred, the low rpm audio came on, and rpm dropped to 6200. The pilot lowered collective slightly and rpm returned to 6600. A right turn was made toward a landing area. Rpm again dropped to about 5800 and the aircraft touched down hard, yawing to the right. Substantial damage resulted from an attempt to take off with the aircraft over gross weight limitations.

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The big trouble with density altitude is that you can't see it. When a pilot about to take off is confronted with a thunderhead which looks like the after-effects of a 20-megaton nuclear blast, he prudently stays on the ground. The same aviator, no matter how experienced, can be capable of sailing blithely off into the wild blue yonder on a sunny day which is every bit as lethal for an aircraft which has been loaded with no thought to DA.

It's no great secret that hidden dangers are the ones most likely to trip you. DA may be hidden from you. It isn't hidden from Army rotary wing aircraft, which are as sensitive to sudden changes as a skittish colt. On a sunny summer day, Fort Rucker looks the same at noon as it did at breakfast. No new mountains, or anything. Just the same old flat Alabama landscape we all know.

But no Huey in its right mind is fooled. It knows that while Rucker's actual altitude is under 400 feet, its density altitude varies between minus 1,000 and plus 4,000, depending on the time of day and the mood the sun is in. To a hard-working Huey, that makes the difference extra pounds do to a horse in a handicap race. It will tell you so, too, and in no uncertain fashion, if you load it with no thought to density altitude.

Rucker is not an exception. There is hardly any place where Army aircraft are operating that DA ranges can't vary widely on a day-to-day basis. A jungle which can be comparatively cool at night can be steamier than a commercial laundry by mid-morning.

What really is this thing called density altitude?

It obviously has something to do with air density or mass per unit volume. To be specific, density altitude is altitude corrected for changes in temperature, pressure, and, oftentimes, humidity. Air density will be decreased by a rise in temperature, a drop in pressure, or an increase in humidity. This last effect is due to the fact that while water is obviously more dense than air, water vapor is a gas which is less dense than air. A mixture of dry air and water vapor is therefore less dense than an equal amount of dry air.

As the temperature of air increases, so does its ability to hold moisture, and thus it becomes less dense. Density altitudes obtained from sources such as Air Force weather stations include the effects of humidity. The standard density altitude formula, the dead reckoning computer and most density altitude charts are based on dry air; humidity is not considered. If the air is hot and the relative humidity is high, the error can approach 500 feet. Mission planning that does not consider the effects of humidity can thus result in a decision to carry an extra passenger or extra cargo with potentially dangerous results.

The steps to take then are:

• Check weight and balance.

• Make an approximate correction for humidity. If the air is cold and dry, the correction is negligible. If it is hot and humid, add 400 feet to the pressure altitude to correct for humidity. This will effectively increase the density altitude by about 500 feet.

• Use performance charts to determine mission allowable gross weight.

• Repeat above steps for each point of intended landing (or hovering).

• If the result is marginal, reduce the load or fuel still further since the charts are not exact, and other parameters have not been considered, such as load factor due to angle of bank or deceleration, engine condition, winds, and nonstandard lapse rate.

Everybody's problem

In Army aviation, weight is everybody's problem. It is true the helicopter is about as sensitive to

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density altitude changes and weight loads as a hay fever sufferer is to milkweed and goldenrod, but even workaday fixed wings can become balky if you put too much of a burden on them.

It's a fact that **any time** you improperly load an aircraft you are imposing additional stresses which are not going to improve its flying performance or lengthen the time before it will have to be retired to pasture.

Weight is one thing. Balance is another. The two have a definite connection, though. Weight is a simple matter of pounds and ounces. Balance is how it is distributed. Much to the Army's distress, pilots who are careless about weight requirements aren't exactly as scarce as watermelons in Greenland.

Here's a classic case involving some UH-1s. Several of them were assigned the task of carrying troops from a point at low altitude to one up in the hills. One of the helicopters broke down at an intermediate point and the pilot of another, obliging soul that he was, loaded aboard the stranded troops. Not that they ever got there. Long short of the destination, rising actual and density altitudes forced the laboring Huey to a messy landing in a patch of woods.

Here was a pilot who had given no thought to the mission as a whole from takeoff to touchdown, not in the way the pro would handle it. Instead, using his own crystal ball, he managed to arrive at the conclusion that he could pack aboard more passengers than they do on subways at the rush hour and still land them safely at a place where even Alpine climbers would have trouble handling the thin air. He was wrong.

Expecting miracles

Every aircraft has definite limitations. You might get a near-miracle in performance from your helicopter for a while, but only as long as it can deliver maximum performance under optimum conditions. For instance, everybody knows that it is not unusual for a helicopter to lose rpm on takeoff. You won't get the miracle you are asking for when that happens to you in an overloaded helicopter when the DA is high.

About the only miracles being passed these days are the result of solid hard work and unremitting attention to detail. As a matter of fact, once you have that I lesson under your belt you don't need any miracles.

Where you **will** find density altitude and weight and balance given its proper share of respect is in units which have sound training and supervisory programs aimed at impressing younger pilots with the importance of weight and balance and keeping old hands from forgetting about it.

Training and supervision can go only so far. After that it is a matter of mature responsibility.

Weight and balance and density altitude, like calories, are fixed facts of life. Pretending they aren't there, or can be tinkered with, isn't going to make them go away.

It is just going to weigh on you that much heavier. That's all. •

Selected Aircraft Mishap Briefs

Information based on preliminary reports of aircraft mishaps reported in May 2015.

Cargo helicopters

H-47F 

-Crew was attempting to release the aircraft's M1151 load when the front hook reportedly failed to release immediately. The vehicle was dragged by the aircraft's forward momentum and sustained damage as a result.(Class C)

-Post-flight inspection revealed that lubricant was leaking from the swashplate area. Further inspection revealed a bushing was jammed as FOD in the non-rotating swashplate area. (Class C)

Observation helicopters

MD-530 

-During landing aircraft lost tail rotor effectiveness, entered an unrecoverable attitude and crashed. (Class A)

Fixed-wing

C-12 

-V Series. Engine torque exceedance was discovered during routine FDR download. Exceedance is suspected of having occurred during flight featuring single-engine operation. (Class C)

Utility helicopters

H-60 

-M Series. Aircraft was landing for a MEDEVAC mission in dust conditions when it touched down and rolled forward into a ditch. All four main rotor blades subsequently made contact with the ground and sustained damage. (Class B)

-L Series. Crew was conducting NOE flight training on an approved route when the aircraft contacted wires. Aircraft was landed without further incident. (Class B)

-L Series. Crew was executing a dust landing when the main rotor blades made contact with the tail rotor, severing the drive shaft. (Class B)

Unmanned Aircraft Systems

RQ-7B 

- Engine failed. Chute deployed. UA recovered with damage. (Class C)

Information based on preliminary reports of aircraft mishaps reported in June 2015

Cargo helicopters

H-47 

F Series. Aircraft sustained damage during connection of a 155MM howitzer for sling load operations. A stabilizing arm from the howitzer contacted the ramp, which resulted in damage to the lower edge of the ramp. (Class C)

Observation helicopters

AH-6M 

-During AH-6M FADEC demonstration, aircraft experienced rotor over speed. (Class C)

During AH-6M manual FADEC operation, aircraft experienced rotor over speed. (Class C)

Fixed-

C-12

-W Series. Crew experienced over temp condition of right engine during flight. Engine replaced. (Class C)

- P Series. During approach, crew experienced a significant wind gust. Left landing gear contacted ground and aircraft bounced back up. During post flight, right prop was found to be damaged. (Class C)

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Continued from previous page **June 2015**

Utility helicopters

H-60 

-A Series. Aircraft was hovering to parking, crew experienced severe wind gust. Aircraft made un-commanded contact with the ground. (Class A)

-L Series. HH-60L crew experienced a No. 1 engine fire warning light and smoke emanating from left side of the aircraft. Crew conducted emergency landing and egress. Spindle damage noted on post flight. (Class C)

-L Series. During normal approach crew did not notice a stump in the LZ. The stump made contact near the No. 1 fuel cell creating a hole in the sheet metal and internal damage to the aircraft. (Class C)

Unmanned Aircraft Systems

MQ-1C 

-After 10 hours of flight, the MQ-1C lost altitude at a rapid rate striking power lines and crashing. (Class A)

RQ-7B 

-UA climbed 15 feet in un-forecasted winds prior to TALS touchdown point. Engine automatically disengaged and the UAS dropped to the runway, damaging the payload, wings and center of aircraft. (Class B)

-During flight training, the crew experienced failure of the left flap servo. UAS landed with the chute and sustained damage. (Class C)

-UAS experienced loss of link during flight. Aircraft landed with chute and sustained damage. (Class C)

Information based on preliminary reports of aircraft mishaps reported in July 2015

Cargo helicopters

H-47 

-G Series. CP door separated in flight. (Class C)

-G Series. Crew experienced a bird strike. Windscreen, MRB damage. (Class C)

Attack helicopters

H-64 

-D Series At 100 FT AGL, crew heard loud report from No. 2 engine area, low rotor RPM followed by a hard landing. (Class A)

-D Series Aircraft descended into trees during combat maneuvering flight. Damage to MRS and right-side fuselage. (Class B)

Observation helicopters

MH-6M 

-FADEC failure at a hover. Aircraft experienced rotor over speed. (Class C)

Utility helicopters

H-60 

-A Series. During NVG RL progression roll-on landing, MRB made contact with the aircraft tail rotor driveshaft. (Class B)

-A Series. Dual engine over-speed condition occurred during simulated engine emergency. (Class B)

-M Series. During live fire training, the crew experienced an explosion and separation of the 30mm cannon flash suppressor. Damage to one MRB and fuselage. (Class C)

Continued on next page

Continued from previous page **July 2015**

Fixed-wing

C-12

-W Series. Crew experienced over temp condition of right engine during flight. Engine replaced. (Class C)

W Series. #1 Engine over-temp after take off. (Class C)

U Series. #2 Engine over-temp during climb out. (Class C)

Unmanned Aircraft Systems

MQ-1C

-UA crashed following lost link after GCS shutdown. (Class A)

RQ-7B

Engine failed after launch and struck trees. (Class B)

Information based on preliminary reports of aircraft mishaps reported in August 2015

Observation helicopters

OH-58D

-Crew was conducting an MTF when the aircraft reportedly initiated un-commanded rotations and descended into trees. Post-flight inspection revealed that the aircraft nose cover was intermeshed in the tail rotor, presumably after having been blown out of the aircraft from its stowed position. (Class A)

-Crew was training in manual throttle maneuvers while in cruise flight when they experienced an engine failure indication following vibrations and a loud report from the engine compartment. On landing aircraft sustained skid gear damage. (Class C)

Utility helicopters

H-60

M Series. Crew was conducting a shipboard landing when the aircraft sustained damage as the result of structural contact. (Class A)

A Series. Crew was attempting a dust landing when the aircraft landed hard, resulting in MRB strike with the tail boom drive shaft. (Class B)

M Series. Main rotor blades contacted the tail boom during a roll-on landing for a CE RL progression training mission. (Class B)

Unmanned Aircraft Systems

MQ-1C

-Crew reportedly received battery/alternator warning indication while system was in flight and subsequently lost link while attempting to maneuver the system for return. Crew initiated a controlled landing and the system came to rest largely intact. (Class A)

If you have comments, input, or contributions to Flightfax, feel free to contact the Aviation Directorate, U.S. Army Combat Readiness Center at com (334) 255-3530, DSN 558-3530

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