AIRBORNE PUBLIC SAFETY ASSOCIATION

The Safety Wire

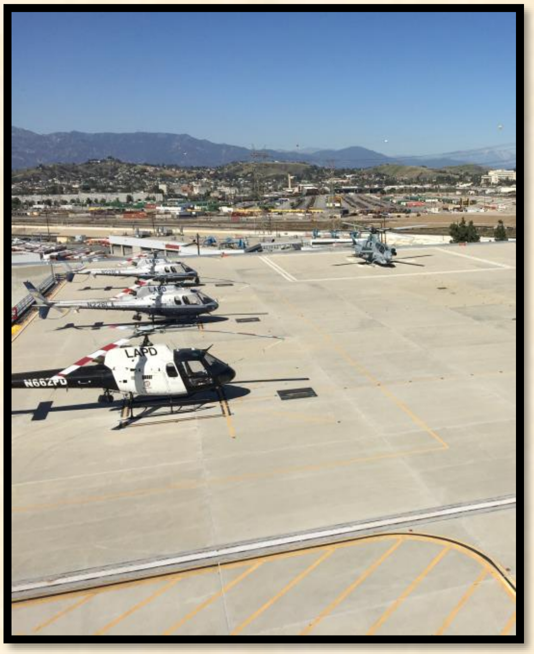
April 2018

Human factors are not all bad.

Usually when we talk about human factors, we discuss all of the limitations and pitfalls associated with the involvement of humanity in aviation. From the first engineering draft of an aircraft to the last flight it ever takes, people are involved in the operation and maintenance of every second of a flying machine's life. This is true for both manned and unmanned aircraft. We discuss the limitations of the 5 senses, fallacy of multitasking, frailty of situational awareness, fatigue, nutrition and an endless list of other factors. In accident reports, human error is usually one of the top contributing factors. Over time, 'human' has become such a bad word when it comes to aviation safety that there are efforts to remove the human as much as possible.

I think it is important to remember the benefits of human factors. We work in a field that is defined by turning the impossible into normal. Aviation is constantly at the forefront of technology and human performance. This means that there are rarely answers to the questions we ask or problems we face. It is the unique human capacity to combine technical skills and knowledge with ingenuity and imagination to create solutions where there were previously none. Aviation uses both halves of the brain. Public safety aviation takes this to a whole new level. Not only do we operate and maintain complex flying machines, we utilize them in the highly unpredictable world of law enforcement, SAR, firefighting, etc. Simply put, we are often forced to work off-script in scenarios that cannot be accurately predicted by computer models. And it is here where human factors make us successful. We must understand ourselves in order to protect against our limitations and also to maximize our performance. Bravado and determination are not enough.

When faced with a challenge, we have several options with which to respond.



Usually, we think of 'rule-based' responses, which cover our checklists and defined procedures such as mechanical system failure checklists and maneuvers. These responses do not require much thought if we have trained appropriately and are done almost instinctively. The issue is, they require a problem to present itself as scripted. Often, challenges do not fit into a predefined box. At those times, we are left with creative responses. To make ourselves successful in deploying a creative solution we should:

1. Incorporate realistic training scenarios that go beyond the basic application of a maneuver. Add variables to a scenario that require the pilot to use higher-level, correlative-learning responses instead of simple rote application of reaction that has been done the exact same way 1,000 times before. This is more work for the CFI, who must create the same parameters and safeguards for each new scenario.
2. Hit the books. Being creative is only half of the answer. It is the creative application of knowledge, skill and experience that we are striving for. One thing I appreciate about giving flight instruction is that it forces me to review

old textbooks and the aircraft POH. No matter how many times I read them, it improves my skillset each time I do.

3. Understand human factors. Take an online class, go to a seminar, read a book…do all three! The more we understand these factors, the more we can use them in our favor. Understand how to amplify our human capacity through health, training and crew resource management.
4. Learn from others. Many before us have had to deal with off-script scenarios. Read accident reports and ‘there-I-was’ stories. Check out the accident database. Through these experiences, we can move our own understanding from rote to correlative, which is the level we need for creative problem solving.

**COMPUTERS ARE USELESS,
THEY CAN ONLY GIVE YOU ANSWERS.**

~PABLO PICASSO

APSA AEROMEDICAL BRIEFING

DUDLEY CROSSON, PHD

As many of you may remember from my ALSE/PPE presentation, up to this point, there has been no specific standard for helicopter helmets to be build and tested to. For years, the National Park Service and US Forest Service aviation have had issues with non-military helmets. The U.S. Department of the Interior (DOI) and the U.S. Forest service (USFS) have issued two documents establishing aviation helmet standards and requiring use of approved aviation helmets by their pilots, aircrew, and contractors.

- *Aviation Helmet Standard* establishes design and performance standards for aviation helmets
- *Interagency Aviation Life Support Equipment* (ALSE Handbook) requires use of approved helmets

Southwest Research Institute, a highly-regarded research organization with expertise in helmet testing, systems engineering and human factors, assisted DOI and USFS in developing the *Aviation Helmet Standard*.

What does the *Aviation Helmet Standard* do?

- Establishes aviation helmet design and performance standards

- Requires helmets to be tested at a certified laboratory before approval
- Requires that manufacturers certify and label each helmet
- Establishes a list of approved helmets

Why did DOI develop the *Aviation Helmet Standard*?

- Some aviation helmets have unknown performance properties
- Government regulatory agencies have not provided guidance
- Manufacturers have not established an industry-wide aviation helmet standard
- Other helmet standards, such those for motorcycle and motor vehicle helmets, do not include the design parameters and performance measures needed for the aviation environment

Who must use approved helmets?

- Pilots and aircrews employed by or under contract to the Dept. of the Interior, its agencies, or the Forest Service
- Pilots and aircrews of government agencies, organizations, and companies who voluntarily comply with the ALSE Handbook

Why should aircrew use helmets approved by the Dept of the Interior?

- Approved helmets meet the design and performance requirements of either the U.S. military or the *Aviation Helmet Standard*
- Approved helmets have been fully tested

Which military helmets are approved?

The ALSE Handbook approves these military helmets and their commercial versions when manufactured by the military helmet manufacturer:

- Helicopters – HGU-56/P, HGU-84/P, SPH-4B, and SPH-5
- Fixed-wing – HGU-55/P and HGU-68/P

Which non-military helmets are approved?

As of April 19, 2018, no non-military aviation helmets had been certified by a testing laboratory and approved by the Department of the Interior and Forest Service.

Where to find the Dept of Interior and Forest Service helmet documents?

These documents can be found on the DOI website:
www.doi.gov/aviation/safety/helmets

- *Aviation Helmet Standard*
- *Interagency Aviation Life Support Equipment* (ALSE Handbook)
- List of approved non-military helmets

Resources

Transport Canada Aviation Safety Newsletter http://www.tc.gc.ca/media/documents/ca-publications/Aviation-Safety-Letter-1-2018-eng.pdf

Human Factors Newsletter
http://www.decodinghumanfactors.com

NASA Safety Callback
https://asrs.arc.nasa.gov/docs/cb/cb_459.pdf

HAI Doc's Rotor Safety Tip of the Week
https://www.youtube.com/watch?v=OXI-gVEwK0w&feature=youtu.be

APSA Online Meetings

The schedule for upcoming APSA online meetings is as follows.
If you would like to join, send an email to: Safety@PublicSafetyAviation.org

UAS:
Wednesday, May 9, 2018
1:00 PM - 2:00 PM EST (1800 UTC)

Safety Officers:
Friday, May 18, 2018
1:00 PM - 2:00 PM EST (1800 UTC)

Maintenance:
Friday, May 25, 2018
1:00 PM - 2:00 PM EST (1800 UTC)

The inexperienced pilot pushes on in adverse conditions...

When the more experienced pilot turns back...

To join the most experienced pilot,

who never took off in the first place.

~ Unknown

Reality Check...

Note: *The following reports are taken directly from the reporting source and edited for length. The grammatical format and writing style of the reporting source has been retained. My comments are added in red where appropriate. The goal of publishing these reports is to learn from these tragic events and not to pass judgment on the persons involved.*

From the CONCERN Network:

During a flight to a scene, the crew noticed a few odd things with the pilot such as slow start of the aircraft, erroneous radio calls, distracted behavior and just a perception that "something is wrong". Upon landing and while attending the patient in the back of the ambulance, the crew discussed the situation with the Flight Chief Medical Officer and elected to take the patient by ground. The Executive Director/Director of Operations agreed with their decision and grounded the aircraft in place.

The pilot was taken off flying status and was medically evaluated. It was determined that he had an epileptic condition and has since retired from flying.

A flight crew was transporting a patient from a scene flight when the pilot suffered a medical emergency that impaired his ability to operate the aircraft. The pilot had engaged the stability augmentation system and autopilot systems (HeliSAS) after departure from the scene and moments later stopped responding to the medical crew over the ICS.

After several attempts to elicit a response from the pilot, the flight paramedic accessed the cockpit and assisted the pilot, who landed the aircraft safely in a rice field while the flight nurse contacted the company's Operations Control Center.

The flight paramedic and nurse performed an emergency shut down of the aircraft and removed the pilot from the aircraft. Additional resources were dispatched to transport the patient and the pilot to appropriate medical facilities.

Aircraft: **Bell 206B**
Injuries: **1 fatal, 3 Serious, 1 Minor**
NTSB#: **WPR16FA072**

https://www.ntsb.gov/_layouts/ntsb.aviation/brief2.aspx?ev_id=20160218X71040&ntsbno=WPR16FA072&akey=1

The commercial pilot of the helicopter was performing a local air tour around the island with four passengers onboard. During the flight, he noticed a vibration throughout the cabin. The pilot diverted toward the destination airport; however, when the vibration stopped shortly thereafter, he decided to initiate a turn so the passengers could see a nearby landmark. The vibration returned shortly thereafter, and the pilot began to maneuver toward the destination airport a second time. The pilot stated that the vibration developed into a grinding sensation, which was followed by illumination of the main rotor low rpm warning light and an increase in engine rpm to the point where the engine and rotor RPM needles were no longer matched on the power turbine gauge. The pilot initiated an approach to a grassy area near the shoreline; however, due to the presence of people nearby, he turned the helicopter slightly left to land in the water as close to shore as possible. The pilot said that, about 20 ft. above the water, it felt like the main rotor stalled, the helicopter lost lift, and it "fell out of the sky." The helicopter descended rapidly into the water and sank about 20 ft. from the shoreline.

Three of the passengers were able to egress the helicopter following impact; however, the middle aft seat passenger was trapped inside. A first responder stated that he and another person repeatedly dove underwater to cut the passenger's seatbelt straps and extract him. The first responder reported that the passenger's life preserver appeared to be entangled with the seatbelts. Postaccident examination of the life preserver revealed signatures of inflation and cut waist straps, with no other damage noted. It could not be determined when or how the life preserver was inflated; the first responder could not recall whether it was inflated and the nurse providing CPR said it was not inflated. Review of treatment records for the passenger revealed evidence consistent with drowning, and no traumatic injuries to the head or neck. It could not be determined whether the passenger was unable to extricate himself from the restraint, or if he had a period of unconsciousness resulting from the impact that contributed to his drowning. The helicopter's doors were not installed at the time of the accident and all five seat restraints were found to be in working order and undamaged.

Postaccident examination of the helicopter revealed that the engine-to-transmission drive shaft was separated at the transmission side. Metallurgical examination of the engine-to-transmission drive shaft components revealed that the forward coupling did not appear to be lubricated and that there were multiple indications of exposure to elevated temperature, such as heat tinting and loss of the temperature plates on the forward outer coupling, high-temperature cadmium-induced brittle fracture of two forward attachment bolt heads, and a loss of hardness of the bolt head material due to high-temperature tempering. The external spline teeth on the forward spherical coupling were worn down to the bottom landings, while comparatively minor wear marks were observed on the mating internal spline teeth of the forward outer coupling. The asymmetry in the wear pattern between the spherical coupling and the outer coupling combined with the observations consistent with elevated temperatures indicate that the assembly likely failed by overheating due to lack of lubrication. This resulted in softening and subsequent failure of the spring that limits and centers the spherical coupling. When the spring failed, the coupling shifted

Photo 6 - Engine to Transmission Drive Shaft - Transmission End

forward, damaging the forward end of the outer coupling, fracturing the forward cover plate, and wearing the external spline teeth down to the bottom landings. Following the failure of the drive shaft, the engine would have continued to operate, but would not have been able to drive the main rotor.

Interviews with the pilot, the owner of the company, and a non-mechanic rated maintenance assistant indicated that maintenance had recently been conducted on the engine-to-transmission drive shaft, even though this was not recorded in the helicopter's maintenance records. In addition, the owner, who was a rated mechanic, was not present the entire time throughout the removal, inspection, and subsequent reinstallation of the engine-to-transmission drive shaft.

It is likely that, when this maintenance was conducted, grease was not applied to the forward coupling as specified in the manufacturer's maintenance manual. Further review of maintenance records revealed no entries pertaining to a current annual inspection or 100-hour inspection. Additionally, a component inspection sheet provided by the operator revealed that several required component inspections were overdue and had not been completed at the time of the accident.

Although the FAA was conducting oversight in accordance with their guidance, increased inspections may have uncovered the inadequate maintenance and documentation, which in turn, may have prevented the accident.

SURVIVAL ASPECTS

A witness, who was a Federal Police Officer at the WWII Valor in the Pacific National Monument, reported that, following the accident, 3-4 people dove into the water to rescue a 16-year-old passenger trapped inside the helicopter, who was seated in the aft middle seat. The officer reported that he and a Navy diver took turns with a knife, going underwater to cut the straps off the passenger. After about 5-6 attempts, they were able to bring the passenger to the surface and CPR was immediately administered by nurses and doctors who were visiting the memorial. The officer added that an AED was also used. The officer did not remember if the passenger's life preserver was inflated or not; however, he recalled seeing yellow while underwater. In addition, the officer stated that the life preserver was tangled with the seatbelts, which, coupled with poor underwater visibility, made it difficult to extract the passenger.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The in-flight failure of the engine-to-transmission drive shaft due to improper maintenance, which resulted in low main rotor rpm and a subsequent hard landing to water.