

Guideline : Human Factor

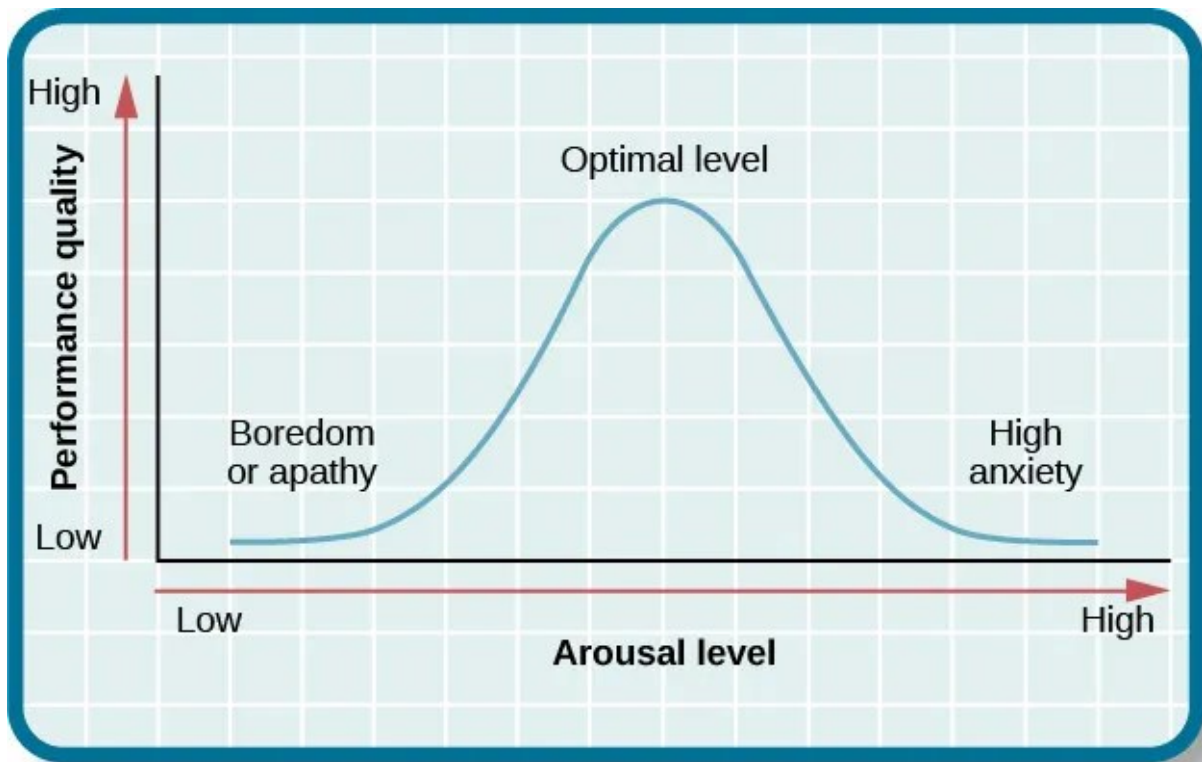
Introduction

- Despite all the changes in technology to improve flight safety, one factor remains the same: the human factor which leads to errors. It is estimated that approximately 80 percent of all aviation accidents are related to human factors
- ADM is a systematic approach to risk assessment and stress management. To understand ADM is to also understand how personal attitudes can influence decision-making and how those attitudes can be modified to enhance safety in the flight deck. It is important to understand the factors that cause humans to make decisions and how the decision-making process not only works, but can be improved.
- Aeronautical decision-making (ADM), has been recognized as critical to the safe operation of aircraft, as well as accident avoidance.

(STRESS)

We are often told that a little amount of stress can be good. That is correct. The body releases energy in the form of stress hormones, so that you can act quickly in emergencies. A moderate level of stress can increase concentration and improve your ability to react.

However, too much stress can have the opposite effect. It may paralyze you, slow you down, cause panic or even blackouts. You may get confused and find it difficult to solve situations. For this reason, it is important to learn how to cope with stress while flying drones.



The Yerkes-Dodson Law and Performance

The concept of optimal arousal in relation to performance on a task is depicted here. Performance is maximized at the optimal level of arousal, and it tapers off during under- and overarousal.

Yerkes and Dodson hypothesized that as arousal increases, the ability to form a habit or perform a task well also increases. It gives you sufficient motivation.

But that works only up to a certain point, known as the optimal level. As arousal surpasses that point, your performance begins to deteriorate. You're too stressed and anxious to do your best.

The best way coping with your stress is your well preparation.

Well Preparations in case of UA operation are the following conditons;

- Perform pre-flight check to ensure the Unmanned Aircraft is in good condition and functioning properly prior to take-off or launching.
- Check that the Unmanned Aircraft fly must not fly into restricted area, limited area and dangerous area and also at government buildings and hospitals unless permission is given.
- A thorough site and flight safety assessment covering the take-off and landing points, and areas along and surrounding the UA flight paths shall be conducted in daylight hours prior to the intended SUA operations, to identify, record and address any hazards, restrictions and obstacles in the associated areas that might affect the operations. Circumstances permitting, the arrangement of a recce flight(s) in daylight hours should be considered to assist in the site and flight safety assessment process.
- Brief and debrief all members of the flight team and associated staff and ensure they are aware of their responsibilities and tasks for the particular Unmanned Aircraft operation
- Carefully check the weather and wind forecasts for the area that will operate.
- the UA pilot must become familiar with UAS operations, the aircraft and its equipment.
- Have an emergency response plan including plan for accident, medical care and plan for problem solving in case of uncontrol aircraft.

So, If UA pilots well prepare for their own operation, They will cope with all emergency situations and also react to that situations properly.

How to avoid stress

- **Speed:** Fly your drone slow rather than fast.
- **Flight style:** A defensive way of flying gives you better control of the drone as well as the surroundings.

- **Environment:** Try to fly in areas with little, and more quiet, activity.
- **Good foresight:** If you are well prepared for the flight, you will feel calmer. (Check Section 5: Planning and performing a flight – operational procedures)
- **Sleep:** Be well rested before and during flight!

Don't drink and fly

Never drink alcohol or use any other kind of intoxicants that will affect your abilities during a flight. If you do, you can have your certificate of competence revoked.

All use of drug-classified substances, unless prescribed by a doctor, is illegal and can result in imprisonment.

How does alcohol affect us?

It does not take much to be affected by alcohol, often less than we think. That is the reason why there is a zero tolerance against alcohol consumption while flying drones. Many of your important capacities will suffer, such as your visual ability, responsiveness and ability to move. You will also find it more difficult to estimate distances, you will have tunnel vision and you will not notice signs of fatigue in time.

There is no way to increase the breakdown of alcohol. Sleep, movement, coffee or whatever - none of it can make the process go faster, even if it appears so. The speed of the breakdown depends entirely on one's personal capacity. If you have been drinking a lot, you should not fly the next day either.

Why you should not fly under the influence of alcohol

- **Distance estimation:** You will find it difficult to estimate distances.
- **Vision:** Your night vision will become poorer, and you will be more sensitive to glare. Also, you are more likely to experience tunnel vision and double vision.

- **Reactions:** You will not react as fast as when you are sober.
- **Movement:** You will find it more difficult to make precise and soft movements.
- **Fatigue:** It will make you tired and drowsy, and you will not notice these signals as quickly as when you are sober.

Do you use medication that affects your abilities?

Some medicines have an effect that is similar to that of alcohol and other intoxicants. If you are on medication, it is important to make responsible assessments of your abilities and limitations.

You should not fly if your medication makes your performance dangerous or risky. This goes for prescription medicines too. Examples of common side effects are decreased attentiveness, longer reaction time, and impaired judgment.

Different medications affect you in different stages – some only at the beginning, others constantly or only when you quit. In addition, combined medications or alcohol combined with medicine can increase or alter the effect.

If you are using medication

- Medication can have the same effect on your performance as alcohol and drugs.
- Medication can affect your attentiveness, reaction time and judgment.
- Combined medications or alcohol combined with medication can increase the effect.

Getting enough rest?

It is important that you are well rested during flight in order not to pose a safety risk. Fatigue will degrade your concentration as well as your ability to react, make decisions, coordinate and perceive sensory information. Flying tired is just as serious and can have the same consequences as flying drunk.

The risk of accidents due to fatigue is bigger at night, in the dark, at the end of the flight or under the influence of alcohol, drugs or other intoxicants.

If you fly for a long period of time, your commitment may decrease over time – you may start to think about other things, daydream or even doze off. These are common fatigue signals that you should take seriously. Make sure to pause if you notice that you are starting to lose concentration – resting for 20 minutes can be sufficient.

If you have not slept enough, you may fall into micro-sleep. Micro-sleep is extremely short episodes of sleep that can occur anytime and anywhere. If they happen at the wrong time, they can have major consequences, not least with a drone in the air.

To avoid fatigue and its consequences

- Fly well rested and make sure you get enough sleep.
- Respect fatigue signals. Pay special attention to these signals at the end of the flight or if you fly at night or in the dark.
- Fly short rather than long passes.
- Take breaks, 20 minutes of rest can suffice as a recovery.

Eyesight

We perceive most of the information we need with our eyes, and eyesight is also the sense that is most useful to you during your flights. Many of us have some type of visual impairment, which may develop unnoticed. For this reason, it is good to have your sight checked at regular intervals, preferably once a year. If you need glasses or contact lenses, you must use them during flights.

The two sharp percent

The **direct vision** is the part of your sight that is in focus in the visual field. Normally, the visual field is 180 degrees, of which the direct vision constitutes only one to two percent. This means that only two percent of your vision is sharp, everything else is blurred.

Activity in the periphery

The **side vision** enables you to perceive also that which is out of focus - the blurred parts of your vision field. The side vision enables you to notice movements and detect obstacles or dangers that are outside your focus while you are flying.

The vision gets worse in the dark

Darkness is not only making us tired, but also impairs our vision. Therefore, we need to be more attentive during flights in the dark. Many suffer from nearsightedness in the dark, as it is difficult for the lens of the eye to adjust when there is not enough light. It is also common for the lens to lose its elasticity over the years, which means that our **night vision** can become worse as we get older. Some people don't have night vision at all, usually from birth. This is called **nyctalopia** or **night-blindness**.

The likelihood of becoming dazzled increases when one's night vision is poorer. Therefore, be careful of strong light if your night vision is poor. Your eyes will have trouble switching from darkness to light and vice versa.

Make sure the technology is adapted to the environment. If it is dark outside when you fly, you can reduce the brightness of the radio transmitter's display. And if it is very bright outside, you may need to use a monitor hood.

Visually scan the sky

When we fly drones we are doing it within visual line of sight and besides seeing the drone clearly we should also keep our eyes on the airspace around us. This means that it is important to visually scan the airspace in a proper way.

Our eye sees as best when we focus our sight and can use all the visual cells tightly grouped in "macula of retina". (cone cells are more tightly spaced here than at the rest of the eye and can register details much better than the rod cells. We are best perceiving motion when we are not looking around but using our peripheral vision. (Rod cells used for peripheral vision makes picture blurry but are more sensitive to motion than cone cells).

In order to make a good visual scan of the airspace it is best to systematically move visual focus between several different points in the sky than just looking around.

You have to practice your visual scanning to look at the drone and your instruments as well so that you scan all three parts in regular intervals. The drone - control unit - surroundings. This method is used by airline pilots and it implies looking for a short period of time at your control unit before looking at the sky again. If you need to look at your control unit a bit more than you do so and then you look at another part of the sky and so on. This requires a bit of practice but when you get it right it makes you a much safer pilot which is good for you as well as others.

What do I need to pay attention to?

- Don't sweep around with your eyes when watching out for other aircrafts
- Focus your vision and move it between several different points in the sky
- Practice your scanning and get good at it
- Remember – when another aircraft shows up it can fly really fast and it's crucial to spot it as early as possible!

Practice makes perfect

The more experience you get from flying drones, the better your **visual scanning ability** will be. This makes it easier for you to perceive risks and solve difficult situations.

Other senses of importance while flying a drone

Hearing is important in order to hear things that might interfere with your flight or route, such as emergency services, other aircraft, birds, wind, water and so on. And, of course, odd noises that indicate failure leading to breakdown or some other accident. Therefore, don't listen to music or similar in headphones while flying.

The sense of feeling is important for you to be able to feel that all parts of the drone are properly fastened. Some radio transmitters also have warning vibrations if something should happen while the drone is in the air.

The sense of smell is important if there is a sudden smell of burning.

How are you affected by others?

One way or another, almost everyone is affected by being part of a group. This is called peer pressure, and it can be both negative and positive. But regardless, it is essential that, as a remote pilot, you trust your own skills and fly responsibly.

Negative peer pressure

In some social contexts you may feel that you don't dare to stick out or seem like a coward, or that you just have a hard time saying "no". This is called **negative peer pressure**. This pressure can cause you to fly more risky and do things that you know are not right, for example drinking alcohol before or while flying a drone.

Positive peer pressure

Social contexts where you can be sincere with yourself and others, are characterized by **positive peer pressure**. You don't have to feel that you are under pressure to do something that you know is wrong, and you might even make better decisions.

How are you acting yourself?

It is important that you too act responsibly and do not try to push people to do things they don't want to during flights.

Different methods of learning give different results

To understand in depth what you learn

As its name implies, **deep structured learning** means that you understand in depth the things you learn and read. You will be able to understand the logic behind particular rules, but also context and causes as a whole. The knowledge will stick and become a natural part of your flying when you are out in the field.

To forget as soon as you have learnt something

The opposite of deep structured learning is **surface learning**. If you just quickly cram enough to pass the theoretical examination, the facts will probably not stick.

Inevitable role models

Learning unconsciously by observing other people's behavior, is called **imitation learning**. In many cases, this is inevitable – therefore, being a good role model is also important.

Experienced or just too comfortable?

Often, experience will give you the best competence. By flying enough you will eventually be able to operate automatically. This is called **overlearning**. It is mostly positive – you can fly the drone without paying too much attention to the operation itself. Instead, you will concentrate on the surroundings, discover hazards and plan the next step in time.

But if you become too comfortable, you will also become less alert since you trust a bit too much in your own competence and ability. Besides, if you fly often in the same area, you may take too much for granted and become less vigilant. This is called **probability** learning.

However, it is not only negative: you will also learn what is expected and required in the area.

Automation-How it affects you as a remote pilot

Rapid advancement in technology within aviation and UAS has led to advanced automation which has changed the pilot's way of work. Instead of flying the drone manually the pilot monitors periodically different systems and the flight, which has its pros and cons. Automation has improved efficiency and safety but it provides a challenge for human performance. You as a remote pilot need to know how automation can affect your ability to fly the drone in a safe way.

What is the benefit of automation?

The general benefit of automation is that it can reduce work load for you as a remote pilot, both mentally and physically. For example, the RTH function can aid you in both return- and landing phases so that you can shift your focus on making sure that the landing area is clear to land. Follow-me-mode is another function that can relieve you. Another positive effect is that automation improves precision in navigation.

How automation does affects my performance?

Automation relieves you of piloting but you still have to be involved in flight and always ready to act if something goes wrong. We are poor at supervising the routines as humans. Supervising

the drone can be under-stimulating and negatively affect your attention. In case something goes wrong and it affects the drone for example a failing RTH, you have to quickly assess the situation, make a decision and take over manually which can be a heavy burden for you as a pilot.

Manual skills are getting worse when they are not used (such as your ability to fly the drone) and it can have a negative impact at your situational awareness. For example an RTH landing takes care of braking distance that you have to account for under different circumstances when you make a manual landing. Use the automation when appropriate but don't forget to fly manually now and then so that you don't lose your flying skills. It can be hard to detect fault in automation, depending on how advanced automation functions your drone has. A lot of automation functions are taking place in the background and are not always visible. That is why it can be hard to understand the logic behind the automation's behavior making it harder to predict its next move. Different alarms can also be discovered too late if you are not alert during the flight. Good knowledge of your drone's automation functions is very important.

Automation can give you a false sense of safety. It can be tempting to relax and let the automation that is faultless most of the time, take over. Always be aware of your drone's position, where it is going and what could happen next. Keep in mind that your awareness and your manual flight skills are important for a safe drone flight. Remember that it is always you who is responsible for a safe flight and not the automation. You as a remote pilot are a very important piece of puzzle in aviation safety!

What do I need to pay attention to?

- Don't lose your **flight skills** – switch between manual flight and automation
- Stay up-to-date with your drone's automation functions (a.k.a. modes) – possibilities and limitations
- Don't trust automation blindly – monitor your flight. Take over if in doubt!
- Be mentally prepared for emergencies and how to deal with them in best possible way
- Automation is not responsible for a safe drone flight, you are!

Risk awareness – a skill that takes practice

What can influence my risk awareness?

Several factors affects our risk taking, for example our experience of being in control of a situation, our drone or the environment has a huge influence. It is important for you as a remote pilot to think in terms of risks and be aware of what can affect your risk awareness and ultimately your decisions.

We as individuals have a tendency to underestimate risks where consequences are known a bit later, for example a slight change in wind direction which turns into a strong headwind on your way to a home position can result in a lower battery level than expected and can limit your options.

It is quite common to (unknowingly or on purpose) deny or diminish risks because of the strong sense of completing something that you already started. An example of such a situation may be a huge focus on completing a mission with a consequence of not aborting the flight when you should. In order to avoid getting stuck in willingness to complete a mission and return home it is very important to have clear operating procedures and follow them. For example you should always go for landing when reaching a certain level of battery charge and never exceed it, no matter how much is left of the mission. Something unexpected can always happen. It is also important to set your personal limits and never exceed them.

What do I need to pay a special attention to?

- Be aware of your limitations – don't exceed them and take no unnecessary risks
- Follow current operating procedures – they are there for yours and others safety
- Personal limits – set a level that doesn't exceed your abilities or operating procedures
- Remember – even if the mission is important, flight safety is the most important!

We tend to be more self-confident after getting some experience which can lead us to start bending the limits and finally taking exaggerated and unnecessary risks. If you have often been in risky situations and nothing bad happened, there is a high probability that you will take even bigger risks that can result in situations that can be very demanding and have a negative impact on safety. It is important to try to have an oversight of the situation to be able to decide if there are less risky options. Previous successes doesn't guarantee safety in the future, each flight is unique and has its risks and challenges.

(5 Hazardous Attitudes)

Hazardous Attitudes and Antidotes

Being fit to fly depends on more than just a pilot's physical condition and recent experience. For example, attitude affects the quality of decisions. Attitude is a motivational predisposition to respond to people, situations, or events in a given manner. Studies have identified five hazardous attitudes that can interfere with the ability to make sound decisions and exercise authority properly: **anti-authority, impulsivity, invulnerability, macho, and resignation.**

Hazardous attitudes contribute to poor pilot judgment but can be effectively counteracted by redirecting the hazardous attitude so that correct action can be taken. Recognition of hazardous thoughts is the first step toward neutralizing them. After recognizing a thought as hazardous, the pilot should label it as hazardous, then state the corresponding antidote. Antidotes should be memorized for each of the hazardous attitudes so they automatically come to mind when needed.

Anti-authority: “Don’t tell me.” This attitude is found in people who do not like anyone telling them what to do. In a sense, they are saying, “No one can tell me what to do.” They may be resentful of having someone tell them what to do or may regard rules, regulations, and procedures as silly or unnecessary. However, it is always your prerogative to question authority if you feel it is in error.

Impulsivity: “Do it quickly.” This is the attitude of people who frequently feel the need to do something, anything, immediately. They do not stop to think about what they are about to do, they do not select the best alternative, and they do the first thing that comes to mind.

Invulnerability: “It won’t happen to me.” Many people falsely believe that accidents happen to others, but never to them. They know accidents can happen, and they know that anyone can be affected. However, they never really feel or believe that they will be personally involved. Pilots who think this way are more likely to take chances and increase risk.

Macho: “I can do it.” Pilots who are always trying to prove that they are better than anyone else think, “I can do it—I’ll show them.” Pilots with this type of attitude will try to prove themselves by taking risks in order to impress others. While this pattern is thought to be a male characteristic, women are equally susceptible.

Resignation: “What’s the use?” Pilots who think, “What’s the use?” do not see themselves as being able to make a great deal of difference in what happens to them. When things go well, the pilot is apt to think that it is good luck. When things go badly, the pilot may feel that someone is out to get them or attribute it to bad luck. The pilot will leave the action to others, for better or worse. Sometimes, such pilots will even go along with unreasonable requests just to be a "nice guy."

The 5 Hazardous Attitudes	Antidote
Anti-authority	Follow the rules. They are usually right.
Impulsivity	Not so fast. Think first.
Invulnerability	It could happen to me.
Macho	Taking chances is foolish
Resignation	I’m not helpless. I can make a difference.