ISSN 2181-3187

FACTORS THAT AFFECT AIRCRAFT SAFETY IN UNPLEASANT WEATHER

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Annotation. Air traffic controllers play a crucial role in ensuring the safety of aircraft in all kinds of weather conditions, including dangerous weather. Their responsibilities include managing air traffic flow, providing pilots with critical weather information, and issuing directives to ensure that aircraft remain at safe distances from each other. In dangerous weather conditions, air traffic controllers have to be even more vigilant and proactive in their efforts to keep aircraft safe. They work closely with meteorologists to monitor weather patterns and make decisions about how to manage incoming and outgoing flights. One of the most critical tools that air traffic controllers use in dangerous weather is the Terminal Doppler Weather Radar (TDWR) system. This system provides controllers with real-time information about wind shear, turbulence, and other weather phenomena that can pose a threat to aircraft.

Keywords: flight safety, size of aircraft, weather conditions, low clouds, heavy rain, strong winds, snow and ice, thunderstorms, Instrument Rating(IR), Visual Meteorological Conditions (VMC), Instrument Meteorological Conditions (IMC),

If a dangerous weather event is imminent, air traffic controllers may issue ground stops or ground delays to prevent aircraft from taking off or landing until conditions improve. They may also reroute flights to avoid areas of severe weather or instruct pilots to adjust their altitude or speed to minimize the impact of the weather. In some cases, air traffic controllers may also have to provide emergency assistance to pilots who are experiencing weather-related difficulties. For example, they may issue instructions to help pilots navigate through fog or heavy rain, or provide guidance on how to respond to a sudden wind gust. Overall, air traffic controllers play a critical role in ensuring the safety of aircraft in all weather conditions, including dangerous weather. Their ability to quickly and effectively respond to changing weather conditions is essential to minimizing the risk of accidents and keeping passengers and crew safe.

However, both "demand" and "control", as well as "social support", can vary widely according to several factors dealing with different working situations, e.g. work environment, equipment, work planning and procedures, workload distribution, team composition, working hours, rest pauses, shift schedules and human relations.

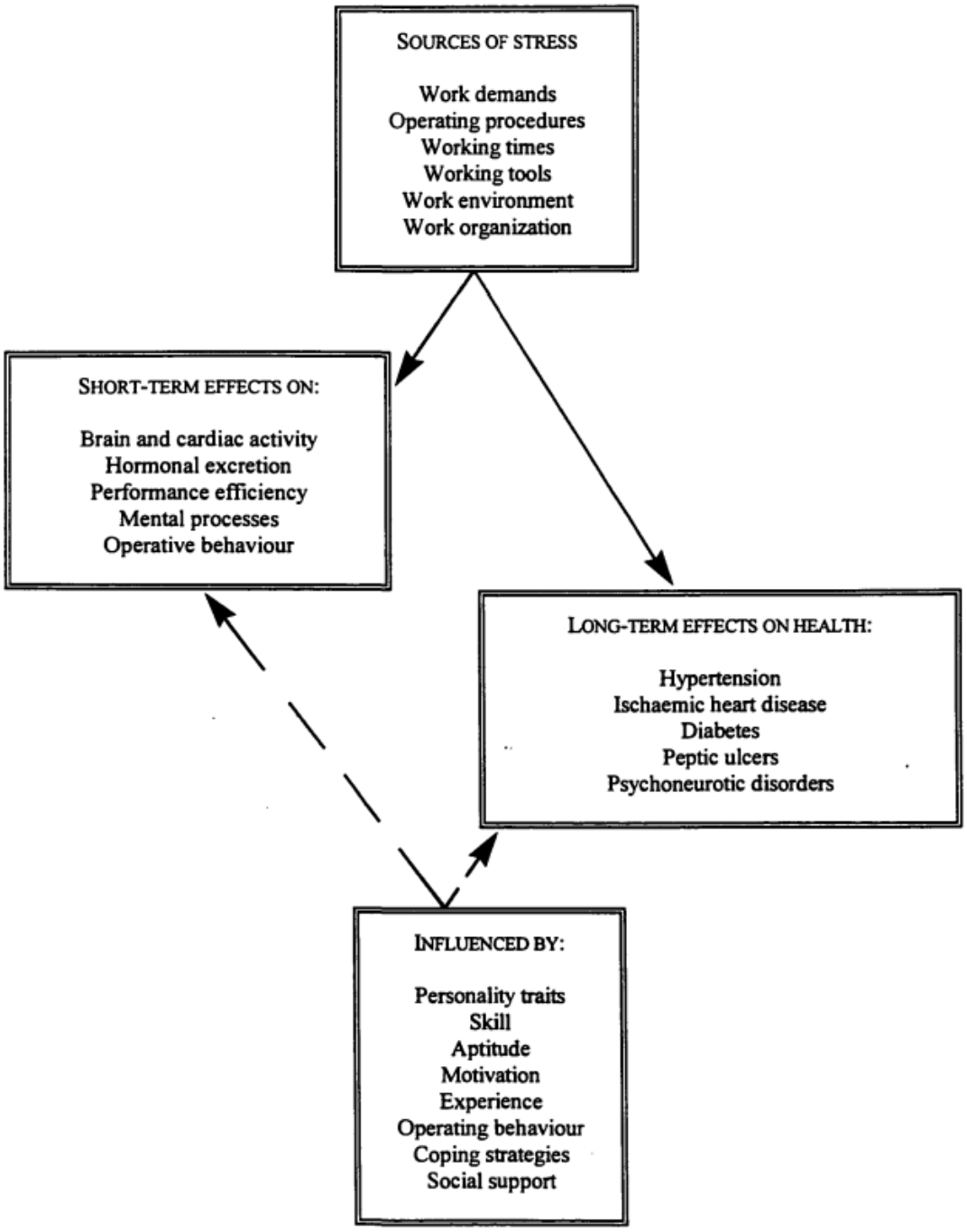
Furthermore, the consequences on an ATC's performance and well-being may differ widely among individuals in relation to many factors dealing with age, life styles, life events, work experience, personality traits (introversion, anxiety, type A), behavioural

ISSN 2181-3187

characteristics (mood, sleeping habits, morningness), attitudes, motivation, and physical and mental health. Moreover, many other factors related to social conditions can play an important role in this respect, e.g. socio-economic status, housing conditions, commuting, family attitudes, social support and integration.

Therefore, all these aspects can have more or less influence on an ATC's job satisfaction, health and well-being according to different circumstances (Figure 1). They can interact and interfere with each other, giving rise to not only possible additive or multiplicative, but also subtractive effects, so that it is often very difficult to evaluate and compare the effective stress and strain in different groups and individuals. This is the reason why many studies on the stress of air traffic controllers reported apparently contradictory findings.

ISSN 2181-3187



Most research indicates that these responses are in some way related to the workload, which can be evaluated in terms of the number of aircraft under control or expected to come under control, peak traffic counts, duration and type of communications, tight work schedules, and number and complexity of problems to be solved. However, big differences among air control centres can be recorded, mainly in relation to air traffic density. On the other hand, they appear to be greatly influenced by subjective factors, such as personality traits (anxiety, introversion), aptitude, skill, ability, motivation, experience and operating behaviour.

Whether or not it is possible for a pilot to navigate bad weather is highly dependent on a few factors. While some pilots will be able to fly through rain and strong winds with ease,

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others may have a harder time. The level of safety when flying in weather that is considered bad is dependent on three major aspects of the flight. The first is the type of aircraft that is being flown, the second is the experience level of the pilot flying the aircraft, and lastly, whether the information of there being bad weather en route was known by the pilot beforehand or not.

Size of aircraft

Smaller aircraft, especially those belonging to the light aircraft and microlight variety, may not be the best choice when flying in the middle of strong winds or heavy rain. The chances of the aeroplane experiencing extreme turbulence go up the smaller and lighter the aircraft gets. Larger aircraft, such as commercial airliners, come equipped with multiple engines and are generally heavier and sturdier than the smaller varieties. These are able to withstand strong winds and heavy rains with relatively more ease. Since beginner and private pilots usually fly smaller aircraft, it's best to stay grounded since lighter aircraft are at a greater risk of sustaining damage when flying in bad weather.

Experience of pilot

As opposed to a beginner, there are many stressful situations that an experienced pilot can navigate with ease. A pilot with a fair bit of training behind them, as well as the needed Instrument Rating (IR), which is discussed further on in this article, will generally be much more comfortable flying in unideal weather conditions as opposed to an amateur. An experienced pilot will understand how to avoid situations that are too risky and, if a risky situation does arise, they will be better equipped to handle it in the best way possible. More experience also makes a pilot relatively calm, enabling them to handle issues such as turbulence without losing their cool. A beginner pilot may not have all the skills needed to get out of a dangerous situation induced by bad weather, and their lack of confidence in their skills may not help the situation either.

Forecasted weather

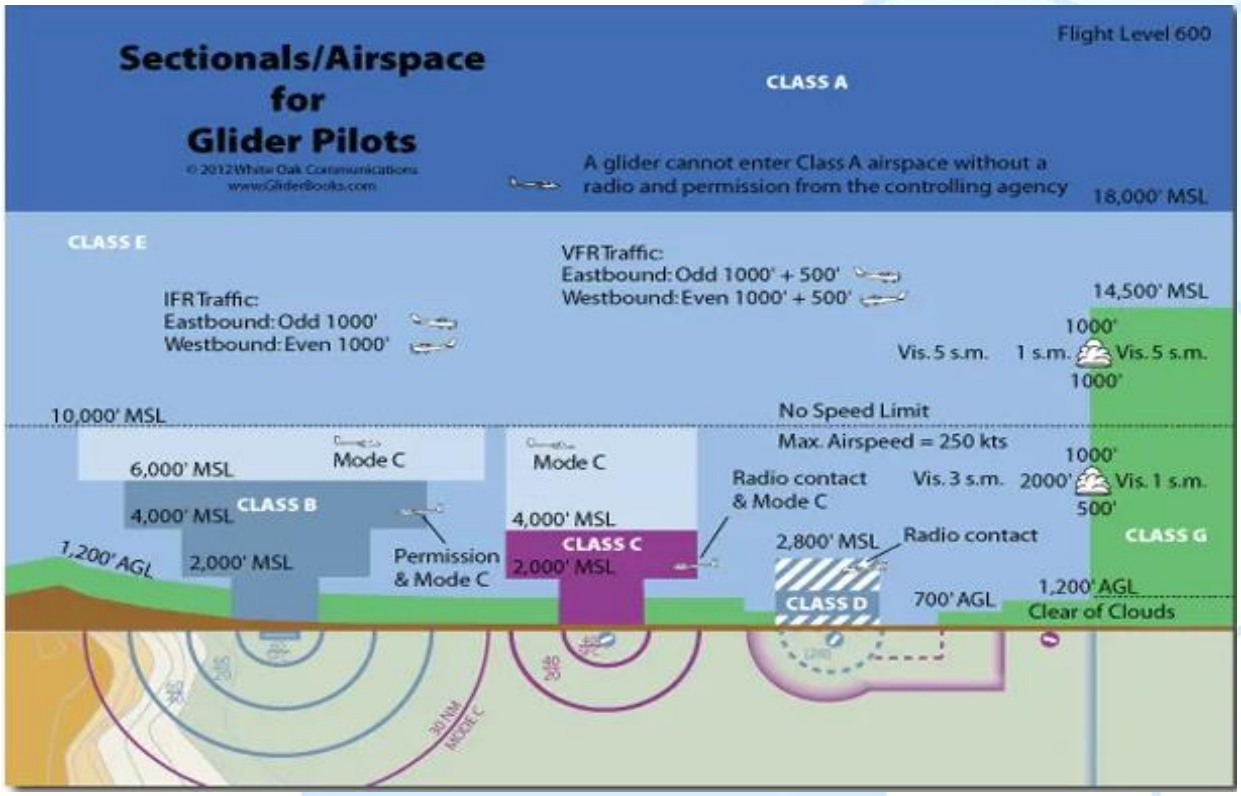
Bad weather can't harm a pilot if they know when, where, and how to avoid it. For this reason, it is best to check weather predictions and the meteorological conditions of the airspace you plan on entering beforehand. If a pilot knows what to expect, they are much better equipped to handle what may be thrown at them. When a pilot is aware that there is a patch of airspace where a storm is raging, they will take the necessary precautions and fly around it. Similarly, if a pilot finds out mid-flight that there is a storm ahead, they can choose to simply go back to where they took off from. Most weather-related accidents happen when a pilot flies into bad weather without anticipating it, which leaves them ill-prepared to handle issues of impaired visibility and heightened turbulence. Due to this, it is necessary that you do your homework before taking off and are aware of the weather en route. In case of sudden developments, you should be in contact via radio with ground control so that you can be guided adequately.

Flying in different types of weather

ISSN 2181-3187

Air Space			Mnemonic
Class A			No VFR
Class B			3, CoC
Class C			3, 152's
Class D			3, 152's
Class E	less than 10,000 MSL		3, 152's
	at or above 10,000 MSL		5, 111
Class G	1,200 feet or less AGL	Day	1, CoC
		Night	3, 152's
	more than 1,200 AGL but less than 10,000 MSL	Day	1, 152's
		Night	3, 152's
	10,000 MSL		5, 111

Not all "bad" weather is hazardous to a flight. Knowing when bad weather is too bad can make all the difference for a pilot. Light rain and strong winds don't have to be reason enough to stay grounded, but knowing when the weather is developing into something more dangerous is necessary for a safe and smooth flight. Here are the different types of unideal weather conditions that a pilot may experience, and whether they warrant a complete grounding of flights or not. Keep in mind that this is with regards to recreational pilots flying smaller aircraft. Larger aircraft are able to withstand relatively more extreme weather as opposed to light aircraft.



Low clouds

The clouds really aren't the problem, it's how they affect visibility. If a cloud is so low that you cannot avoid flying through it, then it is best to keep your feet planted on the ground. While pilots with more experience and an Instrument Rating (IR) can fly through conditions with limited visibility with the help of avionics, amateur pilots who have a

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basic Private Pilot Licence (PPL) with no IR should steer clear of flying in such conditions.

Heavy rain

Rain in and of itself isn't the issue. Most aircraft can fly through the rain with ease and without sustaining any damage. However, when the rain is heavy, visibility may be impaired, which ends up becoming a problem. Again, you can fly through rain easily if you have an IR on top of your PPL, but it's best to keep out of the sky if you don't. Also, rain with hail or freezing rain is a major aviation hazard and should be avoided. Hail can damage the body of an aircraft and most airplanes are not designed to deal with icing that happens as a result of freezing rain.

Strong winds

The biggest pitfall of flying in strong winds is turbulence. Smaller aircraft may be tossed and the pilot and passengers may experience extreme turbulence. While it isn't a major hazard, strong winds can make for a pretty frightening flight. For those flying larger aircraft, strong winds are not much of an issue. However, pilots flying smaller aircraft, especially very light aircraft such as microlights, should avoid taking to the skies.

Snow and ice

As mentioned above, most small aeroplanes, such as light aircraft and microlights, do not have the equipment needed to de-ice in case of a build-up of snow on the wings or freezing. If you are mid-flight and notice any icing, it would be best to land as soon as possible. For this reason, flying in snow and ice is not a good idea for amateur pilots and those flying smaller aircraft. The added stress of having to make an emergency landing may catch a new pilot off guard and cause them to fumble. Poor visibility is also an issue when it comes to flying in the snow.

Thunderstorms

Thunderstorms are probably the first weather phenomenon that comes to mind at the mention of bad weather, and that is understandably so. Thunderstorms combine strong winds and heavy rain to make for an extremely bumpy flight, so it's best to steer clear of them. If the storm is accompanied by lightning, then the aircraft should stay grounded until the storm passes or there is an option available to fly around the patch of bad weather.

Meteorological conditions

In aviation, there are two main overarching types of meteorological conditions. The first is Visual Meteorological conditions (VMC) and the second is Instrument Meteorological Conditions (IMC).

Visual Meteorological Conditions (VMC)

Visual Meteorological Conditions (VMC) are ideal for flight. VMC means the weather is good and that a pilot can take to the skies without depending on instruments. Having the ability to see clearly what's ahead helps put pilots at ease since most amateur pilots are dependent on their five senses when it comes to navigation. VMC usually

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translates to relatively clear skies, which means it is safe to take off for amateur pilots who do not have Instrument Ratings (IR). Light rain or cloud cover may be present, but not to the extent of becoming a hindrance.

Instrument Meteorological Conditions (IMC)

Sometimes, pilots need to rely on more than just their eyes in order to fly. Such conditions, where a pilot's visibility is affected due to weather, are referred to as Instrument Meteorological Conditions (IMC). Flying in IMC means relying on in-flight instruments to navigate the aircraft since a pilot's regular vision is impaired. Pilots who do not possess Instrument Ratings (IR) are not eligible to fly in IMC. In fact, flying without an IR on top of your pilot licence in IMC is actually illegal in the United Kingdom, so it is best to stay grounded during such conditions.

Instrument rating (IR)

For those pilots who wish to get more out of their Private Pilot Licence (PPL) and acquire the ability to fly even when visibility is impaired due to rainy or cloudy weather, getting an Instrument Rating (IR) should be the next item on the list. The IR permits a pilot to fly in IMC, certifying that the pilot knows how to make use of in-flight instruments in order to navigate. Here are all the reasons why you should get an Instrument Rating (IR).

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