



The A to Z of Fearless Flying

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Abstract

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<p>This thesis examines and analyses aviophobia, generally known as fear of flying, combining the author's extensive experience as a commercial pilot and safety instructor with insights from cognitive science and psychology. The theoretical framework explores the psychological and physiological factors contributing to flight anxiety and examines different coping mechanisms. It also studies the role of the flight crew in mitigating passenger fear, emphasizing the importance of effective communication and empathy. Some of the external reasons for anxiety, like turbulence, are also subject to closer examination. The key component of this research is the production of an informative booklet, "The A to Z of Fearless Flying".</p> <p>The primary objective of this thesis is to create an accessible and practical resource for individuals experiencing anxiety or fear related to flying. The target audience includes those with a mild phobia of flying, individuals who experience discomfort while flying, and even those who have never flown before. The development of the booklet was supported by an extensive review of existing literature on fear of flying, psychological and cognitive theories, as well as the author's extensive experience from the field of aviation. The production process includes drafting, feedback integration, and refinement of the booklet's contents. It also speculates on the future use, considers possible commercial development and requirements.</p> <p>The booklet, "The A to Z of Fearless Flying", serves as a practical application of the theoretical framework. It is designed to educate and empower anxious passengers, offering them knowledge about flight procedures, safety measures, and reasons behind common anxieties. The author uses his expertise as a pilot and safety instructor to provide practical and accessible information, to explain phenomena like different noises and turbulence. The reader joins the author on an imaginary flight and is walked through the different procedures and phenomena, step by step. The author's expertise as a pilot and safety instructor lends credibility to the information presented, ensuring accuracy and clarity.</p> <p>The thesis concludes by discussing the potential impact of the booklet in reducing flight anxiety and enhancing the travel experience. It also addresses the limitations of the study and suggests alternatives for future research, including the development of interactive resources and feedback on the contents by empirical studies. The author recognises the impact a diminished level of anxiety can have on individuals' lives and the aviation industry as a whole.</p>
Key words Fear of flight, anxiety, flight safety, turbulence.

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1 Introduction

Since the Wright brothers first successful flight, there has also been fear of flight. In the early days of flying as flight technology was still in its infancy, there were many accidents. The general perception of flying was (correctly so) one of danger and unpredictability. Anxiety and fear were quite common among those who witnessed or experienced early flights. In World War I airplanes were commonly used, further exposing the public to the realities of flight, with numerous crashes and casualties. Pilots and crew members who experienced the horrors of aerial warfare often developed psychological trauma, including fear of flying.

As commercial aviation began to emerge after World War I, and air travel became more accessible to the public, concerns about safety and security grew. In the following decades, as air travel grew in popularity, psychoanalysis gained popularity, and psychoanalysts began to explore fear of flying. Loss of control, vulnerability and fear of death were seen as the main anxieties. Starting in the 1970s, at the same time as air travel was becoming increasingly more popular and not only something for the rich, behavioural and cognitive therapy techniques were developed to address fear of flying. These approaches focused on identifying and challenging irrational thoughts and fears, as well as gradually exposing individuals to flying situations in a controlled manner.

Despite occasional accidents, modern commercial aviation is safe. Improved technology, rigorous safety regulations, and experienced pilots have significantly reduced the risks associated with air travel. Notwithstanding all the technological advancements and air travel being remarkably safe, there is still a call for handling fear of flight. Some airlines offer fear of flying courses combining education, relaxation techniques, and exposure therapy to help individuals overcome their anxieties. Cognitive behavioural therapy is another method for treating fear of flying. It helps individuals identify and challenge negative thoughts, develop coping strategies, and gradually confront their fears.

The author has worked as a professional pilot for 30 years, besides also being a safety instructor for 8 years. The instructed subjects include communication, teamwork, leadership, and aviation psychology. During the years as a pilot and instructor, there have been many contacts with customers who are afraid of flying, and it has felt good to have been able to contribute to lessen these fears, mainly through short discussions before the flights. These encounters have made the author realize that many simply lack sufficient knowledge and could be aided by information. While serious anxiety needs to be handled by professionals, the author is convinced that many frequent fliers could lessen their hesitation for boarding an airplane, simply by having information readily accessible. That information could consist of a booklet with short explanations and briefs, for instance of what happens on an aircraft and what the different noises and motions mean.

The theoretical framework is straightforward in this thesis. It mainly focuses on the research of the psychology behind the fear of flight. What is it that makes flying, from a fear point-of-view, so much worse than getting on a train or riding a bus? What are the factors that trigger this fear? What is the general consent, are there any general methods in combatting the fear of flight, or are there several solutions like flight crew involvement? Triggers for fear of flying, like basic weather phenomena, are also presented.

The framework is followed by a detailed description on the progress of the project, from the birth to completion to the future. The author describes the different challenges in making a booklet, goes through the work process and defines the target group. Some of the challenges discussed are distribution and commercial production, or possible limiting factors like a too narrow approach to a complex subject.

Before presenting the outcome, the work is critically discussed and the reliability of the thesis evaluated. The expertise of the author in the field of aviation lends credibility to the booklet, while at the same time raising the bar. Being an expert in aviation, does not automatically make you an expert writer. Writing a thesis is a learning process, learning how to express yourself academically and critically. The booklet "The A to Z of Fearless Flying" is a step on the way, but hopefully a step that can provide help to anxious flyer.

2 Theoretical framework

While it does sound grand to define the target audience as anyone who intends to set their foot in an aircraft, this still needs to be the definition on a macrolevel. Narrowing it down the focus is on those passengers who feel hesitation or discomfort when considering getting on a flight but are still able to get on that flight. Customers with a more pronounced fear of flying lie outside the scope, as they could do well with consulting professional help. These customers will most likely not be aided by a booklet, but instead need personal support to work on their anxieties.

According to Foreman and van Gerwen (2018, 1), research indicates that about 35 out of every 100 people develop a fear of flying at some point in their life. She further states that almost everyone knows someone who has it. Bor and van Gerwen (2017, introduction) present the range as between 10 to 40 per cent of air travellers experiencing some kind of fear response to the air travel process. From this can be concluded that it is more common than generally thought.

Crangle (2010, 19) lists causes behind fear of flying, on a non-psychoanalytical level, stating that it commonly can be associated with a bad experience which happened while flying. On the other hand, she also states that many others admit having no idea why the fear developed. According to Crangle (2010, 19) nowadays many are more concerned about airport security and the possible act of terrorism. While the author of this thesis agrees that these fears were prevalent in the years following the 9/11-attacks, in his own experience they are rarely mentioned nowadays. The level of airport security and anti-terrorism protocols have improved, which is apparent from the lack of media shared acts of terrorism on aircrafts.

There are many possible reasons. Lack of terms of reference (hard to see outside), family influence (transferred to children unintentionally by parents fearing to fly), stressful life changes, high level of stress, lack of knowledge or media, are a few she mentions (Crangle 2010, 21). The lack of knowledge is something the author of this booklet aims to target. Aviation, while statistically safe, is a popular subject in media attracting headlines in a way no other transportation form is. The USA department of Transport publish statistics from the U.S, about the relative safety of air travel (Foreman and van Gerwen 2018, 17). From the table can clearly be seen the excellent safety statistics of airliners. (Table 1.)

Table 1. Danger of flying in relation to other modes of transport or situations in the USA (adapted from Foreman and Van Gerwen 2018, 17)

Mode of transport/situation	Number of annual deaths in the USA
Car	45.000
Walking	8.000
Staying at home	20.000 accidental deaths
Working at the office	11.000 accidental fatalities
Homicide by spouse or relative	7.000 homicides
Airlines (Scheduled passenger flights)	0 (2010 – 2023)

2.1 Fears and phobias

A phobia is an irrational, intense, persistent fear of certain situations, activities, things, or persons (Brown 2010, 7). The main symptom of a phobia is the excessive and often unreasonable desire to avoid the beforementioned fear. When it is beyond one's control or if it interferes with daily life, it can be called a phobia (Brown 2010, 8). While aerophobia per definition is the fear of flying, there are other phobias that make people avoid flying, like claustrophobia, acrophobia and agoraphobia. PTSD is not per definition a phobia but still can make people avoid flying. The Diagnostic and Statistical Manual of Mental Disorders (Brown 2010, 16) lists and describes some of the fears and phobias, keeping in mind that people respond differently to traumatic experiences. (Table 2.)

Table 2. List of the main fears and phobias that can make people avoid flying (Brown 2010, 16)

Fear	Description
Posttraumatic stress disorder (PTSD)	Mistrust of the system, including pilot training and air traffic control
Claustrophobia	Fear of enclosed spaces
Acrophobia	Fear of heights

Fear	Description
Agoraphobia	Fear of having a panic attack while unable to escape from the space where the attack is occurring.

While PTSD is not really a phobia, the symptoms are similar. It occurs when individuals are exposed to stressful or traumatic experiences, such as war or accidents. People with PTSD exhibit many symptoms, but lack of trust is often at the core. They may not trust the pilots (he probably drinks), the mechanics (he only has his job because he is unionized), or the ATC (they are just sleeping on the job) It does not matter if the beliefs can be disputed, if one distrustful belief is confronted, another one rises to take its place. All these erroneous beliefs must be replaced using valid sources of information, but most likely also behavioural therapy.

Describing the physical reaction of fear, the following happens: When you have a fearful thought, the brain sends a signal to your hypothalamus gland to mobilize your body for action. The hypothalamus is what regulates your autonomic nervous system and controls heartbeat and breathing among other functions. All animals have this reaction to possible danger, and it is called fight-or-flight. It is normal and a necessary part of human existence and has allowed us to continue and thrive as a species. This reaction occurs with perceived danger, whether it is real or not, and when the response is exaggerated it is a phobic response and must be controlled (Brown 2010, 17).

Once this thought activates your body, epinephrine is pumped into the bloodstream. Blood vessels constrict, blood pressure goes up, heartbeat rate increases dramatically. Blood flows from your hands, feet, and brain to your central body cavity. Blood sugar also increases, preparing the body to react physically. The increased heart rate may for some increase the fear, as they fear they will have a heart attack. One interesting detail is that palms often get sweaty, despite blood being drained from them, which is paradoxical as they should be getting colder when the blood is drained. The high level of epinephrine causes this reaction (Brown 2010, 19).

Muscles also tense in response to fear. If the period of fear is short, the tension will dissipate quite quickly, but if you are tense for a long time, it can produce a lot of discomfort and even severe pain. Legs may also shake uncontrollably. Vision may become blurred as too much oxygen in the bloodstream causes the pupils of the eye to dilate, although at the onset of the reaction your vision can be slightly improved because of your heightened physical state. It is common for the hearing to improve, causing the fearful passenger to hear the mechanical sounds of an aircraft even better. The stomach may also become upset, as more acids are secreted into it, as part of the fight-or-flight reaction.

Brown (2010, 24) argues that while medication certainly may assist in handling fear of flight, he is against it as the only coping tool. He explains that the problem with medication is that they are not curative, and the fearful flyer will be reliant on them for the rest of his life. Medication may also cause addiction. The underlying reason is still the physical reaction to fear, the perception of being in danger.

2.2 Cognitive coping

While according to Kraaij, Garnefski and van Gerwen (2017, chapter 6) little is known about which specific method or elements of treatment programs work best, there are several available worldwide. The article lists about 50 treatment facilities in the Western world, but this may have changed since publication, an updated figure was not available. This is largely because many therapists and mental health professionals offer this service as part of their general practice, and not all of them are listed in specific databases. Greco, Van Gerwen, Spinhoven, Diekstra & van Dyck find that existing treatment programs have been proved to reduce fear of flying effectively (Kraaij, Garnefski and van Gerwen 2017, chapter 6).

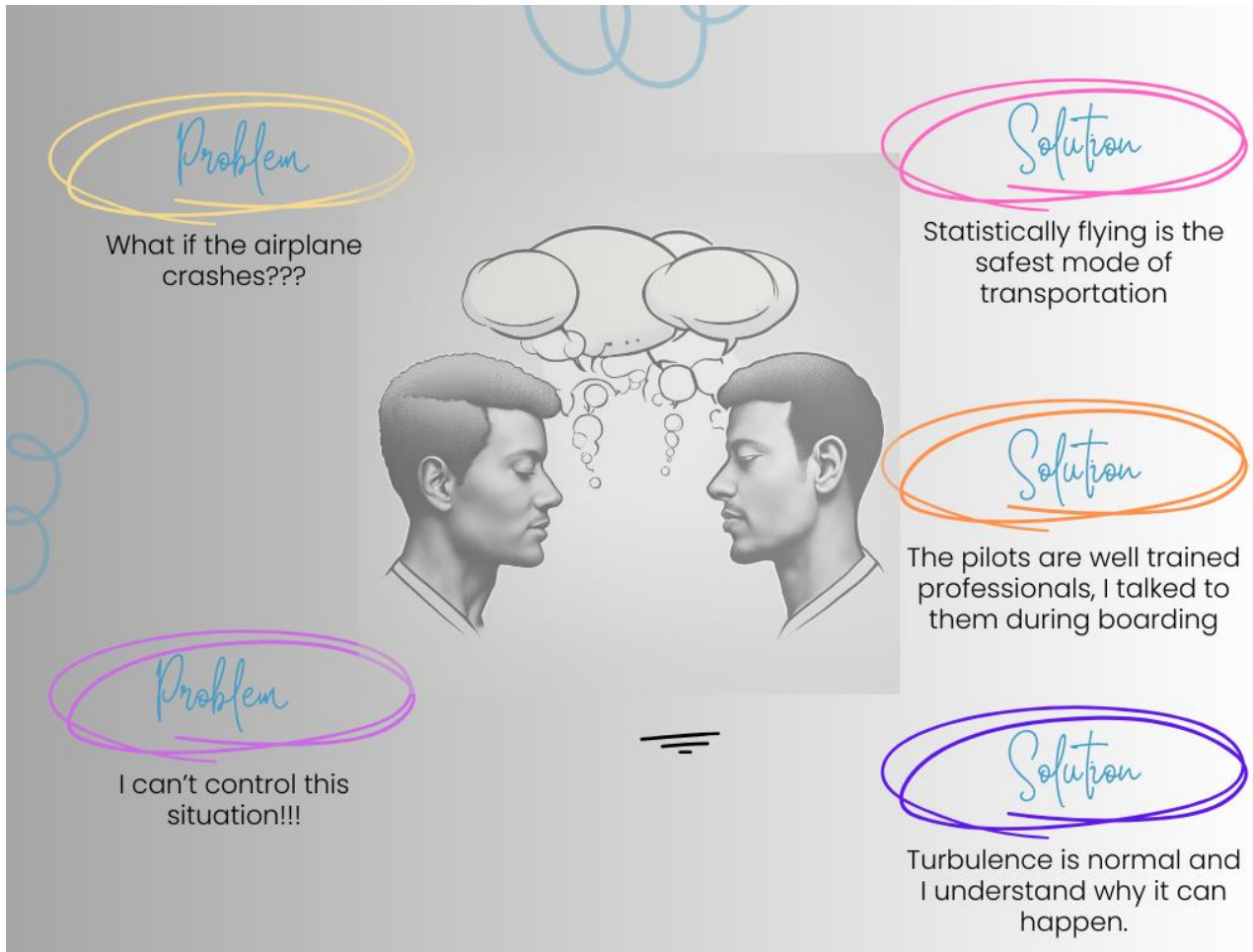


Figure 1. In cognitive coping the passenger uses rational arguments to suppress the irrational thoughts. Muscle relaxation is often a part of the treatment.

The way people deal cognitively with stressful events may be an important factor in determining wellbeing. If certain cognitive coping strategies can be proved to be effective in dealing with stressful flight events, these strategies could be promoted. Garnefski, Kraaij and Van Gerwen made a study which supports the use of cognitive strategies in treatment programs for flight-anxiety. (2017, chapter 6). Coping training and cognitive restructuring appear to be the most efficient strategies, while self-blame, acceptance, rumination and catastrophizing seem less efficient.

Roberts (2017, chapter 7) has developed a multi-dimensional approach with good results. It is an eight week course consisting of four core treatment modules. The first stage focuses on progressive muscle relaxation and guided imagery, the second is an educational program with visiting experts, the third one uses group work techniques for group cohesion and support, and the last one uses in vivo exposures, meaning airport and aircraft visits including a graduation flight.

2.3 Computer-assisted Therapy

Bornas, Llabres and Tortella-Feliu (2017, chapter 13) argue that computer assisted fear-of-flight therapy has worked well. It is a computerized exposure treatment, requiring almost no or little therapist involvement and may be completed with as little as four hours of actual exposure. The patient is exposed to pictures and sounds of the different stages of flight, starting from preparation for travel, ending with approach and landing. After this first exposure, the patient evaluates his or her anxiety on a Likert scale. If the score is too high the sequence is repeated until a low anxiety score is received, before moving on to the next stage on the patient's fear hierarchy. The therapy is completed when he/she has completed all stages of flight.

While the beforementioned process is simplified for the benefit of this thesis, studies show good results (Bornas, Llabres and Tortella-Feliu 2017, chapter 13), and considering the development and advancement of computer technology and virtual reality, this may well be the future for fear-of-flight treatment.

2.4 Flight Crew involvement in the Fear-of-Flying

For the airline industry, fear-of-flight is a lose-lose situation. It tends to keep capable (and paying) passengers away from buying tickets and flying, but it also may cause problems onboard, with fearful passengers suddenly wanting to leave the aircraft (Tomaro 2017, chapter 14). While such incidents are rare, especially insisting on getting offloaded after the journey has started, it does not only cost time, but also money for the airlines. While it does have the ingredients for a comic cartoon strip, in real life, such situations often are threatening and heavily rely on the interpersonal skills of the flight crews.

There are a few recommendations and guidelines for airlines and crews to help coping with fearful passengers. Paradoxically, often when the airline has the maximum ability to offer services to the fearful passenger, the passenger has the least need for it, and vice versa (Tomaro 2017, chapter 14). The point of sale is the first possibility to interact. While the identities of the anxious passengers are not known at this point, information about "preparation for the flight for the fearful passenger" should be readily available and marketed. This program can be considered both preventive and promotive. If the airline can win the confidence of the frightened consumers, the more consumers will utilize that airline. Accomplishing the goal of prevention will ensure promotion (Tomaro 2017, chapter 14). The author of this thesis fully agrees with the beforementioned point-of-view, and it is one of the reasons for creating a fear-of-flight booklet. Supported by informational brochure and community referral sources (courses for fear-of-flight, therapists, etc.), airlines should

not just increase the total comfort of its flights, but also create goodwill throughout the consuming public.

Tomaro (2017, chapter 14) has identified several misperceptions of the aviation environment that, when corrected, have a positive effect upon flight anxiety. Misconceptions like “the wings could break off the fuselage of an aircraft (in turbulence), “the engines lift the aircraft off the ground, or “the aircraft is in a free fall during descend”, are easy to identify and a capable airline employee can correct these. Other popular misconceptions are “the aircraft could roll upside down in a turn”, “there is airless space in the atmosphere (so called air pockets)”, and “the aircraft slows down and could fall from the sky, when the captain reduces power”.

Muscle relaxation and controlled breathing are also simple to teach, and these are powerful fear/anxiety control techniques. Many individuals are unaware of the effects of their muscle tension levels on their anxiety (Tomaro 2017, chapter 14), and conversely believe that muscles will relax when the anxiety goes away.

Airline staff should be and partially are taught communication skills, when it comes to fearful passengers the importance of accurate and empathic communication cannot be emphasized enough. With a little training and practice, flight crews can learn these skills to better identify and handle the anxious passengers.

Fearful passengers can generally be divided into two categories – enlightened and unenlightened (Tomaro 2017, chapter 14). For most parts, it will not be possible to identify enlightened passengers, as they can be said to have at least the situation somewhat under control. They understand how the procedures work and most importantly have some idea about what to do to



Figure 2. Cabin crew member calming scared passenger (generated by the AI tool Imagen)

cope with the risen amount of anxiety. The unenlightened are more important to identify, as they often can be on the brink of mental collapse. Signs of stress maybe visible, and they can have questions about the weather, the captain, the aircraft, etc. The time of asking may also be the giveaway, as the passenger may start requiring plenty of attention during the busy boarding stage. Not all passengers who ask questions or demand extra attention are fearful passengers, but initially it is safer to treat them as such.

Communications training for flight crews should include instruction on both effective and ineffective communication strategies. Anything that could be defined as judgmental, argumentative, authoritarian or persuasive should be avoided. The reason is that such statements may worsen the already brittle self-esteem of the fearful flyer, causing further negative reactions. To successfully help a passenger the crew member must form a bond with the passenger (Tomaro 2017, chapter 14), and use that bond to help the passenger control their breathing and muscle tension level, until the acute anxiety has run its course. It can be challenging for a crew member to find the time required for such assistance, but it is still better than having to return for landing.

While cabin crew members handle most of the contact with passengers, pilots do well to learn about how to communicate as well. The author finds that often the possibility to shortly meet the flight crew and exchange a few words with them, already helps. Honesty with passengers is crucial (about turbulence, for instance), but the fearful passenger can be assured about the capability of the aircraft to handle such occurrences. It is also a good habit to make an announcement during the flight, should the aircraft enter turbulence. This will aid in calming the anxious passengers. The author of this thesis has not seen a study confirming this, but these precautions are based on years of experience and feedback received.

2.5 Phenomena causing Fear-of-Flight

There are several occurrences that may trigger fear of flight in a passenger, like unexpected and loud noises, but weather is often the main culprit. The author finds that especially turbulence understandably creates unease in many passengers. Even if a passenger does not feel anxious, prolonged or severe turbulence may create nausea. The anxiety is often based on misconceptions like the wings will break and fall off, or that there is an airhole and the aircraft will simply drop. These beliefs stem from a lack of knowledge about different weather phenomena and how the aircraft is constructed and deserve a closer look.

Weather affects every flight and influences aircraft performance and flight safety. It is the state of the atmosphere at a given time and place that causes weather. Affecting variables are temperature, moisture, wind velocity, visibility and pressure differences (Federal Aviation Authorities 2023, chapter 12). While understanding weather and how it affects flight safety is an essential part of pilot training, for this booklet the focus is on turbulence and how it affects flying.

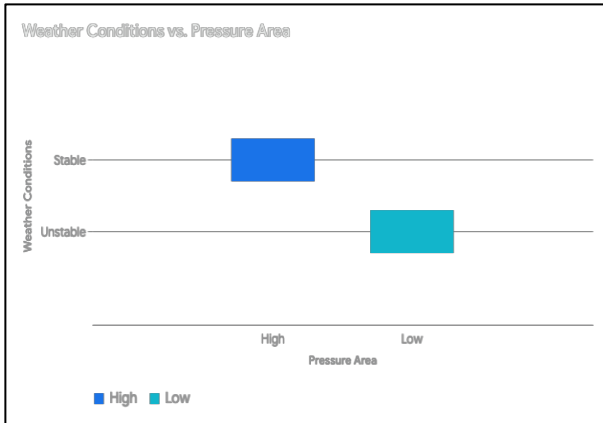


Figure 3. In high pressure areas the air normally stable, while in low pressure areas it is unstable (generated by the AI tool Imagen)

turbulence may occur. Turbulence is really the fluctuations in wind speed and direction. It is to some extent comparable with waves on the sea, with the difference that the waves in the air are not visible, but still work in a similar fashion. Normally the stronger the winds, the bigger the waves are. Vessel speed and size affects how much the turbulence is felt onboard, both at sea and in the air. The slower the speed, the softer the ride and bigger vessels are steadier reacting less to changes in both air- and waterflow. Waves in the sea are created by disturbances in the airflow. The disturbed airflow creates bigger waves, which in turn further disturbs the airflow, creating even bigger waves, until an equilibrium is found.

The disruption of airflow can be caused by several reasons, including wind shear, convection, jet streams, and mountains. Wind shear is a rapid change in wind speed or direction over a short distance. It normally appears near the ground, where terrain or other obstacles disturb the smooth flow of air, creating swirls and eddies. The most challenging wind shears are found in conjunction with thunderstorms, where there often are strong vertical winds. As moisture in the clouds becomes too heavy and falls as raindrops, a vertical airflow is created. If the rains are intense enough, the vertical winds created may in worst cases be strong and even dangerous for airplanes. Today this phenomenon is well known. Pilots are trained in how to react if they end up flying in strong windshear, but more importantly equipment and training make avoiding windshear straightforward. It is only in extreme cases close to the ground, that wind shear may become an issue.

To simplify, wind is essentially created by pressure differences in the atmosphere, where air wants to move from a high-pressure area to an area of lower pressure. These pressure areas are normally shown on meteorological maps on tv, for instance on the evening news. Although it is not a strict rule, generally high-pressure is associated with good weather and low-pressure with less stable weather. The bigger the pressure difference, the stronger the winds are.

Strong wind does not mean turbulence, it is only when the smooth flow of air is disturbed that

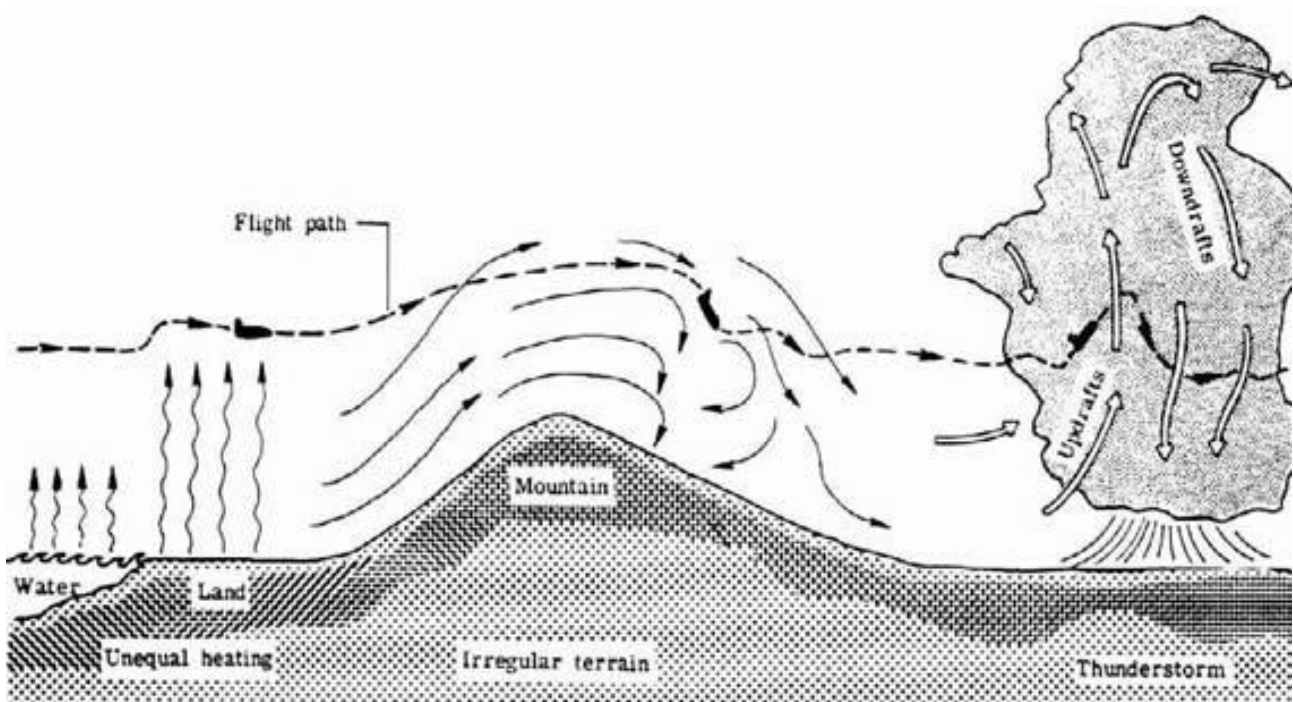


Figure 4. Different types of turbulence will affect the airplane flight path at different stages of the flight (Aviation Explorer, 2009)

Convection is the process by which heat is transferred through the vertical movement of air. On hot days, the sun heats the ground, which in turn heats the air above it. The warm air rises, creating updrafts and downdrafts that can lead to turbulence. Convection rarely is dangerous for passenger aircrafts but can certainly create a bumpy ride.

Jet streams are powerful, high-altitude winds that flow rapidly through the atmosphere. They are typically several kilometres wide and several kilometres deep, and they can reach speeds of up to even 250 kilometres per hour. The strong winds within jet streams can create turbulence, especially where the jet stream is changing direction or speed. This is because the air within the jet stream is moving at a different speed than the air outside of it and when two airmasses collide it can create turbulence. Jet streams are a well-known phenomenon and visible on the weather forecasts the pilots use. They are considered in the flight planning, but as they mostly aren't turbulent, it is more on a good to know-level of information.

Mountains and other obstacles can also create turbulence when air flows over them. This rarely affects passenger aircraft during the cruise phase as they cruise well above any mountains, but at airports in the vicinity of mountains it may have an impact. Safety regulations prohibit flying too close to obstacles and high terrain, meaning mountain waves seldom are an issue. Smaller, private

planes may be more affected as they may end up flying closer to mountains, but in those cases local knowledge is important.

The intensity of turbulence can vary from light to severe (National Weather Service 2024). Light turbulence is quite common and occupants inside the aircraft may feel a slight strain against the seatbelt or a shudder in the aircraft. This may be sufficient for anxious passengers to react, but as in most cases service is allowed to continue and there are no difficulties in walking in the aisles, it should be possible to contain the anxiety. There may be some slight changes in aircraft altitude and speed, but it always remains in control.

In moderate turbulence the aircraft always remains in control, but changes in altitude and attitude are normal. The airspeed may also vary, but that is rarely felt inside the passenger cabin. The fasten seatbelts-signs will be turned on, service discontinued, and everyone including crew, should secure themselves with the seatbelt. Staying seated with your seatbelt fastened is a safety measure, to ensure no injuries should the turbulence increase. Eating and drinking onboard is difficult and unsecured objects may be dislodged. If seated at the window with the wing in sight, it may be possible to see the wingtip flex, moving up and down, especially on larger passenger aircraft. As wings are constructed of metal and composites, they need to be able to flex in order not to break. The movement is natural but may cause concern in the anxious passenger.

Severe turbulence is very rare, and flights are never planned through areas of forecasted severe turbulence. There are large abrupt changes in altitude and attitude, as well as in speed. The aircraft may momentarily be out of control, but the construction of it will ensure that it neither breaks down or falls from the sky. To the best knowledge of the author, during the last 50 years in aviation, no aircraft has broken down nor fallen from the sky due to turbulence. The latter is per the laws of physics impossible, but large and abrupt changes in the surrounding air may create a feeling of it. Occupants will be forced against their seatbelts and even large unsecure objects may be dislodged.

3 Approach and Method

The target group for a booklet about fear of flying is adults who experience anxiety or fear related to air travel. This includes people who have never flown before, those who have flown but experience discomfort, and individuals with a diagnosed phobia of flying. The booklet aims to provide information, strategies, and support to help readers overcome their fear and enjoy the benefits of air travel. The qualitative criteria can be defined as an increased understanding of fear of flying. Readers should get a better understanding of the causes, symptoms, and common misconceptions. The booklet should further empower readers by providing a sense of control over their fear and the ability to take proactive steps to overcome it.

The objective is to produce a booklet with information about the psychology behind fear of flying, while at the same time providing explanations about many issues that may cause anxiety or discomfort, often due to lack of knowledge. The goal is to be able to share the leaflet with as many as possible, with the hopes of putting minds to ease. The indicator of a successful thesis is positive feedback from users of the booklet. Further research, such as a future master's thesis utilizing interviews and questionnaires to assess the booklet's impact, is worth considering.

The qualitative outcome can be measured in several ways, which mostly will be outside the scope of this thesis but should be considered for a master's thesis. Collecting feedback from readers through surveys, online reviews, or social media can provide valuable insights into how the booklet impacted readers' experiences and perceptions of flying. Surveys before and after reading the booklet can help assess the usefulness of it. Conducting focus group interviews with a diverse group of readers can provide in-depth qualitative data about their experiences with the booklet, including their thoughts, feelings, and suggestions for improvement. Case studies, following individual readers' journeys and documenting their progress can provide powerful testimonials and demonstrate the effectiveness of the booklet.

From a feedback point of view, it would be interesting to produce hundreds of booklets, place them in airplanes with feedback links and summarize and analyse the feedback. Besides legal and times challenges, from a sustainability point of view it is an inefficient method and makes little sense. Distribution stations at the gate would likely be missed by several of the target group and eventually end up as waste. There is a considerable risk of it ending up not even for recycling. A printed version for sale and distribution in stores is beyond the scope of the planned booklet.

A PDF, easily downloadable to the mobile phone and with a comprehensive index, seems like the most practical solution. Considering easy accessibility for passengers, this can be done through a QR-code in the aircrafts. It is probable that the airline would not accept such a solution, as there

already is one QR-code on the seatbacks of the fleet at Finnair, giving the customer access to the onboard network. To lessen the confusion, a link or QR-code could be placed on the opening page of the onboard network, clearly indicating the topic. While an airline naturally does not want to advertise a topic like fear-of-flight, it should still be placed and headlined clearly enough for the anxious passenger to find it. Flight crew should also be briefed on the existence and location, as some of the customers share their anxiety with them.

3.1 Limiting factors

While the author wishes to reach as many as possible and encourage people to fly, there are limitations, as far as the scope of this product goes:

- Given the diverse reasons of aviophobia, including past experiences, personality traits, and specific phobias, a single approach may not be universally effective.
- Fear of flying can be rooted in complex psychological and physiological factors. Simplifying these concepts into a concise booklet can be challenging without oversimplifying or causing further anxiety.
- A booklet is limited when it comes to providing interactive elements like videos, audio, or virtual reality experiences that could be helpful. Interactive elements can enhance the learning experience and make it more engaging, especially for individuals who struggle with traditional print formats. For example, a virtual reality experience could allow users to gradually expose themselves to flying situations in a safe and controlled environment, while a video could demonstrate relaxation techniques or provide information about aviation safety in a visually appealing way.
- While a booklet can offer information, it cannot provide ongoing support and guidance in a way that a therapist or counselor can. A professional counselor can help identify and address the root causes of fear, develop personalized coping strategies, and gradually expose to flying situations in a safe and controlled manner, while providing emotional support and encouragement throughout the treatment.
- Information about aviation safety and statistics can easily be misinterpreted or used to fuel fear rather than lessen it. It's important to present information in a balanced and accurate way, emphasizing the safety of modern air travel while acknowledging that accidents can happen. Additionally, it's crucial to avoid generalizing or sweeping statements that could contribute to fear and anxiety.
- Due to space constraints, a booklet may not be able to go deeply into specific techniques like relaxation exercises, visualization, or cognitive-behavioral therapy. However, it can provide an overview of these techniques and refer readers to additional resources for further information and guidance.

SUMMARY OF LIMITING FACTORS

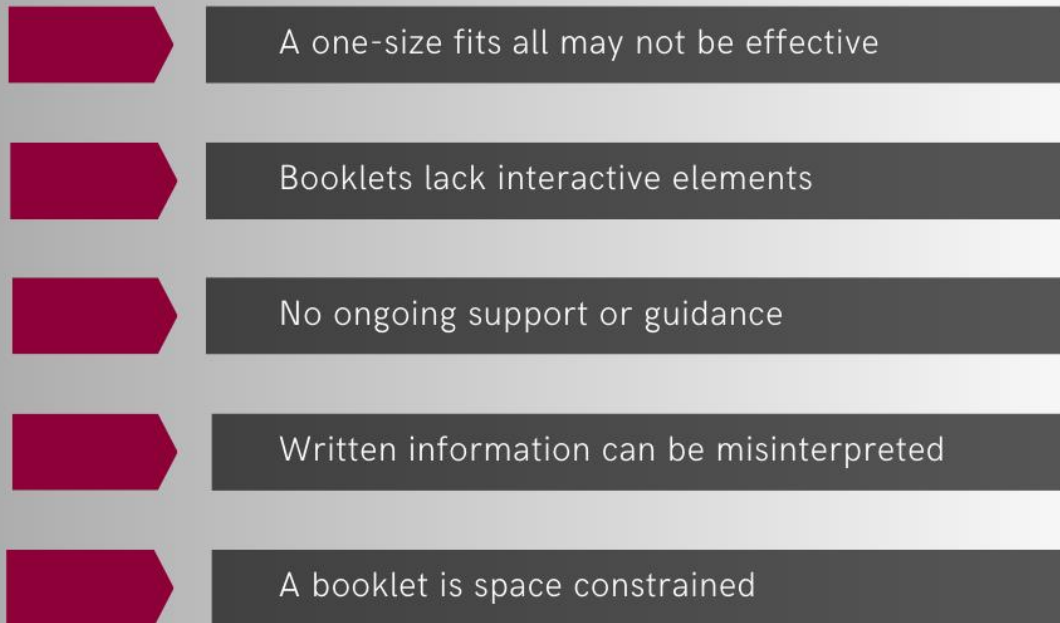


Figure 5. The main limiting factors summarised.

Despite these limitations, the author is convinced that a well-written booklet can be a valuable starting point for individuals with fear of flying. It can provide information about the causes and symptoms of fear of flying, common coping strategies, and resources for further support. However, a booklet is not meant to be a substitute for professional help. Individuals struggling with profound fear of flying, should seek the guidance of a qualified therapist or counsellor.

3.2 Producing the booklet

The author of the fear-of-flying booklet has worked as a professional pilot for almost 30 years. During these years he has several times met passengers experiencing fear of flight on some level. In most cases these travellers have informed cabin crew during boarding, of their anxiety, and requested if it is possible to briefly meet the flight crew. Already seeing the pilots, ensuring they are “normal people”, has in some cases given these customers more confidence to handle the flight. Discussions have mostly been about why they fear flying and what could remedy that, flight safety, what happens in turbulence, or different sounds during the flight, to name a few. In most cases

these discussions seem to have had a positive effect on the passenger, calming them down and giving them confidence. Praise for the bravery to inform flight crew about their anxiety has also been well received.

In the experience of the author, announcements from the captain also play an important role in calming the anxious passengers. Finding the right tone of voice in these announcements is challenging but becomes easier with practice and experience. Especially if the aircraft flies into turbulence, announcements explaining what is happening and why, are highly valued among the passengers, not only among the anxious ones. These announcements are believed to foster a sense of control among passengers.

As the author also works as a safety and emergency instructor, this has enhanced his interest in cognitive functions and matters. His employer previously arranged courses for treating fear-of-flying, but it remains unclear whether it was lack of customers or something else that caused the courses to cease. At present day, while there may not be a big need for courses, fear of flying still exists but maybe to a lesser degree. The reasons behind this could make for an interesting study. Based on his own experience, the author believes that increased aviation safety is one of the main reasons. Air travel is more reliable and less risky than 20 or even 10 years ago. With less accidents or incidents involving aircraft, there is less negative media representation, reducing public fear. Air travel has also become more accessible and affordable, making it a common mode of transportation for many people. As more people fly, flying becomes normalized.

While there certainly still is a need in the world for psychological therapy to treat severe fear-of-flight, the author is convinced that many could benefit from a simple booklet explaining matters. The increasing pace of modern life, coupled with the strong influence of social media, has resulted in diminished attention spans and a preference for easily digestible information. A simple booklet, downloadable to different platforms, could be a working solution.

3.3 The process

The process of a fear-of-flying booklet started in spring 2024. While the underlying idea had existed longer, it was not until the other courses at Haaga-Helia had been completed, that the thought process truly started.

Although the thesis was intended to focus on aviation, particularly flying, other topics were initially considered. One possibility would have been benchmarking and examining the use of standard operating procedures for cabin crews in different airlines, commissioned by the Finnair Flight Academy. While the subject area itself would have been interesting and at least partially within the scope of the authors' knowledge, it failed to pique the interest of the author in the same way fear of

flying did. Another possibility would have been a joint effort with another student to examine the application of regulations regarding work and rest in taxi flying (here: aircrafts seating up to 6 passengers). There were still some uncertainties from the commissioning party during the summer, and while teamwork with the other student had worked very well in the past, there were too many challenges in combining schedules, to be seriously considered from the part of the author.

With the decision made and the subject of the thesis approved by Haaga-Helia, the thesis seminars were quite helpful. By having to answer several questions about the planned thesis, and formulating thoughts into sentences, the form of the project eventually emerged.

While the outline of the fear-of-flight booklet itself was reasonably clear from the start, the theoretical framework and empirical part offered more challenges. At this time, it was unclear how much literature there was available on the subject. The AI application Gemini was used for ideation and brainstorming, as well as researching available sources. For instance, the prompt: "Please give me list of referenced books on the subject of fear of flying", was used. As the suggested materials were challenging to come by, none of them were eventually used. Instead, an application named Perego, offering a wide database of academic e-books and articles, was mainly used. Another prompt used with Gemini for ideation was: "Explore the psychology behind the fear of flight". The received information was verified from other sources and used solely as foundation. The AI application was utilized responsibly, with careful attention to data protection and copyright regulations. All sources cited in the thesis have been used correctly and are not AI generated.

While the introduction to a wide extent was created already during the thesis seminars, the theoretical framework required extensive use of several sources. The aim was to find if there were several existing theories on the mechanisms behind fear of flight and compare them if need be. It turned out to be a sufficiently well researched subject, with sources agreeing on most of the triggering mechanisms, as laid out in the theoretical framework. Cognitive science also provided valuable inputs, adding width and weight to the framework.

Based on research of the framework and the experience of the author, turbulence is one of the main triggers for anxiety during a flight. A chapter about turbulence was added to the theoretical framework, laying a solid foundation for the booklet itself. In the booklet the chapter about turbulence is further boiled down, to only give a brief but concise explanation about the phenomenon and why it should not be feared.

The booklet about fear-of-flight is in large parts written based on the knowledge and experience of the author. Facts from the theoretical framework were used, together with facts from material mentioned in the sources. As the booklet isn't an academically written paper, references to in-text

sources have been omitted. The intent was to make the booklet as brief and concise as possible, also easy to digest. The language chosen was more that of popular literature, again for clarity. The planned use of the booklet is not only for preflight education or information, but to an even larger degree during situations of anxiety. It is the opinion of the author that people experiencing heightened levels on anxiety or other feelings, in worst cases may not be even receptive to more difficult and comprehensive material. Hence there is a clear need to simplify text, even with the risk of oversimplifying. Later with eventual feedback from readers, it will be easier correct the tone in the text, should it be necessary.

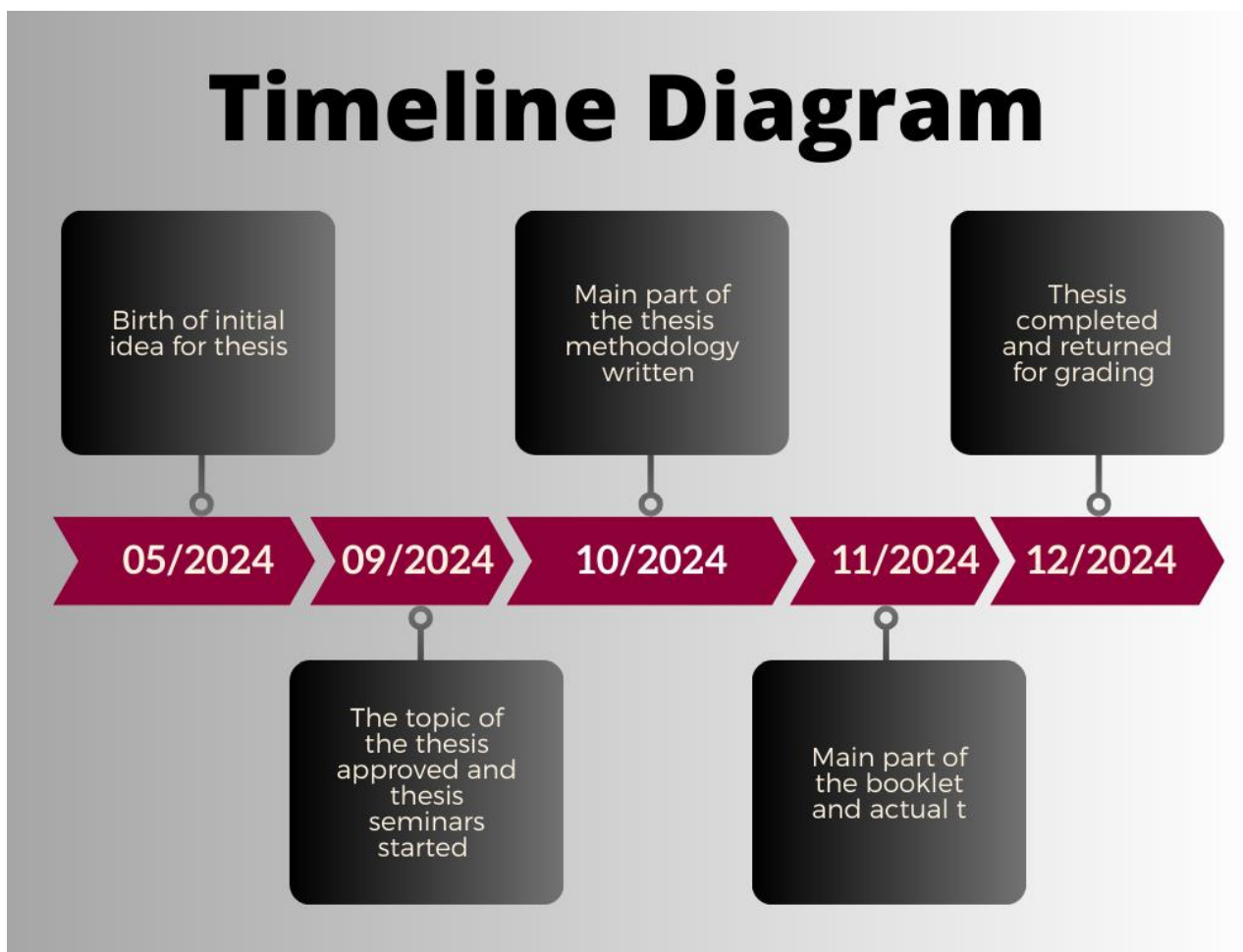


Figure 6. While the idea to the thesis was born in May, the actual process started in September and finished in December,

The first version of the booklet was a draft. It was completed to get feedback for the thesis. The second included all the text, as well as the index and glossary, properly linked. Links are important as it should be easy look up any issue that may cause anxiety in the reader. As the booklet is concise, it may pique the interest even of passengers simply just curious about aviation. Even if aviation today is de-glorified and lacks the glamour from the earlier days, many passengers do still

feel some excitement boarding an aircraft and may want to know more about flying. With the attention span of people becoming shorter and shorter, social media being the main culprit, conciseness is almost a requirement.

The third version of the booklet was the almost completed one. The text was finished, albeit still open for improvement suggestions and some illustrations and graphs. Intention was to receive feedback mainly on the text, while working simultaneously working on the final appearance. Working on the images for the final version, created a new challenge. While the copyrights for these are liberal, commercial material has stricter requirements.

Finding suitable pictures for even thesis use, turned out to be a challenge. Eventually, the decision was made not to include pictures in the booklet, except for two taken by the author, in the introduction. The pros and cons will be discussed more thoroughly in the next chapter.

The fourth version was the final one, returned as an attachment to the theoretical part for thesis evaluation. While it is outside the scope for this thesis, but the fourth version is also the one that could be tested on actual passengers. The author is genuinely interested in receiving feedback and suggestions from actual travellers, but time constraints limit it this time.

The future fifth version considers the feedback and could be ready for commercial launch, if that ends up being the target. Another possible target is academic, making it into a masters' thesis. A masters' thesis would include empirical studies with target groups, thus laying a solid academic foundation for the contents. The whole process, including work on the thesis, is presented in more detail in Figure 7.

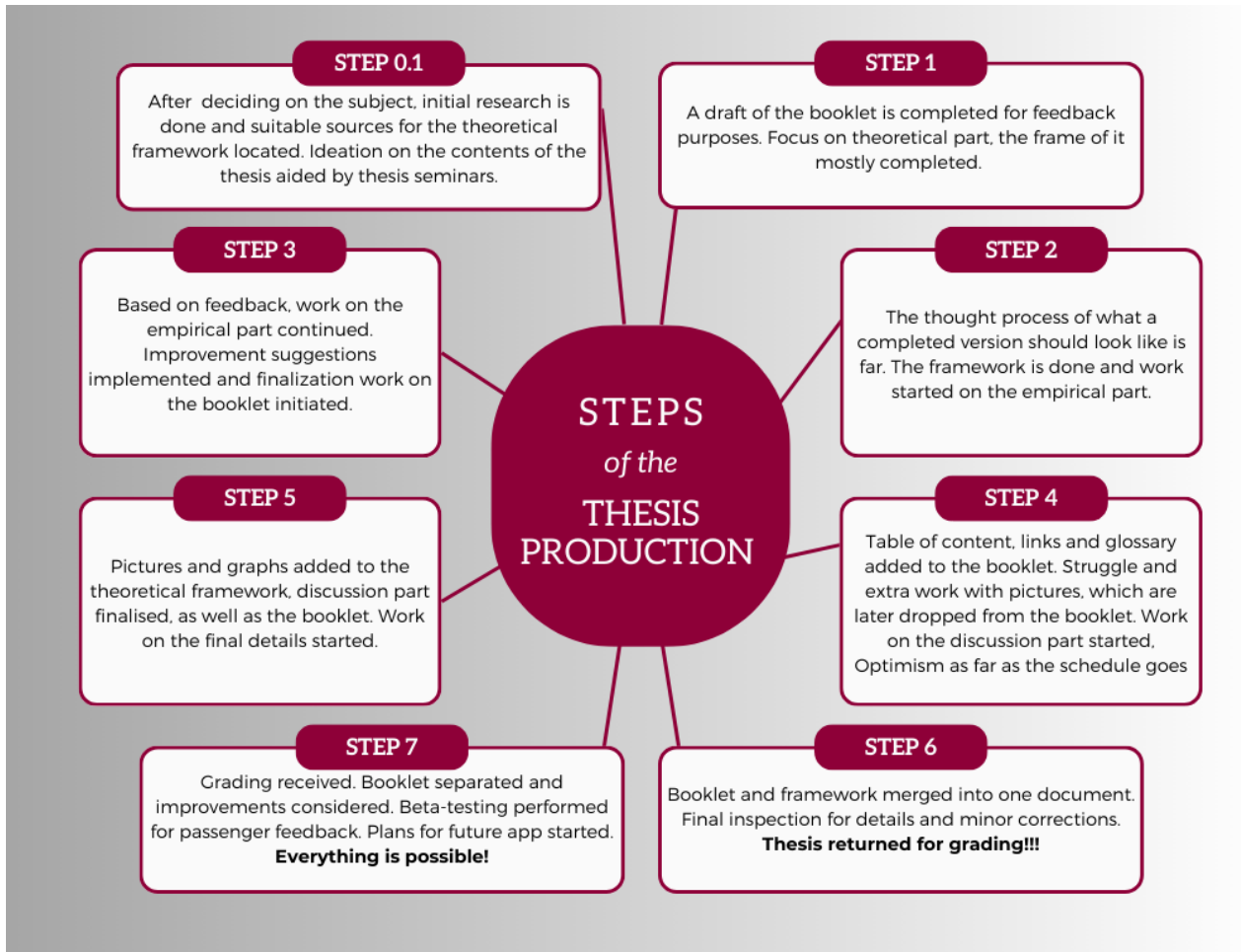


Figure 7. Progress map of the production process.

3.4 Discussion

Fear of flying is a prevalent issue, while in the last years it has received little attention in Finnish media. One reason can be that there have been bigger and more urgent issues to tackle, both nationally and globally. The pandemic had the headlines for an extended time. The travel industry and with-it aviation was one of the industries suffering the most. While hardly no-one travelled during the pandemic, it is obvious that fear of flight was not an issue. Fear of Covid was much more urgent and serious for the individual.

Once the pandemia stopped creating headlines, it was not long before the Russian attack on Ukraine started creating new ones. Finnish and European aviation had barely recovered from the previous blow when a new one was delt. Finnair was and is still, one of the airlines hit the most, as Russian airspace is closed. While the routes to Asian destinations have become longer for most European operators, geographically Finland suffers the most. It is however good to keep in mind that this is still economics. In Ukraine, the suffering is real, and people are getting killed.

Another point of view is that in Europe, and specially Finland, aviation has almost always been safe. The safety standards are high, and accidents are rare. As there haven't been many headlines, people haven't been reminded about the risks of flying (however low they are). It does raise an interesting question. The US is the birthplace of aviation and flying is widespread. Almost every town has its own airport and traveling by air has become a norm. Safety is just as good as in Europe, maybe even better, it is 15 years since the last airline crash with fatalities. Still, based on available material, fear of flight seems to be a bigger issue than in Europe. Why is that? Without the actual numbers this is of course speculation, but it could be interesting to have a deeper look at it.

It is more than 10 years since fear-of-flight courses were arranged by Finnair at the Finnair Flight Academy (FFA), and there hasn't been any discussion among the instructors at the FFA on the topic in the last years. With manufacturers and legislators lobbying and preparing for flights with less or no pilots, fear of flight may rise into the headlines. The same discussion is already beginning to surface regarding autopiloted cars. While aviation is not as far as the car industry with this, and autopiloted airplanes (without actual pilots) are only looming in the future, it is a qualified guess that it will emerge as a new fear-of-flight issue. What better than to already be prepared? This will, when pertinent, require a new chapter in the booklet.

It is fair to discuss the necessity of a fear-of-flight guide. There are some already existing on the market, and how necessary is it anyway? You could even go as far as to ask how necessary is it to fly? With the efforts to reduce carbon levels, many feel flying should be reduced to a minimum.

It is good to keep in mind that despite the headlines, aviation is only responsible for 2,5% of the world's carbon footprint. Aviation should absolutely reduce its footprint, but it has received unproportionate headline attention. It is hard not to agree that unnecessary flying could be reduced, but today's globalized world needs global means of getting around. The pandemic showed that it is possible, at least for a while, to avoid flying and conduct business through Teams or similar meetings. Still, feedback from the business world indicates that face-to-face meetings cannot be totally replaced, and they are on the rise again. Apparently, it is worth the cost.

Why write a fear-of-flight booklet, when other similar products already exist? It would be easy to simply state that this one is better, end of story, but that hardly qualifies as an argument (except maybe in the Donald Trump-world). Still, it must be the firm belief of the writer, what sense would it otherwise make to write something?

Usability is the key word here. Not making a printed version of the booklet, makes updating it easier. It is also an environmentally conscious choice. With social media platforms encouraging a

continuous flow of data, especially among the younger generations, books are not fashionable right now. It may well be, when the now teenagers are thirtysomething, that books stay out of fashion. A booklet is short enough to keep the attention span, at least for a while, and a good glossary enables the fast flipping through, familiar from the social media platforms. As most of all people always carry their phones with them, it makes sense to have a booklet that is downloadable. An audio version is also a good idea, it could be relaxing to listen to it while flying.

In the future it may make even more sense to make it into an app or have it continuously online. That would make improvements easier. Embedded sounds and video clips are also another development possibility. Especially sounds would make it a lot easier to identify the different noises. Video clips could quickly explain for instance, what makes the airplane fly or what turbulence is about. These would also be more familiar for the TikTok-generation. Another development is to make it into an audio book. That could open for more possibilities, like including relaxation exercises. The booklet mentions listening to something relaxing on your headphones during the flight, as a means of trying to relax. Listening to and watching the actual booklet (featuring relaxation exercises) is taking that idea further. All these improvements do require solid beta-testing, to find the proper content.

Success of the booklet will be easy to measure. If it makes even one traveller to have less anxiety during a flight, it can be said to be successful. The aim and the hopes are higher, but improving the quality of life for even one, is not a bad target.

The learning path of the thesis has been interesting. While writing mostly comes effortlessly and at times is even enjoyable, academic writing is a new experience. The challenge has been to keep the texts focused. Adjectives and feelings, while making a text livelier, don't generally belong in an academic text. Opinions, if they are well founded, can be expressed, as well as arguments. Referencing took a while to get used to as well, but the instructions at the Haaga-Helia website are clear and provide good help. Finalizing the thesis, the different writing tools have become more familiar, which will be helpful in the future.

Even if no actual SWOT-analysis has been presented in the text, Strengths, weaknesses, opportunities and threats have been argued for in the discussion-part. Figure 8. presents most of the arguments summarised.

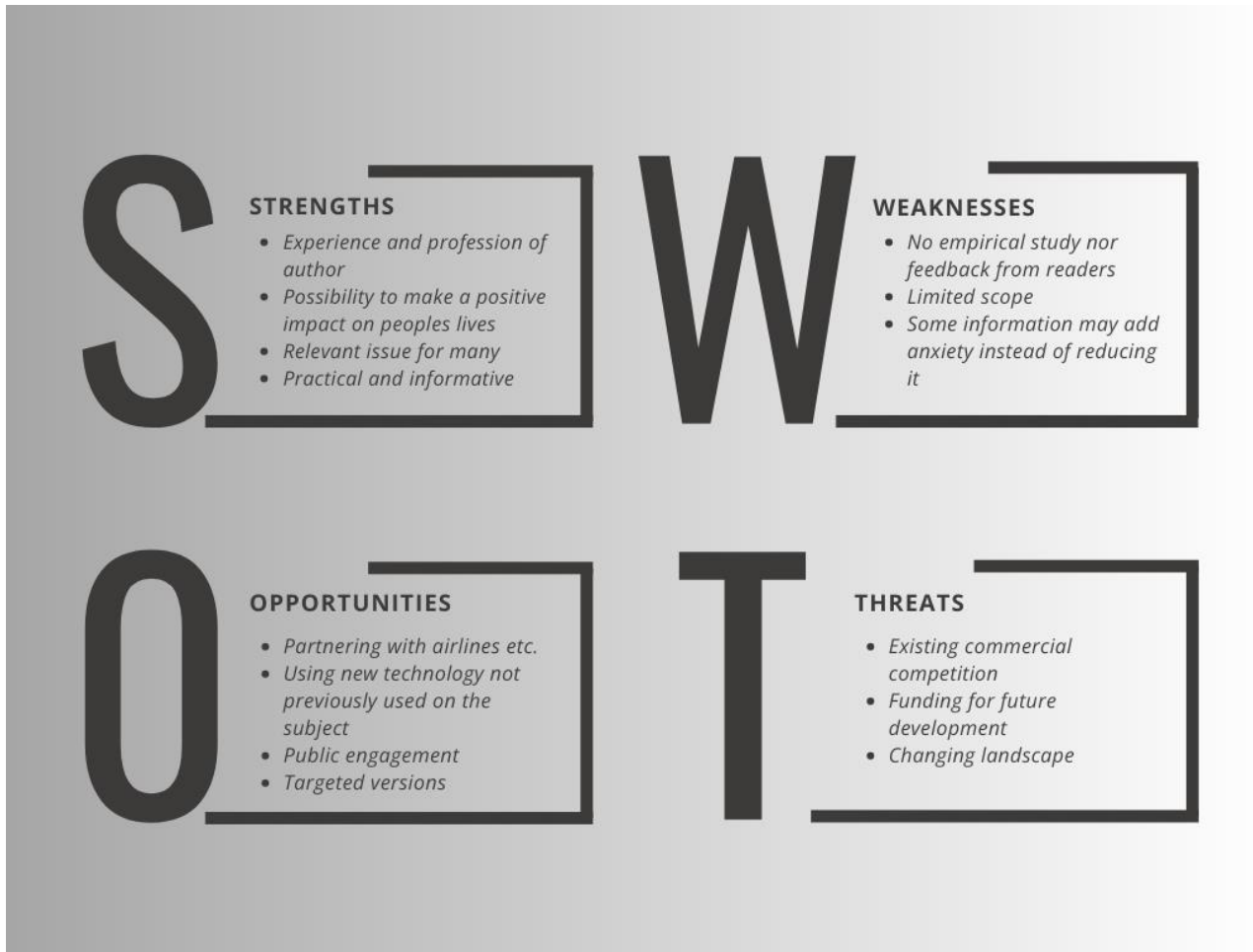


Figure 8. SWOT-summary of “The A to Z of Fearless Flying”

One of the strengths of this thesis is the solid knowledge of and interest in aviation. Having actively flown for many years ensures the knowledge base is stable. Also working as an instructor gives a more pedagogical touch in writing a guide, as it is easier to keep the explanations simple enough. While these are strengths, they are also weaknesses. Too much knowledge of a subject makes it difficult to focus on the most important issues, and it is easy to cram too much information into the text. While thorough knowledge of a subject generally can be seen as good, it makes arguing for and against more difficult. It also makes it more challenging to embrace other opinions objectively.

Initially it was challenging trying to boil down the own visions to writeable form, but the thesis seminars and the feedback received from them, gave clarity and belief it can be done. The most difficult stage was getting started, after that it was all about taking it step by step. The feedback from the thesis counsellor along the way was also valuable, both the encouragement and the suggestions for improvement. Writing the theoretical part was more challenging, as it included arguing and referencing from sourced material. Keeping the focus not to make it too widespread was another challenge.

The booklet itself was easier to write. Most of the knowledge already existed in the head, the challenge being formulating it into clear and concise language, without being condescending. Here the experience of being an instructor helped. It was easier to write also because it was possible to take liberties that don't necessarily match with academic writing. As the target was to make the text smooth and easy to follow, it felt natural not to include references. Referencing would have been a challenge as most of what was written can be claimed to be generally accepted knowledge or basic knowledge for aspiring pilots.

A challenge, that surfaced only when finalizing the booklet, were pictures and illustrations. It turned out to be difficult to find or even create (with the help of AI) suitable pictures. While thesis copyright regulations are liberal, many pictures and illustrations, despite this, are still copyright protected. Initially the booklet is part of a thesis, the future goal is still (commercial) publication which changes the rules.

Having searched and found some pictures, inserting them suitably in the text, the next challenge emerged; Does the picture or illustration really add something of value to the guide? It can be argued that one picture tells more than a thousand words, but it is not necessarily true. As the booklet is a guide, with the intent to alleviate flight anxiety in readers, what if a picture does the opposite? If a picture does not have a positive impact, why include it in the first place? Pictures will also significantly enlarge the size of the booklet (or downloadable file), which may become an issue with distribution. While for some topics, it was possible to find mostly suitable pictures, for others it was difficult. Turbulence, for instance, would have benefitted from good illustrations, but it turned out nothing short of impossible finding them. When looking at future versions of the booklet or an app itself, it should be easier with for instance short videos or audio clips inserted. Now the decision was made exclude all pictures, except for the initial ones. It was not an easy decision but feels like the right one. Now the booklet is more streamlined, keeping a balanced appearance.

The learnings from writing this thesis are mostly about how to source material and write academically. Content wise, it was interesting to learn the theories and methods on how to battle fear of flight. Especially the cognitive methods provided new information that can be used in the work as a pilot and instructor, when meeting passengers suffering from fear-of-flight. The booklet itself provided little new information, which can be seen as a weakness from an academic point of view. As the main objective of the booklet is to provide relief to anxious passengers, it is hard to see it as a failure. On the contrary, if the objective is reached by even one individual, it should be considered a success.

Sources

Aviation Explorer, 2009. Different types of turbulence. URL:

https://aviationexplorer.com/aircraft_airliner_turbulence.htm Accessed: 1.12.2024

Bor, R. & Van Gerwen, L. 2017. Psychological Perspectives on Fear of Flying. Routledge. New York. E-book. Accessed: 1.12.2024.

Bornas, X., Tortella-Feliu, M. & Llabres, J. 2017. Computer-assisted Therapy for Flight Phobia. In Bor, R. & Van Gerwen, L. (eds.). Psychological Perspectives on Fear of Flying, chapter 13. Routledge. New York. E-book. Accessed: 5.12.2024.

Brown, D. 2010. Flying without Fear. New Harbinger Publications. Oakland. E-book. Accessed: 26.10.2024.

Crane, D. 2018. A Pilot's Guide to Aircraft and Their Systems. Aviation Supplies & Academics, Inc. Washington. E-book. Accessed: 10.10.2024.

Crangle, M. 2010. Conquer Your Fear of Flying. Gill & Macmillan. Dublin. E-book. Accessed: 23.10.2024.

Federal Aviation Authorities. 2023. Pilot's Handbook of Aeronautical Knowledge. Aviation Supplies & Academics, Inc. Washington. E-book. Accessed: 4.11.2024.

Foreman, E. & Van Gerwen, L. 2018. Fly Away Fear. Routledge. New York. E-book. Accessed: 1.11.2024.

Johnston, N. & McDonald, N. 2017. Aviation Psychology in Practice. Routledge. New York. E-book. Accessed: 20.10.2024.

Kraaij, V., Garnefski, N. & van Gerwen, L. 2017. Cognitive Coping and Anxiety among People with Fear of Flying. In Bor, R. & Van Gerwen, L. (eds.). Psychological Perspectives on Fear of Flying, chapter 6. Routledge. New York. E-book. Accessed: 5.12.2024.

Meijer, G. 2020. Fundamentals of Aviation Operations. Routledge. New York. E-book. Accessed: 31.10.2024.

National Weather Service 2024. Turbulence. URL:

https://www.weather.gov/source/zhu/ZHU_Training_Page/turbulence_stuff/turbulence/turbulence.htm#:~:text=TURBULENCE%20INTENSITY,%2C%20moderate%2C%20severe%20or%20extreme.

Accessed: 8 November 2024.

Roberts, R.J. 1989. Passenger Fear of Flying: Behavioural treatment with extensive in vivo exposure and group support. *Aviation Space and Environmental Medicine*, 60, pp. 342-348.

Roberts, R.J. 2017. Multi-dimensional Approaches to the Treatment of Passenger Fear of Flying – Practical and Contextual Challenges. In Bor, R. & Van Gerwen, L. (eds.). *Psychological Perspectives on Fear of Flying*, chapter 7. Routledge. New York. E-book. Accessed: 5.12.2024.

Sobaca Limited, 2010. *Lose Your Fear of Flying*. Andrews UK. London. E-book. Accessed: 17.10.2024.

Tomaro, M.P. 2017. Flight Crew Involvement in the Fear of Flying. In Bor, R. & Van Gerwen, L. (eds.). *Psychological Perspectives on Fear of Flying*, chapter 14. Routledge. New York. E-book. Accessed: 5.12.2024.

Wright-brothers.org, 2011. The first flight in 1903 of a powered aircraft. URL: https://www.wright-brothers.org/Information_Desk/Just_the_Facts/Airplanes/Wright_Airplanes.htm Accessed: 1.12.2024

Appendices

Appendix 1. The A to Z of Fearless Flying – booklet

The A to Z of Fearless Flying



Introduction

“When I was about 12, I was out for a morning run. It was a nice, quiet Sunday morning in a small town. Most people were still in bed or having their breakfasts, the street was empty. Suddenly I saw this (in my eyes) huge German Shepherd dog, galloping towards me. I froze and looked around, there was no one. The dog kept running close. As I was the only one in sight, it was clearly heading for me.

Everything happened in slow motion, I was sure that my last moment had come. It was not that I was especially scared of dogs (just big ones), just anxious and had been taught to be careful near dogs. You know, not make any sudden moves, first let the dog sniff at you so it can know if you are friend or foe. Apparently, this massive dog had already made up its mind and I was going to die. By the time the dog was close, I had already surrendered. Eyes closed, exposing my throat for its teeth.

I felt the paws on my shoulders and...the dog started licking my face! Can you imagine the relief I felt?”

Now, what does this have to do with fear of flying? As it turns out, quite a bit. Some fears are taught to you as a child, knowingly or unknowingly by your parents, others may stem from lack of knowledge or from what you've read in the papers. The point is that fears are rarely irrational. Being told that flying is safest form of travel doesn't help if you are anxious about flying. During my 30 years as an airline pilot and safety instructor, I have met many passengers, worried about different aspects of flying. Without exception they have all been rational, sane people. So don't worry, you are neither alone nor weird.

If you are anxious about flying, this booklet is for you. Even if it just happens occasionally, or just when the flight hits some air bumps (OMG), this is for you. I will explain to you exactly what is happening during a typical flight. I will go through what causes different sounds and [noises](#) you hear, how the aircraft copes with extreme weather conditions and [turbulence](#), the A to Z of a normal flight.

I will not go through any hypnosis or therapy techniques. If you feel no amount of rationalising will help, or your fears are deep rooted, you may want to seek help from any one of the excellent courses that are available and provided by many airlines. My goal is to explain exactly what happens not just during a flight, but also before, making you familiar with almost everything you can experience onboard. My hope is that next time you board an aircraft, you can sit back and relax, maybe even enjoy it.

Have a good flight!

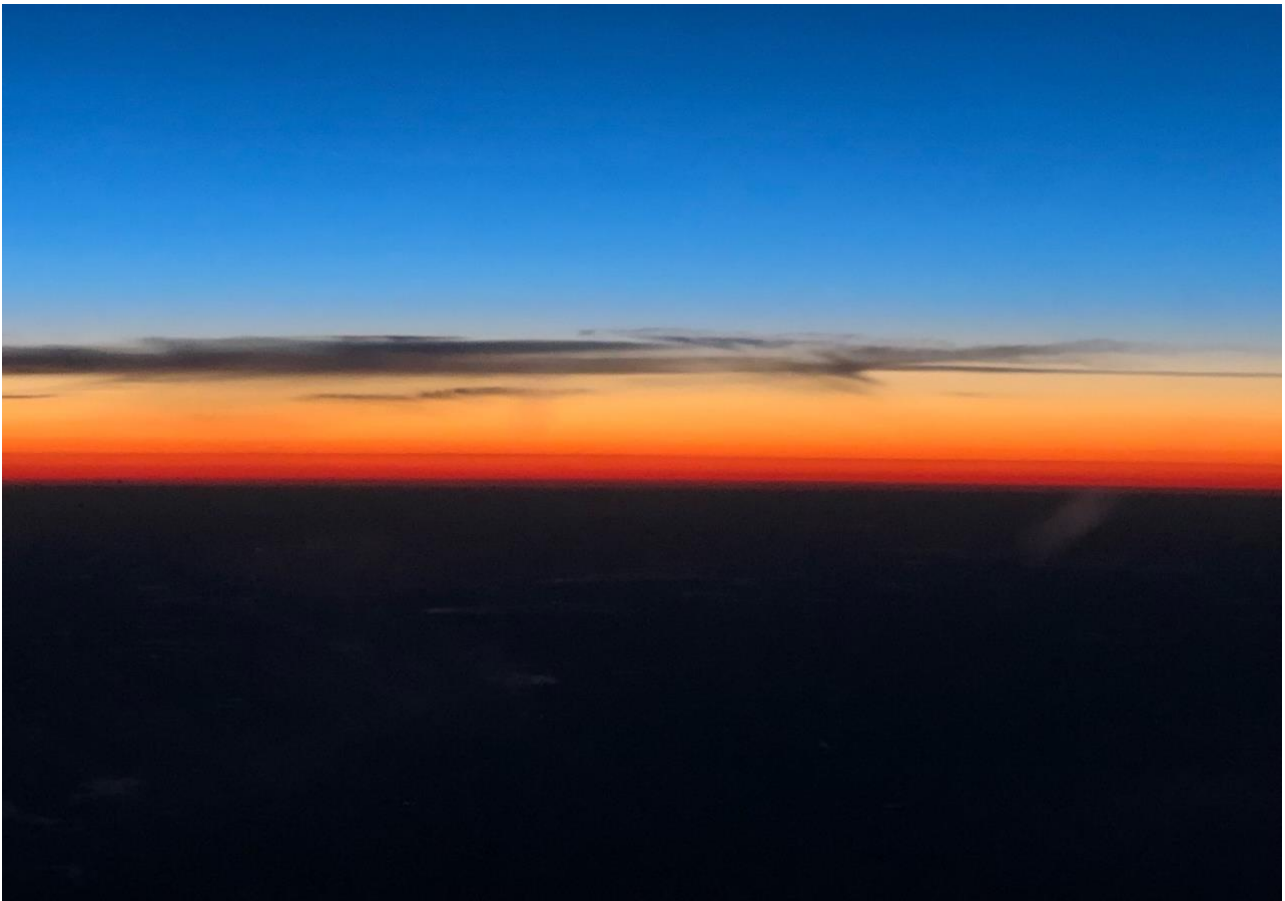


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Background

Much like birds, aeroplanes are designed to fly, it is their sole purpose. They may look a little clumsy or awkward on the ground, but once airborne it is a different story. The airflow over the wings produces the lift required for it to fly. The engines provide the power necessary to reach the speed at which the airflow is sufficient. The plane has wings, a rudder, flaps and more, controlled by the pilot who performs the functions required for manoeuvres like climbing, descending or turning. In addition to the pilots, there are also autopilots, who can be programmed to perform almost all the same manoeuvres that the pilots do, even land the aircraft.

Aircraft safety is built on redundancy. This means there is always one and sometimes even two backup systems for everything on board. The fuel system, electricity, flight controls, hydraulics, you name it, all have backups. All aeroplanes are in that sense over-designed and engineered. Aircraft operate well within what they are capable of, in every single department. No matter if its accelerating, turning, climbing or descending, the aircraft can do so much more. During manufacturing the aircraft are tested by engineers and test pilots, taken almost to their limits. In normal passenger flights they are operated well within its capabilities, for one reason only: your safety!

Modern aircraft are designed to be flown by two qualified pilots: the captain and the co-pilot (also known as first officer, in older aircraft there also was a second officer). The captain sits on the left side and the co-pilot on the right side, facing the front and the controls. A [flight deck](#) is designed for each pilot to be able to fly the aircraft independently. There are [dual controls](#), so that if one pilot is unable to perform his duties, the other pilot can take over without leaving his seat. One pilot can safely operate and fly the aircraft, if necessary. Pilots eat different foods during the flight, to avoid the possibility of both getting sick at the same time.

Before being hired, airlines have strict criteria that pilots must meet before being hired. The selection process includes aptitude tests, where skills and ability to perform under pressure (among other things) are tested. Interviews and medical examinations further ensure the suitability to work as a pilot. Once hired, a structured training program will ensure pilots have the required knowledge and skills before being allowed to fly passengers. Pilots learn about meteorology, aerodynamics, physics, and navigation, to mention a few.

The theoretical skills are then practised in a [simulator](#), that inside is the replica of a flight deck and moves exactly like a real airplane. The piloting skills are finally tested before being allowed to fly passenger airplanes. Even on the airplanes the new pilots initially fly with experienced instructors who ensure the trainee has sufficient skills and knowledge. After that, they fly with captains who typically have thousands of hours flying experience on airliners, so rest assured you are in capable and good hands.

Pilots train and are tested twice a year in the simulator, both knowledge and physical skills are tested. Pilots must have sufficient skills to manage even challenging, unlikely situations. These situations can be compared with evacuations drills in workplaces or cruise ships, situations that you are unlikely to

ever experience but still may prepare for. Besides the recurrency training to uphold skills and knowledge, pilots also annually undergo a medical examination by doctors specialized in aviation and its challenges.

Before the flight

While passengers are waiting for the boarding to start, crews are preparing the flight. In the cabin, cabin crew members check the equipment and make sure everything is working, if ever needed. On the flight deck, the pilots start with planning the flight. They go through company information (like how many passengers and any special info about them), flight information (route and other affecting items), weather, to name a few.

Once all of this is studied, the pilots make the decision on how much fuel to carry. While it could be easy to think that it is better to carry a lot of extra fuel just in case, carrying unnecessary fuel will eventually end up as an extra cost for the passenger, as the heavier the aircraft the more fuel it burns. Regulations still require enough fuel to be carried, to always have a suitable alternate should destination not be available, sometimes even enough for two alternates. As weather and destination info are considered during flight planning, the chances of running out of fuel are virtually non-existent.

When the aircraft is fuelled and the cabin ready, it is time for the passenger to get onboard. Meanwhile, one of the pilots starts preparing the airplane computers with flight and route info, while the other goes outside to do a visual inspection of the aircraft (to verify it is in order). Once both pilots are on the flight deck again, they will together start going through that everything is properly inserted in the flight computers. They will also, with the help of a [checklist](#), go through the equipment on flightdeck, to make sure everything is considered and not left to memory. After that they will brief, meaning discuss how to do what and when, to make sure both agree. These checks and briefings follow a certain pattern called [Standard Operating Procedures](#), making sure it doesn't matter even if the pilots don't know each other from before. It is still done in the same manner, every time, every flight.

In the cabin, during boarding, the cabin crew supervise and assist passengers, not only in finding their seats, but ensuring that aisles are kept free and usable. This is important during ground operations, take-off and landing, as in a worst case scenario it may be necessary to quickly leave the aircraft. While such an event is extremely unlikely, preparations are still done, every time. The philosophy to always be prepared is one of the main foundations in aviation.

Once seated, with some minutes to spare before the doors are closed and the flight officially starts, there's a few things that are good to know. In the seat pocket you will find safety instructions, showing you how to behave and what to do in some scenarios, like evacuation or loss of cabin pressure. The cabin crew later also demonstrates these actions to all passengers. It is required by air law and not done to scare you, nor is it done because it is likely to happen. Keep in mind that one of the reasons for the good safety record of aviation, is the safety mindset to always be prepared.

While seated, there's a few other things that are good to know. You may hear a "yapping" sound, like small dogs barking. It is the sound of the hydraulic pumps, being activated when the ground crew opens or closes the door to the cargo holds. With the engines running, they will uphold the pressure in the [hydraulic systems](#), until that there are separate pumps taking care of the pressure.

You may also hear a "pinging" noise. It is the sound of the crew calling each other on the intercom system, instead of shouting. The sound of the fasten seatbelt-sign is also similar, before departure the captain turns it on when the aircraft is ready to get moving. Currently, it is also quite normal that the captain makes a welcome announcement on the intercom, informing you, among other things, about flight time and weather enroute. Certain announcements are also made by the cabin crew, mainly concerning flight safety. Many passengers regard these announcements as a nuisance, but they are required by aviation law and are for your safety.

If the aircraft has just arrived and is scheduled depart soon again, it may be fuelled at the same time as boarding. This is not dangerous, but preparations are still made should something go wrong. Cabin crew will instruct you not to fasten your seatbelt (for quicker exit) and will keep the aisles as free as possible, not allowing toilet visits. They will also stand next to the emergency exits, should they be needed (also for quicker exit). The pilots will announce when fuelling is completed. It is possible that there is a slight smell of fuel, but only a slight.

De-icing and anti-icing

In countries with winter temperatures below the freezing point of water (0 degrees Celsius), there is an added challenge for aviation, snow. The challenge is different for aircraft and airports. While for the airports it is keeping the runways as clear of snow as possible and not slippery, for aircraft the challenge has to do with the airflow over the wings. For the wings to work optimally, the airflow over them should be smooth. Snow or ice forming on the wings means that this smooth airflow is disturbed. If it is disturbed enough, the wing would lose its ability to carry the aircraft. As the challenge is well known, this sounds more serious than it really is.

Critical parts on the aircraft, like engine cowlings (the rim of the engine air intake) and leading edges of the wings are heated, which prevents ice from forming. This is called anti-icing and takes care of the problem during the flight itself.

De-icing is done before the flight. It can be done either at the gate or before the take-off runway, at certain de-icing pads. The pads are nowadays preferred, as there it is easier to collect the used de-icing fluids, for environmental reasons. When there is snow or ice on the wing surface, it must be removed before departure. This is done by spraying hot de-icing fluid (a glycole mixture) on the wings, melting and removing the snow and ice. Even frost is normally removed. If there is no more precipitation, this is sufficient. The glycole won't disturb the smooth flow of air over the wings, due to its texture as it mostly runs off. This is the de-icing part.

If it is still snowing or there is a risk of contaminants (snow or ice) to form on the wings, another layer of glycole is sprayed on the wings, an anti-icing layer. This layer is thicker and will prevent snow not just from sticking to the wings but will also melt it. The texture of this thicker layer is also smooth and will not affect the airflow over the wings.

Glycole is used as it has been found to have suitable chemical features, when used on ice and snow. The freezing point is much lower; hence it can be used in even freezing conditions. For environmental reasons the used glycole is collected at the de-icing pads, and after a cleaning process used again.

Preparing for take-off

Aircraft doors are heavy and constructed in a way that makes it impossible to open them during flight, when the aircraft is pressurized. If you are seated close to the doors, you will hear a “thud” when they are closed. You may also hear a “thud” when a pushback-tractor is connected. Planes are not able to reverse, so a tractor-like vehicle will push it back to a location, where the plane can move forward with its own engines.

Engine start will create a whining sound, when the jet engines are being started. Propeller engines are louder, and part of the sound is from the rotating propeller. During engine start you may also feel that there is no air conditioning, the cabin may become silent because of this (for a short while). The air conditioning on the ground is handled by a separate power unit or small engine onboard called the APU (Auxiliary Power Unit). This APU reroutes all the air to the engines during engine start. With the engines running, they take care of the air conditioning, just like in a car.

After the engines have been started, you may hear an electrical “whirring” sound. This means the flaps are being operated. If you sit by the window, you can see that the wing area is getting bigger. This growth is done by the flaps, enabling the aircraft to take-off and land at lower speeds. Lower speeds mean less runway is needed, which makes it more economical (and environmental) to take-off and land. Once the aircraft is flying and climbing to higher altitudes, the flaps are operated in the other direction, making the wing smaller and more aerodynamic. This allows the airplanes to fly faster and more economical.

During taxi, the aircraft uses its engines to move, meaning the engine sound may increase when the pilots need to move forward, and decrease again when less power is needed. It can be described as a “whining” sound. While the cabin crew makes a safety demonstration, demonstrating how to use certain safety equipment (again, required by law, but the intent is to familiarize the passenger with the equipment), pilots are busy making everything ready for take-off. They test the flight controls to make sure they move correctly, once more discuss (or brief, as it is called in aviation) the setup of the flight and how they intend to do it and go through a [checklist](#) to make sure all is set.

Air Traffic Control (ATC)

Air Traffic Control, normally referred to as ATC, can be seen as the supervisors of the flight. First, they approve the flight plan, that is the route the pilots (or the airline) want to fly, and co-ordinate it with other aircraft. Sometimes there are delays when too many planes want to leave at the same time or go to the same destination. Poor weather at airports also slows the traffic flow down. In these situations, the ATC issues departure times or arrival times for the aircraft, what is generally known as slots. This way there can be a steady flow of aircraft, instead of everybody trying to leave or arrive at the same time.

ATC supervises traffic on ground using radar but also visually from a tower. When the planes are airborne, they use radar. Controllers are seated in a room full of radar screens, where they monitor the traffic flow and give instructions to the aircraft. All this is done to make sure the planes don't get too close to each other. The pilots mainly receive instructions via radio, at all stages of the flight, but some instructions can nowadays be received by a system like SMS-messages. Every flight has its own callsign, for the pilots to know who is being instructed. Separation from other planes both on ground and in the air, is mainly handled by the controllers, but in the name of safety also pilots are required to keep a look out. If it is a clear day or on the ground, the pilots may see other the traffic visually but can also follow them on the navigation screens. In addition, the airplanes talk to each other via computers and will sound an alarm if they are getting too close to each other.

The control towers handle the traffic near the airports. This airspace is restricted, and you can only enter with the permission of the controller. It is one of the basic air rules and small aircraft are happy to stay away. Further up in the sky the airspace where the airliners operate is also restricted. It is so high that smaller aircraft even cannot reach it. The airliners fly in the equivalent of motorway lanes or corridors in the sky. They are separated from each other by height and width, keeping to their planned route and altitude ensures no collision is possible.

The take-off and climb

During flight preparations, using computers, the pilots have made performance calculations. This means they have considered weight, weather, length of runway and anything else that might affect the performance. These calculations are important as they decide the take-off speed, that is the speed needed for the aircraft to become airborne. As a rule, the heavier the aircraft, the more speed it needs to build up to become airborne and vice versa. Different sized aircraft may have different speeds, as have different types of aircraft.

Keeping in mind the focus on safety, calculations are also made for situations where something goes wrong. There is a decision speed called V1, below which it is still possible to stop the aircraft using the remaining runway. This is called a [rejected take-off](#), RTO, a manoeuvre well-rehearsed in the

simulator. What happens after V1 then? No need to worry. The aircraft will continue its flight, even if an engine fails at the worst possible moment. Commercial aircraft have at least two engines and are designed to safely perform on one engine if necessary. Pilots regularly practise also this manoeuvre in the simulator.

When the plane receives its take-off clearance from the controller, the pilots advance the throttles and start the take-off roll. This is heard as an increasing engine noise. As the speed builds up you may feel bumps as the plane crosses runway lights set into the tarmac. Some runways may be bumpier than others, but the aircraft have strong suspensions, way stronger than cars. Strong winds may cause a sideways movement to be felt, but the pilots counteract for this using a big rudder to steer. The rudder is on the tailfin of the plane and becomes more effective as the speed builds up. If the noisiness, bumpiness and sideways movement happen all at once, it may certainly feel uncomfortable for a short while but rest assured that the aircraft is well equipped to handle conditions like these. If you remember from a previous chapter that during certification the aircraft are flown in all sorts of conditions, engineers and test pilots really test the aircraft to establish safe limits. Even operating on the limits is safe, but normal operations are far from these limits.

When the speed is sufficient, the pilot pulls back on his controls. This moves the positions of the smaller, horizontal wing on the tail of the aircraft, changing the direction of the airflow. This change of airflow adds lift to the wings and the aircraft becomes airborne. The engines are still loud, and you may also hear the “clunking” noise of the landing gear being retracted. Even the sound of the hydraulic pumps may be heard, as the gears are hydraulically raised. The landing gears are retracted into the wings to reduce drag, and held there by a securing mechanism, ensuring that they cannot drop by mistake.

As the plane builds up altitude, the next thing you can notice is the lowering of the nose. It may feel like a drop as we are more sensitive to downward movement, but it is really the pilot lowering the nose to build up speed. Next you will normally hear a decrease in engine sound, meaning that the pilot is reducing thrust. No engines, whether in a car, boat or airplane, are designed for maximum thrust all the time and hence the thrust is reduced when there is sufficient speed and altitude. It is called climb power and used until reaching the cruising altitude, where even less power will be enough.

With sufficient speed it is time to make the wings smaller, to gain speed and save fuel. This is done by retracting the flaps and may be heard as a “whirring” sound. If seated by the window just behind the wings, you can see the flaps being retracted into the wings. Now the aircraft is in what is called a “clean” configuration, able to build up speed and altitude. Looking out the window, you may feel that the airplane is travelling too slowly and worry it will drop out of the sky. This is an optical illusion, created by the distance to any fixed object. In fact, take-off speeds are around 230km/h, and cruising speeds 800-900km/h. There may be a little buffeting as the plane breaks through the clouds, and shortly after that you will hear the “ping” of the fasten seatbelt-sign being turned off (by the pilots) and service will shortly start.

Turbulence

Turbulence during flights can cause anxiety in many passengers, even confident flyers may become nervous. However, turbulence is a common occurrence for pilots and is absolutely no cause for concern. Aircraft are constructed with less stable air in mind. A fascinating detail for some, which may feel scary if you don't know the reason behind it, is that wings are designed to bend. In turbulence the wingtip can be seen to move up and down. A solid wingtip would be susceptible to break, but as they are designed to flex, the wing will be able to withhold much more load. The wing load is also tested during manufacturing, and it is virtually impossible to reach loads that would cause rupture.

First, there is nothing like an "air pocket", it is a myth. Turbulence in the air can be described as waves on the sea. The stronger the winds, the bigger the waves. A bigger boat reacts less to waves, as does a slower one. Strong winds do not always mean turbulence. If the airflow is unrestricted, like most of the times, it will be smooth. It is when air is distorted or different air masses collide, that turbulence can happen.

The main rule for pilots is to avoid turbulent areas. The forecasts normally highlight areas of possible turbulence, but often it is only a precaution and the air is smooth. The pilots have a few ways of dealing with actual or forecasted turbulence:

Modern airliners have weather radars, which will pick up moisture in the air. If there is a lot of moisture (droplets) moving around, this will show on the radar screen. To avoid these areas pilots can climb, descend or change course. This is done in co-operation with [air traffic controllers](#). Speed can also be adjusted, making the air bumps feel softer. If radar shows thunderstorms at the airport, pilots can also delay the landing and wait for the weather to clear. This is taken into consideration already at the planning stage, so there will be sufficient fuel.

To be on the safe side, service can be stopped and the fasten seatbelt-sign switched on. This is a precaution, should the turbulence be worse than expected or forecasted. The pilot at the controls is always seated with his seatbelt fastened, as a safety measure. Having your seatbelt fastened and maybe even tightened, makes you move more comfortably aligned with the aircraft and the effects of turbulence will be felt less.

Generally speaking, there are three reasons for turbulence:

Air masses – Warm air rises and is replaced by cooler air. Sometimes these air masses collide causing unruly air, much like when water moving in different directions comes together. This thermal rising is common and especially noticeable during warm days. Urban areas, with lots of dark surfaces, cars and other objects, generate more heat than rural ones. Land also heats up quicker than sea. Turbulence caused by air masses mainly occurs close to ground or at low altitudes. Even though it understandably may cause discomfort, it is mostly brief and well within the performance limit of the aircraft. Turbulence caused by air masses is well known by pilots, easy to forecast and behaves rationally.

Precipitation – In humid (and warm) conditions, moisture rises from the ground, creating an upward draft. When the moisture becomes bigger droplets and cools, it stops rising and clouds are formed. If there is strong upward activity, these fluffy white clouds known as cumulus, are formed. The stronger the updraft (due to heat and moisture), the higher the clouds and in some cases [cumulonimbus clouds](#) are formed, also known as thunderstorms. In these clouds the water droplets become too big to stay airborne and start falling as rain. This downward movement creates a downward draft. Where the upward moving air meets the downward, static electricity is created and eventually released as lightning. It may be comforting for you to know that airplanes won't be damaged by lightning strikes, as they are constructed in a way that will make the lightning continue onwards without damaging the plane. The physicians call this construction "Faraday's cage".

The turbulence in thunderstorm clouds can be strong and hence pilots take precautions and avoid flying through them. While the aircraft will not break, passengers may feel it as scary. Turbulence caused by thunderstorms is also well known and easy to forecast by meteorologists. This sort of turbulence is more prevalent in warmer climates and summer, where there is more warm air (and moisture) rising. Logically the winter months offer more stable conditions, as does the air above the clouds.

Clear air turbulence – While most people understand that there may be turbulence in clouds and windy conditions, the bumpiness for no visible reason is not as obvious. The challenge with clear air turbulence (CAT) is that it cannot be seen by the naked eye, nor on radar. It can however be detected by the aircraft instruments. Most of the CAT occurs in and around jet streams.

Jet streams are powerful, high-altitude winds that flow rapidly through the atmosphere (due to the changes in atmospheric pressure). They are typically several kilometres wide and several kilometres deep, and they can reach speeds of up to even 250 kilometres per hour. The strong winds within jet streams can create turbulence, especially where the jet stream is changing direction or speed. This is because the air within the jet stream is moving at a different speed than the air outside of it and when two airmasses collide it can create turbulence. Jet streams are a well-known phenomenon and visible on the weather forecasts the pilots use. They are considered in the flight planning, but as they mostly aren't turbulent, it is more on a good to know-level of information.

Adverse weather

Adverse weather conditions like strong winds, heavy rains or thick fog, may cause some passengers to feel ill at ease. Rest assured that weather is one of main focal points in flight planning. Weather is looked upon in detail, concerning all stages of the flight. Everything that can affect the flight is studied and taken into consideration, including clouds, winds (and winds aloft), temperatures, visibility and even volcanic eruptions. Nowadays the forecasts are accurate and detailed, even if it still hard to forecast if the sun will shine. However, whether it is sunny or not (which is what normally concerns the

holiday traveller), doesn't affect the flight as the crew focuses on affecting weather. Let's look at adverse weather in more detail.

Strong winds are rarely a problem for airplanes. They are certified (and tested, as mentioned before) for take-offs and landings even in strong crosswind conditions, the wind can even be up to storm strength. The runway in use can also be changed to get a more beneficial departure or landing direction, as wind aligned with the runway is of no concern. Pilots train for windy conditions in the simulator, and there are established limits, well within the certification.

The biggest setback with strong surface winds is normally the gusts. The gusts are created when the wind doesn't have an unobstructed path (buildings, trees, etc.) and hence varies in strength. This variation is mostly felt as bumpiness and normally lasts only a few minutes when close to the ground. If the conditions are too difficult to make a safe landing, the pilots will not complete the landing but instead make a [go-around](#). It is called a go-around when the pilots add thrust and raise the aircraft nose, so the plane starts climbing again. This is rarely done but considered to be a normal manoeuvre. Safety is again at the forefront, if the pilots don't assess a landing to be safe, they will not attempt it. There is no risk of running out of fuel because of this, as legislation requires extra fuel for unforeseen circumstances to be carried as a safety precaution anyway. If the pilots deem that the weather at the destination may be a hazard, they will choose to even carry additional fuel on top of that.

While clouds and rain affect a flight to a lesser degree, mist and dense fog may cause some delays. Not because it is more dangerous, but because in poor conditions and especially poor visibility, the distance between departing and landing aircraft is increased (to increase the safety margins), slowing the traffic flow down. Pilots really don't need to see anything else than the runway lights when departing and landing, for the other stages they can rely solely on the instruments. Modern aircraft have such sophisticated equipment (including [autopilots](#)), it is possible to land even in zero visibility. That said, pilots are guided by minimum weather standards, laid down by aviation authorities. No pilot may legally attempt to land if the criteria is not met. If the weather is too poor for landing, the flights always carry extra fuel allowing for a diversion to another airport with better weather.

Approach and landing

During descent closer to the airport, the engine sound may vary, as pilots increase or reduce thrust in accordance with instructions from the controller. At times the aircraft may fly level, and at times descend with the nose slightly downwards. The controller may request a certain speed from the aircraft, or order it to descend, with the intent to place it into the traffic flow.

As the destination approaches, the pilots will switch on the fasten seatbelt-sign. This is an indication for the cabin crew to start preparing the cabin for landing. The same rules as for departure apply. Everybody must be in their seats, with seatbelts fastened, overhead lockers closed, and hand luggage stowed away. No loose items that could bounce around are allowed to be left even in the galleys (that is what the planes' kitchen is called). After verifying the cabin is ready for landing, cabin crew will

inform the pilots. Only with the cabin ready the pilots are allowed to land the aircraft. All these preparations are made not because something is expected to go wrong, but to be ready for the unlikely event if something should occur.

Approaching the airport, preparing to land, the pilots need to slow down. This is mainly done by reducing the thrust and extending the flaps, i.e. enlarging the wings. Bigger wing surface allows the plane to fly at slower speed, needing less runway. The “whirring” sound will be from the flaps extending, this is done in several steps. As engine thrust is varied, so is the engine sound. If the speed or altitude needs to be adjusted quicker, the pilots can extend [speed brakes](#), from the upper side of the wing surface. It can be seen as a small part of the wing extending upwards, creating more drag, which helps in slowing the aircraft down. This will also be felt as a little buffeting.

The lowering of the landing gear can be quite loud and consists of “clunking” and “thumping” noises. With the landing gear down and the flaps extended, noise from the wind will increase. The aircraft is now set up for landing and the pilot is keeping the aircraft aligned with the runway, by making small adjustments, both in steering and thrust. These adjustments can be felt and heard; a small buffeting can also be felt.

Just before the touchdown, the nose of the plane is raised, and the thrust levers retarded to idle. The aircraft now sinks on to its main wheels. You will probably feel one or two jolts as the main landing gear touch the runway. After that the nose is lowered and the pilot will apply wheel brakes, like what we have in cars, but bigger and stronger. The speed brakes on top of the wings will also extend, transferring the weight of the aircraft to the wheels to reinforce braking. The pilots will also activate the reversers. This means the thrust of the engines is almost reversed, adding to the braking. The reversers are heard as an increased noise and can also cause some rattling. All this is normal and in fact a “textbook” landing.

If it goes wrong

However unlikely, technical failures are still possible. The pilots practise the most challenging and urgent scenarios in the simulator. Due to the [redundancy](#), that is the amount of backup systems, it is virtually impossible that the aircraft cannot be controlled at any time. Some failures will affect other systems, and that is why pilots have checklists to deal with these issues.

When there is a technical failure, the pilots will consult the relevant checklist. There are checklists for every situation that has happened or can be seen to happen, however unlikely. One pilot will concentrate on flying, the other will handle the checklist. As the captain is legally responsible for the safety of the aircraft, it is common that he will be at the controls of the aircraft.

The first priority is to ensure that the aircraft remains under control. Even with an engine failure, the aircraft can still be flown, and a safe landing made. The next priority is to land at the nearest suitable airport. Single engine flying is not difficult and practised regularly in the simulator.

The chances of all engines failing is next to zero. It would require a large flock of big birds, massive enough to destroy both engines. However unlikely, this happened a few years ago, when after bird strikes into both engines, an aircraft had to make an emergency landing into a river in New York. All passengers survived, most unharmed. Engines are tested for bird strikes during manufacturing and must be able to withstand a certain sized bird being ingested into it. The loss of all engines, turn the aircraft into a glider. From an altitude of 1.000m, it can glide almost 20 km, giving the pilots some time to find a suitable landing spot. Also this manoeuvre is practised in the simulator at times. To lessen the risk of bird strikes at lower altitudes, the airports have systems to disperse the bird flocks.

As the air at high levels where airliners fly, is thin and insufficient for normal breathing, aircraft are pressurized. Pressurization is done by the engines. They take fresh air from the outside and compress it and filter it, before releasing it into the cabin. This means that while the aircraft is flying at 10 kilometres height, inside the altitude is only 2 kilometres. Safety margins are added again, as even at 3 kilometres height the air is still breathable. The pressurization system has two backup-systems for redundancy, meaning that even if two systems fail, it is still possible to pressurize the aircraft. As a last backup, oxygen masks are provided for all passengers and crew (although the pilots have a different sort of masks). If the sensors feel that the cabin loses pressure, masks will drop from the overhead compartments. This separate system will provide oxygen, until the plane has descended to an altitude where it is possible to breathe again.

If a fire were to break out on board the aircraft, the crew would deal with it with conventional fire extinguishers. Crew regularly train for this in a fire fighting simulator, like what fire fighters train in. There are also smoke detectors in the toilets in case someone lights a cigarette. On the flightdeck the pilots are alerted by several fire warning systems, there are warning bells and lights that are impossible not to notice. Engines and cargo holds all have their own systems and extinguishers, with backups of course.

In addition, the flightdeck has many warning systems, alerting the pilots to any problems. The warnings are often both audible, through beeps and horns, and visual, through lights and captions. There are warnings for landing gear not being down, for flaps being in the wrong position, for other aircraft being too close, and many more. There are also minor warnings, stating that something may later become an issue. For all of these there are checklists, that will help pilots handle any potential problems. The technical department can also be contacted for consultation, through that SMS-like system.

It is also worth looking at the role of the cabin crew. While their most visible task is ensuring your comfort and well-being during the flight, their most important task is still your safety. They are trained to handle all sorts of challenging situations like medical emergencies or firefighting, even evacuation, should it ever be necessary. Besides everything else, they are also trained in psychology. Not enough of course to be a psychologist, but certainly enough to assist with anxieties of different sorts. Like the pilots, they too undergo refresher training annually.

Conclusion

It is a proven statistical fact that aviation is the safest form of travel. In 2023 over 4 billion passengers were transported last year and there were over 35 million flight departures. The global accident rate was less than 2 per one million departures. The only accident with fatalities happened in Asia, with 72 fatalities. Considering over 4.000.000.000 passengers were transported, there is no logical reason why you shouldn't feel safe.

But of course, statistics alone won't steady a nervous flyer's heart rate. The mind is as fascinating as it is complicated. Despite the good statistics of aviation, 10-40% of all passengers express some level of anxiety when it comes to flying – so you are certainly not alone.

If your anxiety is pronounced or creating a serious issue for you, several organisations run “fear of flying” courses. These usually involve psychology sessions, cognitive training and informal briefings with current airline captains and safety trainers. They may also include a short flight, with cabin crew beside you all the way, and frequent commentary from the captain. Keep in mind that the cabin crew on normal flights are there to help you, so it may be good to let them know if you are anxious.

You may find it relaxing to take some headphones with you, and soothing music or whatever keeps your focus elsewhere. This may help to dull the noise of the engines and any unfamiliar sounds. Do yourself a favour, ignore the media frenzy about aviation. Aviation always makes for good headlines, and it is the media's job to sell news and newspapers. Stories will become sensationalised and blown out of proportion.

Knowledge is power. The aim of this guide is for you to have gained an understanding of how the airplanes fly and the many safety procedures they follow. By now you should have some idea of the expertise of the crew and how they are trained. The most important thing is that now you should understand the sensations you experience and the noises you hear. They are all listed in a separate glossary, where you can quickly look them up, should you forget. Very little should come as a surprise for you. By understanding what is happening all around you, and why it is happening, logic should begin to make its way into the equation. While not completely ridding you of anxiety, it should help to calm you down and perhaps even enjoy the flight.

Relax and have a good flight!

Glossary

Air Traffic Control (ATC)

The system of air traffic control that regulates air traffic to prevent collisions and organize and expedite the flow of traffic. The controllers use radar screens to keep track of the aircraft, but also do it visually from a tower at the airports.

Autopilot

An automatic flight control system that can keep an aircraft flying straight and level, or follow a programmed flight path. The autopilots are even capable of landing the aircraft. Modern airliners have at least two autopilots for operational stability.

Checklist

A list of procedures that the crew must follow. As there are many systems details onboard, the manufacturer and the airline have jointly worked out a workflow to ensure all the essential preparations and checks are done. Often the pilots follow a workflow, but will verify everything is done, using a checklist. Checklists are also used for problem solving, as they ensure all options are considered.

Clear Air Turbulence (CAT)

Turbulence that occurs in clear air, often associated with jet streams. The challenge with CAT is that it is not visible with the bare eye, but the forecasts for where it can be found are good and those areas can easily be avoided if need be.

Crew Resource Management (CRM)

A set of skills and techniques used to enhance communication and teamwork among flight crew members. These different skills, that include leadership, communication, decision-making, situational awareness, to name a few, are trained annually during ground training but also in the simulator.

Cumulonimbus Clouds

Large, towering clouds often associated with thunderstorms and severe weather, including turbulence. Cumulus clouds, the fluffy white ones, can also be turbulent.

Dual Controls

Both pilots have similar controls in front of them and are capable and able to fly the aircraft by themselves, if need be.

Flight Deck

The cockpit of an aircraft, where the pilots operate the controls. There are always at least two pilots in a crew, on longer flights there can be more so they can take turns. The pilots have similar tasks and take turns in doing them, but there is always a captain (also known as commander) who has the responsibility on an aircraft. The captains are experienced and have been flying for many years.

Fog

A visible mass of tiny water droplets or ice crystals suspended in the air near the Earth's surface. Other words describing similar phenomena are **mist** and **haze**.

Go-Around

A maneuver where the pilot aborts a landing and initiates a climb. This is done by the pilots if the landing is not deemed safe. The manoeuvre is normal and not difficult, but as the aircraft attitude changes from nose down to nose up, together with an addition of thrust, it may initially cause anxiety in some passengers.

Hydraulic System

A system of pressurized fluid used to operate various aircraft controls, such as landing gear and flaps.

Jet Stream

A narrow, fast-flowing, high-altitude air current. Where winds of different speeds meet there can be turbulence.

Noises

- Hydraulic Pump: A "yapping" sound, similar to small dogs barking. Often heard before and after the flight, when no engines are running.
- Intercom Ping: A "pinging" sound used for communication between crew members.
- Engine Start: A whining noise produced by jet engines during startup.
- Propeller Engine: A louder noise, partly due to the rotating propeller.
- Flaps Operation: A "whirring" sound as the flaps are extended or retracted.
- Landing Gear Retraction/Extension: A "thumping" sound as the landing gear is retracted or extended.
- Wind: Increased sound of airflow, as the aircraft gains speed and altitude, or during approach, with flaps out and gear down.
- Reversers: An increased sound as the engine thrust is reversed during landing.
- Seatbelt sign: A "ping" sound indicating the seatbelt sign is being turned on or off

Redundancy

The inclusion of extra components or functions in a system to increase reliability and reduce the risk of failure. In the name of safety, airplanes have one or occasionally even two backup arrangements for most systems. These backups ensure an airplane can be flown and steered at all times.

Rejected Take-off (RTO)

A procedure where a takeoff is aborted after a certain point, typically due to an engine failure or other emergency. This point ensures sufficient runway to stop the aircraft. After this point, called V1, the pilots will continue the take-off. An aircraft can safely take-off and fly even with a single engine.

Standard Operating Procedures

A standardised way to do a workflow. Following a routine ensures both pilots know what to expect from the other. As a crew may not be familiar with each other from previous flights, the Standard Operating Procedures (SOP's) ensure smooth co-operation and teamwork.

Simulator

Pilots train in full flight simulators. The simulators are exact copies of the aircraft on the inside (you can even see a simulated outside through the windows), and are programmed to move and behave exactly like a real airplane. From the outside it looks like a small, modern cabin, standing on long legs. While simulators are expensive to build, it is still more economical to practise in them compared with the real airplane. Simulators are a superior tool for practise, as they can be stopped at anytime and any scenarios practised several times.

Spoiler

A device used to increase drag and reduce lift, often used during landing. Also called **speed brake**. Can be seen as a small wing extending upward from the top of the wing, when in use.

Turbulence

Irregular motion of the air, often causing an aircraft to move shake or buffet. Can be visualized like waves on the sea. The bigger the waves, the rougher the ride. Size and speed affect how much is felt on an aircraft. The aircraft are constructed in a certain way to ensure they can withstand turbulence.

Wind Shear

A sudden change in wind speed or direction over a short distance. Can occur in strong thunderstorms, but they are detectable with instruments and pilots will avoid them.