The Accident of the Sikorsky S-76B Helicopter Operated by Island Express Helicopters Inc.

(in the Light of the "Dirty Dozen")

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Abstract *The human factor, the limitation of human performance, has a fundamental impact on aviation today. Results of aviation safety investigation reports show that human error is increasingly influencing the occurrence of aviation incidents as a root cause and contributing factor. Human error committed by military or civil aircrew is always dependent on the human beings themselves, not on the profession or job. The article uses a well-known accident involving an S-76B helicopter operated by Island Express Helicopters Inc. from civil aviation to interpret the importance of human performance and error. The analysis of this accident also showed that errors can occur not only at the operator level but also in the background system, causing problems.*

INTRODUCTION

The safety investigation of aviation incidents reveals a certain regularity that can be compared with the historical and technical development of aviation. The 'flying wire entanglements', built by the Wright brothers or Bleriot, or the accidents involving aircraft used in World War II, were caused by technical failures in most cases, in addition to human error. However, rapid technological developments in the field of aviation, together with the emergence of multiple integrated digital systems, have brought the human factor to the fore as a root cause. One of the fundamental activities in the field of aviation safety is to investigate the events that have occurred and to identify the root causes to minimise the risk of similar events occurring in the future.

HUMAN FACTOR IN AVIATION INCIDENTS

Man in the machine… This may mean something quite different nowadays, with the rapid development, growth, and proliferation of artificial intelligence, but in aviation, the human factor, human error, has always been present and will remain with us as long as there is a human in the decision-making position. Humans, by their very nature, make mistakes; therefore, it should come as no surprise that human error has been implicated in a variety of occupational accidents, including 70% to 80% of those in civil and military aviation.[1]

What is human error itself? How does it affect aviation?

Human activity is characterised by a continuous series of decisions. Even in the case of various scientifically formulated and supported decision chains, such as John Boyd's OODA[2] cycle or the MDMP[3] procedure used in military operations planning, there may be a degree of uncertainty in the decision, or the chance of a subjectively made wrong decision, which may arise from poor situational awareness, inadequate assessment of available information, excessive bias, overconfidence, or even errors of judgement resulting from inappropriate responses due to the time pressure of decision-making, which is a regular occurrence, especially in military aviation as a time-critical activity.

We all experience on a daily basis that the human brain tends to filter information, simplify processes, and become inattentive – factors that can ultimately lead to mistakes, accidents, or undesired events.

According to a definition, *human error* is an action that has been done, but that was *"not intended by the actor; not desired by a set of rules or an external observer; or that led the task or system outside its acceptable limits"*.[4]

Another interpretation views *human error* as a *cause*, an *event*, or a *consequence*.[5] When considered as a *cause*, human error is an action or activity that results in an aviation occurrence. It can also be seen as an *event*, where the focus is on the human act itself – regardless of whether the error leads to harmful consequences or becomes an actual incident (thus turning into a cause) or not. From the perspective of the person committing the error, it is a recognized phenomenon or event. Yet another approach sees error as a *consequence* – that is, a faulty decision or action may stem from an associated latent condition. These factors are not always visible but exert their negative effects in a hidden way.[6]

1 Wiegmann, D. A., Shappell, S.: *A Human Error Analysis of Commercial Aviation Accidents Using the Human Factors Analysis and Classification System (HFACS).*

2 Observe, Orient, Decide, Act.

3 Military Decision-Making Process.

4 Senders, J. W., Moray, N. P.: *Human Error: Cause, Prediction, and Reduction.*

5 Dudás, Zoltán: *The Most Frequent Human Errors in Aviation – The Dirty Dozen*; Hollnagel, E.: *The Emperor's new clothes or What happened to "Human Error"?*

6 ibid. 52.

This concept aligns with the system-centred model of human error, which views imperfection as an inherent part of human nature. Harmful outcomes do not stem from unpredictable or mysterious factors. Frontline (operational) personnel are not the root cause but rather the inheritors of systemic flaws. Accordingly, effective error prevention relies on strengthening defensive layers – such as technical systems, training, and regulations – and mitigating the traps that threaten human performance.[7]

Error, however, almost always carries a negative connotation – it tends to judge the individual, even when the error is not the cause but rather a consequence, stemming from latent characteristics embedded within a specific organization.[8]

Several models attempt to make the phenomenon of human error more understandable. Without aiming for completeness, the following models are briefly presented as relevant to the perspective of this article.

J. T. REASON'S "SWISS CHEESE" MODEL

One of the most well-known models is Reason's "Swiss Cheese" model. Without going into the details of its structure or illustration, this approach attributes problems to the combination and interaction of active failures and latent conditions.[9]

According to the theory, investigation of aviation incidents and accidents almost always reveals an identifiable active error that triggers the sequence of events. However, all systems may contain inherent weaknesses – latent conditions – that are "built into" the system from the planning, before operations even begin. These conditions remain hidden and uncorrected for long periods, eventually contributing to failures.[10]

The Reason model highlights the complexity and interdependence of systems in aviation operations, where the actions of one actor can affect the actions and performance of others.[11] This means that both individual human errors and embedded latent errors can influence other elements of the system and contribute to further failures. The Swiss Cheese Model exemplifies a modern, systems-based approach to safety that views human error as a natural part of operations – not as the direct cause of an incident, but as a symptom of deeper systemic issues. It encourages open reporting and analysis of errors without blame or punitive consequences. This mindset promotes proactive safety by identifying and addressing threats at the level of everyday operational deviations, well before they escalate into major incidents.[12]

7 Beller, Balázs, Dudás, Zoltán: *The Reason model in the 21st century: How long is Swiss Cheese good for?*

8 Dudás, Zoltán: *The Most Frequent Human Errors in Aviation – The Dirty Dozen*, 52.

9 The author has published on the subject in more depth in the article "*The Reason model in the 21st century: How long is Swiss Cheese good for?*".

10 Beller, Balázs, Dudás, Zoltán: *The Reason model in the 21st century: How long is Swiss Cheese good for?* 29.

11 Dudás, Zoltán: *Flight safety without human error?*

12 ibid. 80.

DOUGLAS A. WIEGMANN/SCOTT A. SHAPPELL – HFACS

The Human Factors Analysis and Classification System (HFACS) is a general human error framework originally developed and tested within the U.S. military as a tool for investigating and analysing the human causes of aviation accidents.[13] This system is based on Reason's model of latent and active failures. Since its initial development, the HFACS framework has been adopted by various military organizations – including the U.S. Navy, Marine Corps, Army, Air Force, and the Canadian Armed Forces – as a complementary tool to enhance existing accident investigation and analysis systems. The HFACS model has been applied to aviation accidents, yielding objective, data-driven intervention strategies while enhancing both the quantity and quality of human factors information gathered during accident investigations.[14]

The HFACS describes human error at each of the four levels of failure (*Figure 1*):

- unsafe acts of operators (e.g., aircrew, ATC[15] personnel);
- preconditions for unsafe acts;
- unsafe supervision;
- organizational influences.[16]

Wiegmann and Shappell followed Reason's way of thinking, so the unsafe acts could be divided into *errors* and *violations*. While both are common within most settings, they differ markedly when the rules and regulations of an

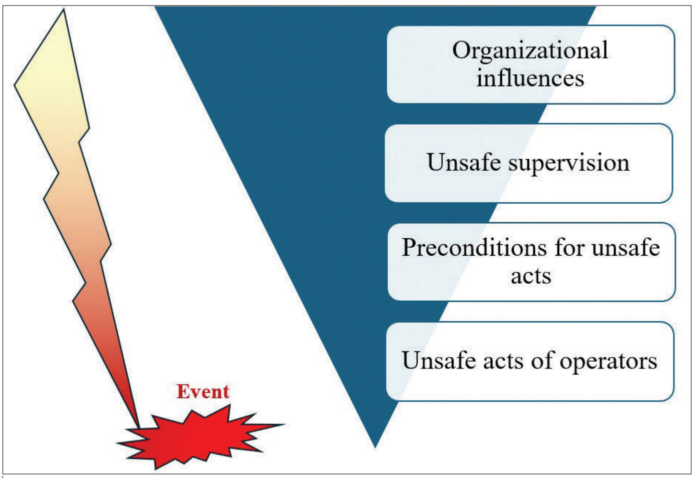

Figure 1: *HFACS basic model (source: created by the author based on Wiegmann and Shappell)*

13 Wiegmann, D. A., Shappell, S.: *A Human Error Analysis of Commercial Aviation Accidents Using the Human Factors Analysis and Classification System (HFACS).* 1.

14 ibid. 3.

15 Air Traffic Control.

16 Wiegmann, D. A., Shappell, S.: *A Human Error Analysis of Commercial Aviation Accidents Using the Human Factors Analysis and Classification System (HFACS).* 4.

organization are considered. That is, *errors* can be described as those "legal" activities that fail to achieve their intended outcome, while *violations* are commonly defined as behaviour that represents the arbitrary disregard for the breaching of rules and regulations. It is within these two overarching categories that HFACS describes three types of *errors* (*decision, skill-based,* and *perceptual*) and two types of *violations* (*routine* and *exceptional*).[17]

1) Unsafe acts of operators

Error

One of the more common forms of error, *decision errors*, represents conscious, goal-intended behaviour that proceeds as designed; yet the plan proves inadequate or inappropriate for the situation. Often referred to as "honest mistakes," these unsafe acts typically manifest as poorly executed procedures, improper choices, or simply the misinterpretation or misuse of relevant information. The second error form, *skill-based errors*, occurs with little or no conscious thought. The difficulty with these highly practiced and seemingly automatic behaviours is that they are particularly susceptible to attention and/or memory failures. The third error form, *perceptual errors*, occurs when sensory input is degraded, or "unusual," as is often the case when flying at night, in bad weather, or in other visually impoverished environments. Faced with acting on imperfect or less information, aircrew run the risk of misjudging distances, altitude, and descent rates, as well as responding incorrectly to a variety of visual/vestibular illusions.[18]

Violation

Two distinct forms of violation have been identified. The first, *routine violations*, tend to be habitual by nature and are often enabled by a system of supervision and management that tolerates such deviations from the rules.[19] Often referred to as "bending the rules". *Exceptional violations*, on the other hand, are isolated departures from authority, neither typical of the individual nor condoned by management. It is important to emphasize that although many exceptional violations may be shocking in nature, their classification as "exceptional" does not stem from their severity. Instead, they are deemed exceptional because they are uncharacteristic of the individual involved and are not sanctioned by supervisory authority.[20]

For achieving the goal of a flight safety investigation, concentrating on the errors and violations is not enough to describe the overall picture. Wiegman and Shappell use the latent condition theory of Reason as factors.[21] HFACS urges investigators to examine these factors as the underlying preconditions, categorized as substandard conditions and practices of operators.

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17 ibid. 3.

18 ibid. 5.

19 Reason, J.: *Human error.*

20 Wiegmann, D. A., Shappell, S.: *A Human Error Analysis of Commercial Aviation Accidents Using the Human Factors Analysis and Classification System (HFACS).* 5.

21 Martinolli, J. B.: *HFACS taxonomy and Accidents and Barriers methodology in Bow Tie Analysis, one Introductory Analysis.*

2) Preconditions for unsafe acts

Conditions of operators

The first category, *adverse mental states*, includes factors like loss of situational awareness, mental fatigue, circadian disruptions, and detrimental attitudes (e.g., overconfidence or complacency) that impair decision-making and lead to unsafe behaviour. The second, *adverse physiological states*, covers conditions such as spatial disorientation, hypoxia, illness, intoxication, and medical issues that hinder safe performance – common contributors to aviation accidents. The third, *physical/mental limitations*, refers to situations where operators lack the sensory input, cognitive capacity, or reaction time to respond effectively. This includes not perceiving hazards or being unable to act quickly or skilfully enough, even under optimal conditions.[22]

Crew Practices

Substandard crew practices often contribute to unsafe conditions and actions. *Crew resource mismanagement* – such as poor communication within the cockpit, with ATC, or among team members – can lead to confusion and poor decisions. Additionally, *personal readiness failures*, like ignoring rest requirements, alcohol restrictions, or engaging in physically exhausting activities before flight, can impair performance, even when not violating formal rules.[23]

3) Unsafe Supervision

While aircrews are accountable for their actions, many unsafe acts stem from latent supervisory failures. HFACS identifies four categories:

Inadequate supervision: Lack of proper training, guidance, or oversight increases operational risk.

Planned inappropriate operations: Poor planning, such as unrealistic schedules or improper crew pairing, places crews at risk.

Failure to correct known problems: Supervisors ignore known issues (e.g., performance deficiencies), fostering unsafe conditions.

Supervisory violations: Deliberate disregard for rules, such as allowing unqualified crew to fly, directly contributes to accidents.[24]

4) Organizational influences

Upper-level management decisions can indirectly shape supervisory practices and operator behaviour, often going unnoticed during accident investigations. HFACS identifies three key areas:

Resource Management: Involves staffing, training, funding, and equipment. Under financial strain, safety measures are often the first to be reduced.

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22 Wiegmann, D. A., Shappell, S.: *A Human Error Analysis of Commercial Aviation Accidents Using the Human Factors Analysis and Classification System (HFACS).* 5.

23 ibid. 6.

24 ibid. 6.

Organizational Climate: Refers to structural and cultural factors (e.g., unclear policies, poor communication) that impact safety and performance.

Operational Processes: Includes procedures, schedules, risk management, and oversight. Ineffective processes or pressures (e.g., time, productivity) can degrade system safety.[25]

HFACS provides several benefits for organizations striving to minimize human error and improve flight safety. It is good for performing a structured analysis, offering a clear and systematic way to classify human errors and identify root causes and latent conditions. It helps to conduct a proactive approach, assists the organizations in identifying potential hazards before accidents occur. HFACS allows the organization to perform data-driven improvements, and supports trend analysis and the development of targeted safety interventions. Finally, it supports cross-industry utility: as is known, the HFACS has been adapted for use in healthcare (e.g., surgical errors), railway transport, military operations, mining, and maritime sectors as well.

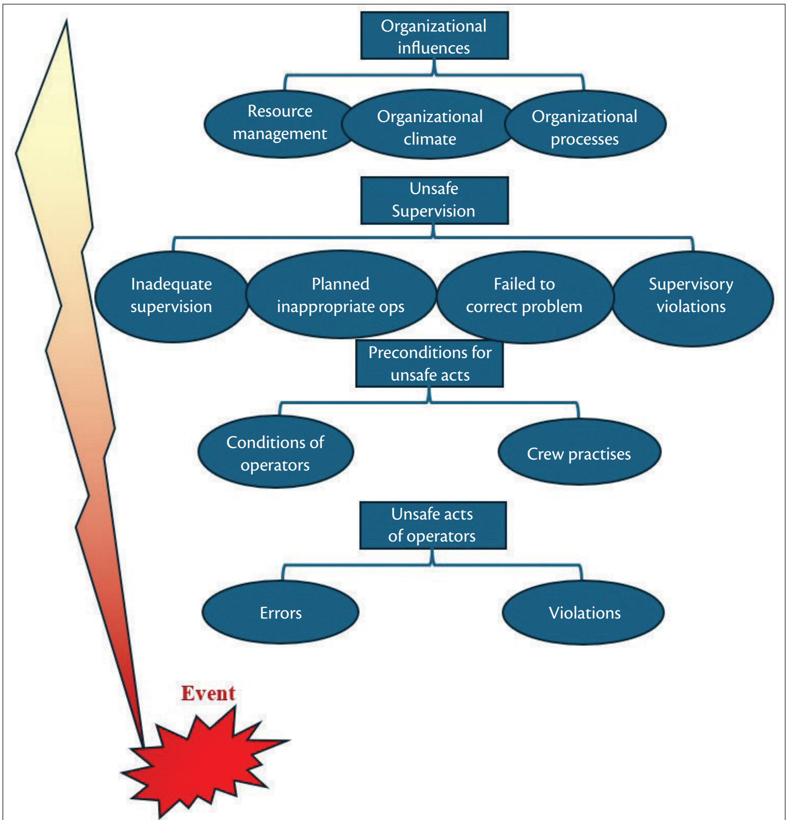

Figure 2: *Levels of HFACS*
(source: created by the author based on Wiegmann and Shappell)

25 ibid. 6–7.

GORDON DUPONT – THE "DIRTY DOZEN"

There were several human errors and performance-related factors that contributed to the occurrence of aviation incidents that are worth examining from a different perspective. The Dirty Dozen is a concept developed by Gordon Dupont in 1993, while he was working for Transport Canada. He has identified 12 human error factors that compromise human performance, efficient and safe operations, and can lead to human error (unsafe acts), primarily in relation to aviation incidents due to maintenance deficiencies. However, these factors are not only applicable to aviation maintenance shortages but are also capable of identifying problems commonly encountered in aviation, i.e., they can provide a correlation between the applied models, where the same emerging failure can be captured from multiple angles using the underlying assumptions of the models.[26]

The members of the "Dirty Dozen"

Dupont identified the following factors as important fields of human acts to investigate in case of aviation incidents (in maintenance):

1) Lack of communication
Typically, only around 30% of verbal communication is understood, with people best recalling the beginning and end of a message. To improve clarity, state key points first and last, and use written tools like checklists for complex information.[27]

2) Complacency
Complacency is self-satisfaction that dulls awareness of danger. Routine tasks can mask warning signs, leading you to see only what you expect.[28]

3) Lack of knowledge
Air operators have a regulatory responsibility to ensure that their personnel have the required training.[29]

4) Distraction
Distraction pulls attention away from the task and is a leading cause of forgetfulness. When returning after a break, we often believe we are further along than we really are.[30]

5) Lack of teamwork
The lack of teamwork, especially in a multi-crew environment, used to have a great impact on aviation incidents. To prevent or minimise the negative effect, an effective team will:

- Stay focused on a clear mission – Everyone understands the common goal and works towards it.
- Uphold shared expectations – Team members know their roles and what is expected from them.
- Communicate openly and consistently – Information flows to everyone who needs it, reducing confusion.

26 DUDÁS, Zoltán: *The Most Frequent Human Errors in Aviation – The Dirty Dozen*. 55.
27 Transport Canada: *Human performance factors for elementary work and servicing*. 2.
28 ibid. 2.
29 ibid. 3.
30 ibid. 3.

- Foster mutual trust – Members rely on each other's integrity and competence.
- Collaborate and support each other – Everyone contributes and steps in to help when needed.

6) Fatigue
Research shows that fatigue impairs judgment in much the same way as alcohol. When we are tired, we often underestimate the risks we face and overestimate our ability to handle them. For example, being awake for 17 hours can impair performance as much as having a blood alcohol level of 0.05%. After 24 hours, that impairment rises to 0.1% – the legal limit for intoxication in many places. Fatigue not only lowers cognitive ability but also increases susceptibility to distraction.[31]

7) Lack of resources
A lack of resources can interfere with one's ability to complete a task because there is a lack of supply and support. Low-quality products also affect one's ability to complete a task.[32]

8) Pressure
Urgent demands that impact performance typically come from four sources: the company, the client, colleagues, and ourselves. Interestingly, the greatest pressure often comes from within. Self-induced pressure arises when individuals take responsibility for problems they did not create – carrying the so-called "monkey on their back." Learning to be assertive and declining unnecessary burdens can help reduce this type of stress.[33]

9) Lack of assertiveness
Assertiveness is the skill of clearly and respectfully expressing your thoughts, feelings, and needs without being aggressive. It involves open, honest communication while maintaining a constructive tone. To apply assertiveness effectively, try to get the person's attention and state your concern, explain the potential consequences, offer a constructive solution, and require feedback. It is quite practical, if the focus is on one issue at a time, to avoid exaggeration, stick to the facts, and remain calm.[34]

10) Stress
Stress comes in two forms: acute (short-term, task-related) and chronic (long-term, life-related). Chronic stress can amplify acute stress. Dealing with stress is not easy. For example, deep breathing helps with acute stress, while chronic stress often requires lifestyle changes.[35]

According to NATO research, the most psychologically stressful and challenging feature of being a pilot is the time pressure: movement can slow down as a response, or, on the contrary, become rushed and disjointed; both cases are dangerous.[36] From this point of view, the Stress and Pressure factors of the "Dirty Dozen" are connected to each other.

31 ibid. 3.
32 ibid. 3.
33 ibid. 3.
34 ibid. 4.
35 ibid. 4.
36 Szabó, Sándor András: *Stress and Flight (Heart Rate Variability Parameters in Simulated and Real Flight Stress Situation).*

11) Lack of awareness

Situational awareness is one of the most important skills required for a pilot. It means that the pilot is aware of their aircraft position according to the ground, to other aircraft, to the environment, or understands their activity in accordance with the aircraft itself in the present and the near future.[37] Lack of awareness is a failure to foresee all consequences. To avoid this, crewmembers always ask themselves: "What if…?", "Do I see the full picture?", and "What have we missed?".[38]

12) Norms[39]

Norms are unwritten rules followed by most in a group, company, and can be positive or negative. A positive norm could be checking the aircraft cockpit's interior before closing the canopy, while a negative norm is pushing an aircraft into the hangar without assistance.

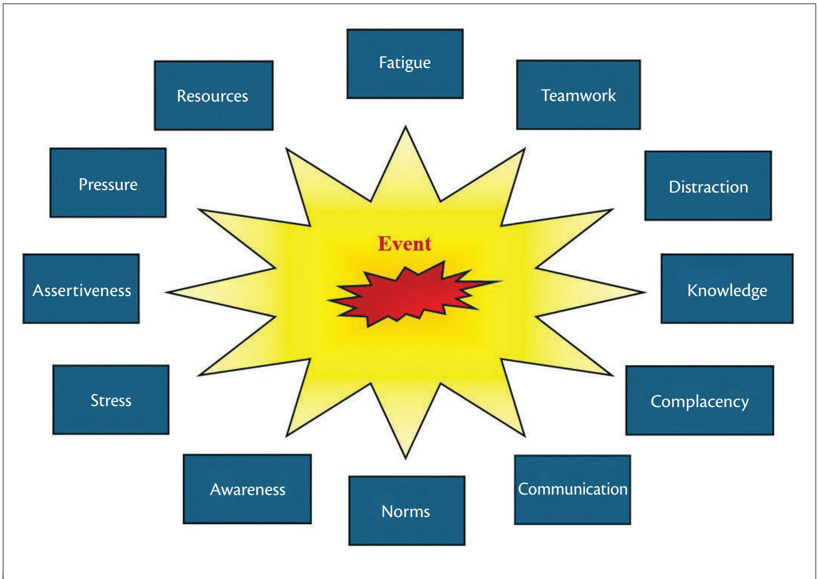

Figure 3: The "Dirty Dozen"
(source: created by the author based on Dupont)

CASE STUDY

The aim of this case study is to show the "Dirty Dozen" impact on a well-known and highlighted aviation accident in the recent past, involving one of the best basketball players in the world. The secondary goal is to show that all applied models or procedures have a common part, could be a source of each other, or

37 Szabó, Sándor András: *A katonai repülő-hajózó állomány repülőorvosi minősítése és kiképzése a NATO standardizációs egyezmények szellemében. (Különös tekintettel a szív-érrendszeri adaptáció és readaptáció vizsgálatára komplex és szimulált repülési stressz környezetben).*

38 Transport Canada: *Human performance factors for elementary work and servicing.* 4.

39 ibid. 5.

support each of them to meet the higher needs of investigators.

On January 26, 2020, around 09:46 Pacific Time, a Sikorsky S-76B helicopter with tail number N72EX began a rapidly descending left turn and crashed in Calabasas, California. The pilot and eight passengers were killed, and the rotorcraft was destroyed. The helicopter was operated by Island Express Helicopters Inc. (Long Beach, California), conducting contractual flights under visual flight rules as per Federal Regulation 14 CFR Part 135.

The helicopter took off from John Wayne Airport (Orange County, SNA, Santa Ana, California) around 09:07 and was en route to Camarillo Airport (CMA), about 24 miles west of the crash site. After take-off, it remained at altitudes below 1,700 feet above sea level, generally maintaining an altitude of 400–600 feet AGL (Above Ground Level). The flight proceeded without incident towards CMA. Air traffic controllers informed the pilot of weather conditions, including a cloud base at 1,100 feet, 2.5 NM visibility, and occasional fog. The cloud layer top was at 2,400 feet, with no significant clouds above that level.

At 09:44, approximately 2 minutes before the crash, the helicopter, flying west at around 1,370 feet (450 feet AGL) above the US 101 freeway and rising terrain, requested permission from ATC to climb above the clouds. The pilot began to climb at a vertical speed of 1,500 feet per minute.

At 09:45, the helicopter reached an altitude of approximately 2,370 feet (about 1,600 feet AGL), then rapidly descended in a left turn towards the ground. As the helicopter was descending, ATC asked the pilot to "state intentions," to which the pilot responded that they intended to climb to 4,000 feet. A witness near the crash site first heard the helicopter and then saw it "fall out" of the clouds just 1-2 seconds before impact. The helicopter then struck the hillside.[40]

The accident received significant media attention, particularly because the NBA's Los Angeles Lakers legend Kobe Bryant and his daughter were on board.

The National Transportation Safety Board (NTSB) conducted the investigation, concluding its report (NTSB/AAR-21/01 PB2021-100900) on February 9, 2021. The following conclusions were made:

1) No safety issues were identified during the flight:
- No deficiencies in pilot training, health, alcohol, drugs, or fatigue.
- No malfunction of the helicopter.
- No pressure from Island Express Helicopters Inc. or the client to complete the flight.

2) Although air traffic control did not report a radar and radio communication loss with the helicopter, this failure of the controller did not contribute to the occurrence of the accident.

3) If the pilot had completed an updated flight risk assessment form considering available weather information, the flight would have remained within the company's low-risk category, but the pilot should have consulted the operations manager and submitted an alternative plan.

40 National Transportation Safety Board: *Rapid Descent into Terrain Island Express Helicopters Inc. Sikorsky S-76B, N72EX Calabasas.*

4) When the pilot requested to climb, he lost visual contact with the horizon and the ground during the cloud encounter. The loss of external visual reference likely started as intermittent but became complete as the helicopter turned left and descended off its planned path over the 101 freeway.

5) The pilot's poor decision to fly at excessive speed, given the weather conditions, did not align with the training for adverse weather avoidance and reduced available time for alternative actions.

6) The pilot experienced spatial disorientation while climbing under instrument meteorological conditions (IMC), leading to loss of control and collision with the terrain.

7) The pilot's decision to continue flying in worsening weather was likely influenced by pressure to meet client travel needs, lack of an alternative plan, and bias towards continuing the flight as it neared the destination.

8) Island Express Helicopters Inc. did not have a documented policy or safety evaluation to ensure pilots consistently and correctly complete flight risk assessment forms, hindering the form's effectiveness as a risk management tool.

9) A fully implemented, mandatory safety management system could improve the company's risk management capabilities.

10) Proper simulation tools in scenario-based helicopter pilot training could enhance pilots' ability to accurately assess weather and make appropriate decisions.

11) Objective research evaluating spatial disorientation simulation technologies could help identify the most effective applications for training pilots to recognize and successfully mitigate spatial disorientation.

12) A flight data monitoring program could help operators identify and mitigate factors that influence deviations from established norms and procedures, especially for operators like Island Express Helicopters Inc., that perform single-pilot operations with limited opportunities to observe pilots in the operational environment.

13) A crash-resistant flight data recorder system that captures parameter data, cockpit voice, and image recordings could provide valuable information on visual cues related to adverse weather and pilot focus after entering instrument meteorological conditions.[41]

Reviewing the NTSB report, it is clear that some factors from the "Dirty Dozen" list may have contributed to the event. As we discussed before, "Dirty Dozen" was originally developed for maintenance issues, but it is really a handy tool for other aviation incidents as well. Upon examining these 12 factors, I arrived at the following conclusions:

1) Lack of Communication

The lack of communication on board – considering that, according to FAA regulations, the operation of the S-76 helicopter in a single-pilot operation was feasible under VMC conditions during

41 ibid. 8–9.

passenger transport – was not really an issue, as there was no one with whom to communicate on board in professional issues. The pilot maintained two-way radio communication with the air traffic controller; however, it is uncertain whether the question intended as a warning was fully understood by the pilot in the final stages of the flight (the pilot intended to climb, but the ATC noticed the decrease in altitude and inquired about the pilot's intentions).

From the HFACS perspective, it could be a *perceptual error* that the sensor detection and the data processing failed (heard but not listened to) by the pilot in the quite overwhelming situation in the cloud.

2) Complacency

This factor may have been relevant, as the pilot filled out a flight risk assessment form about 2 hours before take-off. According to the scoring criteria of the form, the flight was categorized as low-risk based on the company's published classification. However, the updated weather information available at the time of departure indicated conditions that met the criteria on the form requiring the pilot to consult the operations manager and submit an alternative plan. This did not happen, as the pilot had already completed the same flight earlier in the week. Furthermore, the company's guidelines were not clear on whether they expected the pilot to analyse the weather report before take-off and reassess the risks.

It could be considered overconfidence when the pilot flew at significantly higher speeds than the weather conditions warranted, depriving themselves of the extra time needed for proper decision-making, and when they began to climb and the helicopter entered IMC. The pilot trusted their decision and proceeded with the manoeuvre. While the pilot's training emphasized avoiding entry into IMC by slowing down and manoeuvring or landing, there was no evidence to suggest they attempted these actions.

From the point of view of HFACS, this factor is part of the precondition of unsafe acts, as adverse mental states belong to the condition of the operator.

3) Lack of Knowledge

The pilot's entry into IMC and the subsequent analysis suggest that poor decision-making during flight in the clouds could have stemmed from a lack of skills or diminished knowledge. Although the pilot had received Instrument Flight Rules (IFR) training years prior to the incident, due to company policy and cost-effectiveness, they had been operating single-pilot Visual Flight Rules (VFR) flights. As the helicopter rapidly ascended into the cloud layer and gradually turned left, the pilot, having lost external visual references, was likely relying on vestibular illusions (where the vestibular system in the inner ear creates a false perception of the helicopter's position and trajectory), which could have led to spatial disorientation. The lack of knowledge and recognition – the principle of "trust the instruments, not your 'buttocks'" – contributed to the complex flight situation.

This factor could particularly support the HFACS adverse physiological states as spatial disorientation and the physical/mental limitations refer to situations where operators lack the sensory input, cognitive capacity, or reaction time to respond effectively. Of course, the unsafe supervision as another factor of

HFACS can be detected in this part of the event.

Finally, as an error in HFACS, perceptual errors faced by the pilot increased the risk of misjudging the altitude and descent rate of the helicopter.

4) Distraction

Since the S-76 helicopter lacked both a flight data recorder and a cockpit voice recorder, there is no evidence to determine whether any factor could have distracted the pilot during the critical stages of the flight, potentially affecting their decision-making. However, the continuously decreasing visibility, the low-level clouds, or the loss of visual contact with the terrain could have increased the feelings of tension or discomfort on board as well.

5) Lack of teamwork

Teamwork could not be considered in this aviation accident.

6) Fatigue

It cannot be definitively proven that fatigue played a role in the aviation event; however, it is worth noting that the pilot's usual daily routine (waking up at 6:00 AM and going to bed at 10:30 PM) was somewhat disrupted on the day before the accident. On January 25, the pilot woke up around 6:00 AM, flew charter flights between 8:25 AM and 4:34 PM, and went to bed around 10:30 PM. The pilot's mobile phone activity indicates that on January 26, their "mobile" day started at 6:46 AM and ended at 12:24 AM, with breaks longer than one hour between 9:45 AM to 10:59 AM and 11:06 AM to 5:53 PM.[42] While the reduced rest time – given the pilot's flight and other activities on previous days – did not necessarily cause fatigue, it could have negatively affected the pilot's ability to maintain concentration, situational awareness, or decision-making during the period when the helicopter entered the clouds.

This factor could be applied to the HFACS personal readiness part in crew practices. Thus, fatigue could not have been the main contributing factor to the accident.

7) Lack of resources

There is no evidence that the operator supported low-quality products by the firm. However, NTSB found that the proper simulation tool in scenario-based helicopter pilot training, flight data monitoring program, crash-resistant flight data recorder system, cockpit voice recorder, or fully implemented mandatory safety management system was missing.

In this case, the resource deficiency (training, monitoring capability, and safety management system) could be attributed to the poor weather conditions and the potential lack of human performance and cognitive processing capacity when the pilot entered IMC.

It concerns several areas of the HFACS method, like resource management, organizational climate, impact on the condition of the operator, and crew practices.

8) Pressure

The NTSB found no clear evidence of time pressure or compliance stress; however, the mistakes made during the flight (insisting on completing the flight at all costs, lack of an alternative plan,

42 ibid. 8.

and undertaking a flight into IMC without proper training) do not completely rule out these factors.

In my opinion, the pilot's actions – continuing the flight at all costs and climbing into the clouds – could be indirect evidence that "client" pressure and expectations played a role in the decision-making process. According to some reports, the "high-profile client" specifically enjoyed flying with the pilot and requested joint flights, as there were repeated disagreements with other pilots regarding whether to proceed with the flight or cancel and divert to an alternate airport.

We should take into consideration as well that the greatest "monkey on their back" factor, which holds pressure on us to do something risky, is ourselves.

9) Lack of assertiveness

The lack of assertiveness cannot be proven either, considering that the pilot was the company's chief instructor on the S-76B type and had demonstrated adequate performance in all previous tests and inspections. According to the company's operations manager, the pilot who was involved in the accident was exemplary both as a pilot and as a chief pilot. He was described as the "most passionate, dedicated, hardworking, and safest"[43] pilot the manager had ever worked with. The manager stated that the pilot was completely professional and a competent instructor who provided guidance and re-evaluations to any trainee who failed in a manoeuvre.

10) Stress

Like previous conclusions (pressure), the impact of stress as a factor cannot be conclusively proven. However, according to the travel agency's administrator, the pilot involved in the accident had been flying with the prominent client for years, and in the past year alone, the pilot had flown the client 10 times between the SNA and CMA airports, including the day before the accident. The administrator mentioned that the relationship between the pilot and the client had developed "into a friendship,"[44] and added that the client trusted the pilot so much that he even allowed the pilot to transport his children alone. Based on this and previous information, it cannot be ruled out that the pressure to perform – seen as acute stress – may have been a contributing factor in the cause of the accident.

11) Lack of situational awareness

Although it is difficult to imagine a lack of situational awareness given the pilot's training and experience, the findings made by the authorities during the investigation suggest that this could have been a contributing factor to the accident. The narrowing visibility, the rising terrain, and the low cloud base should have prompted the pilot to either turn back or land. Unfortunately, this did not happen.

From the HFACS point of view, the lack of situational awareness leads to spatial disorientation, which can be referred to as adverse physiological states and the physical/mental limitations as it was discussed above.

43 ibid. 26.

44 ibid. 26.

12) Norms

The investigation also highlighted that issues related to adherence to norms are particularly prevalent in risk assessment and weather evaluation. The violation of norms, primarily the phenomenon of norm degradation (practical drift), where uncomfortable rules are virtually overridden, may have played a role in the error. Rules designed to ensure safety can be seen as constraints by practitioners, leading them to view these rules as obstacles to swift execution. Despite small deviations, exceptions, and creative interpretations, the system may continue functioning without noticeable changes in safety levels. Over time, these self-imposed relaxed norms can become the new baseline standards.[45] When this phenomenon is combined with overconfidence, time pressure, and the need to conform, it creates the perfect conditions for an aviation event to occur.

There is no pure evidence, but the found information shows potential likelihood of violation as an HFACS unsafe act, due to "bending the rules" or "exceptional violation". The operator did not perform an update of a risk assessment due to the decreasing weather situation, but as NTSB also stated, Island Express Helicopters Inc. did not have a documented policy or safety evaluation to ensure pilots consistently and correctly complete flight risk assessment forms.[46]

SUMMARY

In conclusion, the S-76B accident was caused by a controlled flight into terrain due to loss of spatial orientation, but reading the NTSB safety investigation report, further human error can be identified in the chain of events. The "Dirty Dozen" showed that these were most likely to be overconfidence, time pressure, lack of situational awareness, and possible exceeding of standards.

As a member of the military aviation authority, it could be a good question why I have decided to use this case study instead of a military accident. The answer is quite simple: I believe that all safety models can be applied for military use as well – human errors depend on the people, not on the affiliation. I have to say as well that my aim was not to blame anyone or hurt someone's feelings. As an airman, the main goal is to learn from every incident and accident to increase the level of aviation safety and minimise the possibility of similar aviation incidents.

The NATO Standardization Office maintains two working groups – Flight Safety Working Group and Aeromedical Working Group –, and they put great emphasis on human factors and human performance issues. The main goal of these two organizations is the identification of physiological deficiencies, organisational procedural failures caused by human factors, and the development of possible technological defences. To support this information, the NATO Research and Technology Organization prepared a Technical Report on Spatial Disorientation Training – Demonstration and

45 Dudás, Zoltán: *The Most Frequent Human Errors in Aviation – The Dirty Dozen.* 57–58.

46 National Transportation Safety Board: *Rapid Descent into Terrain Island Express Helicopters Inc. Sikorsky S-76B, N72EX Calabasas.* 26.

Avoidance in 2008. The research showed that the rate of accidents due to spatial disorientation increased by almost 10% per 100,000 flight hours[47] between the time frames of 1983–1993 and 1993–2002 in all aircraft types.[48] The spatial disorientation is only one of the several human factor issues that have happened and will happen with aviators.

Finally, I would like to say that the NTSB report was fully completed, and this article intentionally aims to add and interpret additional thoughts by using different human factor tools.

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47 From 24.7% to 33.0%.

48 Bles, W.: *Spatial Disorientation Training – Demonstration and Avoidance.*

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AZ ISLAND EXPRESS HELICOPTERS VÁLLALAT SIKORSKY S–76B TÍPUSÚ HELIKOPTERÉNEK KATASZTRÓFÁJA (A „PISZKOS TIZENKETTŐ” TÜKRÉBEN)

Szerző **Beller Balázs alezredes,** HM Állami Légügyi Főosztály, a Nemzeti Közszolgálati Egyetem, Katonai Műszaki Doktori Iskola doktorandusza

Kulcsszavak légiközlekedés-biztonság, humán faktor, hiba, HFACS, Piszkos tizenkettő

Absztrakt *Az emberi tényező, az emberi teljesítmény korlátozása alapvető hatással van a mai repülésre. A repülésbiztonsági vizsgálati jelentések eredményei azt mutatják, hogy az emberi hiba egyre inkább befolyásolja a légi közlekedési események bekövetkezését mint alapvető ok és hozzájáruló tényező. A katonai vagy polgári repülőszemélyzet által elkövetett emberi hiba mindig magától az embertől függ, nem pedig a szakmától vagy a munkától. A cikk egy jól ismert, polgári légi közlekedési baleset elemzését használja fel, amely az Island Express Helicopters vállalat által üzemeltetett S–76B helikopterrel történt, hogy bemutassa az emberi teljesítmény és hiba fontosságát. A baleset elemzése arra is rámutat, hogy a hibák nemcsak a végrehajtó szintjén jelentkezhetnek, hanem a háttérben, az üzemeltető szervezet rendszerében is megbújhatnak, ami problémákat okoz.*