Review Article

Applying Sport Psychology to Aviation

Ensuring Resilient Pilot Performance Through Self-Regulation Techniques and Tools

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Abstract: Pilots, in both civil and military aviation, must possess a unique combination of cognitive and psychomotor skills to manage the complexities of flight. Moreover, they need to be able to perform these skills under high pressure when things go wrong, when fatigued, after long periods of low cognitive demand, and in collaboration with others. In this sense, there are parallels between the domain of aviation and sports. Professional athletes receive targeted training to instill self-regulatory techniques which ensure optimal performance under different stressors. Because of the parallels between the two domains, a review of the sports psychology literature was performed to identify evidence-based self-regulatory techniques, and training practices for development of these techniques, that could be relevant for pilots. Identified techniques were goal setting, visualization, self-talk, pre-performance rituals, and mindfulness-based techniques. More general performance-enhancing techniques were the development of a growth mindset and grit. Technologies to support the training and application of these techniques that were identified were the use of virtual reality (VR) and physiological monitoring. In conclusion, several self-regulation techniques used by professional athletes could enhance the performance of military and civil pilots. Factors such as integration into existing operational routines, organizational culture, and psychological safety must be carefully considered to ensure successful adaptation and implementation in the aviation context.

Keywords: aviation psychology, crew resource management, mental toughness, pilot performance, stress management

In both civil and military domains, human performance is pivotal to (mission) success, operational efficiency, and the safety of crew and passengers (Chan & Li, 2023; Clemente Fuentes & Chung, 2023). From managing routine take-offs and landings to responding effectively during emergencies, pilots operate within dynamic and unpredictable environments that demand precision and resilience (Causse et al., 2019; Helmreich et al., 1999; O'Hare, 2006; Rosa et al., 2022). For instance, pilots must simultaneously monitor aircraft systems, interpret air traffic instructions, adapt to unpredictable weather, and coordinate with crew members, all while managing internal cognitive and emotional factors (Morris & Leung, 2006; Zhou et al., 2024). Military pilots operate within environments defined by even higher levels of complexity. They must integrate precision flying with mission planning, multitasking across air-to-air and air-to-ground engagements and responding to rapid changes in operational conditions (Morris & Leung, 2006; Svensson et al., 1997; Tusˇl et al., 2020).

In both civil and military aviation, the ability to maintain high performance under pressure is not only a technical requirement but a psychological one. Irregular working hours introduce demands such as fatigue, maintaining vigilance across extended duty periods, and making critical decisions despite disruption of the natural circadian rhythms (Caldwell, 2005). Stress caused by high task demands, emergency events, or tactical dangers can impair cognitive performance and ultimately cause cognitive lockup (Landman et al., 2017; Rivera et al., 2014). Consequently, resilient cognitive skills are recognized as vital for pilot effectiveness and mission success (e.g., European Union Aviation Safety Agency, 2025; Steinman et al., 2019).

These demands parallel those in elite sport, where high physical and cognitive performance is required under high pressure, in spite of negative emotions, and, depending on the sport, in dynamic circumstances (Bernier et al., 2025; Caso et al., 2023). Athletes must balance

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environmental variability and internal physiological load to perform reliably despite external and internal stressors (Caso & van der Kamp, 2020; Fuster et al., 2021; Hamlin et al., 2019). Acute stress has been shown to negatively impact performance in athletes as well as pilots (see Landman et al., 2017; Nieuwenhuys & Oudejans, 2012). Chronic stress, if not managed effectively, can contribute to fatigue that could lead to degraded attention, impaired memory, and decreased resilience (Lupien et al., 2018; McEwen, 2017). In aviation, these outcomes have been linked to lapses in attention and decision-making errors that may compromise safety (Cordoba et al., 2025; Masi et al., 2023; Stokes & Kite, 1994; Young, 2008). Similar findings in sport psychology reveal that athletes exposed to sustained competitive pressure can experience performance decrements due to heightened anxiety and over-activation of physiological stress pathways (Hufton et al., 2024; Thiessen et al., 2024).

The pressure to perform is not solely confined to operational environments; both pilots and athletes also endure significant stress during training and evaluation phases. In aviation, the consequences of failing an upgrade to captain or not passing a proficiency check can be severe, leading to mental health problems, career stagnation, or even career termination (Lempereur & Lauri, 2006). Similarly, in sport, athletes often face intense pressure during selection trials, qualification events, or championship tournaments, where failure to meet expectations can result in loss of sponsorship, coaching changes, or even non-renewal of their contract and possible retirement (Park et al., 2012).

Another parallel is that high-performance aviation often occurs in multi-crew or formation flying environments (e.g., military flying formations), where the ability to operate as a cohesive team is vital (Mansikka et al., 2023). Moreover, team members must maintain clear communication, trust, and mutual understanding throughout their operations (Alharasees et al., 2023; Mavin et al., 2018). Similarly, team sports require a high level of collaboration, trust, and role clarity to achieve collective success (Caso, 2025a; Caso, Furley et al., 2025; Caso, McGuckian et al., 2025; Kraus et al., 2010). In both domains, role ambiguity, interpersonal conflict, and communication breakdown can significantly degrade team performance, highlighting the central role of team dynamics in both pilot and athlete performance. These parallels between the demands and stressors in the two contexts mean that pilot training could possibly benefit from conceptual models and evidence-based performance-enhancing techniques and training methods developed within sport psychology.

Sport psychology has evolved as a discipline dedicated to understanding, assessing, and optimizing the mental and emotional components of elite performance (Lochbaum et al., 2022). The ability of athletes to manage attentional focus, recover quickly from setbacks, maintain motivation, and adapt to changing competitive dynamics (e.g., adjusting to both team and opponent tactics) has long been a central theme in sport psychology (e.g., see Bernier et al., 2025; Deci & Ryan, 2000; Fletcher & Sarkar, 2012; Fuster et al., 2021; Galli & Vealey, 2008; Staiano et al., 2023). It has resulted in evidence-based self-regulatory techniques, coping strategies, and effective mindset-development skills, which have demonstrated significant benefits across a range of sports disciplines (Bernier et al., 2025; di Fronso & Budnik-Przybylska, 2023; Lange-Smith et al., 2023). Importantly, these techniques have been applied in other domains that feature significant cognitive and emotional demands, including space exploration (e.g., Caso, 2025b; Pagnini et al., 2023), military operations (e.g., Caso, 2024), and increasingly, aviation. Moreover, applications of technologies for mental training in sports, such as virtual reality (VR), could provide valuable opportunities for training mental skills in aviation as well.

The goal of this paper is to review the sport psychology literature to identify techniques and concepts relevant to training development and performance improvement in military and civil pilots. This is achieved by first focusing on the core psychological skills with potential for transfer; and second, by exploring the implementation considerations and contextual adaptation. It is worth noting that we draw upon both representationalist theories (i.e., the role of shared mental models and cognitive schemas in guiding team performance; Cannon-Bowers et al., 1990; Salas et al., 2005) and anti-representational or ecological theories (i.e., perception–action coupling, constraints-led approaches; Chemero, 2003; Gibson, 1979) that have shaped the sport psychology literature.

Although this review adopts a general approach to pilot performance across aviation platforms, it is important to acknowledge that the specific competencies required can vary significantly between different types of pilots. For example, helicopter pilots must master precision hovering, low-level navigation, and complex spatial awareness in confined environments (Dreslin et al., 2023; Ledegang et al., 2024), whereas F-35 fighter pilots emphasize high-speed maneuvering, sensor management, and multi-domain threat assessment (Lemons & Carrington, 2018). Pilots of commercial airliners prioritize contingency planning and management, crew resource management, and monitoring automated flight systems (Alaminos-Torres et al., 2023; Arsintescu et al., 2020). Thus, despite these differences, this review intentionally takes a broad, cross-domain lens to highlight the common psychological demands that unite pilots across disciplines. Lasty, this review does not explicitly consider the unique psychological and operational dynamics associated with military combat or situations where loss of life is imminent. These environments entail additional moral, psychological (e.g., exposure to acute danger and the need for split-second decisions under extreme threat), and physiological considerations that merit dedicated examination beyond the scope of this paper.

Core Psychological Skills and Technological Tools With Transferable Potential

Self-Regulation Techniques

Several techniques that are used to regulate behavior and emotions have been long studied in sport psychology and could be effectively adapted for aviation (see Jensen et al., 2020; Jentsch et al., 1997; Vealey, 2007). These self-regulation techniques, such as goal setting and imagery, can be helpful for pilots in the preparation of flights, during their flights, or during pilot education and training, as well as improving performance resilience (McCrory et al., 2013). Accordingly, this section briefly presents these techniques across distinct subsections.

Goal Setting

A well-researched technique in sports is the deliberate establishment of goals (i.e., goal setting), which is used to enhance focus control, boost motivation, and foster sustained participation. Clear, specific objectives help individuals to focus on task-relevant cues and maintain motivation even in the face of setbacks or fatigue (Jeong et al., 2021; Mann et al., 2013). There is robust empirical evidence supporting the effectiveness of goal setting in enhancing performance across a variety of domains. For example, Kleingeld et al. (2011) found that goal setting significantly improves performance in complex and high-pressure tasks, especially when goals are specific, challenging, and accompanied by feedback. Kyllo and Landers (1995) examined further that goal setting had a moderate-to-large positive effect on performance, particularly when combined with public commitment and peer support.

In aviation, structured goal setting could be implemented across the mission lifecycle – from pre-flight preparation, through in-flight execution, to post-flight debriefing – to clarify priorities, support self-monitoring, and build long-term confidence. For example, goal setting could assist pilots in defining task priorities, reviewing procedural checklists, and identifying specific performance targets. In flight, short-term operational goals (e.g., workload distribution) could help pilots to maintain situational awareness and adapt to rapidly changing conditions, such as weather or system malfunctions. Lastly, post-flight debriefings provide opportunities to evaluate goal achievement, identify cognitive or procedural gaps, and refine strategies for future missions, which aligns with the evidence-based principles of competency-based training and assessment (CBTA) and evidence-based training (EBT) frameworks (see European Union Aviation Safety Agency, 2025).

Empirical work in aviation supports this approach. Studies on crew resource management (CRM) have emphasized the importance of goal-oriented behaviors and feedback loops in promoting team coordination, error management, and adaptive expertise (see Helmreich et al., 1999; Mavin et al., 2018). Similarly, McCrory et al. (2013) found that structured psychological skills training, which included goal-setting components, significantly improved self-regulation behaviors and self-efficacy among military pilot trainees. Moreover, several simulator studies highlighted that goal-directed reflection and feedback enhance pilots' ability to transfer training to novel flight situations, reducing negative transfer and improving resilience during unanticipated events (e.g., see Beltran, 2024; Pennings et al., 2025).

Imagery

Imagery, or visualization, is a widely used mental training technique in sport psychology that involves creating mental simulations of a task or performance scenario (e.g., the shooting of a penalty kick). This process engages the brain's sensorimotor networks in ways similar to physical execution, helping to refine motor skills, regulate emotional responses, and mentally prepare for complex or high-stakes situations (Jensen et al., 2020; Vealey, 2007). For instance, Jordet (2005) found that an imagery intervention program enhanced the visual scanning behavior (see Caso et al., 2023; Caso et al., 2024; Jordet et al., 2020; McGuckian et al., 2018) of elite athletes.

In aviation, imagery could be used to mentally rehearse emergency procedures, decision-making under stress, or responses to rare events such as system failures or severe weather conditions. Sajdak (2023), for instance, found that imagery practice improved airline pilots' situational awareness, reinforcing its value as a tool for cognitive preparation (see also Jentsch et al., 1997). A comparable aviation-specific practice is "chair flying," a technique where pilots mentally walk through procedural checklists or cockpit flows outside of the flight deck. Although chair flying is widely used informally by pilots preparing for simulator sessions or check rides (Hohmann & Orlick, 2014), it often lacks structured guidance or psychological framing. Embedding principles of sport imagery into chair flying could enhance its effectiveness by encouraging vivid sensory involvement, emotional regulation, and scenario variation. Similarly, the "silent review" recommended by the International Air Transport Association (IATA) for cabin crew, is a technique where individuals mentally rehearse safety protocols prior to take-off and landing (IATA, 2017). Expanding this concept to pilots, with formal training on how to construct and use imagery for various phases of flight, may improve both routine readiness and resilience in critical moments.

Self-Talk

Self-talk is the verbalization of actions or motivational words, and it can be either instructional (e.g., giving oneself cues like "breathe") or motivational (e.g., "you've got this") and may be spoken aloud or silently in one's mind depending on the context. It can be performed out loud or just in one's thoughts. In sports, it is used to strengthen confidence, direct attention, and manage emotional responses (Hatzigeorgiadis et al., 2009; Theodorakis et al., 2000). In aviation, self-talk could be useful for pilots in situations of high pressure or startle, to manage stress and focus attention on relevant aspects of the situation (Field et al., 2018). From a broader psychological perspective, self-talk could also be viewed through the lens of acceptance and commitment therapy (ACT).

ACT does not aim to eliminate internal experiences (e.g., anxiety or negative thoughts), but instead encourages individuals to observe their thoughts nonjudgmentally and commit to actions aligned with their values, even in the presence of discomfort (see Mahoney & Hanrahan, 2011; Watson et al., 2023). In this context, self-talk could become a tool not just for performance enhancement, but for promoting psychological flexibility, that is, the ability to stay focused and take effective action in line with one's goals despite internal challenges. For example, a pilot under pressure might use ACT-informed self-talk such as: "I notice that I'm feeling anxious, but I can choose to stay focused on my next task."

Pre-Performance Routine

Pre-performance routines are structured "habits" or behaviors performed before a performance to enhance focus, reduce anxiety, and create a sense of control. In elite sports, such routines are commonly used by athletes to regulate arousal levels, enhance concentration, and mentally prepare for competition. These rituals can be physical (e.g., a specific sequence of movements), cognitive (e.g., a mental checklist or visualization), or emotional (e.g., motivational self-talk; Cotterill, 2010). In aviation, similar routines could enhance cognitive readiness. For instance, rehearsing non-normal procedures (e.g., the windshear or go-around procedure when this could be expected), could help to reduce cognitive load by automating early procedural steps and freeing mental resources for unexpected events. Moreover, ritualizing these practices supports consistency and smooth transitions into high-performance states under pressure. A notable example from civil aviation is the "reset" method, a protocol introduced to enhance resilience and team performance under stress. The method includes brief verbal check-ins like, "how are you?" to assess a teammate's status and provide mutual support when stress levels rise, mirroring psychological techniques in elite team sports (see Vlaskamp et al., 2025).

Mindfulness

Mindfulness-based techniques are increasingly used in elite sports to help athletes regulate attention, manage emotional arousal, and sustain focus in high-pressure situations. Mindfulness involves intentionally directing attention to the present moment in a nonjudgmental way (Kabat-Zinn, 2003; Jekauc et al., 2024). This capacity to stay grounded in the "now" is critical in situations of mental fatigue, distraction, or performance anxiety. Evidence from sports psychology shows that mindfulness training can improve attentional control, reduce stress responses, and enhance recovery mistakes (Moen et al., 2016; Rogowska & Tataruch, 2024). Regular mindfulness training could be a valuable tool for pilots in managing the cognitive load associated with routine cockpit duties. For example, Li et al. (2022) studied that "quick coherence techniques" significantly increased psychophysiological resilience in commercial pilots, thereby improving their mental/ physical health, cognitive functions and emotional stability.

Table 1 provides a summary comparing self-regulation techniques, including their core principles, demonstrated outcomes in sport psychology, and applications in aviation.

Cultivating Performance-Enhancing Mindsets

Although personality is shaped in childhood and remains relatively fixed throughout one's lifetime, certain stabile attitudes and behavioral patterns can be changed through training, therapy, or life experiences (Roberts et al., 2017). The following section explores such capacities that influence how individuals respond to challenges and regulate their motivation and learning.

Growth Mindset

The concept of a growth mindset refers to the belief that abilities and intelligence can be developed through effort, learning, and persistence. In contrast to a fixed mindset, which views ability as innate and unchangeable, a growth

Table 1. Comparison of self-regulation techniques: core principles, demonstrated outcomes in sport psychology, and applications in aviation

Self-regulation technique	Key principles	Demonstrated outcomes in sport psychology	Application opportunities in aviation
Goal setting	Establishing clear, specific, and challenging goals to enhance focus and motivation	Improves performance and persistence; enhances self-regulation and feedback use.	Structured goal setting across flight preparation, execution, and debriefing to clarify priorities, support self-monitoring, and strengthen learning
Imagery / visualization	Mental rehearsal of performance scenarios activating sensorimotor networks similar to actual execution	Improves skill acquisition, confidence, and emotional regulation	“Chair flying” and mental walkthroughs of procedures and emergencies; strengthening situational awareness and stress management
Self-talk	Use of instructional or motivational inner dialogue to guide attention and emotion	Enhances confidence, focus, and anxiety control	Supports focus under pressure (e.g., startle events); fosters psychological flexibility using ACT-informed phrasing
Pre-performance routines	Consistent physical or mental actions before performance to optimize readiness	Reduces anxiety, improves concentration, and enhances consistency	Pre-flight rituals or “reset” routines to stabilize attention and promote crew coordination before critical tasks
Mindfulness	Nonjudgmental attention to the present moment to regulate thoughts and emotions	Reduces stress, improves focus and recovery	Used to manage cognitive load, fatigue, and startle through breathing and awareness techniques during and between flights

mindset views it as something that can be developed. This means that challenges, failures, and negative feedback are seen not as threats to the ego, but as opportunities for learning and improvement (Dweck, 2006). In sport psychology, fostering a growth mindset has been shown to enhance athlete development, increase motivation, and build resilience, particularly when facing setbacks (Brady & Alleyne, 2017; Gontijo et al., 2023). Creating a growth mindset environment involves more than individual belief; it requires cultural and instructional alignment. Coaches, for example, who frame errors as learning opportunities and emphasize progress over perfection help athletes develop greater psychological flexibility and tolerance for failure.

As pilots need to continuously learn and adapt to changing technology and organizational practices, cultivating a growth mindset in aviation is important. Dweck’s (2016) emphasis on resilience and adaptive learning is directly applicable: Pilots who embrace a growth mindset are more likely to reflect on poor decisions or mistakes, take initiative in improving weak areas, and remain open to new procedures or tools introduced through training. They are more likely to use simulator training for improving their skills instead of merely for passing tests (Pennings et al., 2025). A growth mindset can also play a pivotal role in organizational culture (Dweck, 2016). Cultivating a culture of continuous learning helps normalize the idea that expertise is never final and that even highly experienced pilots must remain mentally flexible and receptive to change. Pilots, in such context, would be encouraged to challenge themselves during training, engage in self-reflection, make proactive use of feedback, and share insights with their peers. Accordingly, several aviation organizations are beginning to integrate the growth mindset concepts into their training and culture, for example, Transport Canada (i.e., the federal aviation authority; Donaldson, 2019).

Grit

Grit is increasingly recognized as an important psychological characteristic in high-performance domains. Grit is defined as the combination of sustained passion and perseverance toward long-term goals, even in the face of setbacks or prolonged challenges (Duckworth et al., 2007). In both sport and aviation, where success depends not only on technical proficiency but also on enduring motivation and mental stamina, grit has begun to attract empirical interest. For example, in elite athletes, grit has been linked to higher levels of commitment, training adherence, and resilience under competitive pressure (Tedesqui & Young, 2017). Similarly, in aviation, recent studies suggest that grit may predict persistence and correlate with psychological resilience in operational settings (Robertson-Kraft & Duckworth, 2014; Walden, 2025). The development of grit (e.g., via clear goal hierarchies, mentorship and social support, feedback systems), therefore, could support pilots in maintaining effort and perseverance during trainings, handling cumulative stressors, and recovering from failure or error without disengagement. At the same time, assessing grit could be a valuable selection component or screening tool in pilot recruitment.

Technologies for Training or Applying Psychological Skills

While traditional psychological techniques can be taught through instruction, recent technological advances could provide new training tools and applications. In both sport and aviation psychology, the integration of digital and data-driven tools has expanded opportunities to assess, develop, and maintain psychological competencies in realistic and feedback-rich environments. Two particularly promising innovations in this regard are the extended reality (XR) systems and psychophysiological monitoring technologies, which together provide immersive, evidence-based platforms for enhancing performance and well-being.

Extended Reality

Educational tools such as VR, augmented reality, or mixed reality could be used to train and improve several psychological elements both in sports and in aviation. VR enables athletes to improve perceptual–cognitive skills such as awareness and it could help to educate psychological techniques like imagery or mindfulness (Caso, 2025c; Gerwann et al., 2025; Neumann et al., 2018). In recent years, there has been an increasing number of studies examining the potential of VR technologies in aviation training, highlighting their capacity to enhance capabilities such as experiential learning, adaptive decision-making, and stress management (Guthridge & Clinton-Lisell, 2023; see also Marron et al., 2024).

However, integration of XR may present challenges related to its validity and fidelity (Rompapas et al., 2021; Stoffregen et al., 2003). Validity ensures the accurate measurement of real task performance, whereas fidelity reflects how closely a simulation replicates real-world environments, including emotional and behavioral responses (Gray, 2019). Therefore, to create effective simulations, developers must assess fidelity and validity metrics such as physical, psychological, and biomechanical realism (Harris et al., 2021), while also mitigating potential negative effects such as excessive mental workload and motion sickness.

Psychophysiological Monitoring

Psychophysiological monitoring tools, such as eye-tracking systems and wearable devices, have become increasingly valuable in assessing and enhancing psychological functioning in aviation contexts. Eye-tracking technologies can provide real-time feedback on visual attention patterns, such as data of situational awareness, workload, and fatigue (Causse et al., 2025; Peifil et al., 2018; Ziv, 2016). For instance, metrics such as fixation duration and saccadic behavior could examine whether a pilot is effectively scanning the environment or experiencing attentional narrowing due to stress or fatigue. Recent research has shown that visual scanning strategies differ systematically with expertise level, reflecting adaptive gaze control among experienced pilots (Lounis et al., 2021). Empirical studies now extend this approach to training (see Cheng et al., 2024; Mengtao, 2023; Tai et al., 2025). Collectively, these findings highlight eye-tracking as both a diagnostic and educational tool capable of optimizing gaze strategies and supporting adaptive decision-making in modern flight training.

Additionally, wearable devices such as smartwatches and biometric patches can track indicators such as heart rate variability, skin conductance, and sleep patterns, which are closely linked to mental fatigue, emotional regulation, and cognitive readiness (Albertoni & Sorvillo, 2024; George et al., 2023). Monitoring these signals in real time allows for early detection of stress or fatigue accumulation, enabling timely interventions such as rest breaks, breathing exercises, or mindfulness protocols. By integrating these technologies into pilot training and operations, aviation psychology could more precisely address individual differences in psychological factors such as resilience, attention, and stress response.

Implementation Considerations and Contextual Adaptation

Translating sport psychology techniques into aviation practice requires careful consideration of the unique operational, cultural, and organizational factors that define the aviation environment. While the studies reviewed demonstrate potential benefits to strengthen pilot training and performance outcomes, their practical impact ultimately depends on how effectively these elements are integrated within the existing training frameworks and operational systems and acceptance by pilots. Therefore, understanding the implementation context, such as training structures, instructor competencies, organizational culture, pilot attitudes, and others, is essential to ensure the successful adoption of these psychological methods.

In aviation, pilots are familiar with nontechnical skills or CRM training, which has traditionally focused on leadership, teamwork, and communication skills (Helmreich et al., 2019). Recently, the focus of training has shifted toward the concept of "resilient performance" (Airbus Safety First, 2022), defined as the ability of a flight crew member to recognize, absorb, and adapt to disruptions. This evolution demands a broader set of psychological and cognitive skills, yet CRM training is still in the process of adapting to these emerging needs. Sport psychology methods could support this transition by enhancing the alignment of CRM training with resilience-oriented goals and by equipping pilots and instructors alike with practical tools for managing performance under pressure.

Transferring sport psychology techniques to aviation is not a simple matter of replication. While core principles such as focus, routine, and emotional regulation are broadly applicable, the operational realities of piloting introduce unique contextual demands that shape how these techniques must be adapted. Pilots, unlike athletes who often benefit from real-time feedback and direct interaction with coaches or sport psychologists, typically operate in environments where immediate psychological support is unavailable. This places greater emphasis on self-regulation, autonomy, and the ability to apply mental skills independently under pressure. Therefore, the nature of aviation, which is marked by time-critical decision-making, dynamic environmental conditions, and the imperative of passenger and crew safety, requires that psychological training be integrated into existing operational routines. The techniques must be compatible with (aviation) components such as checklists, standard operating procedures, and safety-critical tasks, ensuring that they enhance rather than disrupt performance (Beltran, 2024). Moreover, as in sport, psychological support and potentially the inclusion of a sport or performance psychologist could be integrated into the various phases of pilot training. For example, during initial and recurrent training phases, mental skills instruction could be embedded alongside the technical and procedural learning. This integration could help to normalize the use of psychological tools as part of routine practice, rather than as reactive interventions in moments of crisis. Post-mission debriefing could also include structured psychological reflection, providing opportunities to consolidate learning, review performance under stress, and identify areas for future development as is already applied in military aviation (Moldjord & Hybertsen, 2015).

Structured reviews, with a sport psychologist, could include analysis of cognitive workload, stress responses, and decision-making strategies under pressure. At the same time, such reflective practices could support learning transfer, encourage adaptive coping, and cultivate a (growth mindset) culture of psychological literacy and continuous improvement (Tyler et al., 2022). Integrating psychophysiological data, such as heart rate variability, sleep quality, or attention fluctuations, into debriefing processes could further provide pilots and instructors with actionable information to optimize future performance and well-being (see Alaimo et al., 2020; Mansikka et al., 2016; Wang et al., 2024).

However, it is important to recognize that the integration of psychological skills training within aviation varies significantly across organizational and national contexts. Especially in civil aviation organizations, the presence of sport or performance psychologists remains limited or entirely absent due to cultural or budgetary constraints. While some organizations embed psychological support within training and flight operations, others continue to prioritize a narrow focus on technical and procedural competencies. Consequently, successful implementation depends not only on evidence-based practice but also on cultural organizational acceptance. As an example, a (video) behavioral analyst was introduced into an elite soccer club with the aim of providing the technical staff with video-based feedback on players' psychological performance (see Caso, Furley et al., 2025; Caso, McGuckian et al., 2025). This could be a potential starting point in aviation organizations where the instructor is an experienced pilot, possibly in combination with unobtrusive monitoring tools (e.g., see Shute, 2011).

The implementation of psychological skills training should not be viewed merely as a welfare initiative but as a strategic investment in safety, performance, and long-term cost efficiency. Airlines operating in highly competitive environments often face pressure to minimize nontechnical training expenses. However, evidence from both aviation safety research and high-performance domains indicates that psychological preparedness directly influences operational reliability, error management, and recovery from disruptions (Fletcher & Sarkar, 2012; Helmreich et al., 1999). Even small reductions in human-error-related incidents, simulator retraining hours, or fatigue-related inefficiencies could lead to substantial financial benefits. Furthermore, intangible returns such as enhanced crew cohesion, improved instructor–pilot communication, and reduced turnover linked to burnout translate into measurable organizational advantages (e.g., Yanzeng et al., 2024). Finally, such programs may also decrease training disruptions, including dropouts or the need for additional training sessions.

One barrier is the distrust that pilots may have toward management and the training apparatus, caused by constant evaluations (Lempereur & Lauri, 2006). The involvement of a (sport) psychologist may also raise concerns that shared psychological information could be reported to the authorities. Pilots often do not disclose mental-health-related information at their medical examination for fear of losing their license (Hoffman et al., 2023). Also, pilot unions might object to the storage and use of such data due to privacy concerns. For instance, video recordings on the flightdeck have been prohibited by unions although use in simulators is generally allowed. For wearable devices, concerns about privacy and distrust of the employer are also issues that need to be addressed, even though many pilots already wear smart watches (Strong, 2020). Also, wearables should not interfere with performing pilot duties. Further research into pilot acceptability of such devices is needed before they can be implemented.

Beyond these concerns, cultural or individual resistance could also stem from perceived threats to professional identity and autonomy. Pilots are trained to value self-reliance, technical competence, and emotional control; hence, the introduction of psychological training may be misinterpreted as questioning these attributes. Studies on pilot culture suggest that attitudes toward mental health support are often shaped by stigma, fear of license loss, and hierarchical communication barriers (e.g., see Hoffman et al., 2023). In elite sport, initial resistance to sport psychologists was mitigated by embedding mental skills training directly into technical sessions rather than presenting it as therapy (di Fronso & Budnik-Przybylska, 2023; Galli & Vealey, 2008). Military aviation units have addressed comparable challenges by emphasizing the operational relevance of mental resilience, framing psychological training as mission enhancement rather than mental health intervention (Jensen et al., 2020). Aviation organizations could adopt similar approaches, introducing psychological skills modules within CRM or EBT programs, framing them around operational excellence, and integrating them through instructor-led application rather than external counseling models.

To facilitate acceptance and long-term integration, instructors and sport psychologists could have a fundamental role. Instructor training programs could include modules on basic sport psychology principles (e.g., goal setting), so they can model and reinforce these skills in simulator and line operations. Embedding mental skills exercises into existing structures (e.g., pre-flight briefings, LOFT scenarios, or recurrent simulator sessions) would ensure that they become part of the procedural rhythm rather than an additional task. For instance, simulator sessions could conclude with short debriefs that include both technical and psychological reflections (e.g., identifying stress triggers). In recurrent training, dedicated micro-sessions on self-talk, visualization, or breathing regulation could be practiced in tandem with emergency procedure drills. Over time, such integration could normalize mental skills use and reduce stigma, similar to how physical warm-ups and recovery protocols became standard in professional sport. Finally, organizations could promote psychological literacy by highlighting performance gains rather than remedial goals, demonstrating that mental skills training supports the same safety and precision values that define aviation professionalism.

Future Research

While this review highlighted the conceptual and practical relevance of sport psychology principles for aviation, systematic empirical validation is essential to establish their effectiveness and transferability. To date, most applications of psychological skills training in aviation have been conceptual or derived from analogies with sport or military domains. Future research should therefore adopt longitudinal and intervention-based designs to evaluate how these methods influence pilot performance and well-being across different phases of training and operational contexts. Experimental and quasi-experimental studies could, for instance, examine the effects of structured mental skills programs during simulator or line operations. Comparative studies across civil and military aviation, or between novice and expert pilots, could clarify how experience level moderates the effectiveness of psychological interventions. At the organizational level, research should explore how factors such as training culture and instructor attitudes influence the successful adoption and sustainability of mental skills training. Finally, there is a growing need for cost–benefit and implementation studies to determine how psychological training can be integrated into existing training frameworks. Developing validated metrics for psychological readiness or resilient performance could provide organizations with measurable indicators of progress, bridging the gap between conceptual promise and operational practice. By pursuing these research directions, the field can move toward a more evidence-based and contextually grounded integration of psychological skills within aviation safety and performance systems.

Conclusion

Pilots and athletes operate in domains characterized by intense psychological demands, such as sustained focus, high-stakes decision-making, time pressure, and exposure to fatigue. Sport psychology, with its established methodologies for enhancing psychological components such as self-regulation, attention control, resilience, and performance consistency, provides a valuable framework for addressing these challenges in aviation. Accordingly, techniques such as goal setting, imagery, self-talk, and mindfulness have demonstrated their effectiveness in sport contexts and they have considerable potential when adapted for the operational and safety-critical requirements of flight environments. By systematically translating and tailoring these mental skills for aviation, organizations could strengthen pilot readiness and performance, for example, by reducing susceptibility to cognitive overload, and fostering adaptive coping in routine and crisis situations. Moreover, the integration of emerging technologies, such as biofeedback tools, VR-based simulations, and psychophysiological monitoring, could provide novel pathways for ongoing mental training, performance tracking, and recovery support throughout a pilot's career. Lastly, the adoption of psychological tools from sport psychology is more than a transfer of techniques; it signals a broader commitment to human performance and mental well-being in aviation. Embedding psychological competencies into pilot training and operational systems not only could enhance safety and decision-making but also could contribute to a resilient and reflective professional culture capable of sustaining excellence in complex flight environments.

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