Adapt and Thrive: Double-Loop Learning and Safety Culture at the FAA

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EXECUTIVE SUMMARY

Results of the National Commission on Military Aviation Safety (2020) indicated **military aviation losses 2013–2020 included the lives of 224 pilots and crew, 186 aircraft, and $11.6 billion in damages**. "Due to poor data collection and analysis, the Services and the Department of Defense are missing out on valuable opportunities to reduce risk, prevent mishaps, and optimize human performance" (National Commission on Military Aviation Safety, 2020, p. 9). Voluntary safety reporting programs have been integral to a **94% decrease in the risk of fatal accidents** (Namowitz, 2021). Voluntary programs like the Air Traffic Safety Action Program (ATSAP) are vital to organizational learning and safety.

The purpose of this research study at the George Washington University was to examine management perceptions of behaviors, policies, and practices that affect organizational learning—specifically single-loop and double-loop learning, as well as the defensive routines that inhibit learning—in the Air Traffic Organization of the Federal Aviation Administration (FAA). Single-loop learning is simply learning from mistakes to improve practices in basic error detection and correction. More complex double-loop learning involves the ability to critically reflect on and evaluate one's own mistakes and practices and rethinking organizational assumptions and goals. Defensive routines block organizational learning; such routines include efforts to maintain the status quo and avoid embarrassment or admission of error. As FAA Acting Administrator Nolen (2022) stated, "Our mission to provide the safest aerospace system in the world requires us to adapt, learn, and innovate. ... All of us need to think differently—to question the way we have traditionally done things."

Interviews with nine senior managers employed or retired from the FAA provided rich data, which were categorized into themes related to single-loop learning, double-loop learning, and defensive routines. Senior managers indicated that the ATSAP promotes a judgment-free environment for identifying and learning about mistakes and safety risks. However, managers also felt the program was perceived or even misused as a "get-out-of-jail-free card" to avoid individual accountability. The FAA shows adaptability to constant change. However, more two-way communication will develop a more adaptive safety culture. Gathering input from all levels of the organization, increasing dialog and two-way communication, and decreasing defensive behaviors such as managers' need for unilateral control could help the organization increase learning and become more adaptive.

Practical Recommendations:

- Ongoing communication is needed with managers and frontline controllers to improve perceptions of ATSAP related to performance management. All staff need to understand the benefits of ATSAP.
- The organization is still operating with top-down hierarchy and needs to expand two-way communication between managers and air traffic controllers.
- Critical self-reflection should be stressed in managerial training.
- The ATSAP system should be expanded to include Unmanned Aircraft Systems, commercial space operations, advanced air mobility, and other new entrants. Further, the program should be regularly evaluated.

FAA SAFETY CULTURE

Results of the National Commission on Military Aviation Safety (2020) indicated military aviation losses 2013–2020 included the lives of 224 pilots and crew, 186 aircraft, and $11.6 billion in damages. “Due to poor data collection and analysis, the Services and the Department of Defense are missing out on valuable opportunities to reduce risk, prevent mishaps, and optimize human performance” (National Commission on Military Aviation Safety, 2020, p. 9). Voluntary safety reporting programs have been integral to a 94% decrease in the risk of fatal accidents (Namowitz, 2021). Voluntary programs like the Air Traffic Safety Action Program (ATSAP) are vital to organizational learning and safety.

As the needs of organizations are ever changing, leaders and employees also must change and adapt. Learning is essential to any organization’s success (Argyris & Schön, 1978; Liker, 2004; Saadat & Saadat, 2016; Senge, 1990). Like other organizations using learning for problem-solving and adaptation (Koornneef et al., 2009), the Federal Aviation Administration

Safety culture:

In a safety culture, every member of the organization values and prioritizes safety, which is reflected in organizational norms. The FAA (2021a) noted a just safety culture provides transparency and a nonpunitive system to disclose errors.

Air Traffic Safety Action Program (ATSAP):

In collaboration with the FAA, the National Air Traffic Controllers Association created this voluntary safety reporting program (FAA, 2018). Employees are promised that no punitive or disciplinary actions will be taken as a result of reporting errors that could impact safety (National Air Traffic Controllers Association, 2017). ATSAP removes problems from the sole purview of FAA headquarters and allows air traffic controllers to safely report risks and errors.

When an air traffic controller files an ATSAP report, the report is reviewed by an ATSAP analyst who removes any identifiable information. The event is reviewed by the Event Review Committee, consisting of an Air Traffic Organization manager, a member from the National Air Traffic Controller Association, and a representative from the Air Traffic Safety Oversight Service. The committee may recommend training, which is conducted at the facility of the air traffic controller who filed the report. If multiple reports suggest a systemic issue at a facility, the committee may require the facility to conduct a Corrective Action Plan, which could include changes in directives, creation of a workgroup, or changes to training (FAA, 2021d). The committee then reviews whether the safety issue has been addressed.

Quarterly ATSAP reports are shared—with personal information protected—to show examples of issues and help employees and managers learn from mistakes.

(FAA) is continuously looking for ways to learn and improve the air traffic control system. This study was designed to investigate FAA manager perceptions of behaviors, policies, and practices that promote organizational learning as well as those defensive routines that inhibit organizational learning. Findings may be used to create training to improve the use of the Air Traffic Safety Action Program (ATSAP) and other forms of learning in the organization to increase air traffic safety.

Air Traffic Control

Within the FAA, the Air Traffic Organization includes approximately 35,000 employees, of whom 14,000 are air traffic controllers (FAA, 2020a, 2021b). The purpose of air traffic control service is “to prevent a collision involving aircraft operating in the system”; provide “a safe, orderly, and expeditious flow of air traffic”; and support missions of national security and homeland defense (FAA, 2019, § 2-1-1). Air traffic controllers have a first duty priority to separate aircraft and issue safety alerts while exercising good judgment (FAA, 2019).

The FAA has conceptualized air traffic control as a “complex life-and-death system” (Air Traffic Control Association, 2020, p. 27). Due to the multiple factors such as weather, runway configurations, taxiways, air traffic controllers, aircraft, and drones, Jarrar and Balouki (2018) stated air traffic control is complex and unpredictable, requiring adaptive learning and management to maintain safety. The National Airspace System is a complex, dynamic, event-driven world, and thus the FAA is challenged to continuously search for methods or procedures to increase organizational learning leading to effective problem-solving (Air Traffic Control Association, 2020). Additionally, new entrants into the National Airspace System, such as unmanned aircraft systems and commercial space aircraft, have made managing air traffic operations increasingly complex, requiring new methods, procedures, and multiple response strategies to deal with system demand (FAA, 2016). Air traffic management is facing “rapid change” (Whitley & Leone, 2020, p. 92).

Safety Management System

The FAA implemented a safety management system to monitor, assess, and address the associated risk within the operation. A safety management system is a systemic, formal structure designed to reduce risk and increase safety through system-wide procedures and practices (FAA, n.d.-c). The National Transportation Safety Board (2020, 2021) advised all aircraft operators to participate in the FAA's voluntary safety management system; lack of a safety management system increases risk to the flying public.

Safety Culture

The most important element in a safety management system is the safety culture in an organization (Air Safety Support International, n.d.; Önen, 2016). In their study of aviation safety and air traffic control, Ek et al. (2003) noted the importance of a learning culture to produce a safety culture. The U.S. Department of Transportation (2018, 2021) promotes a safety culture by using data-driven information, actions, and behaviors that demonstrate a commitment to safety. Aviation organizations must establish and continuously improve their safety culture to protect the flying public (Holguin et al., 2007).

Just Safety Culture

The FAA (2021a) has referred to the need for a just safety culture allowing for "self-disclosure of errors" and "due consideration of honest mistakes, especially in a complex environment like the National Airspace System" (para. 2). Voluntary, nonpunitive programs allow FAA employees to report safety issues. According to the FAA (2021c), voluntary reporting programs such as the Safety Review Process and ATSAP have improved safety, training, and maintenance procedures (see sidebar on ATSAP).

Improving the FAA Safety Culture

The FAA (2018) has described an inadequate safety culture and a need for improved organizational learning leading to better air traffic safety. Despite use of ATSAP and 181,288 submitter reports, the FAA (2021e) reported safety culture as the top systemic safety problem, identified in 42.5% of the systemic problem reports. The top causal factor for safety culture problems was supervisory and organizational factors, particularly "lack of safety culture" (FAA, 2021e, p. 8). This trend has remained consistent with previous ATSAP data and quarterly reports (FAA, 2021e). For example, the FAA (2018) reported safety culture was the top system problem identified in the first quarter of Fiscal Year 2019, based on 303 of 813 reports (37.3%) in the quarter. The top causal factor for a problem with safety culture was "supervisory and organizational factors" (FAA, 2018, p. 15) reported in 213 of the 303 reports. Although "the ATSAP database is widely regarded as a valuable source of experiential information about risk" (FAA, 2018, p. 19), a safety culture in the organization could be improved (FAA, 2018, 2021e). Therefore, this study was designed to help determine ways to improve the use of ATSAP and other forms of double-loop and organizational learning in the organization to increase safety and promote safety culture.

WHAT IS DOUBLE-LOOP LEARNING?

Organizational learning can vary from single-loop learning, which is simply learning from mistakes to improve practices, as well as more complex double-loop learning, which involves critical reflection and rethinking organizational assumptions and goals (Argyris & Schön, 1978), as in the example of ATSAP. Another topic relevant to organizational learning is defensive routines, which block organizational learning; such routines include efforts to maintain the status quo and avoid embarrassment or admission of error.

Single-Loop Learning

Single-loop learning is basic learning from experience and changing a strategy or procedure accordingly. Organizations that are hierarchical and require conformation to organizational processes and procedures tend to use single-loop learning (Argote & Miron-Spektor, 2011). An example of FAA single-loop learning is the Lessons Learned document for detection and correction of error (FAA, 2020b). The Lessons Learned document emphasizes a single point of error to determine where to assign blame. After pinpointing the failure, a new rule or procedure is created. To enhance safety and production, managers require strict compliance to all applicable rules, orders, regulations, and policies to ensure a mistake is not repeated. The goal of this approach is to solve the problem with no regard for group dynamics or morale; a direct micromanaging approach will ensure that the mission is accomplished. This is an example of single-loop learning: solving routine, repetitive issues in a rule-based context (Argyris, 1977; Matsuo & Nagata, 2020).

Double-Loop Learning

Double-loop learning adds an additional loop of reconsidering the basic foundation on which the procedure is based. Objectives, policies, and the status quo may be questioned and adapted. In double-loop learning, the underlying values and mission of the organization may be challenged.

Single-loop learning:

- FAA Lessons Learned document
- Monitoring results to change procedures & strategies
- Top-down communication
- Rules & regulations

Double-loop learning:

- FAA ATSAP
- Monitoring results to change procedures & strategies—and also underlying assumptions and goals
- Two-way communication
- Information sharing at all levels
- Critical reflection
- Adapting
- Trust
- Safety culture

Double-loop learners ask intentional, reflective, relevant questions to rethink traditional policies and processes to increase adaptability. Double-loop learning yields improved organizational performance (Argyris, 1977; Jaaron & Backhouse, 2017; Sekelova & Lalis, 2019; Wijethilake & Upadhaya, 2020).

With ATSAP, air traffic control practitioners can report risks and errors without assignment of blame (FAA, 2018). ATSAP provides an example of double-loop learning. Double-loop learning requires collaboration and reflection. An organizational environment promoting double-loop learning allows a

team approach. Highly skilled professionals like pilots can overcome defensiveness based on their expert status and reexamine errors through reflection (St. George, 2019).

> Air safety is fertile ground for double-loop learning due to double-loop learning's capacity to mitigate or prevent future disasters (Choularton, 2001; Malakis & Kontogiannis, 2010).

Double-loop learning is appropriate for complex problems that require creative solutions and potentially new processes or goals (Argyris, 1982). For example, Abouraia (2018) advocated airlines use double-loop learning in instrumental and policy issues to improve crisis management. Compared to single-loop learning, double-loop learning allows airlines to more quickly recover from uncertainties or crises.

Throughout the literature, organizational learning and double-loop learning in particular have been presented as ideal to keep organizations competitive, adaptive, and sustainable (e.g., Argyris, 2004; Mano, 2010). Nicolaides and McCallum (2013) described double-loop learning as "increasingly necessary to adapt and thrive" (p. 250). However, organizational defensive routines, a common problem in organizations, prevent double-loop learning.

Defensive Routines

Organizational defensive routines are individual actions and organizational policies that protect employees or leaders from embarrassment or potential threat (Argyris, 1990). Whether through policy or actions, defensive routines create a bubble around an organization to mitigate risk and achieve unilateral control. Defensive routines include unilateral control; face-saving; bureaucratic red tape; and avoidance of embarrassment, action, decision-making, risk, blame, or responsibility (Ashforth & Lee, 1990). Defensive routines block organizational learning, creativity, risk, and adaptability (Ashforth & Lee, 1990).

Defensive routines:

- Saving face
- Unilateral control
- Blame
- Resistance to change
- Preserve status quo
- Red tape
- Delayed decision-making
- Prevent double-loop learning

METHODOLOGY

The purpose of this research study was to examine management perceptions of behaviors, policies, and practices that affect organizational learning—specifically single-loop and double-loop learning as well as the defensive routines that inhibit learning—in the FAA. In a review of the published research on civil aviation, Kira et al. (2019) noted a significant shortage on aviation management research. Kira et al. argued that aviation management research is needed to address critical industry challenges, to adapt to changing technology and operational philosophies in aviation, and to advance aviation management. The findings of this study could inform professional development to improve double-loop learning and the FAA safety management system.

Participants were nine current or retired senior managers from the Air Traffic Organization or other areas within the FAA. Interviewees were men and women with 14–40 years of experience with the FAA, and all had former military experience. Most interviewees described working in various roles and facilities with the FAA.

These professionals participated in semistructured interviews via Zoom videoconference. Interviewing allowed the voice of the participants to be expressed and heard. Participants were assured of anonymity. All participants answered the same interview questions. Interviews ranged from 25 minutes for one participant to 75 and 79 minutes for two other participants. Interview transcripts were then coded thematically, as shown in Table 1.

Table 1. Codes From Transcript Analysis

Double-Loop Learning	Continuous learning & data collection Staff development & support Collaboration Holistic approach for the good of the facility/system ATSAP: positive • Change in mental models, culture • Judgment-free environment Adapting Change is constant Monitoring Dialog/two-way communication Critical reflection Trust • Transparency/integrity • Just culture • Walk the walk/lead by example • Buy-in Crisis Creativity	Single-Loop Learning	Rule-following Standardized procedures
		Defensive Routines	Individual accountability • ATSAP: get-out-of-jail-free card • Difficulty enforcing staff performance requirements Top-down communication Resistance to change Saving face Resistance to describe or even remember failure Unilateral control Mixed messages Avoiding action Blame Bureaucracy Risk avoidance Lack of trust

ORGANIZATIONAL LEARNING IN THE AIR TRAFFIC ORGANIZATION

Single-Loop Learning

Managers stressed the importance of rules and regulations in a safety environment. Participants ensured rule-following through constant reminders and reinforcement of procedures with staff. Participants described using single-loop learning to maintain standardized safety procedures. However, when asked to describe a failure or difficulty in the organization, Participant H described a facility where "standardized operating procedures were extremely outdated, which was causing errors throughout the operation."

> "Our rules and regulations need to be complied with. They mean something. They're put there for a reason." – Participant E

> "Once you stop learning, failure is right around the corner."
> – Participant B

As the FAA has conceptualized air traffic control as a "complex life-and-death system" (Air Traffic Control Association, 2020, p. 27), it is easy to see how managers view air traffic operations as a zero-fail mission that is built upon rule-based compliance. This type of unilateral control model is sometimes necessary when an objective is framed as win-loss or in a produce-or-perish environment (Argyris & Schön, 1996). Yet, organizations should balance both types of learning, single- and double-loop (Nicolaides & McCallum, 2013; Yang, 2018).

Double-Loop Learning

Collaboration and continuous learning are vital aspects of double-loop learning (Reynolds, 2014). All nine senior managers interviewed stressed data collection as part of their strategy to ensure a safety culture. For continuous learning, all participants repeatedly emphasized staff development, training, and support. Participants described following up with employees and ensuring they have the proper tools for the job. Managers mentioned teamwork, mentoring, and leading by example.

Monitoring is another vital aspect of double-loop learning and adapting to change (Williams & Brown, 2018). Both single- and double-loop learning involve monitoring consequences; the difference is in the depth of response to the consequences. A strong safety culture using double-loop learning requires a deep analysis for continuous improvement at all times to enhance decision-making (Argyris & Schon, 1974). In the aviation safety community, at a practical level, effective double-loop learning practices include continual monitoring to ensure practices and organizational vision remain relevant to safety. Seven participants noted change is constant within the FAA, making adapting a continual requirement. As a result, participants included adapting to change as part of their decision-making. Managers described monitoring and gathering feedback to determine need for change in policies, procedures, or training.

> "With the National Airspace System being so dynamic and ever changing and technology just being brought in, in all phases of this, we have to continually evolve." – Participant B

> "I try to embody the just culture system. Silence is really killer."
> – Participant G

All participants had a military background, and many had worked their way up through the ranks of the FAA to their current executive position, holding many diverse roles at varying sites. They sought to lead by example to promote trust and two-way communication. Participants frequently cited aspects of transformational leadership such as transparency, integrity, trust, setting an example, achieving buy-in from employees, and seeking input from all ranks of the organization.

Defensive Routines

All defensive behaviors mentioned by the interviewer were described by senior managers as prevalent in the FAA: unilateral control, top-down communication, resistance to change, saving face, blame, mixed messages, avoiding action, bureaucracy, risk avoidance, and lack of trust.

Unilateral Control and Top-Down Communication. All nine participants observed unilateral control routines through top-down communication in the FAA. Participant F said unilateral control was "still very prevalent." Participant B described directors making decisions and policies without consulting those on the front lines. Participant F noted the need for input from those in the field to make informed decisions and policies.

Some participants, in spite of espousing two-way communication, also revealed they relied on top-down communication. The same participants described trying to avoid "pushback" from staff.

Participant A described getting "pushback" when communicating policies top-down to the workforce and holding staff to the standards. Participant H directly espoused top-down communication, insisting information should be "available from the top-down, never starting at the bottom." However, such top-down communication is not conducive to information gathering or sharing.

> Managers implement policies when they have "no idea of the impact in the field operationally. So the operation is subject to having to suffer through compliance when there's a better way or a better policy could have been formulated." – Participant F

Resistance to Change. Participants noted a history of poor labor relations in the FAA, including punitive behaviors by managers, which have improved in the last decade. However, Participant E noted the agency is "still in a period of labor strife." Comments by participants suggested a need for more cooperation between managers and workforce. The current situation may include self-interest and resistance to change on the part of the workforce and a lack of two-way communication and collaboration on the part of management.

Saving Face. Participants not only described face-saving behaviors in the organization, but some also demonstrated face-saving during the interview. When asked to describe a time when they experienced or observed failure in the organization, four participants were surprisingly resistant to describe or even remember a failure. Participant B described forgetting about failures to move forward.

> "I never make mistakes."
> – Participant C

One who admitted to error described an employee using ATSAP rather than reporting a problem directly to management to avoid feeling like "they were telling on their peers." Another participant admitted to delaying addressing safety reports at a facility and explained, "If I believe in what we're doing here, then yes, I have to override my need to protect that facility."

Blame. Participants described the FAA—prior to the safety culture and ATSAP—as a punitive culture of blame. Additionally, performance metrics prevented errors being reported. I remember the procedure for operational errors during my first couple of years as an air traffic controller, prior to ATSAP, which was not fully implemented until 2010. After an operational error, the facility quality control department would compile the audio and video replay using a radar replay tool to review airborne events. During the review of operational errors, the training department would request all developmental air traffic controllers and certified professional controllers to sit in a conference room to review the operational error from beginning to end. The controller who made the operational error was in the conference room as well. Even though there was no name attached to the operational error, everyone in the room was able to identify the person based on their voice. During the replay of the operational error, the controllers involved in the operational error would slide down in their seat due to shame, guilt, embarrassment, and unwanted attention while 30 people watched an operational error review and critique of their actions. This type of event review was typically done monthly, created a culture of fear, and contributed to air traffic controllers not wanting to voluntarily identify actual or potential safety concerns.

The agency has improved dramatically with the implementation of ATSAP. Interesting, a need for blame and "accountability" relates to the next finding: the difficulty of implementing a double-loop system such as ATSAP in a single-loop organizational culture.

ATSAP: A DOUBLE-LOOP SYSTEM IMPLEMENTED IN A SINGLE-LOOP CULTURE

Positive Change Toward a Just Safety Culture

ATSAP has changed the culture of the organization, promoting more double-loop learning and a more just culture, which is noticeably improving opportunities for learning and the safety culture. Participants agreed ATSAP promotes a judgment-free environment for learning. ATSAP allows information gathering and comparison across facilities to determine causes and whether issues are systemic.

> "ATSAP helped create a just culture in which people were not threatened with having to go back to remedial training or lose all their certifications because of one oversight." – Participant F

> "ATSAP changed the mindset of blaming an individual to looking at the one individual as a part of a system. I thought that was great because, like many other people, I don't think one individual is the problem. I think it's more of a program-based and systemic type of issue. Being able to address it that way was a big plus for the FAA."– Participant B

"Get-Out-of-Jail-Free" Card

Although participants viewed ATSAP as a positive part of a safety culture and information gathering, they also felt the program was misused to avoid individual accountability. Five interviewees used the term "get-out-of-jail-free card." Participant F also disliked that the ATSAP procedure took assessment of response through a bureaucratic external procedure rather than allowing the site manager to "have a more effective response," or direct control. Several participants felt without assigning blame and individual accountability, employee performance could not be improved. Some participant responses reflected defensive behaviors related to blame and control.

> "Managers do not understand the purpose of ATSAP and how it can be useful to improve the safety culture." – Participant A

Participant A explained people "did not trust" ATSAP when first implemented. An important implication for the FAA is that, even though the FAA (n.d.-b) literature for managers explains that ATSAP should not impede performance management, managers do not have the same perception. This finding showed a mix of appreciation for double-loop learning combined with latent defensive routines requiring some sort of punishment for the employee.

More internal FAA research is needed to determine why. The FAA needs to investigate a forum with managers to gather perceptions of managers and communicate how managers can still manage performance.

> "Supervisors now are dispirited. They feel they have no management support. They've pretty much given up on performance management. They feel that they have nothing that they can use in a meaningful way with air traffic controllers to affect meaningful change in their behaviors. And I think there needs to be some redress of that. There needs to be a balance between ATSAP, which is essentially considered a get-out-of-jail-free card, and performance management." – Participant E

Previous researchers have found implementing double-loop learning to be a challenge in hierarchical organizations (Johannesen et al., 2019; Li et al., 2021; Nicolaides & McCallum, 2013). Occupational culture is an obstacle. Li et al. (2021) stated, "A blaming culture arises from inherent power differences between employees and supervisors" (p. 8). In the Li et al. study, although leaders espoused double-loop learning, they preferred a top-down, linear method of organizational learning. Typically goals or performance indicators are controlled by managers, with little input from frontline employees (Li et al., 2021).

NEED FOR TWO-WAY COMMUNICATION & REFLECTION

Two-Way Communication

Although participants noted some collaboration and two-way communication, gathering input from all levels of the organization was an area for improvement. Bottom-up learning is based primarily on experience, whereas top-down learning is based on goals and task demands (Argote & Miron-Spektor, 2011). Both dimensions complement one another in two-way communication.

All nine managers referenced a problem with unilateral control through top-down communication rather than two-way communication. Participant I advocated a need for less top-down communication and more facility-level participation in decision-making.

> "I think one of the ways that they can improve related to safety is empowering the people who are actually in the field, who actually have to carry out those safety-related functions, that make decisions. ... If you want buy-in, you should also allow input." – Participant F

> "A good safety culture is open communication. The management team also can't create an environment where a controller may feel embarrassed to come to them to ask questions. Controllers shouldn't be made to feel that they should already know the answer to something and feel shamed for asking." – Participant I

Double-loop learning is uncommon in hierarchical governmental agencies (Johannesen et al., 2019). Nicolaides and McCallum (2013) stated many leaders still operate from assumptions based on a "traditional command and control notion of authority" (p. 251). In a unilateral control environment, a top-down, linear way of learning can quickly increase organization-specific competencies and knowledge but produces less innovative knowledge.

> "Speaking truth to power is a key component of a safety culture and a just culture, and yet in this agency, we're not there yet." – Participant E

Critical Reflection

Interestingly, only one participant used the term *reflect*; managers typically described asking questions or encouraging feedback. Participant F (the only participant to use the term *reflect* or *self-reflect*) described using feedback "as a means of being able to self-reflect, hopefully improve my actions, my activities, and personal growth." Participant I also espoused crucial self-reflection: "I look at myself every day and assess what I can improve upon or how can I do a better job."

Managers need training to incorporate self-reflection more deeply into their practice. Such self-reflection is more likely to help remove residual defensive routines or need for unilateral control. Double-loop learning requires organizations to reflect on beliefs and assumptions. Whereas the FAA has used double-loop learning to implement ATSAP, the practice of self-reflection is not common in management. Organizations that do not promote self-reflection are less adaptive. For example, without self-reflection, employees who view themselves as experts are less likely to notice or admit to errors (St. George, 2019), and staff may face negative consequences for discussing problems without having a solution ready.

ATSAP may be a welcome first step toward more of a reflective culture in the FAA. Self-reflection should be encouraged among all staff to move the organization to a double-loop learning culture free of defensive routines such as saving face. The FAA provides leadership training and may need to emphasize self-reflection among leaders, as well as encouraging input from staff and a reduction in unilateral control.

> "Getting input is extremely important. If the agency seeks to get the answers from the lowest level on upward, I think they could definitely receive valuable information they need to improve safety." – Participant I

DISCUSSION

ATSAP has changed the culture of the organization, promoting more double-loop learning and a more just culture, which is noticeably improving opportunities for learning and the safety culture. Additionally, the organization shows adaptability to constant change. However, more two-way communication will develop a more adaptive safety culture. Gathering input from all levels of the organization, increasing dialog and two-way communication, and decreasing defensive behaviors such as a need for unilateral control could help the organization become more adaptive and increase organizational learning.

ATSAP and Double-Loop Learning

ATSAP is a double-loop learning project implemented in a single-loop learning culture. The FAA is an organization based on standardized procedures and employing many former military. ATSAP uses a double-loop approach to address the problem rather than assign blame. Double-loop learning relies upon the strategic importance of collaboration and critical reflection. The more ATSAP reports that are received, the greater the likelihood that critical safety issues are identified and corrected. Additionally, so that the error is not just detected and corrected (single-loop learning), it is important to review the data through reflection and monitoring (double-loop learning) so that local, regional, or national trends and issues are identified and communicated with both internal and external stakeholders. Such practices will support hazard identification, risk assessment, and safety assurances into a process that is both repeatable and proactive (International Civil Aviation Organization, 2018).

Managers are responsible for creating an environment where reporting is valued. A private, internal brochure and FAA ATSAP information page for frontline managers specifically states that ATSAP does not limit performance management:

> As managers, you must properly apply the processes within ATSAP, but perhaps your most crucial role is leadership in creating a climate where reporting is not only safe but valued, and employees have confidence that they will not be punished if they tell the truth. Accountability is not based on outcome. The protective provisions in ATSAP focus on safety improvement rather than reactionary responses, but are not intended to constrain proactive performance

> management. You CAN talk to your employee after an event, and you CAN recommend corrective action, including Skill Enhancement Training. (FAA, n.d.-b, p. 2)

Multiple instances of noncompliance from an individual, or errors resulting from substance abuse, will result in an ATSAP report not being accepted from the individual, allowing corrective action (FAA, 2021d). The system has been designed to allow performance management, but managers do not seem to understand that aspect. Managers are still struggling with the notion of air traffic controllers being able to admit mistakes via ATSAP and not be disciplined as they once were during earlier parts of their career. As the FAA moves from a blame culture to a just culture, many managers (as noted in the interviews) still referenced ATSAP as a "get-out-of-jail-free" card. Managers still are concerned with discipline instead of the enormous benefits of ATSAP. The military background of most managers may contribute to this mindset.

According to the FAA Voluntary Safety Reporting Programs Executive Committee (2021) Fiscal Year 2021 annual report on voluntary safety reporting programs, the ATSAP Event Review Committee reviewed 9,868 reports, of which 72% were safety events and 28% were safety problems related to policies or procedures. Based on these reports, the committee was able to collect air traffic control input from frontline employees to mitigate safety hazards and identify unknown risk to the National Airspace System. This process used bottom-up communication to improve safety.

Confidential reporting systems have a positive effect on learning from incidents and should be an essential part of any organization (Sieberichs & Kluge, 2021a, 2021b). In a blame culture of unilateral control, the mindset is that "if people do the right thing, bad things should not happen. Consequently, whenever something goes wrong, someone must have done something wrong" (Kofman, 2010, p. 1). Unilateral control also supports and incorporates face-saving defensive routines that make air traffic controllers as well as managers fearful of being vulnerable to admit mistakes and errors, preventing exploration of new mindsets or practices.

ATSAP provides the Air Traffic Organization with a viable model to detect and correct error, providing vigilant monitoring of the National Airspace System through accounts of safety events from air traffic controllers. Yet managers still have trouble fully believing in ATSAP and its benefits. Argyris (1993) stated, "Top managerial level is typically at the forefront of espousing change but not producing it" (p. 245).

Just Safety Culture

In a just culture, the mental model of blame is replaced with an opportunity to learn. In an ideal organizational environment for air traffic controllers, two-way communication, shared goals, shared values, and mutual respect are important, as they are associated with a safety culture (FAA, n.d.-a).

The benefit of ATSAP is that it promotes not only air safety but also psychological safety internally by allowing air traffic controllers to report risks and errors to the National Airspace System without fear. From there, the data and individual performance are analyzed by the Event Review Committee to determine the root cause of the problem. This approach has a widespread effect on the total workforce because of its critical but collaborative approach to problem-solving. More safety internally creates more safety externally.

As proactive, voluntary reporting programs such as ATSAP become adopted by other agencies, perhaps mindsets will change more readily. FAA Air Traffic Organization Safety and Technical Training (AJI-1) has declared that evolving the voluntary safety reporting program through promotion and education while enhancing data collection, evaluation, and sharing capabilities is a top priority for Fiscal Year 2022 (FAA, 2022). The goal of the evolution is to increase information on system performance to employees at every level (FAA, 2022). Continuous assurance, integrated oversight, and the promotion of a nonpunitive environment enhance a safety culture through critical thinking, exchange of information, and trust (FAA, 2017).

However, despite the intention of creation of trust and psychological safety within the organization, these elements remain underdeveloped in the agency. In a hierarchical organization, the organizational culture will need to shift to create a true safety culture. Participant A stated ATSAP is viewed as "a get-out-of-jail-free card. I think that managers do not understand its purpose and how it can be useful to improve the safety culture." Participant B described a lack of trust between managers and employees. Even managers who espoused two-way communication and trust still demonstrated a tendency toward unilateral control in terms of trying to avoid "pushback" from staff and in needing to feel power over performance management. Edmondson and Moingeon (2001) stated that in organizational learning, "trust can be defined as the belief that relinquishing some degree of control over a situation to one or more others will not lead to personal loss or harm" (p. 158). Managers must feel able to relinquish some unilateral control to promote trust in the organization.

Strong organizational safety leadership is a precondition of a positive safety culture (International Air Transport Association, 2021). *Just* does not mean blame free or the lack of personal responsibility (Houston, 2015). Staff are evaluated, and reckless or deliberate violation of rules is unacceptable. Honest errors are addressed with training rather than punishment, however. In a just culture, unacceptable behavior is clearly explained. Safety reporting is encouraged (Houston, 2015).

RECOMMENDATIONS

- Ongoing communication is needed with managers and frontline controllers to improve perceptions of ATSAP related to performance management. All staff need to understand the benefits of ATSAP.
- The organization is still operating with top-down hierarchy and needs to expand two-way communication between managers and air traffic controllers.
- Critical self-reflection should be stressed in managerial training.
- The ATSAP system should be expanded to include Unmanned Aircraft Systems, advanced air mobility, commercial space operations, and other new entrants. Further, the program should be regularly evaluated.

Training on the Benefits and Use of ATSAP

In a hierarchical system like the FAA, managers may feel a loss of control and thus a loss of some psychological safety and confidence. The individual results of voluntary reporting need to be shared with managers, so they understand that in many cases, air traffic controllers receive training in response to an ATSAP filing. The FAA needs to communicate the benefits of the system to overcome residual defensive behaviors among managers.

The FAA Air Traffic Organization Safety and Technical Training is responsible for materials and training related to ATSAP, led by the Vice President of Safety and Technical Training. Additionally, the FAA safety management system has a point of contact specific to air traffic, the Air Traffic Organization Safety Management Group manager. When the ATSAP mobile app was created, air traffic controllers could file ATSAP reports at home or while they were away from the facility when no one was around. Managers viewed this as a loss of managerial power. Most managers did not perceive that the air traffic controller who filed the ATSAP report could be saving future lives by proactively reporting a safety concern. Managers want control and the process of discipline (accountability) to come through them. Thus, an ingrained system of unilateral control must be overcome for ATSAP to be accepted completely into the organizational culture.

Two-Way Communication

Input from those who work on the front lines is vital. two-way communication can be displayed with joint messages and verbal briefings from senior FAA management and senior union leadership from the National Air Traffic Controllers Association. As the union represents vital hands-on experiences from frontline bargaining-unit employees, participation from senior union leadership in collaboration with senior FAA management would create a top-down and bottom-up approach that promotes double-loop learning. Participation of all staff is important, but with a strong union, air traffic controllers likely will need the encouragement of union leadership. Currently, joint written messages are disseminated to the FAA workforce but joint verbal or face-to-face messaging by both parties is rare.

Self-Reflection

In this study, many leaders were resistant to reflect on instances of failure. Schön (1983) stated reflection is central for innovation, deep learning, and problem-solving. The FAA should encourage reflective practices among all staff. Nicolaides and McCallum (2013) described specific meetings in a governmental organization where staff at all levels considered their individual perspective, that of other individuals, and that of the organization as a whole. Staff considered a list of double-loop-related questions about individual blind spots or biases, reconsideration of norms, and dynamics at play. This process might be adapted for use in the FAA, also incorporating the six drivers of a safety culture described by Houston (2015): commitment, behavior, awareness, adaptability, information, and a just culture.

Expansion of ATSAP

The ATSAP system thus should be expanded to include Unmanned Aircraft Systems, advanced air mobility, and other new entrants. Additionally, ATSAP should incorporate commercial space operations and transportation, as space travel expands to civilians.

In my 15 years as an air traffic controller, I have never witnessed an air traffic controller withholding reporting a safety issue due to embarrassment or threat. It has actually been quite the opposite. When ATSAP was launched in 2008, air traffic controllers were relieved, as they could openly admit embarrassing or dangerous mistakes without fear of punishment by management or de-certification for an operational error. Additionally from my experience, ATSAP increased dialog with air traffic controllers as they began to look at everything critically and would submit ATSAP reports on not only themselves but also peers. Air traffic controllers could openly discuss issues with equipment or outdated procedures because filing the ATSAP report led to the issue being reviewed by a neutral party other than local facility management.

Studies such as this one are important to promote a more effective safety culture. To ensure the effectiveness of ATSAP and other safety initiatives, the FAA must achieve buy-in. ATSAP is currently a double-loop learning system implemented in a mostly single-loop system. Staff and leaders need training to encourage more two-way communication, critical reflection, self-reflection, double-loop learning, and a just safety culture. Additionally, managers could use some reminders that ATSAP does not eliminate employee accountability. The result would be a more collaborative workforce, stronger safety management system, and safer airspace.

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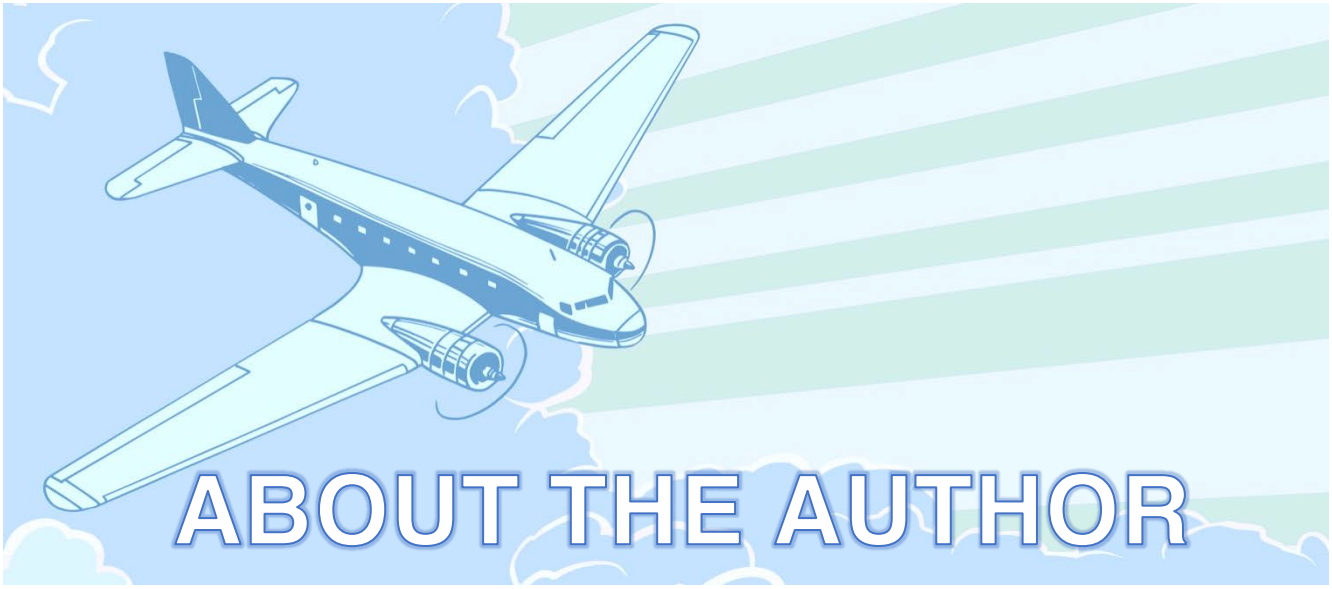

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