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Leadership within ad hoc multiteam aircrews

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Abstract
This paper is a systematic literature review with the aim to build a foundation for future research on leadership in aircrews focusing on the characteristics of ad hoc teams and multiteam systems. Research questions are: How is leadership performed in an ad hoc multiteam system-aircrew? And, how can a leader of an aircrew mitigate the challenges of leading an ad hoc multiteam system-aircrew? Twelve articles were reviewed following a systematic search using LUBsearch and a complementary search using Google Scholar. The results show leadership styles and behaviours, ad hoc team characteristics and the system of leading several different teams within a larger multiteam system. The paper points out the importance that leaders of aircrews understand leadership in both ad hoc team formation and multiteam systems. The paper suggests three future areas of research: a larger literature study to build a larger and broader foundation, research within abusive supervision in ad hoc aircrews and research within shared leadership in aircrews.

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Introduction

Most professional teams have a leader, the same goes for aircrews that have the captain. An aircrew in civil aviation that provides passenger service usually consists of two or more pilots and two or more cabin crew. These aircrew members are usually put together in a team on a daily basis. The formal leader of the entire crew is the captain pilot, but the cabin crew also has a leader in the senior cabin crew member (or *purser*). Leadership in such a crew composition has certain challenges and characteristics, some of which this paper aims to investigate, namely leadership of newly formed aircrews and leadership in aircrews consisting of several teams.

To define what this paper means by a *team*, this paper will use the definition by Salas et al (2005): "A team is two or more individuals with specified roles interacting adaptively, independently, and dynamically toward a common and valued goal" (Salas et al, 2005, p.559-562). Leadership can also be viewed or defined in a multitude of ways. This paper will use a view of leadership described by Yukl (2006) as the process of influencing others to understand and agree which tasks should be completed and how. Leadership is also the process of making it easier to use collective and individual efforts towards a shared goal (Yukl, 2006). Using these views puts the focus of leadership on the social process of a leader in a team, in this paper the team is the aircrew inside of an aircraft.

In aviation, leadership is a part of modern crew resource management training, and it is also one of the core non-technical skills (NOTECHS) pilots are being evaluated on (Flin et al, 2003). In the NOTECHS it is called *Leadership and Managerial skills* and the categories of it are: *Use of authority and assertiveness* (balancing the authority role and creating an atmosphere of challenge and response with the possibility of decisive action), *providing and maintaining standards* (making sure the crew follows standard operating procedures SOP), *planning and coordination* (providing and coordinating plans to achieve a high performance from the crew) and *workload management* (appropriate prioritisation of tasks). The leadership category has some similarities to the other social skill category *Co-operation* which consists of: *Team-building and maintaining, Considering others, Supporting others* and *conflict solving* (Flin et al, 2003).

The definitions and descriptions from the NOTECHS shows that social skills are needed to both lead and participate in a team. Salas et al (2005) constructed a model of teamwork consisting of five core components where *team leadership* is one of those components. The leader of a team should diagnose problems, generate and apply solutions to them. The leader enables effective teamwork through several functions. From the first creation of the team the leader helps create and maintain a shared mental model of the goals and objectives. The leader also maintains the constraints of the team, established roles and available resources. The leader also monitors internal and external changes to help the team adapt to the environment. The leader also establishes expectations regarding performance and behaviour of the team members (Salas et al, 2005).

The other four core components are: *mutual performance monitoring, backup behaviour, adaptability* and *team orientation* (Salas et al, 2005). Building trust in a team is critical for effective teamwork as it changes how team members interpret each other's behaviour. According to Salas et al a shared mental model and a climate of trust is required for mutual performance monitoring, which is when team members keep track of each other's tasks and trigger backup behaviour to ensure all team tasks are being completed (2005). Adaptability is the team's ability to adapt and change their actions depending on changes in the environment. Team orientation is more of an individual's attitude towards working together in a team and also to enhance performance and listen to input from other members.

Leadership can be performed both by styles and behaviours. The *CAP 737 Flight-Crew Human Factors Handbook* (CAA, 2014) describes three leadership styles: autocratic, democratic and laissez-faire. Autocratic being a result driven style where the leader makes most of, if not all, decisions. Democratic where the leader practises inclusion in the decision making, and laissez-faire where the leader leaves the group free to decide on its own (CAA, 2014). Other than styles, different types of personalities have been linked to leadership performance on flight deck, as well as to flight safety overall. Some personality traits are linked to positive safety results (e.g. empathy, self-confidence and independence), and some others to a negative safety result (Moriarty, 2015).

This paper has defined one view of leadership (based on Yukl, 2006) but there is no unison definition of it and several changes have happened over the years. In the early 20th century the worldview tended to be that some "great men" were born with inherit traits that simply made them leaders (Bolden, 2004). And although plenty of research is still put into these traits, no consensus has been made about what they are and only weak generalisations exist to tell of their effects. A more modern view is that leadership is situational, and the focus is less on traits, and more on qualities, behaviour, standards and competencies (Bolden, 2004).

Leadership behaviour focused at safety and at rewarding safe conduct in an operation can be linked to an increase in safety behaviour by the employees. In an organisation that values both safety and performance, leadership becomes crucial as the leader has to convey the importance of both parameters being valued in the employees decision making (Hofmann & Morgeson, 2004).

Comparing safety driven organisations, aviation stands out as one of the most successful high-reliability organisations (HRO) there is (Alavosius et al, 2017). Due to the large effects safety breaches can have in these organisations, a HRO is characterised by clear operational boundaries. This creates a work situation that is highly standardised but also required to flex with external conditions. According to Alavosius et al (2017), leaders within the CRM framework of these HROs face two fundamental challenges: maintaining procedural integrity and occasionally managing unanticipated events, which could pose a threat to life. Leadership becomes the essential integrated function that all elements of CRM relies upon. And in different situations, any member of a crew can demonstrate leadership (Alavosius et al. 2017).

An effective leader manages a shared situational awareness among the crew members as well as defends the crew members from distractions. Alavosius et al, claim that the leader is the single most important factor for establishing an organisational culture (2017). Furthermore, enabling skills and fostering team member growth are leadership skills that can be practised by any member of the crew (Alavosius et al. 2017).

This paper has already defined the *team* using the definition from Salas et al (2005), and the first object of this paper is to look at the leaders role in aircrew team formation. The composition of pilots and cabin crew and who the formal leader is has already been established. But another characteristic of aircrews is that they are usually put together for each new workday, and the crew members may never have met each other before. This category of team will in this paper be referred to as *ad hoc teams*.

Ad hoc teams are teams of varying members that come together to work towards a common goal, or solve a common problem. Ad hoc teams may also be called swift-starting teams and be categorised even further. Aircrews can be categorised as swift starting action teams (Mckinney & Smith, 2005). Mckinney & Smith writes that swift starting action teams have three characteristics: the members are highly trained strangers from the same organisation, the team members must perform immediately and without any time to warm up and the stakes facing the team are high from the start (2005).

Ad hoc teams exist in multiple different areas of work (aviation, medical emergency teams, military etc.) but share common problems. With the swift forming of the team they lack the time to build trust, develop shared mental images and even a shared team identity (White et at, 2018). White et al also writes that power and leadership in ad hoc teams are both influenced by the team itself, and by the expected or presumed roles by the members of the team (2018). Other challenges facing leaders of ad hoc teams are those summarised by Pascal et al (1999) with difficulties distributing tasks, anticipating team member reactions, motivating team members and building or maintaining team atmosphere. Not being able to work or train together beforehand means that the leader of an ad hoc team is left with less understanding of team members strengths and weaknesses as well as the team members not knowing each other's ideas of teamwork (Pascal et al, 1999).

This paper aims to incorporate one more characteristic of leadership within aircrews, and that is being a leader of several teams within a larger team (Cabin crew and pilots are two different, smaller, teams within the larger team, the aircrew).

A way of viewing teams within teams is as a Multiteam System (MTS) The definition of a Multiteam System is "two or more teams that interface directly and interdependently in response to environmental contingencies toward the accomplishment of collective goals" (Mathieu et al, 2002, p 290). The different teams in a MTS can have different proximal goals, as long as they share a common distal goal. In aviation, the common goal would be the safety of the aircraft and its people. MTS teams can be embedded in one organisation, or be part of a larger system in which teams from different organisations interact with each other. A large part of MTS success is teams being able to share a mental model, which puts another kind of leadership in focus (Mathieu et al, 2002).

Leaders in MTSs can be trained to increase the output of a MTS as a whole, without increasing the performance of the smaller teams themselves (Dechurch & Marks, 2006). In the research of Dechurch & Marks, leaders focusing on team performance instead of member performance achieved greater success, and the performance of the MTS was greater than the sum of the performance of the individual teams (2006).

Traditional ideas about leadership and team coordination may not always work in a MTS (Davison et al, 2012). Constructing a MTS such that different teams have different roles and coordination can increase performance more than having smaller teams act towards the same goal in the same manner. Different MTSs need different construction and coordination mechanisms depending on the number of different teams and the amount of members. Coordinating between different teams is the *boundary spanner*, which as the name suggests spans the boundary between the teams communicating and coordinating (Davison et al, 2012).

A failure in coordination within a MTS may cause the shared goal to fail even though all teams within the system have achieved their own proximal goals (Shuffler & Carter, 2018). The research made in one field of MTSs may not be translatable to another field of MTSs, and there is no clear consensus on core competencies required to successfully operate MTSs. Shuffler & Carter suggests that team training and leadership training should be used to make sure component teams share a sense of purpose of the shared common goal (2018).

Zaccary et al writes that in less complex MTSs, the centralisation and importance of leadership and boundary spanners are increased, and a focus on vertical coordination yields a better result (2020). And even with the importance of vertical leadership, smaller MTSs have an increased shared leadership over the component teams as well as a flexible structure over the course of an MTS event (Zaccary et al, 2020).

This paper aims to look at the leadership within the whole aircrew, with a focus on the formal leader, the captain pilot, and to build a foundation for future research in this area. To incorporate the whole aircrew within the leadership research it will be focused around the ad

hoc and multiteam system nature of aircrews. An effective way to build a foundation for future research, and the method of this paper, is to conduct a systematic literature search to synthesise the available literature of the subject. Two research questions are formed to define the search criteria: How is leadership performed in an ad hoc multiteam system-aircrew? And, how can a leader of an aircrew mitigate the challenges of leading an ad hoc multiteam system-aircrew?

Method

To provide a foundation for future research, a systematic literature review was chosen as the preferred method for this paper. The paper was constructed with reference to the six step methodology guide by Sauer & Seuring (2023) on how to conduct a systematic literature review in the field of management. This paper is not aimed at management, but their paper provides a step by step guide on how to conduct a systematic literature review. Following that guide provides this paper with a published, scientific methodology.

The transparency of the systematic review has also been constructed with reference to the PRISMA statement (Page et al, 2021). Although the PRISMA statement is mostly designed for literature reviews in the health sector, it provides a reference as to how a systematic literature review is presented as well as a checklist for the steps of a systematic literature review. A PRISMA flow-chart is used to present the selection process of articles, the older flow-chart from 2009 is deliberately used as it more properly reflects the size and scope of this paper than the new flow chart from the 2020 PRISMA statement.

Due to the size of this paper, only one database was used for the systematic search, and a second manual search was made using a web search engine. Six searches were made using the LUBsearch database. No restriction on publication date was used, and all articles were filtered to have been peer reviewed. These searches were made February 6th 2024. Search 4, 5 and 6 was updated on April 25th 2024.

Search 1 (72 results): *Pilot* AND *Aviation* AND *Leadership*.
Search 2 (55 results): *Leadership* AND (*Aircrew* OR *Air Crew*).
Search 3 (57 results): *Leadership* AND (*Flightcrew* OR *Flight Crew*).
Search 4 (12 results): *Aviation* AND *Ad hoc team*
Search 5 (2 results): *Aviation* AND *Multiteam System*
Search 6 (1 result): *Aviation* AND *Swift Starting team*

In order to mitigate the problem of using only one search database, the same six searches as noted above were also carried out using Google Scholar, and the first 50 articles from each search were screened, and after removing duplicates from the manual searches compared to the systematic searches, 5 more articles were added to the list. A total of 204 (199 from the systematic search + the 5 manually found articles already corrected for duplicates) articles were found. After removing duplicates 143 were left. 143 abstracts were read, and 49 articles were chosen to be read in full. 37 articles were excluded and 12 articles were chosen to be included in this paper. See figure 1. No automation besides the search engine/database was used in the screening, the author manually screened, read, excluded and included the articles.

Inclusion criteria for the articles: articles had to describe either leadership, ad hoc teams or multiteam systems and articles also had to include pilots, or entire aircrews.

Exclusion criteria for the articles: Article was not in English, not peer reviewed, participants were not aircrew, articles focused only on cabin crew, articles about airline management, articles about flight crews in space, military research with a focus on combat.

Although no date restriction was used in the initial search in order to get a complete view of the articles the search provided, after reading the articles, the author decided to exclude articles older than 30 years in order to make the foundation of literature more focused on modern research.

The included articles were read and the contents coded with three themes: leadership style/leadership behaviour, ad hoc team characteristics or multiteam system characteristics. The contents were then grouped and presented with regard to these three themes.
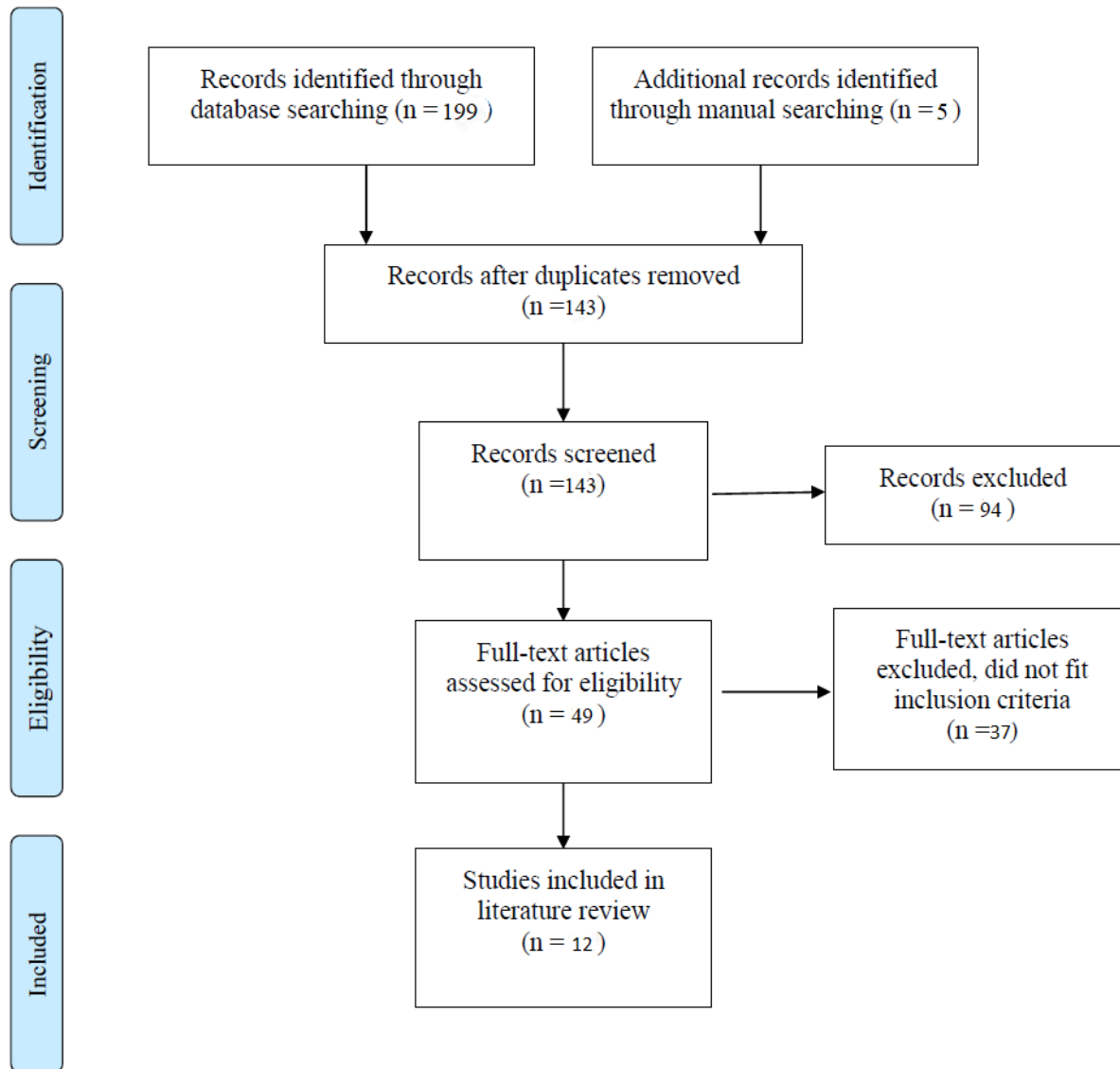

Figure 1. PRISMA 2009 flow-chart showing the systematic article selection. Created with reference to Moher et al. (2009).

Due to the size of this paper, only the author did the systematic selection and coding of papers, and as such, it has not been tested against bias. This is mitigated by a transparent process of the systematic search allowing for the method to be tested, evaluated and reviewed.

Results

Leadership Styles and behaviours

In 2022 Kutlu & Basdemir examined the relationship between leadership styles and crew resource management (CRM) and they used three styles of leadership in their research. They defined three different styles of leadership: *Autocratic* (the leader has absolute power), *Democratic/participant* (the members are involved in the decision but it is ultimately made by the leader) and *Libertarian* (the leader gives as little direction as possible and allows maximum freedom to the members of the group in making decisions) (Kutlu & Basdermir, 2022). Rouco et al. (2021) researched the perceived effect of leadership style and communication style on crew members satisfaction and effort. They use three types of leadership styles: *directive* (autocratic), *participative* (democratic) and *delegative* (allows team members freedom to make their own decisions).

Different leadership styles show different results on decisions, and member satisfaction. Autocratic/authoritarian leadership had a significant positive connection towards cockpit management and is linked to increased speed in decision making and problem solving but reduced communication and coordination (Kutlu & Basdemir, 2022).

Democratic leadership had a positive impact towards individual performance in situations of stress, fatigue and emergency, whereas libertarian leadership was linked to positive attitudes towards communication, teamwork and coordination (Kutlu & Basdemir, 2022). Rouco et al (2021) found that participative leadership is associated with more assertive communication, increased satisfaction and extra effort from the team members. Assertive communication also increases team member satisfaction. Participative leadership also encourages proactive behaviour (Rouco et al, 2021). Grote concludes that important leadership behaviour is balancing between empowering and directive behaviour (Or assertive and authoritative behaviour) (Grote, 2016). Grote also states that performing team coordination has become more emphasised than leadership itself (2016).

Mjøs wrote a paper that showed how the culture of leadership behaviour was significantly changed in a Norwegian airline over the course of 10 years with the introduction of CRM training (2002). After 10 years there were a significantly lower number of pilots who perceived the captain as authoritarian. The amount of failures measured during simulator experiments were also significantly reduced at the end of the 10 year period (Mjøs, 2002). The change in authoritarian leadership did not change the culture of masculinity in the airline, which was still significantly higher than the national masculinity (Mjøs, 2002). Newton (2022) writes how masculine ideals have shaped a pilot leadership style of dominance and submission, and that a feminization of leadership ideals would be beneficial in the future. Feminine leadership having more focus on relationship building, collaborative learning and listening.

Leadership coordination and heedful interrelating

Grote et al. (2010) researched coordination and heedfulness and how that affects crew performance. They differentiate between explicit coordination (spending time on the actual coordination of a task) versus implicit coordination (the team using a shared mental model and coordinating and anticipating tasks without actually communicating them between each other). They also consider *heedful interrelating*, which is the "deliberate efforts made by all team members to constantly reconsider the effects of their actions in relation to the goals and actions of others and to the broader context" (Grote et al, 2010, p. 212). Examples of heedful behaviour according to their study is considering others, considering the future, teaching

others, giving feedback. In the study which examined how 42 different cockpit teams acted in a simulated emergency they could see that the heedful interrelating increased during high task load phases. They could also see that the implicit coordination increased in the same situations while the amount of leadership demonstrated decreased.

When they (Grote et al, 2010) examined the high performing crews with the lower performance ones, they found that the coordination was more balanced between captains and first officers in the higher performing crews. In the lower performance crews the captains showed a larger variety in heedful behaviour which reduced the reciprocating behaviour from the first officer. This created a situation in the high performing crews where first officers were more likely to speak up, or consider the future development of the situation without blindly following instructions. Heedful interrelating helped develop a shared mental model. The other two behaviours linked to better performance was an increase in leadership behaviour in situations with less standardisation, and an overall increase in explicit coordination (Grote et al, 2010). In standardised situations, standardisation acts as a substitute for leadership and creating and allowing those substitutes is a leadership skill in itself (Grote, 2016).

Ad Hoc Team Building

Teams within aviation differ from teams in other areas in the way that the people making up the team are usually not the same from day to day (Grote, 2016). This will be referred to as ad hoc teams, in literature sometimes also called swift-starting teams. This means that a new team building process takes place almost every new workday for flight crew. An aircrew is composed of two ad hoc teams, pilots and cabin crew (Bienefeld & Grote, 2014b). Shared standards and structures as well as systematic briefings are important for any ad hoc team to function properly and that these are areas that help create fast trust building, which in turn is a key to the open communication required in a high-safety work environment (Grote, 2016). And while the roles of the team, or group, are designated by the Standard Operating Procedures there are still differences in leadership in the formation of the groups (Ginnett, 2019).

Ginnett (2019) states that one of the most important factors in determining whether a flight crew will work as a good team or not is a function of the captain. And that several findings show that the rest of the group will form their opinions of the leadership in a matter of minutes, making the group formation at the start of the day a large factor in establishing leadership (Ginnett, 2019).

Patterns of communication are established quickly in newly formed groups and may remain for a long time, making the first moments of interaction consequential for team effectiveness in the future (Zijlstra et al, 2012). The stable communications early on in effective cockpit crews, and leadership itself helps create and enhance the teaming process as well as establish standards and structures (Grote, 2016). Zijlstra et al studied newly certified pilots who were doing CRM training in a simulator and found that the effective teams established a communicational pattern that had less variation in length and complexity compared to the less effective groups. The more effective teams also had more balanced patterns of communications where both parts played a larger role. The less effective teams also had more mono-actor patterns, which is where one part has a communicational pattern without the other part being involved, for example, answering one's own question (Zijlstra et al, 2012).

Bienefeld & Grote (2014b) writes that the behaviour in an ad hoc team is strongly influenced by each member's knowledge and expectation about the roles of the other team

members, and their individual perceptions of the roles. Heedful interrelating can increase effectiveness of team building by loosening the hierarchical structure (Grote et al, 2010). It also increases the development of shared mental models.

A risk of quickly formed ad hoc teams is that they can increase an abusive climate of supervision and decrease the trust put in supervisors by members of the team (Qin & Lee, 2023). The temporary nature of the team may discourage the supervisor from establishing credibility in the team, or building social connections. Ad hoc teams in aviation rely on high standardisation and a high member flexibility. This means that anyone with the same qualifications can perform the same duty. The member flexibility of an organisation mediates the lack of trust building in quickly formed ad hoc teams.

Qin & Lee found a difference in their results between male and female respondents when they examined aircrew and their trust in supervisors. Male workers have a positive relationship between member flexibility and trust in their ad hoc supervisors, while female workers have a negative connection between the temporariness of the team and trust in the ad hoc supervisor (Qin & Lee, 2023). Newton (2022) writes that the masculine ideal in airline pilots creates problems for women in aviation where most leaders are men, and the leader is responsible for creating a safe climate in which each member of the team can voice their concerns and opinions (Newton, 2022). Newton further argues that there must be a cultural shift in aviation to be able to include women and female ideas in order to develop a more inclusive leadership culture (Newton, 2022).

High and low efficiency team building

An article written by Ginnett showed differences between high-efficiency captains (HI-E) and low-efficiency captains (LO-E) when it came to the formation of the group (2019). Highly-efficient captains almost never spoke about the tasks that had to be performed by the different crew members (Ginnett, 2019). Instead they tended to focus on the boundaries of the group, using words such as "we" and paying much attention to expanding the group boundaries of the two groups in the aircraft (pilots and cabin crew) to incorporate each member into the work of the others. Highly-efficient captains also spent some time addressing especially three norms that were important: the importance of communication within the team, a spoken focus on safety and also a spoken focus on cooperation.

The more efficient captains used a more dynamic authority, shifting the amount of authority used throughout the workday, even throughout the brief at the beginning. HI-E captains, however dynamic authority, never used a laissez-faire leadership style (Ginnett, 2019). The captains used three methods to establish an effective leader/team authority relationship.

First the captain established their competence in the group, this was made by conducting a logical brief, showing that the captain had thought about it beforehand (Ginnett, 2019). The captain also used a somewhat technical language specific to the flying profession. In addition to these competency behaviours, the captain also demonstrated a comfortability in the group setting, showing confidence in their position as a leader of the group.

Second, the captain also allowed some show of non-perfection. This allows the other crew members to also take responsibility for the outcome of the group, but without diminishing the competency established by the captain. The last thing most highly efficient captains did during the brief was allowing and making the rest of the group engage by means of social interaction. The other members of the crew spent more time talking during the briefings conducted by HI-E captains (Ginnett, 2019).

Ginnett (2019) continued by constructing a model for explaining why the HI-E captains conduct their briefing like they do, and why it works. Ginnet claims it is because of the organisational shells surrounding the crew. This shell provides training, information and

boundaries for the group to act within. This makes it so that the HI-E captains can focus their brief on the topics not included in this shell. Ginnett goes on to claim that the performance of the crew is in large part established during the first meeting (2019).

Speaking up in ad hoc aircrews

Chute & Wiener explored communication directed from cabin crew to pilots and the problems that arise when cabin crew members are hesitant to tell pilots about something they think is important for the operation (1996). Information from several workshops with flight crew shows that one of the largest complaints from cabin crew is that the pilots fail to introduce themselves properly before the work day. The authors propose a simple standardised handshake introduction during the first meeting of the day to establish a more open foundation for team building (Chute &Wiener, 1996).

Bienefeld & Grote (2014b) writes that leader inclusiveness, the leaders perceived willingness to listen to others, fosters psychological safety and thus increasing the chance of members speaking up to the leader about issues. Speaking up within ad hoc teams is strongly connected to subjective status, this is mediated by psychological safety (a team members belief of being able to take interpersonal risk without fear of punishment, rejection or embarrassment). Leader inclusiveness (a leadership behaviour directed at breaking barriers to allow honest communication) was also connected to increasing the chance of team members speaking up, with psychological safety acting as a mediation as well.

Speaking up across teams did not share the same result. For an increased willingness to speak up across teams, the within team psychological safety was more important. Hence, feeling safe within the group of cabin crew was deemed more important to foster the will of a senior cabin crew to speak up to the captain, rather than the psychological safety fostered by that captain to the senior cabin crew. "Within-team states can influence across-team processes" (Bienefeld & Grote, 2014b, p.941). Focusing leadership outside of the own team also helped bridge the gap and improve team-performance. A certain amount of psychological safety is required to speak up, and that amount is more difficult to reach across teams. Team members in ad hoc teams more easily build association with members of the same professional category. Across team communication is also not practised as much during normal operation as it is in non-normal operations (Bienefeld & Grote, 2014b).

MTS - Multiteam Systems

As stated in the introduction: the definition of a Multiteam System is "two or more teams that interface directly and interdependently in response to environmental contingencies toward the accomplishment of collective goals" (Mathieu et al, 2002, p 290). This can be expressed as a scenario where there are teams within a team. This definition applies directly to the crew of an aircraft, where the pilots and the cabin crew share the same ultimate goal of achieving the highest safety possible (Bienefield & Grote 2014b). But during normal operations the two teams may have different goals for the time being. It also poses several challenges when it comes to exercising leadership in such a system. For starters, the commander of the aircraft is the formal leader of all staff on board, the commander is the leader of the pilots, and also the cabin crew. The cabin crew however has their own appointed leader in the senior cabin crew, who is usually the person who communicates with the pilots as well (Bienefield & Grote 2014b). See figure 2 for an overview of aircrew hierarchy and within- vs across team communication.
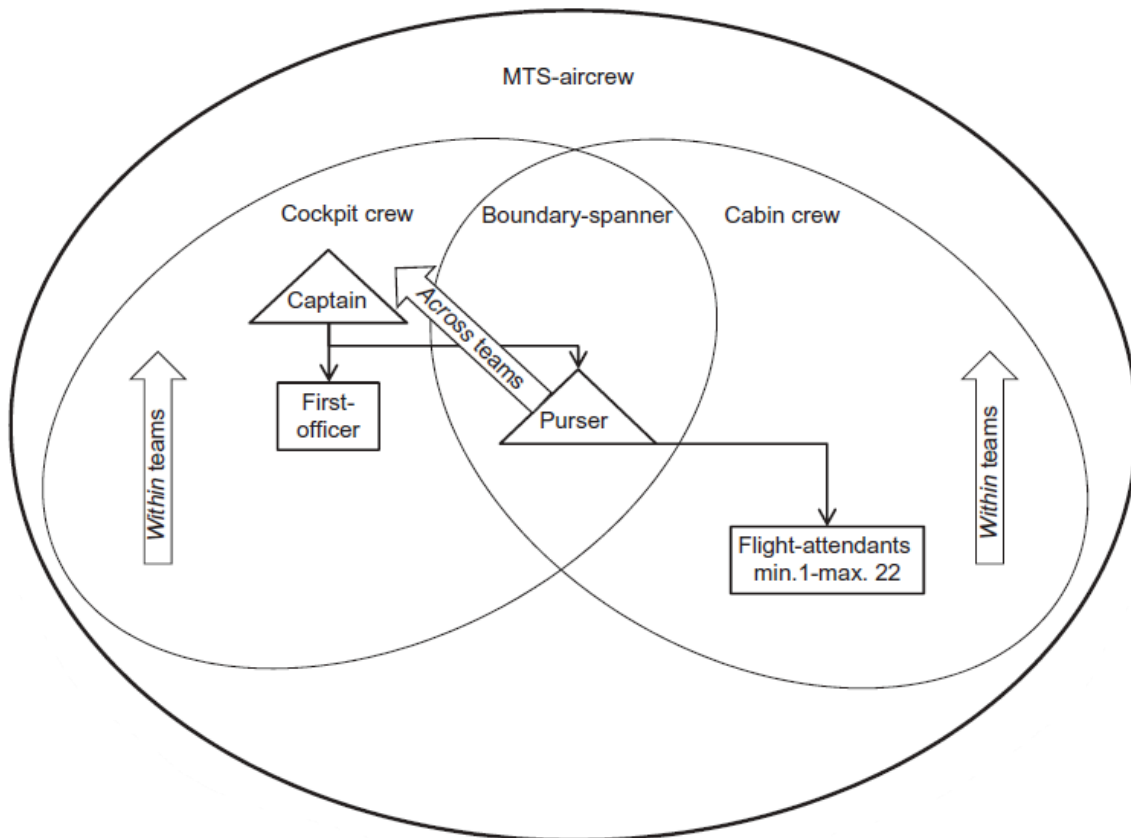
Figure 2. Bienefeld & Grote, 2014b, p.932

During normal operations the coupling of the two teams, cabin crew and pilots, can be seen as loose, while during an emergency the coupling may become tighter depending on the situation (Grote, 2016). During an emergency the goal of the entire crew becomes the same, achieving a safe landing and/or performing an evacuation of the aircraft while keeping all the passengers safe. During this, the teams of the aircraft may receive different inputs or outputs. One team's output may also be the input to the other team (Grote, 2016).

An example of an event where this is important and the goals of each team are aligned is an emergency caused by smoke or fire in the cabin of the aircraft (Bienefeld & Grote, 2014a). The shared goal of saving the passengers can only be completed if the pilots manage a safe landing within time, and if the cabin crew keeps the passengers safe during that time. Bienefeld & Grote (2014a) did research to find out if shared leadership (when the role of leader shifts dynamically in a group in order to achieve group goals) increased the chances for a MTS to be effective. In the successful MTS aircrews, captains, first officers and senior cabin crew demonstrated more leadership behaviour both within and across teams than in the unsuccessful aircrews. The leadership behaviour of the first officer did, however, not increase the goal-attainment beyond the leadership of the captain.

Only in successful MTS aircrews was leadership shared across the teams, and the cross-team leadership shown by the senior cabin crew predicted the goal-attainment for the cockpit crew. In successful crews, the cabin crew also stepped up proactively to demonstrate leadership when the senior cabin crew was occupied. The captain's leadership also played a large role in success when it was used to lead across-teams. The successful leadership both within- and across-teams by the senior cabin crew had a greater overall effect of goal attainment both for the MTS crew as a whole, but also for the cockpit goals, beyond the

effect of leadership from the captain or first officer. The sole leadership from the captain was not enough to succeed in a situation where the goals from each individual team and the MTS team as a whole had to be accomplished (Bienefeld & Grote, 2014a). However, even during shared leadership or delegated leadership the formal responsibility still lies with the formal leader (Grote, 2016).

MTS aircrew boundaries

There are records of several accidents caused by miscommunication between cabin crew and pilots, or situations in which the cabin crew saw something wrong with the aircraft but did not tell the pilots (Chute & Wiener, 1996). Several cabin crew feel unsafe about speaking up to the pilots due to fear of dismissal and rebuke, or out of experience from that. It is also difficult for cabin crew to know when the pilots are busy and not. This increases the risk of an aircraft having two separate teams operating it, instead of one MTS.

When the flight engineer disappeared from the cockpit the communication interface disappeared from the cabin crew who usually could speak to the flight engineer, who could also leave his seat and help in the cabin if there were any questions or problems. With smaller cockpit crews, the pilots have a harder time leaving the flight deck, thus increasing the requirement for technical knowledge for the cabin crew in order to be able to report accurately to the flight deck (Chute & Wiener, 1996).

The boundaries of the different teams inside the aircraft are two. One because of the difference of the teams themselves, pilots and cabin crew, but also the physical boundary between them, the cockpit door. This means that the Senior cabin crew member is the only team member with the opportunity to lead across the teams inside the aircraft (Bienefeld & Grote, 2014a).

The boundary spanner also gathers information from all teams and then filters it before passing it along. Performing this duty with higher skill was the largest contributor to overall MTS aircrew success. The unsuccessful aircrews mentioned earlier in the research from Bienefeld & Grote (2014a) suffered from the boundary-spanner becoming stuck in the middle, unable to cope with all leadership challenges and without the shared leadership assistance from the rest of the cabin crew. Similarly, the leader of a situation has a considerable impact on a high workload situation even if the workload is on another member of the team. For example, if a team member has a problem to handle and the captain sees it as a crew problem instead of the other team members problem, that has a larger effect on the performance than the team members skill in handling the problem (Ginnett 2019).

Discussion

Method and limitations

This paper has aimed to research leadership within an aircrew with regards to the ad hoc multiteam system nature of crews within aviation. The research questions asked were: How is leadership performed in an ad hoc multiteam system-aircrew? And, how can a leader of an aircrew mitigate the challenges of leading an ad hoc multiteam system-aircrew?

The method chosen for the systematic literature search provided 12 articles. The earliest article was from 1996, and the latest from the 2020s, providing a modern representation of the research. The articles provide a solid foundation of scientific material to answer and analyse the research questions. Other limitations to the method chosen are the use of only one search database (although mitigated partly by the use of google scholar as well)

and that the author was the only person doing the selection of the articles, increasing the risk of a bias in the selection process. Transparency in the selection process is an attempt to mitigate these limitations and increase the replicability of the process, and the validity of the results.

A difficulty in analysing the multiteam system nature of aircrews is the fact that the term 'multiteam system' was defined in 2001. That does not change the fact that aircrews before 2001 still qualify as being called multiteam systems, and to analyse aviation literature from before 2001 with the multiteam system outline provided after 2001 would be a relevant way to provide a stronger scientific basis in this area fit for a larger research project than this paper.

Performing leadership in ad hoc multiteam aircrews

Leadership is performed using a variety of leadership styles and behaviours, styles and behaviours which themselves are defined and described differently in different articles. The fact that team-building is part of the *co-operation* category in the NOTECHS makes it easy to make the argument that co-operation is an important social skill involved in leadership. Even more so when looking at the importance of the leader in ad hoc crew formation. The ad hoc nature of aircrew makes team-building relevant every day.

There are also similarities between the different leadership styles described by the other papers as well. Authoritarian-, directive- and autocratic leadership can all be grouped in a similar way. As can participative and democratic. Laissez-faire, delegative and libertarian all share similarities in the leader giving up authority to allow team members full freedom in decision making.

The participative and democratic leadership style leads to more satisfaction among team members, extra effort and more assertive communication, but authoritative leadership has its use in situations requiring speed and swift decision making.

It should be noted as well that aviation seems to be holding on to the older view of masculinity and leadership. *The great man* as expressed by Bolden (2004) being an old view of leadership might still hold some truth in aviation. That is shown by Mjøs (2002) in his article of cultural changes. Although the authoritarian leadership had been reduced, the pilots still showed a significantly larger masculinity culture than the country they operated in. This is further established as a problem by Newton (2022) because the masculine leadership culture makes it difficult for women to establish themselves as pilots and leaders in aviation.

Discussing how leadership is performed requires a discussion about the team setting. Aircrew being part of a, although relatively small, multiteam system brings other challenges than simply being a leader of one team. Communication barriers such as crew members being part of different teams, and separated by a closed door makes it difficult for leaders of one team to lead the other team.

With the ad hoc nature of aircrews, the team formation part becomes increasingly important, since there might be limited time of communication between the members during the operative stages of the workday. The team-building part of leadership becomes centred around that initial meeting and briefing during the start of the work day. In a matter of minutes, behavioural patterns of communication can be established that will stay for a long period of time in the team.

Establishing leadership, member unity and an open social climate during the team formation may carry over to the rest of the day. Fostering a social climate where the members feel safe to speak up is imperative to safe operation, and this raises another difficulty for the captain of an aircrew. As shown by Bienefeld & Grote (2014b), the chances of the senior

cabin crew speaking up to the captain is increased by feeling psychologically safe in their own team, the cabin crew, and not by feeling psychologically safe with the pilots. The captain must be mindful about psychological safety and social climate of not just the whole crew, but also the team of cabin crew alone, because that may affect the communication they will provide to the captain in case of a non-routine event later on. As stated by Salas et al (2005), the establishing of trust is crucial for team members to monitor each other's performance as well.

The ad hoc nature of aircrew means that relationships are built differently than in permanent teams. It can be argued that the individual team members psychological safety is most likely not reset before every new workday, but carried with them. This means that it would not be enough for one leader to be a great leader if the rest of the leaders, or the organisation as a whole does not allow for this kind of psychological safety to build. A pitfall here is the risk of abusive supervision in ad hoc teams. Being an abusive supervisor in a permanent team has a higher risk of exposure, but if the team dissolves after every day, the abusive supervisor may not affect the same team member enough times to make it clear to the organisation. A future area of research would be the effect the occasional abusive supervisor has on ad hoc team building in a large airline organisation. And how the amount of abusive supervision is weighted against the amount of non-abusive supervision in creating psychological safety and social climate in a company where the teams are ad hoc each day.

Looking at the organisational shell model constructed by Ginnett (2019) and the difference in briefing by HI-E captains and LO-E captains, the difference in how they conduct their brief with regards to the amount of time spent on the tasks may be explained by the captains trusting the organisational shells differently. For a captain to disregard briefing the tasks and instead focusing on something else, the captain must trust the shells to have worked, and that the other team members know the tasks simply by being in that position in the organisation. This relates to the effect member flexibility has on swift trust building in ad hoc teams. Each member in the team has a certain amount of trust for each other simply by the roles of each member. A LO-E captain spending time briefing tasks shows a distrust in these roles, and in turn, might reduce the trust the other members have for the captain.

Briefing the importance of safety, as HI-E captains did, might be seen as distrusting the organisational shells, as safety would seem obviously important for aircrew. But once connected to Hofmann & Morgeson (2004) and the fact that in organisations focused on both high safety and high performance, leadership rewarding safety behaviour actually increases safety, it may be theorised that the organisational shells in aviation has a high pressure on both performance and safety and that the HI-E captain offsets this by emphasising the more important one, safety.

The organisational shell helps mitigate the problems listed by White et al (2018) and Pascal et al (1999) by providing team identity, basis of trust, and also by providing a minimum standard that the leader of the team can expect from the members. The captain can expect a first officer to be able to perform what a first officer is trained to perform, the same goes for what the senior cabin crew can expect of the other cabin crew members.

The senior cabin crew member is the boundary spanner in an aircrew and, in a situation requiring the entire MTS to perform, also becomes the most important leader for overall success. The boundary spanner is the only one with access to both teams inside the MTS, and thus, the only member able to lead across teams. But, the formal leader of the aircrew is still the captain. The senior cabin crew risks becoming overloaded with tasks, by being both the leader of the cabin crew, a cabin crew themselves, and also by leading across teams as the boundary spanner. Shared leadership in the cabin, having the other cabin crew assume a temporary leadership position when the senior cabin crew is fully occupied, played a large role in increasing the team success. The fine line of promoting and educating about

shared leadership for certain situations, without compromising the authority of the formal leaders is a challenge for aviation, but also an area where some research should be invested in order to have the resource of shared leadership in situations that might require it.

An argument can be made that recognising and allowing someone else's leadership is in fact also an act of leadership, and one that can be crucial in certain non-normal situations in aviation, especially because the formal leader, the captain, is locked behind a door and unable to see the situation or perform leadership in the cabin of the aircraft. And this kind of leadership requires practice, not only instructions. This is seen in the research by Dechurch & Marks (2006) that showed how being trained in utilising team performance can increase MTS output beyond the sum of the individual teams.

Building and maintaining a shared mental model through the MTS becomes a large part of the boundary spanners job. Since the boundary spanner is the only one communicating to the entire team, this communication and coordination becomes the job of the senior cabin crew member. The paper by Grote et al (2010) researched coordination and heedful interrelating in cockpit crews only. More explicit coordination being one of the markers for teams acquiring greater success, that would most likely be similar for the cabin crew and the MTS as a whole.

An argument can be made to promote explicit coordination for aircrews, and to train all members of an aircrew to use explicit coordination whenever there might be a lack of standardisation in a situation. On the other hand, with several articles describing standardisation as a replacement for leadership. An effective leader could rely on the standardisation and organisational shells and in fact, not use leadership and by doing that reduce the workload in certain situations. For the same reason that the HI-E captains did not brief specific tasks due to the organisational shells, the tasks to be completed in non-normal but standardised situations should not need to be explicitly coordinated. This argument is however contradicted by the fact that explicit coordination was one of the only significant things the successful teams did more of in the article by Grote et al (2010).

Heedful interrelating promoted a more balanced interaction between the pilots. Balanced communication patterns is also one of the significant characteristics of more efficient crews as studied by Zijlstra et al (2012). Heedful interrelating also broke down hierarchical structures and promoted a shared mental model and when practised by the captain it made the first officer more likely to speak up. Speaking up was a part of several other articles (Chute & Wiener, 1996., Bienefeld & Grote 2014b), but there the focus was an upwards voice directed from the cabin to the flight deck. Most likely, heedful interrelating by the pilots would increase the likelihood of the cabin crew speaking up, as it increased the likelihood of the first officer speaking up. The barriers between the two teams of the aircrew makes it difficult to practise this behaviour from the pilots to the cabin crew outside of the initial brief, once again putting emphasis on the importance of those first minutes of team building before the work day.

Conclusion

The object of this paper was to provide a foundation for future research in the area of ad hoc multiteam aircrews and the leadership part of the system. The systematic literature search provided twelve articles that fit the criterias and that was enough to present a result that could be analysed using the research questions.

This paper has shown that in order to be a leader of an effective aircrew one must adhere to the characteristics of leading *both* an ad hoc team, and a multiteam system. Because when the situation requires the entire aircrew to work together, every member counts, both

inside and outside the flight deck door. And that fifteen minute brief conducted eight hours ago may be the deciding factor of aircrew performance.

While the foundation provided in this paper is not as exhaustive as it could be if a larger paper were to be conducted, it does provide a stepping stone for future research. Suggestions for future research are:

- Conduct a larger systematic literature review of the subject using more databases and analyse literature from before the terms of the themes were invented and build a complete and thorough record of the literature within the subject to this date.
- Research abusive supervision within ad hoc aircrews, and the effect that a few abusive supervisors have in a larger system.
- Research how shared leadership can be trained and implemented in an effective way, especially in the cabin crew due to the effect it could have on improving the efficiency of the boundary spanner.

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