



# PERSONALITY PROFILES OF PILOTS IN MULTI-CREW OPERATIONS: VIEWS OF EXPERIENCED AND INEXPERIENCED CREW

Piotr ZIELIŃSKI<sup>1</sup>, Marcin BIERNACKI<sup>1</sup>

<sup>1</sup> Department of Aviation Psychology, Military Institute of Aviation Medicine, Warsaw, Poland

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**Author's address:** M. Biernacki, Department of Aviation Psychology, Military Institute of Aviation Medicine, Krasińskiego 54/56 Street, 01-755 Warsaw, Poland, e-mail: mpbiernacki@gmail.com

**Introduction:** Personality traits and the ability to cope with critical situations play a crucial role in the performance of aviation tasks, especially in multi-pilot crews. However, these factors are noticeably absent from most pilot job descriptions. The aim of this study was to identify the psychological competencies required for effective performance in multi-crew pilots.

**Methods:** A total of 95 participants took part in the survey, where they were asked to complete an original questionnaire developed specifically for this analysis. The questionnaire consisted of 13 statements describing various dimensions of personality and coping styles in difficult situations. Respondents were tasked with assigning a weighting to each personality trait based on its relevance to multi-crew flight performance. Statements were based on the definitions of NEO-FFI, CISS, and PROKOS scales.

**Results:** The results indicated that the optimal levels for most personality traits, such as emotional balance (low neuroticism) and task focus, were rated as high or elevated. Extraversion and openness to experience were rated as average, while lower levels of traits, such as emotion-focused and avoidant coping styles, were considered more desirable.

**Discussion and Conclusions:** The results confirm that certain personality traits can be considered crucial for the effective functioning of multi-pilot crews in aviation. Emotional stability, task focus, and cooperativeness should be prioritized in both the selection of pilot candidates and the training processes. Integrating work psychology with the practical demands of the pilot's role can enhance flight safety and efficiency.

**Keywords:** personality, coping, psychological competencies, multi-crew flights, Crew Resource Management (CRM)

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## INTRODUCTION

The competence stemming from the personality traits of aircrew members is crucial to ensuring both the safety and efficiency of aviation tasks. Operating in a dynamic and demanding environment requires pilots to be flexible and adaptable to changing conditions [15]. This is achievable through effective teamwork, skillful stress management, and clear communication. These elements facilitate the efficient coordination of activities during flight. When combined with adequate preparation, they form the foundation of pilot competence [20,21]. Coping with stress is one of the core competencies of a pilot. In their daily work, especially in crisis situations, it is crucial that they are able to act effectively and quickly. Emotional resilience, in particular, helps them maintain balance, which is essential for logical thinking and accurate decision-making. The ability to control emotions directly affects the safety of the crew and passengers, which is why pilot training often includes stress management techniques. It is also important for pilots to develop interpersonal skills, as working with other crew members under stressful conditions can significantly influence the course of an emergency. Decision-making under high stress and time pressure is another key competency for pilots [4]. Quick situational analysis, risk assessment, and the ability to prioritize actions can determine the safety of passengers and crew. A solid risk assessment enables the anticipation of problems and the implementation of preventive measures. Fostering effective decision-making requires continuous skill development and regular training, including flight simulator exercises that help build confidence in challenging situations [5,14,15].

The concept of Crew Resource Management (CRM) was developed in response to the challenges posed by the specific nature of aviation tasks and based on accident analyses in which errors in multi-crew cooperation were a key factor. CRM is a set of principles, techniques, and procedures designed to improve the safety and efficiency of operations through the optimal management of human and technological resources [16,17]. It focuses on interpersonal skills, communication, decision-making, workload management, and situational awareness within the crew. The primary objectives of CRM can be categorized as follows: 1) Preventing human error by minimizing risks associated with communication errors, poor decision-making, and interpersonal conflicts; 2) Enhancing team collaboration through effective communication, coordinated activities, and mutual support among

crew members; 3) Improving situational awareness, enabling quicker and more effective responses to potential threats; 4) Optimizing resource utilization through the effective management of technology, information, and the skills of crew members [6,10].

The elements described have been shown to significantly enhance crew performance in challenging conditions, thereby ensuring flight safety [25]. CRM was developed in response to a series of aviation disasters caused by communication failures and issues related to human resource management. A pivotal event in this evolution was the Tenerife crash of 1977, in which two aircraft collided at Los Rodeos Airport, resulting in 583 fatalities. This tragedy underscored the critical impact of communication breakdowns and the influence of cockpit hierarchy on flight safety [9]. In the 1980s, the National Aeronautics and Space Administration (NASA) initiated the conceptualization of Cockpit Resource Management, with a focus on fostering collaborative dynamics within the cockpit environment. In the subsequent decade, the 1990s, the CRM concept was expanded to encompass the broader spectrum of the flight operations team, including traffic controllers, ground staff, and other relevant personnel [16]. This expansion led to the adoption of the term CRM. Presently, CRM has become an integral component in the realm of aviation, with its application extending to various sectors beyond aerospace, including medicine (e.g., team-based surgical procedures) and energy [24,28]. CRM in aviation pertains to the effective management of crew resources, encompassing both technical and interpersonal competencies. In terms of technical skills, CRM facilitates efficient communication and collaboration, which are essential in emergency situations that demand rapid decision-making. Effective stress management and sustained focus enable the optimal application of technical skills, even in crisis scenarios. Furthermore, CRM emphasizes the continuous enhancement of technical competencies to keep pace with evolving technologies. Additionally, CRM ensures the optimal management of the aircraft's technological resources, thereby contributing to the safety and efficiency of aviation operations [24,28].

CRM has become a cornerstone of modern aviation, playing a pivotal role in enhancing safety through improved team collaboration, communication, and resource management. Its adaptability has also made it highly effective in other industries that demand precision and

teamwork. Since CRM relies on interpersonal skills, teamwork, stress management, and decision-making, personality traits inherently play a pivotal role in the effectiveness of CRM. Research on aircrew collaboration highlights that personality traits significantly influence communication, conflict resolution, decision-making, and teamwork [8]. The characteristics of crew members, such as pilots and other flight operation participants, directly affect how effectively CRM principles are applied in practice. Both theoretical studies and empirical data suggest that low neuroticism, high conscientiousness, moderate extraversion, and agreeableness foster cooperation, enhance stress management, and improve decision-making within the crew. For example, Helmreich and colleagues analyzed the evolution of CRM training in commercial aviation, emphasizing the crucial role of personality factors in fostering effective crew collaboration [16]. In particular, they emphasized that emotional stability—characterized by low neuroticism and high agreeableness—is crucial for effective collaboration and communication in the cockpit. Additionally, over-dominance (often linked to high extroversion) or a lack of openness can hinder information sharing and contribute to operational errors. Conversely, poorly understood leadership in the cockpit (captain-first officer) may give rise to the so-called “authority gradient,” where less confident crew members hesitate to challenge erroneous decisions made by the captain [16]. In contrast, Chidester and colleagues analyzed the impact of pilot personality traits, based on the Big Five model, on crew cooperation [6]. They found that low neuroticism, along with high agreeableness and conscientiousness, were crucial for effective coordination and communication in the cockpit. Crews characterized by these traits performed better on flight simulators compared to those with high neuroticism or dominant extraversion. In particular, they demonstrated that pilots with low neuroticism were better equipped to cope with stress and cooperated more effectively in critical situations. High agreeableness, on the other hand, was found to facilitate open communication and conflict resolution within the team. Conscientiousness, meanwhile, was linked to attention to detail and precision, which translates into adherence to procedures and mutual trust. The results indicated that personality-balanced crews performed better in simulation tests than crews composed of individuals with high neuroticism or dominant extraversion [9]. In a related publication, Bertram [2] emphasized the importance of assertiveness and receptiveness to

feedback in fostering a collaborative atmosphere. The paper also highlighted the detrimental effects of submissive and unassertive behaviors, which can lead to a “silent cockpit”—a term used to describe an aviation scenario in which concerns or errors go unreported due to a lack of communication [2]. The study emphasized the impact of cockpit hierarchy and personality traits on the quality of collaboration, highlighting the importance of assertiveness and effective communication. It was observed that captains displaying moderate extraversion and a high degree of openness to suggestions were better able to foster an environment conducive to collaboration and open information sharing. Conversely, the study noted that first officers who were submissive and lacked assertiveness—particularly those with high neuroticism—contributed to the emergence of what has been termed the “silent cockpit,” a state characterized by the under-communication of concerns or errors [2]. These findings align with air accident analysis reports from the NTSB (National Transportation Safety Board) and NASA, which indicated that personality traits and poorly understood team leadership can contribute to mistakes [9]. Notable examples include the crash of Eastern Air Lines Flight 401, where the crew’s failure to question the captain’s decisions ultimately led to the accident [12]. Korean Air Flight 801 (1997), on the other hand, illustrates how a strong ‘authority gradient’ and the first officer’s lack of assertiveness were key factors contributing to the crash [1,18,19].

In the context of aviation, a comprehensive personality profile assessment should be conducted as part of aviation medical examinations, which are regulated by aviation law. These examinations aim to verify the psychophysical fitness of candidates to perform pilot duties and other responsible roles within the flight crew. According to legal requirements, this assessment should include aspects of mental health, and procedures related to mental health evaluations are closely tied to medical aviation examinations, rather than the recruitment process. Under European law, regulations set by the EASA (European Union Aviation Safety Agency) play a significant role, mandating specific psychological tests as part of the professional certification process for aviation personnel. These tests are intended to ensure that individuals working in aviation, including pilots, possess the necessary psychological competencies required for effective performance under stress and responsibility. Additionally, documents from the IATA (International Air Transport Association)

highlight the critical importance of soft skills, such as interpersonal skills, teamwork, and effective stress management, which are particularly essential in the context of multi-crew operations, where cooperation among crew members is fundamental to the safety of flight operations. It is important to emphasize that the personality assessment process in aviation employment must comply with current legal regulations, and procedures for evaluating candidates' mental health should be treated as part of aviation medical examinations, rather than a component of general recruitment processes in other industries.

In summary, personality traits and the ability to cope with challenging situations play a crucial role in the performance of aviation tasks, particularly in multi-pilot crews [15,21]. At the same time, there is a noticeable lack of pilot job descriptions that account for these factors. An example of this is job analysis, which aims to identify and assess job requirements in terms of the skills and abilities necessary to perform the role effectively. For example, an important element of the F-JAS is the assessment of job requirements, where experts or job holders evaluate each capability dimension in terms of its relevance to the job [11,29]. The various stages of such an analysis include collecting information about the job, which involves describing the tasks and requirements, and identifying job requirements by selecting relevant capabilities that are key to the role, followed by an assessment of the required level of capability. In particular, it is crucial to determine the minimum level of each selected capability needed to perform the tasks. The purpose of this study was to define the profile of a pilot operating in a multi-pilot crew, as perceived by experts in the aviation community. Studies cited in the introduction suggest the existence of such a profile and highlight key personality traits. However, there is limited knowledge regarding which specific traits are considered essential from the perspective of pilots working in multi-pilot crews. This is a valuable area of study, as it incorporates expert insights while accounting for the unique demands of the working environment. Gathering insights from experienced pilots on the profile of a pilot operating in a multi-pilot crew will provide a broader perspective on the requirements of the job role.

## METHODS

A total of 95 participants (all males) took part in the survey, which was conducted anonymously. It was a group composed of flight crew members

(49 pilots, 46 other crew members) experienced in performing multi-crew flights. The study sample comprised only male participants, reflecting the actual composition of the personnel in the unit from which the participants were recruited. The mean age of the participants was 40.52 years ( $sd=5.74$ ), with an average of 5.4 years ( $sd=3.6$ ) of experience in the multi-crew operations. Respondents were asked to complete an original questionnaire designed specifically for this analysis. Accordingly, the study focused on subjective evaluations of personality traits essential for effective functioning within a multi-person crew. The questionnaire is included in the appendix of the article. It consists of 13 statements describing different dimensions of personality and coping styles in difficult situations. Respondents were asked to assign a weighting to each personality dimension based on its relevance to multi-crew flight performance. The statements in the questionnaire were derived from the definitions of the scales of the following questionnaires: NEO-FFI (NEO Five-Factor Inventory), CISS (Coping Inventory for Stressful Situations), and PROKOS (Profile of Social Competence) [22,26,30].

Below is a brief description of the original psychological tools, along with a description of the scales and an indication of which question from our survey related to the selected personality trait.

The first group of questions was based on the NEO-FFI, a widely used tool for assessing personality traits [30]. The NEO-FFI questionnaire is an abbreviated version of the NEO-PI-R and measures five basic personality dimensions referred to as the Big Five model. These dimensions are as follows:

- 1) Neuroticism (N): The tendency to experience negative emotions such as anxiety, anger, or depression. Individuals with a high score are more prone to stress, while those with a low score tend to be emotionally stable. In the questionnaire used in our study, Question 1 assessed this trait. Q1: *Emotional stability, the ability to remain calm in difficult and stressful situations.*
- 2) Extraversion (E): Refers to the degree to which a person is sociable, active, and energetic. High scores indicate openness to social interaction, while low scores reflect introversion. In the questionnaire used in our study, Question 2 assessed this trait. Q2: *Activity, sociability, optimism, and seeking strong experiences.*
- 3) Openness to Experience (O): The tendency to be curious, creative, and seek new experiences. High scores indicate open-mindedness and

flexibility, while low scores reflect conservatism and practicality. In the questionnaire used in our study, Question 3 assessed this trait. Q3: *Openness to new experiences, curiosity about the world, and greater acceptance of unconventional behavior (as opposed to attachment to traditional ways, conservatism, and rigidity in behavior).*

- 4) Agreeableness (A): Refers to the level of trust, altruism, and cooperation with others. High scores indicate a tendency toward harmonious relationships, while low scores suggest a tendency toward rivalry and skepticism. In the questionnaire used in our study, Question 4 assessed this trait. Q4: *Willingness to cooperate, avoidance of conflicts, trust, and kindness (as opposed to competitiveness, skepticism, suspicion, and stubbornness).*
- 5) Conscientiousness (C): Refers to the tendency to be organized, responsible, and persistent in achieving goals. High scores indicate strong organization and self-discipline, while low scores suggest impulsiveness and a lack of planning. In the questionnaire used in our study, Question 5 assessed this trait. Q5: *Conscientiousness and organization, the ability to persistently pursue goals, diligence, ambition (as opposed to carelessness, a lower sense of duty, and a tendency to act without planning).*

The second group of questions was based on the CISS questionnaire, a tool designed to assess individuals' coping strategies in response to stress [26]. The CISS questionnaire measures the strategies an individual uses in response to stressful situations. It consists of 48 items that assess three main coping styles:

- 1) Task-focused style: Individuals with a high score in this coping style focus on analyzing the problem and taking action to resolve it. Logical thinking, planning, and effective management of the stressful situation are characteristic of this style. In the questionnaire used in our study, Question 6 assessed this characteristic. Q6: *In difficult situation:, a tendency to focus on action and actively seek solutions to encountered problems.*
- 2) Emotion-focused style: This style involves focusing on one's emotions and experiencing them in response to stress. Individuals with a high score in this dimension may be more prone to anxiety, anger, or sadness in difficult situations, which can sometimes hinder effective action. In the questionnaire used

in our study, Question 7 assessed this trait. Q7: *In difficult situations: a tendency to focus on oneself and one's experiences, trying to reduce emotional tension.*

- 3) Avoidance-focused style: This style involves attempting to avoid stressful situations or the thoughts associated with them. It can take two forms: 1) Avoidance through vicarious activities (e.g., engaging in other activities to distract oneself); 2) Avoidance through social contact (e.g., seeking support from others as a way to distract from the problem). In the questionnaire used in our study, Question 8 assessed this characteristic. Q8: *In difficult situations: a tendency to "detach" from the situation, engaging in other unrelated activities.*

The third and final group of questions was based on the PROKOS questionnaire. The PROKOS questionnaire is a tool designed to assess an individual's level of social competence [22]. Social competence refers to the ability to behave effectively and appropriately in social situations that require interaction with others. The questionnaire identifies both strengths and weaknesses in social skills.

Since the PROKOS questionnaire is, in comparison to the NEO-FFI and the CISS, a newer and less widely recognized tool, a more detailed description of its individual scales is provided below:

- 1) Assertiveness (Scale A): This scale measures the extent to which the respondent can handle situations that require setting clear boundaries, negotiating terms, or expressing opinions without fear of rejection. The results can be valuable for professional development, particularly in roles that require negotiation or team management.
  - a) Characteristics of high scorers: These individuals can openly express their opinions and emotions in various social situations without overstepping others' boundaries. They are self-confident, unafraid to defend their interests while remaining respectful towards others. They demonstrate the ability to say "no" in a way that avoids escalating conflicts.
  - b) Characteristics of low scorers: These individuals may struggle to express their opinions or defend their needs, especially in situations that require assertiveness. They are often easily influenced by others, avoid confrontation, or respond in a passive-aggressive manner.

In the questionnaire used in our study, Question 9 assessed this characteristic. Q9: *The ability to influence others, effectively manage people, and direct work.*

- 2) Cooperation (K scale): This scale measures the ability to work effectively with others, based on openness, flexibility, and the capacity to build positive group dynamics.

a) Characteristics of high scorers: These individuals are characterized by their ease in establishing and maintaining cooperation with others. They are attentive to the needs of the group, able to support colleagues, and act in a harmonious manner. They collaborate with respect for diverse perspectives, demonstrating the ability to compromise and work together towards a common goal.

b) Characteristics of low scorers: Individuals with low scores may struggle to work as part of a team. They often prioritize their own goals at the expense of the group or show reluctance to consider the opinions of others. They may also be perceived as less flexible or more challenging to work with.

In the questionnaire used in our study, Question 10 assessed this characteristic. Q10: *The ability to cooperate with others, help and support others, and mitigate conflicts.*

- 3) Social mindedness (T scale): This scale assesses the ability to establish and maintain interpersonal relationships, based on openness, cordiality, and the capacity to engage in social interactions naturally and effectively.

a) Characteristics of high scorers: These individuals are characterized by their ease in making social connections and building relationships. They are perceived as friendly, open, and well-liked in social environments. They can engage others, inspire trust, and create a positive atmosphere during interactions. They exhibit a high level of confidence in social situations, which enhances their acceptance within a group.

b) Characteristics of low scorers: Individuals with lower scores may struggle to form connections or maintain relationships. They often feel uncomfortable in social situations and are sometimes perceived as distant or disengaged from interactions with others.

In the questionnaire used in our study, Question 11 assessed this trait. Q11: *The ability to establish and maintain good relationships with people, and initiate social contacts.*

- 4) Resourcefulness (Z scale): This scale assesses an individual's ability to cope effectively in a variety of social situations, particularly those that require quick decision-making, adaptation to changing circumstances, and finding solutions to challenging or conflictual situations.

a) Characteristics of high scorers: These individuals are distinguished by their ability to respond quickly and effectively in demanding interpersonal situations. They can adapt flexibly to changing conditions, demonstrating initiative and creativity in finding solutions. They are self-reliant, confident, and able to cope well with social pressures, which leads others to perceive them as resourceful and trustworthy.

b) Characteristics of low scorers: Individuals with low social resourcefulness may struggle to adapt to new or challenging interpersonal situations. They tend to be less flexible, inclined to avoid conflict, or dependent on the support of others. They may feel insecure in situations that require quick reactions or decision-making.

In the questionnaire used in our study, Question 12 assessed this characteristic. Q12: *The ability to effectively seek help from others and assert one's rights.*

- 5) Community awareness (S scale): measures the ability to engage with other people and the willingness and ability to support them in a variety of situations. This scale reflects an altruistic attitude and a willingness to act in the interest of the community or group.

a) Characteristics of high scorers: These individuals demonstrate a strong commitment to others. They are helpful, caring, and willing to invest their time and resources to support others in need. They often take the initiative to organize or participate in social activities. They are perceived as highly empathetic and altruistic, which fosters a positive image of them within the community.

b) Characteristics of low scorers: Individuals with lower scores may be less inclined to engage with others or participate in social activities. They are often focused on their own needs and goals, which may result from a lack of time, resources, or a lower tendency to act in the interest of the group. They may be perceived as more distant in social relationships.

In the questionnaire used in our study, Question 13 assessed this characteristic. Q13: *The ability to perceive social needs and goals and engage others in prosocial activities.*

According to the instructions on the questionnaire, the task of the subjects was to mark, using a seven-point scale, the acceptable range of intensity of each of the described psychological trait. This means that for each of the psychological characteristic, the subject was to indicate the minimum and maximum level of intensity that is acceptable for a pilot in a multi-crew flight. Additionally, at the end of the questionnaire, the subjects were to indicate two traits that, in their opinion, are of the greatest importance for effective functioning during such flights, and two whose level is of little importance for effective functioning in the crew.

### Ethical Considerations

The data utilized in this study were obtained from standard, routine selection and psychological assessment procedures for military pilot candidates. These procedures are conducted as part of the official qualification and training process within the Polish Air Force. In accordance with applicable military regulations concerning selection and training, these procedures do not require separate institutional review board (IRB) approval, as they constitute an integral part of the official qualification process. All participants were aware of the purpose of the assessment and its potential implications. Their data were anonymized before analysis and used solely for research purposes, maintaining the highest standards of confidentiality and full compliance with current laws and internal regulations of the military institutions.

### Statistical Analysis

Descriptive statistics were used to characterize the profile of personality traits based on the responses provided in the survey. The intraclass correlation coefficient was used to assess the consistency of responses between participants. To assess the relationship between the participants' experience and possible differences in provided responses, analysis of covariance was used in the paradigm of comparing extreme groups. All statistical analyses presented in the article were carried out using the R software version 4.2.0 [15].

## RESULTS

The qualitative evaluation of the research protocols conducted at the beginning showed that a significant number of the respondents had a problem with interval determination of the acceptable range of the level of psychological traits,

indicating very narrow ranges or even point responses. In effect, the nature of the acquired data makes it impossible to apply a planned analysis of variables (ie, analysis of expected ranges based on acceptable minima and maxima), and requires adapting the analytic method to the specificity of the obtained results. For this reason, in the case of people who (in accordance with the survey instructions) determined the desired level of features in an interval manner, the point result was assumed to be the middle of the interval marked on a given scale. Only the point estimates were taken into account during further analysis.

In order to assess the consistency of the ratings given by the respondents, the intraclass correlation coefficient (ICC) was used. Although the reliability of the responses given by a single rater (i.e. how well the answers of a single rater reflects the group tendency) was only  $ICC_{(A,1)}=.58$ , the reliability calculated for the averaged scores was very high, with  $ICC_{(A,95)}=.99$ , indicating that these averaged scores can be treated as a consistent and reliable reflection of the overall peer ratings.

Thus, the average scores (means and medians for response scale from 1 to 7) for the individual dimensions included in the survey are presented in Figure 1.

As can be seen, for most dimensions, the optimal level is elevated or high. This is particularly visible in the case of emotional stability (low neuroticism) and task-focused coping style. The optimal level of extraversion and openness to experience is assessed as average, which indicates a certain ambiguity in the assessment of these features in the context of MULTI-CREW flights. In the case of the emotion-focused style and the avoidance-focused style, a low level is pointed out as optimal. An average or elevated level of interpersonal competencies is treated as sufficient, with the exception of cooperation competency, the optimal level of which, in the opinion of the respondents, is high.

At the same time, however, the level of avoidance-focused style (31 indications), together with the level of extraversion (32 indications) and the ability to motivate people to prosocial activities (community awareness; 45 indications), are considered the least important features when assessing the predisposition to perform MULTI-CREW flights. On the other hand, the level of emotional stability (65 indications) and the ability to concentrate on the problem (task-focused style; 61 indications) were considered the most important.

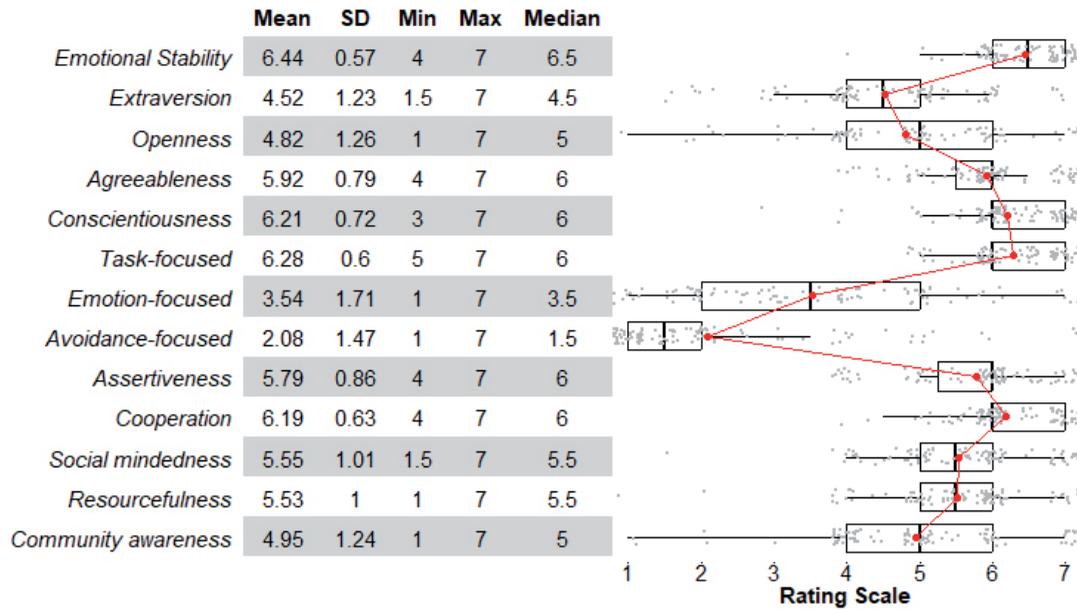


Fig. 1. Respondents' ratings of the desirable level of the personality traits – descriptive statistics and graphic representation.

Tab. 1. Significance of the differences in mean scores from ANCOVA models comparing groups of respondents with low and high experience in multi-crew flights (n=62).

	Mean rating (low -experience group)	Mean rating (high -experience group)	F	p	delta R <sup>2</sup>
<b>Emotional Stability</b>	6.44	6.43	0.01	0.94	0.00
<b>Extraversion</b>	4.36	4.54	0.00	0.98	0.00
<b>Openness to Experience</b>	4.7	4.91	0.45	0.50	0.01
<b>Agreeableness</b>	5.92	6.0	0.01	0.93	0.00
<b>Conscientiousness</b>	6.28	6.2	0.23	0.64	0.00
<b>Task-focused Coping Style</b>	6.32	6.32	0.03	0.86	0.00
<b>Emotion-focused Coping Style</b>	3.6	3.3	0.11	0.74	0.00
<b>Avoidance-focused Coping Style</b>	1.66	2.43	1.09	0.30	0.02
<b>Assertiveness</b>	5.66	5.91	0.43	0.52	0.01
<b>Cooperation</b>	6.02	6.3	0.71	0.40	0.01
<b>Social Mindedness</b>	5.04	5.73	3.29	0.07	0.05
<b>Resourcefulness</b>	5.14	5.73	3.92	0.05	0.06
<b>Community awareness</b>	4.8	5.11	0.02	0.90	0.00

Note. F, p and delta R<sup>2</sup> are ANCOVA statistics from comparing the models with and without the grouping factor (low/high experience), while controlling for the age of the respondents.

After the analysis of general results, the persons filling out the survey were classified according to the years of experience in performing multi-crew flights. The paradigm of comparing extreme groups was adopted; therefore, groups below the first quartile (3 years for MULTI-CREW flights) and above the third quartile (7 years for MULTI-CREW flights) were distinguished. Persons from the middle of the distributions were omitted in these analyses. It is also worth noting that the division into extreme

groups also showed a strong correlation with the age of the subjects ( $r_{bs}=0.58$ ,  $t(60)=5.526$ ,  $p<.001$ ). For this reason, in the analysis of differences, the basic method was the analysis of covariance (ANCOVA), in which the effect of age was controlled in the assessment of intergroup differences for individual scales. Table 1 presents the significance levels and effect sizes for the differences in the average scores between low low-experience and high-experience group.

As can be seen in the table above, the only visible differences reaching the level of a statistical tendency concern features treated as relatively unimportant, i.e. social mindedness and resourcefulness. Regardless of age, people with more experience in multi-crew flights rate slightly higher levels of these traits as more desirable. However, the difference in means does not reach one point, and the percentage of explained variance is negligible.

There are also no visible differences between the two groups in terms of choosing the most and least important features.

To sum up, the survey results can be treated as universal assessments that do not change in the course of professional experience. The most important traits desirable for MULTI-CREW flights are a high level of emotional stability and a task-focused stress coping style. A relatively high level of conscientiousness and cooperative competences is also indicated for MULTI-CREW flights, although they are not considered to be of primary importance.

At the same time, the emotion-focused and avoidance-focused stress coping styles are treated as undesirable features, and their low level is suggested as necessary to perform MULTI-CREW flights. At the same time, the level of avoidance-focused style is treated as a feature of little importance in such situations; however, this indication may result from an incorrect interpretation and equating the unimportance of the feature with the need for its low level.

## DISCUSSION

Personality traits and the ability to cope with challenging situations play a crucial role in the performance of aviation tasks, especially in multi-pilot crews. The aim of this study was to identify the psychological competencies required for effective performance in multi-crew pilots [6,8,17]. This study specifically aimed to define the profile of a pilot operating in a multi-pilot crew, as perceived by experts in the aviation community. Studies cited in the introduction suggest the existence of such a profile and emphasize key personality traits. However, there is limited knowledge regarding which specific traits are considered essential from the perspective of pilots working in multi-pilot crews. This is a valuable area of study, as it incorporates expert insights while accounting for the unique demands of the working environment. Gathering insights from experienced pilots will offer a broader perspective on the role's requirements.

The findings of this study highlight the importance of traits such as emotional equilibrium—characterized by low neuroticism—and a task-oriented stress coping style in the context of MULTI-CREW flight performance. These results align with existing literature on the selection and evaluation of professional competencies in high-stress environments, including aviation, emergency services, and medicine. For instance, Bartram et al. [2] underscore that emotional stability and the capacity for decision-making in crisis situations are critical attributes in professions requiring teamwork and resilience to stress. The traits rated in this study as most important, such as low neuroticism (indicative of high emotional equilibrium) and a strong task focus, underscore the necessity of emotional stability and the ability to maintain logical thinking under challenging conditions. The findings align with previous studies by Helmreich et al. [16] and Chidester et al. [6], which demonstrated that pilots with low neuroticism are better equipped to manage crisis situations effectively. This study underscores the critical importance of a task-focused stress coping style while highlighting the limitations of emotion-focused or avoidant coping styles. These results are consistent with Lazarus and Folkman's (1984) theory, which posits that task-oriented coping is more adaptive in situations demanding precise action and collaboration. Conversely, emotion-focused or avoidant coping styles may exacerbate tension or lead to a deferral of responsibility, posing significant challenges in high-stakes, team-based environments such as MULTI-CREW flights.

The findings further suggest that an average or elevated level of interpersonal competence is generally sufficient, with high cooperativeness being particularly advantageous. Low extraversion combined with moderate openness to experience underscores the importance of balancing assertiveness with receptiveness to suggestions, consistent with Bartram's findings [2]. The issue of the "silent cockpit," often attributed to a first officer's lack of assertiveness, highlights the necessity of targeted communication training. Similarly, research on personality frameworks such as the Big Five model indicates that high conscientiousness and moderate extraversion are associated with greater professional effectiveness in tasks requiring goal orientation and team collaboration [3,13].

It is noteworthy that MULTI-CREW flight experience did not significantly influence the ratings of optimal traits, suggesting that these traits may be more universal and less affected

by variations in work experience. An analysis of groups with differing levels of MULTI-CREW flight experience revealed minimal differences in the ratings of traits such as social mindedness and resourcefulness. This finding implies that while more experienced pilots may place greater value on these qualities in the specific context of such flights, the observed differences are not statistically significant. This is particularly intriguing in light of previous studies, which often demonstrate an adaptation and evolution of preferred traits with increasing work experience [7]. It is possible that the unique nature of MULTI-CREW flights, which demand specific discipline and cooperation, makes such adaptation less feasible.

The results of our study have significant implications for the selection and evaluation of personnel involved in MULTI-CREW flights [1,28]. Specifically, they suggest that the recruitment process should prioritize the assessment of emotional stability, conscientiousness, task-focused stress coping style, and cooperative competence. Additionally, consideration should be given to low levels of emotion-focused and avoidant coping styles. These findings reinforce the importance of certain personality traits in ensuring the effective functioning of multi-person crews in aviation. Emotional balance, task focus, and cooperativeness should therefore be key considerations in the selection of pilot candidates, as well as in training programs, including CRM. Integrating work psychology with the practical demands of a pilot's role can contribute to safer and more efficient flight operations. More broadly, it is important to emphasize that the findings confirm the value of the CRM concept as a tool for enhancing cooperation and stress management within multi-pilot crews. Empirical data indicate that personality traits supporting cooperation, such as agreeableness and conscientiousness, are vital for the successful application of CRM principles [6,16]. Consequently, CRM training should account for personality differences, and crews should be trained in assertive communication and conflict resolution.

### **Limitations of the study and directions for future research**

One issue that emerges from the study is the potential distinction between the 'unimportance' of a trait and the desirability of low levels of that trait. Specifically, while an evasive style was rated as an unimportant trait, a low level of this trait was deemed desirable. This discrepancy may stem from

the challenge of clearly defining the response scale in terms of the desired level of a trait, an issue also acknowledged by the study authors. The literature suggests that such differences in interpretation are common in questionnaire-based studies [23]. In this article, the authors address several issues related to questionnaire surveys, including the phenomenon of 'common method bias,' which refers to the impact of methodological errors on survey results. These errors can arise from challenges such as difficulties in clearly defining response scales and variations in the interpretation of desired trait levels. Another limitation to note is the difficulty respondents faced in defining acceptable ranges for trait levels, highlighting the need for refinement of the survey instrument. While the use of a point score as the midpoint of the interval was a useful adaptation, it limits the interpretability of the results in more sophisticated analyses of variability. Additionally, although the author's questionnaire was tailored to the specifics of the study, it requires further validation and comparison with other psychometric tools.

To gain a deeper understanding of the mechanisms behind the results, future research could incorporate qualitative tools, such as standardized interviews. The addition of interviews could enhance data analysis and provide greater insight into interpretive differences. Furthermore, it would be beneficial to include other professional groups involved in flight operations, particularly navigators, cabin crew, and air traffic controllers. Comparing the results with those from individuals performing other high-intensity tasks would help assess the universality of the findings or highlight the specific demands of individual jobs. Future research could involve larger sample sizes, more diverse populations, and the incorporation of F-JAS-based job analyses [11,29].

Notwithstanding the aforementioned limitations, the results presented provide valuable insights into key competencies in the context of MULTI-CREW flights. Further research could expand these findings to other fields that require precise and collaborative action.

Given the nature of the sample and the scope of the analysis, it is important to note that the results do not yet provide a sufficient foundation for the independent development of new selection tools or the direct modification of existing psychological assessment systems. However, these findings offer significant scientific value in terms of the preliminary identification of factors that warrant further verification in subsequent studies. Additionally, the study contributes new

empirical insights into the functioning of a specific professional group within the context of personality traits, thereby advancing knowledge in this domain. Further, more comprehensive research is required

before the practical implementation of these findings in selection or psychological assessment practices.

**APPENDIX 1**

**Questionnaire**

The crew performing multi-crew flights must “possess appropriate personality predispositions.” To better tailor psychological diagnostics to real needs, we would like to gather direct feedback from individuals performing such flights on what, in their opinion, are the most important predispositions.

For this purpose, we have prepared a short questionnaire and kindly ask you to complete it. The questionnaire is anonymous, and the results will not be analyzed individually but will undergo only group statistical analysis.

- Age:.....Gender(M/F):.....
- Personnel type: .....
- Current type of aircraft: ..... Years of service in the military: .....
- How long have you participated in multi-crew flights (in years): .....

Below are brief descriptions of personality traits along with scales illustrating their intensity. For each trait, please mark ALL levels you consider ACCEPTABLE for a person performing multi-crew flights.

**EXAMPLE:**

If the described trait is Sociability, and we believe that only people with a high intensity of this trait should perform multi-crew flights, we may select only “high” and “very high” levels. If we believe that Sociability is irrelevant and any level is acceptable for individuals performing MULTI-CREW flights, we may select all points on the scale, from “very low” to “very high.” If we think that any level of Sociability might be acceptable, as long as it is not very low, we might select points from “slightly below average” to “very high.”

Descriptions of traits with scales are provided on this and the following page. Please respond to each. Mark ACCEPTABLE levels by placing an “X” in the appropriate boxes on the scale.

1.	Emotional stability, the ability to remain calm in difficult and stressful situations.
	[ ] [ ] [ ] [ ] [ ] [ ] [ ]
	Very Low   Low   Slightly Below Average   Average   Slightly Above Average   High   Very High
2.	Activity, sociability, optimism, and seeking strong experiences.
	[ ] [ ] [ ] [ ] [ ] [ ] [ ]
	Very Low   Low   Slightly Below Average   Average   Slightly Above Average   High   Very High
3.	Openness to new experiences, curiosity about the world, and greater acceptance of unconventional behavior (as opposed to attachment to traditional ways, conservatism, and rigidity in behavior).
	[ ] [ ] [ ] [ ] [ ] [ ] [ ]
	Very Low   Low   Slightly Below Average   Average   Slightly Above Average   High   Very High
4.	Willingness to cooperate, avoidance of conflicts, trust, and kindness (as opposed to competitiveness, skepticism, suspicion, and stubbornness).
	[ ] [ ] [ ] [ ] [ ] [ ] [ ]
	Very Low   Low   Slightly Below Average   Average   Slightly Above Average   High   Very High

5.	Conscientiousness and organization, the ability to persistently pursue goals, diligence, ambition (as opposed to carelessness, a lower sense of duty, and a tendency to act without planning).
	[ ] [ ] [ ] [ ] [ ] [ ] [ ]
	Very Low   Low   Slightly Below Average   Average   Slightly Above Average   High   Very High
6.	In difficult situations: a tendency to focus on action and actively seek solutions to encountered problems.
	[ ] [ ] [ ] [ ] [ ] [ ] [ ]
	Very Low   Low   Slightly Below Average   Average   Slightly Above Average   High   Very High
7.	In difficult situations: a tendency to focus on oneself and one's experiences, trying to reduce emotional tension.
	[ ] [ ] [ ] [ ] [ ] [ ] [ ]
	Very Low   Low   Slightly Below Average   Average   Slightly Above Average   High   Very High
8.	In difficult situations: a tendency to "detach" from the situation, engaging in other unrelated activities.
	[ ] [ ] [ ] [ ] [ ] [ ] [ ]
	Very Low   Low   Slightly Below Average   Average   Slightly Above Average   High   Very High
9.	The ability to influence others, effectively manage people, and direct work.
	[ ] [ ] [ ] [ ] [ ] [ ] [ ]
	Very Low   Low   Slightly Below Average   Average   Slightly Above Average   High   Very High
10.	The ability to cooperate with others, help and support others, and mitigate conflicts.
	[ ] [ ] [ ] [ ] [ ] [ ] [ ]
	Very Low   Low   Slightly Below Average   Average   Slightly Above Average   High   Very High
11.	The ability to establish and maintain good relationships with people, and initiate social contacts.
	[ ] [ ] [ ] [ ] [ ] [ ] [ ]
	Very Low   Low   Slightly Below Average   Average   Slightly Above Average   High   Very High
12.	The ability to effectively seek help from others and assert one's rights.
	[ ] [ ] [ ] [ ] [ ] [ ] [ ]
	Very Low   Low   Slightly Below Average   Average   Slightly Above Average   High   Very High
13.	The ability to perceive social needs and goals and engage others in prosocial activities.
	[ ] [ ] [ ] [ ] [ ] [ ] [ ]
	Very Low   Low   Slightly Below Average   Average   Slightly Above Average   High   Very High

At the end, please indicate two traits (from the ones listed above) that you consider the most important for assessing suitability for performing MULTI-CREW flights (please write down the numbers):

.....

Additionally, the two least important traits in this context are (please write down the numbers):

.....

## AUTHORS' DECLARATION

**Study Design:** Piotr Zieliński, Marcin Biernacki. **Data Collection:** Piotr Zieliński, Marcin Biernacki. **Manuscript Preparation:** Piotr Zieliński, Marcin Biernacki. The Authors declare that there is no conflict of interest.

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