

Competency-Focused Aviation English for Aircraft Maintenance

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Abstract — This paper presents a mixed-methods needs analysis of Aviation English requirements for aircraft maintenance technicians operating in international and multilingual environments. The study addresses the role of precise and context-appropriate communication in maintenance, repair, and overhaul settings, where language use directly influences operational safety and reliability.

The research adopts an exploratory sequential design combining qualitative and quantitative methods. In the first phase, data were collected through an international focus group using the DACUM method to identify key communicative competences. In the second phase, a context-specific survey was administered to practicing aircraft maintenance professionals and trainee cadets in Bulgaria, Ukraine, and Algeria to validate and extend the qualitative findings. The results identify a multidimensional competence framework comprising linguistic, interactional, intercultural, and professional competences required for effective communication in maintenance contexts. Statistical analysis reveals strong correlations between linguistic competence and both interactional and professional competences, highlighting the integration of language performance with operational capability. The findings also identify priority thematic areas for Aviation English instruction and confirm the predominance of receptive skills, particularly reading and listening, in maintenance-related tasks. The study provides empirically grounded insights into the communicative demands of aircraft maintenance personnel and supports the adoption of a competency-focused approach to Aviation English training. This approach emphasizes the ability to apply language in operational contexts and aligns language instruction with the needs of engineering education and industry practice.

Impact Statement

This study provides empirical evidence on Aviation English requirements in aircraft maintenance, supporting the development of competency-focused language training aligned with engineering practice. The findings contribute to improving communication effectiveness, human factors performance, and operational safety in international aviation contexts.

Keywords— *aircraft maintenance, aviation English, competence*

I. INTRODUCTION

Since the early days of aviation, the focus has often been placed on pilots as the visible actors of flight; however, the safety and reliability of aviation operations depend equally on the often less visible, yet indispensable, work of aircraft maintenance personnel. In contemporary aviation environments, effective communication constitutes a core component of professional competence. A high level of proficiency in Aviation English is therefore essential not only for pilots and air traffic controllers, but also for aircraft maintenance technicians (AMTs), cabin crew, ground personnel, and other aviation professionals operating in both civil and military contexts [1]–[3]. This necessity arises from the inherently international nature of aviation, where communication frequently occurs among individuals from diverse lingua-cultural backgrounds.

One of the primary functions of English for Specific Purposes (ESP) in higher education is to prepare graduates for successful professional performance. It is an approach that is driven by an analysis of what learners need to do in the language; it focuses primarily on the linguistic knowledge and skills required to undertake professional tasks and deals with topics and issues within a specific academic, professional or vocational field [4]–[6]. However, the requirements for fulfilling this function evolve in response to ongoing technological, economic, and social changes. In current aviation contexts, particularly in maintenance, repair, and overhaul (MRO) environments, communication is embedded in technical procedures, safety-critical documentation, and multidisciplinary coordination. As a result, AMTs require not only knowledge of specialized terminology but also the ability to perform communicative tasks accurately and efficiently under operational constraints. In such environments, communication is directly linked to the reliability of maintenance processes and, consequently, to aviation safety. The importance of communication in

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aviation maintenance has also been emphasized in human factors research, particularly in relation to outsourced and distributed maintenance contexts, where communication breakdowns may directly affect safety outcomes [3]. Aviation English instruction must therefore address these domain-specific communicative demands to ensure safe and effective professional practice.

Pedagogical approaches such as task-based and content-based instruction have contributed to aligning language learning with professional practice, particularly in contexts where subject-matter instruction is delivered in English. Nevertheless, their applicability is more limited in contexts such as Bulgaria, Ukraine, and Algeria, where technical training is conducted in the local language and English functions as an auxiliary professional medium. In such settings, the challenge is not the integration of content and language per se, but the development of communicative performance that can be effectively transferred to operational environments. This requires a stronger emphasis on the ability to use language under real-world conditions, where time pressure, procedural constraints, and safety considerations shape communication.

In response to these challenges, the present study adopts a competency-focused approach to Technical Aviation English instruction. This approach differs from established competency-based models by emphasizing the operational use of language in context rather than reliance on formalized competency frameworks alone. It integrates elements of credit-based and competency-based education while prioritizing the ability to apply linguistic resources effectively in authentic professional situations. In doing so, it shifts the focus from the acquisition of specialized vocabulary to the functional use of language, from grammatical knowledge to pragmatic competence, and from language as a system to language as professional practice embedded in safety-critical workflows.

Within this framework, communicative competence is understood as the integrated application of knowledge, skills, and attitudes required for effective performance in specific professional contexts. In this study, communicative competence refers to overall communicative ability, while competences denote its constituent domains; the term competency-focused approach is used to emphasize the application of these competences in operational contexts. In line with training principles reflected in aviation standards (e.g., International Civil Aviation Organization), Aviation English for AMTs should support the development of observable and measurable communicative abilities. These include the accurate interpretation of technical documentation, precise use of domain-specific terminology, effective incident and fault reporting, and interaction within multicultural and multidisciplinary teams. The focus is placed on clarity, intelligibility, and appropriateness in safety-critical communication.

Despite these requirements, existing Aviation English research and training frameworks remain largely oriented toward pilots and air traffic controllers, with insufficient empirical attention to the domain-specific communicative

requirements of aircraft maintenance technicians (AMTs). In addition, current pedagogical models—primarily task-based and content-based—do not adequately capture the complexity of communication in maintenance, repair, and overhaul (MRO) contexts, nor do they provide a sufficiently flexible framework for linking language performance to operational competence and safety outcomes. Previous research suggests that the task-based approach and the content-based approach are logically related [7]. To address the above mentioned gap, the present study proposes a competency-focused approach to Aviation English for AMTs, supported by empirical data from a mixed-method needs analysis. This approach aims to align language training more closely with the communicative realities of maintenance practice and to contribute to the enhancement of safety through improved communication performance. Recent studies have begun to address the needs of aircraft maintenance personnel [1], [2], yet a comprehensive competency-focused framework grounded in empirical data remains underdeveloped.

II. MATERIALS AND METHODS

This study employed a mixed-methods exploratory sequential design following the model proposed by John Creswell and Vicki Plano Clark [8]. The research was conducted in two consecutive phases: an initial qualitative exploration followed by quantitative validation. The qualitative phase aimed to identify key variables and underlying constructs related to Aviation English use among aircraft maintenance technicians (AMTs), while the quantitative phase examined the extent to which these findings could be generalized across a broader sample. The results from both phases were subsequently integrated to provide a comprehensive understanding of domain-specific communicative requirements in maintenance contexts. In this study, the term AMTs is used to refer to both practicing aircraft maintenance professionals and trainee cadets specializing in aircraft maintenance.

Data for the qualitative phase were collected through an international focus group using the DACUM (Developing a Curriculum) method. The focus group consisted of 11 participants from Bulgaria, Greece, Poland, Romania, and Ukraine. Participants were selected based on their expertise in aviation education and practice and included subject-matter instructors, English language teachers, and aircraft maintenance professionals. All participants had a minimum of five years of professional experience in the aviation field. The group comprised 5 female and 6 male participants, aged between 28 and 56 years.

The findings from the qualitative phase informed the development of a context-specific survey instrument designed to assess the relevance and distribution of the identified competence domains. The survey was administered to a sample of 95 AMTs, including civilian and military maintenance engineers ($n = 58$) and military cadets specializing in aircraft maintenance ($n = 37$), from Algeria, Bulgaria, and Ukraine. The inclusion of both experienced professionals and trainee cadets provides a comprehensive perspective on current and emerging communicative requirements in aircraft maintenance.

The participant group comprised individuals with direct or developing experience in target language use (TLU) contexts. Regarding age distribution, 44.2% of respondents were between 20 and 30 years old, while the remaining participants were aged between 30 and 50 years. In terms of professional experience, 56.8% of the total sample (n = 95) reported more than ten years of experience in the aviation field. Overall, the sample reflects a balanced representation of early-career trainees and highly experienced practitioners engaged in aircraft maintenance operations.

Quantitative data were analyzed using descriptive statistics and correlation analysis. Pearson correlation coefficients were calculated to examine relationships between the identified competence domains.

III. RESULTS

The focus group participants identified English language proficiency as essential across three key domains: academic training, practical traineeship, and professional practice. They emphasized its role in supporting teamwork and maintaining safety in operational environments. Participants also highlighted the use of technical Aviation English in a range of routine activities during a typical working day, as well as in international training exercises. One participant stated, “the importance of English language for effective and well-organized job performance cannot be overstated.”

The analysis further indicated that communication in aviation maintenance contexts is highly context-dependent and technically referential. Core communicative activities include reading technical documentation, interpreting instructions, and engaging in task-oriented professional interaction. These activities require not only linguistic knowledge but also domain-specific background knowledge related to aircraft systems, avionics, and maintenance procedures.

The competence framework derived from the focus group is presented in Table 1, which summarizes the core competence domains: linguistic, interactional, intercultural, and professional. Each domain includes a set of subcomponents such as vocabulary, pronunciation, accuracy, fluency, teamwork, collaborative communication, background technical knowledge, and regulatory awareness.

TABLE 1. TECHNICAL AVIATION ENGLISH COMMUNICATIVE COMPETENCES

linguistic competence	interactional competence
know and use correctly technical aviation vocabulary	communicate successfully in everyday situations
know and use clear, concise and unambiguous technical language in aviation context	communicate successfully in unpredictable situations
use intelligible pronunciation and intonation	cope adequately with apparent misunderstanding by checking, paraphrasing, confirming, clarifying information and repairing breakdowns
be able to accommodate to various native speaker and non-native speaker accents	demonstrate fluency in speaking

know and use accurate grammar	demonstrate accuracy in speaking
intercultural competence	professional competence
be aware that there are different cultures with different values, beliefs and behaviors	possess initial background professional knowledge
demonstrate openness and flexibility to different cultures e.g. accept their communication style or work strategy	comply with the rules and procedures for communication
be aware of the effects of gender on communication	demonstrate a professional attitude and tone
be aware of the effects of losing face on communication	demonstrate tolerance and collaborative efforts for successful communication
be aware of the effects of hierarchy and authority on communication	be able to offer and accept teamwork

These findings indicate that effective communication in maintenance contexts extends beyond linguistic competence alone and requires an integrated set of communicative abilities.

The quantitative results confirm the importance of Aviation English in the professional domain of AMTs. A total of 96.2% of respondents indicated that English is an integral part of their professional activities. The analysis of Likert-scale responses showed that all identified competence domains were rated as important or very important for a technical Aviation English course.

Correlation analysis (Table 2) revealed statistically significant relationships between the competence domains. Linguistic competence showed a strong positive correlation with interactional competence ($r = 0.810$) and professional competence ($r = 0.793$), and a moderate correlation with intercultural competence ($r = 0.490$). These results indicate that language proficiency is closely associated with effective professional performance and interaction in maintenance environments.

TABLE 2. CORRELATIONS BETWEEN THE COMPETENCES

		Interactional competence
Linguistic competence	Pearson Correlation	0.810**
	Sig. (2-tailed)	0.000
	N	95
		Intercultural competence
Linguistic competence	Pearson Correlation	0.490**
	Sig. (2-tailed)	0.000
	N	95
		Professional competence
Linguistic competence	Pearson Correlation	0.793**
	Sig. (2-tailed)	0.000
	N	95

Descriptive statistics revealed differences in perceived importance of language skills between aircraft maintenance technicians (AMTs) and cadets. Among AMTs (n = 58), reading comprehension was rated as the most important skill (M = 4.89, Mo = 5), followed closely by listening and speaking. Writing received the lowest mean score within this group, although it was still generally considered

moderately important for occupational tasks such as reporting and documentation.

A similar ranking pattern was observed among cadets ($n = 37$), with reading comprehension ($M = 4.62$, $Mo = 5$) and listening ($M = 4.82$, $Mo = 5$) rated as highly important, followed by speaking. However, writing was rated substantially lower than all other skills ($M = 3.00$, $Mo = 2$), indicating a clear tendency among cadets to perceive writing as only marginally important for aircraft maintenance communication contexts.

TABLE 3. MEAN AND MODE OF LANGUAGE SKILLS

variable	N of AMTs	mean	mode	N cadets	mean	mode
Reading	58	4.89	5	37	4.62	5
Listening	58	4.52	5	37	4.82	5
Speaking	58	4.25	4	37	4.05	4
Writing	58	3.85	4	37	3.00	2

Overall, while both groups identified receptive skills as most critical for occupational performance, cadets assigned substantially lower importance to writing compared to all other skills, in contrast to the more balanced evaluation provided by experienced AMTs. The prominence of reading skills identified in the present study is consistent with previous findings, where “the most important skill to be mastered in this field was reading since most tasks require strong reading ability” [1, p. 38].

Survey responses also identified key thematic areas relevant to Technical Aviation English instruction, which informed the organization of topic-based modules for training.

IV. DISCUSSION

Taken together, these findings indicate that communication functions as an integrated component of professional competence in aircraft maintenance rather than as an independent skill. The observed relationships among linguistic, interactional, and professional competences suggest that language use is embedded within operational practice. This supports a competency-focused approach to Aviation English that emphasizes context-dependent communicative performance.

The identification of intercultural competence as a relevant dimension further underscores the multidimensional nature of communication in international aviation environments. Although its statistical association with linguistic competence is moderate, qualitative evidence indicates that culturally influenced communication behaviors may affect teamwork, perceptions of hierarchy, and decision-making processes. Reported examples include variation in communication styles, differences in power distance, and divergent perceptions of authority, as well as challenges related to respect, stereotyping, and organizational culture. These results indicate that aviation communication is shaped by socio-cultural factors and is not linguistically neutral.

The results also carry clear implications for instructional design. The identified competence domains

and their interrelationships support the implementation of a competency-focused pedagogical approach that emphasizes observable performance and practical applicability. In this regard, Aviation English instruction should move beyond isolated linguistic elements and prioritize integrated communicative abilities aligned with operational tasks. The findings are consistent with competency-oriented training perspectives in aviation, which emphasize measurable performance outcomes and operational capability over purely content-based instruction [7].

Content selection emerges as a critical factor in aligning instruction with target language use (TLU) requirements. The findings suggest that instructional topics should reflect authentic maintenance contexts while remaining appropriately calibrated to learners’ technical and linguistic proficiency. For trainee AMTs, this necessitates a careful balance between accessibility and operational relevance. Learning materials should therefore be meaningful, task-oriented, and capable of simultaneously supporting language development and professional awareness. The survey data further enabled the identification of priority thematic areas for a technical Aviation English course. A non-exhaustive set of topics was organized into six modules covering core domains of aircraft maintenance, including aircraft structure, tools and instruments, systems (hydraulic, pneumatic, propulsion), avionics and communication, maintenance procedures, and specialized areas such as armament and electronic warfare. Each module comprises multiple subtopics reflecting typical maintenance tasks and operational contexts. The results indicate that topic selection and sequencing play a critical role in supporting learning, as concepts must follow the internal logic of the discipline and should be introduced progressively. Respondents showed a clear preference for professionally relevant and practically oriented topics, particularly those reflecting real-life scenarios and workplace communication. In line with previous research [9], these findings support the use of scenario-based and context-driven materials that replicate operational conditions and facilitate the integration of language, content, and communicative competences. Within a competency-focused framework, such topics function as a mediating structure through which learners develop both domain-specific language and the ability to apply it in context, rather than as isolated units of content.

Differences in skill perception between AMTs and cadets can be interpreted in relation to varying levels of experience in TLU contexts and exposure to workplace communication demands. While both groups consistently prioritized receptive skills, particularly reading and listening, AMTs demonstrated a more balanced appraisal of productive skills, with writing still regarded as moderately important for documentation and reporting tasks. This likely reflects their direct engagement with operational procedures in which written communication forms an integral part of safety documentation, technical reporting, and regulatory compliance. In contrast, cadets attributed considerably lower importance to writing, suggesting that their perceptions are shaped by limited exposure to authentic workplace communication and a

stronger emphasis on immediate, orally mediated instructional activities. The low valuation of writing among cadets may therefore reflect a developmental stage in which awareness of the procedural and operational functions of written communication has not yet fully matured. Overall, these findings highlight a clear distinction between experienced practitioners and trainees, underscoring the role of professional experience in shaping perceptions of communicative demands in aircraft maintenance settings.

Furthermore, the results indicate that instructional effectiveness depends less on the selection of specific teaching methods and more on the formulation of clearly defined learning outcomes. A competency-focused approach supports learner autonomy and encourages students to take responsibility for their own development through tools such as portfolios and individualized learning plans. This approach facilitates the integration of language, content, and professional competences, enabling learners to construct knowledge through engagement with authentic tasks and contexts. The words of Friginal, Mathews and Roberts can be shared, "Much work remains to be done in all sectors of language in aviation, from research to developing academically well-informed aviation English teaching materials, to developing aviation operational awareness within the English language teaching and testing communities, to helping the aviation industry better understand the need for linguistic awareness" [9, p. X].

Overall, the research study demonstrates that Aviation English training for AMTs should be grounded in empirically identified communicative requirements and structured around integrated competence development. Such an approach enhances both the relevance of instruction and the operational readiness of future maintenance personnel.

V. CONCLUSIONS

This research study demonstrates that effective communication is a fundamental component of operational performance in aircraft maintenance environments. The findings confirm that Aviation English for aircraft maintenance technicians (AMTs) extends beyond the acquisition of specialized vocabulary and grammatical knowledge, requiring instead an integrated set of communicative competences that support safe, accurate, and efficient task execution. The proposed competence framework, supported by both qualitative and quantitative data, highlights the interdependence of linguistic, interactional, intercultural, and professional domains in real-world maintenance contexts.

The results further indicate that language performance is closely linked to operational capability, as evidenced by the strong correlations between linguistic, interactional, and professional competences. These findings underscore the need for instructional approaches that reflect the complexity of communication in maintenance, repair, and overhaul (MRO) environments and that are grounded in authentic target language use (TLU) situations.

In response to these requirements, the study advocates a competency-focused approach to Aviation English instruction. This approach provides a flexible and operationally relevant framework by emphasizing measurable outcomes and the ability to apply language effectively in professional contexts, rather than focusing solely on content coverage or task completion. The training aims to ensure mastery of linguistic, intercultural, strategic, and interactional competences, enabling learners to perform successfully in both routine and non-routine situations.

The findings have direct implications for curriculum development, instructional design, and training practices in both civilian and military aviation education. As noted by Erik Friginal et al. [9], continued efforts are required to bridge the gap between linguistic research, pedagogical practice, and operational aviation needs. By aligning language instruction with empirically identified communicative requirements, the proposed approach supports the development of operational readiness and contributes to the enhancement of safety in aviation maintenance.

Behind every safe flight lies a complex network of technical expertise, where precise communication among aircraft maintenance technicians is as critical as the engineering work itself. Strengthening this communication through competency-focused Aviation English training is therefore not only an educational objective, but a safety measure.

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