

Exploration of Integrating Professional Ethics into Ideological and Political Education in Aircraft Maintenance Professional Courses

—Taking the “Aircraft Power Supply System” Course as an Example

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Abstract

Guided by the goal of building a strong military in the new era, training institutions urgently need to deeply integrate ideological and political education into the entire process of professional teaching when cultivating aircraft maintenance personnel. Addressing existing challenges in ideological and political education—such as loose integration with professional knowledge, superficial material exploration, limited teaching methods, and inadequate assessment—this paper uses the “Aircraft Power Supply Systems” course as a case study. Focusing on “maintenance professional ethics”, it constructs a trinity-based curriculum framework integrating value shaping, competency development, and knowledge transmission. The paper proposes systematic implementation pathways, including precisely mapping ideological materials and innovating diversified classroom integration models. Three consecutive semesters of teaching practice demonstrate that this new model effectively bridges the gap between ideological education and professional instruction. It holds significant reference value for cultivating new-era maintenance specialists who are politically reliable, technically proficient, and professionally exemplary.

Keywords

Curriculum-Based Ideological and Political Education, Aircraft Maintenance Professional Quality, Aircraft Power Supply System, Talent Development, Teaching Reform

1. Introduction

The cause of building a strong military in the new era has an unprecedented and

urgent need for high-quality and specialized military personnel (Fu et al., 2025). Training institutions, as important positions for cultivating the “steel backbone” and “winning sharpshooters” of the future battlefield, must incorporate the fundamental task of fostering virtue and nurturing talent throughout the entire process of education, and ideological and political education in courses is the key approach to achieving this goal. It requires the organic integration of value shaping, knowledge imparting and ability development, like salt in water, nourishing things silently, guiding students to build up political loyalty to the Party’s command and to hone their excellent skills to win battles (Wang et al., 2025).

Aircraft support is the “lifeline project” that generates the combat effectiveness of the air force. Aircraft maintenance personnel are known as the “guardian of the warhawk”, and their work is directly related to flight safety, combat effectiveness and even the defense of national airspace sovereignty (Xu et al., 2021). A tiny oversight can lead to the destruction of aircraft and the loss of lives. Therefore, excellent professional qualities in aircraft maintenance are the soul of aircraft maintenance talent cultivation. Aircraft maintenance professional quality is a combination of loyalty, responsibility, rigor, expertise and dedication, and is the embodiment of the core values of the military in aircraft maintenance positions. Without this deep quality, even the most advanced skills are like a tree without roots or water without a source.

The “Aircraft Power Supply system” course is the “nerve center” of the aircraft engineering curriculum. Modern aircraft rely heavily on secure and reliable power supply networks. From avionics operation to weapon launch, without exception. Once the power supply fails, the fighter aircraft will instantly lose all functionality and become an “iron coffin in the air”. The extreme importance, high complexity, high risk and cutting-edge innovation inherent in the content of the course form a natural and profound isomorphic relationship with the core requirements of aircraft maintenance professional ethics, providing a unique carrier and natural soil for conducting in-depth and precise ideological and political education in the course.

2. Characteristics of the Aircraft Power Supply System Course and Ideological and Political Dilemmas

2.1. Ideological and Political Characteristics of the Course

The “Aircraft Power Supply System” course itself contains extremely rich ideological and political educational resources, and its internal logic is highly consistent with the requirements of aircraft maintenance professional qualities.

First of all, extreme importance carries loyalty and mission. The power supply system is the lifeline of fighter jets, and its maintenance is directly related to national strategic security. In teaching, guiding students to examine every circuit analysis and parameter calibration from the perspective of national security can effectively inspire their political awareness of “serving the military and fighting”

and their sense of mission of “rest assured on my post”.

Secondly, high complexity aligns with rigor and expertise. The power supply system integrates numerous components and involves deep intersections of multiple disciplines. Any minor glitch can trigger a chain of disasters. The “zero error, zero tolerance” work attitude requirement in aircraft maintenance is an excellent platform to temper the rigorous style and craftsmanship spirit of trainees.

Again, high risk is embedded with regulations and bottom lines. There is no room for carelessness in aircraft maintenance work, and strict adherence to maintenance procedures and operation cards is an ironclad rule earned from countless bloody lessons. Through in-depth analysis of historical accident cases and the restoration of the accident chain, trainees can truly feel the heavy cost of “a miss can lead to a thousand miles of error”, and thus establish a sense of awe for the rules in their hearts.

Finally, the cutting-edge innovation echoes the pioneering and strengthening of the military. The emergence of new technologies such as multi-electric/all-electric aircraft, smart power distribution, and high-power-density power supplies is not just an iteration of technology, but a leap in combat effectiveness. Guiding students to focus on the latest developments can cultivate their strategic thinking that “science and technology are core combat capabilities”. By introducing China’s breakthrough achievements in aviation power supply technology, it can greatly enhance students’ national pride and their sense of mission to engage in equipment innovation.

2.2. Problems Existing in the Practice of Ideological and Political Education in Courses

Despite the unique ideological and political advantages of the “Aircraft Power Supply System” course, there are still some deep-seated problems that urgently need to be solved in the current teaching practice, which restrict the full play of the educational effectiveness of ideological and political education in the course.

First, the integration of ideological and political content with professional knowledge is not sufficiently tight. Some teachers have a one-sided understanding of ideological and political education in courses, viewing it as an additional action of political tasks, resulting in a “physical splicing” of ideological and political content with professional knowledge rather than a “chemical integration”, and students perceive fragmented preaching rather than emotional resonance (Shi, 2025).

Secondly, the mining of materials is superficial. Teachers often stop at explicit safety and responsibility, and fail to dig deep and implicit ideological and political resources such as systems thinking, materialist dialectics, and engineering ethics behind the curriculum, lacking systematic sorting and theoretical elevation. For example, when explaining the redundant design of power supply systems, the philosophical wisdom of “bottom-line thinking” was not extended, and the opportunity for ideological elevation was missed (Wu et al., 2024).

Thirdly, the teaching methods are monotonous and outdated. The implemen-

tation of ideological and political education in courses still largely relies on the traditional “full-class lecture” model, where students passively accept and lack emotional experience and internalization of values. Even the use cases are mostly one-way transmission of “the teacher speaks and the students listen”, failing to create interactive situations that allow students to “feel as if they were there and empathize”.

Fourth, the evaluation system is seriously absent. The current assessment system is almost entirely focused on the dimension of knowledge and skills, lacking operational observation points and evaluation criteria for indicators such as professional attitude, values, teamwork, and innovative thinking demonstrated by students during the learning process, ultimately leaving ideological and political goals vacant and course-based ideological and political education merely formalistic (Xu & Zhou, 2025).

3. Curriculum Ideological and Political Goals Based on the Professional Competence of Aircraft Maintenance

3.1. Core Content of Aircraft Maintenance Professional Competence

The professional qualities of aircraft maintenance personnel facing the future intelligent and informationized battlefield can be summarized into the following five aspects:

1) Absolutely loyal political character: This is the soul and foundation of the maintenance personnel. It is necessary to always make following the Party’s command the highest political requirement and to make safeguarding national sovereignty, security and development interests the highest value pursuit.

2) An extremely responsible mission: Regard fighter jets as life and flight safety as a duty. With a high sense of responsibility for every screw, every line, every parameter handled, “I have no mistakes in my work, I can rest assured in my position.”

3) A meticulous work style: There is no small matter in the maintenance work; details determine success or failure. It is necessary to develop the habit of being meticulous and striving for excellence, strictly abide by all rules and regulations and operating procedures, and eliminate any form of “good enough” mentality, empiricism and the mentality of taking chances.

4) Professional skills: Not only be proficient in the maintenance of existing equipment, but also have the ability to keep learning and be innovative. In the face of the ever-changing aviation equipment technology, it is necessary to maintain a sense of crisis of “skill panic”, actively learn new knowledge, master new skills, and study new tactics.

5) The spirit of sacrifice that is willing to contribute: Maintenance work is often behind the scenes, with harsh conditions, heavy tasks and irregular schedules. It is necessary to have the mind and spirit of “success does not necessarily belong to me, but I will contribute to it” and be willing to be an unsung hero.

3.2. The Ideological and Political Goals of the “Trinity” Curriculum

Based on the above connotations, we have systematically and hierarchically decomposed the specific goals of the ideological and political education in the “Aircraft Power Supply System” course, and constructed a “trinity” goal system (as shown in **Figure 1** below):

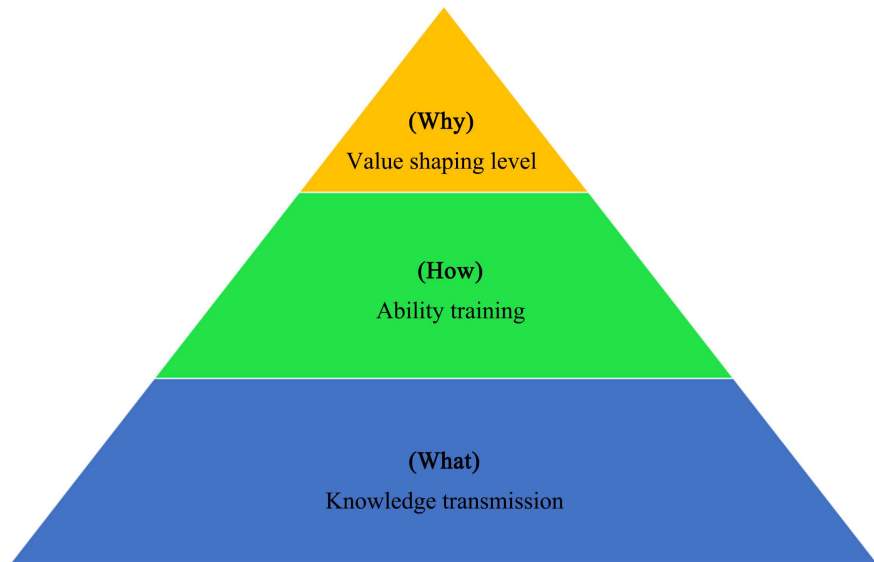


Figure 1. Structure of the “Trinity” curriculum ideological and political goals system.

Value shaping level (Why): This is the fundamental goal of curriculum-based ideological and political education. Guide students to deeply identify with the lofty value and historical mission of aircraft maintenance personnel, firmly establish the professional belief of “loyalty, mission, responsibility, expertise, dedication”, and inspire their intrinsic motivation to devote themselves to the aircraft maintenance cause.

How: This is the key support for ideological and political education in the curriculum. Develop key abilities of students simultaneously in professional knowledge and skills training. These include: systems thinking ability (understanding system correlations), critical thinking ability (independent analysis), risk prediction and emergency response ability (dealing with sudden failures), and rigorous and standardized operation ability (operating according to procedures).

Knowledge transmission (What): This is the fundamental carrier of ideological and political education in the curriculum. While imparting professional knowledge, organically incorporate relevant background knowledge such as engineering ethics, safety regulations, and typical accident cases. Enable students not only to know what it is, but also to know why it is.

These three levels of goals support each other and progress step by step, all pointing towards the ultimate goal of cultivating “politically competent, technically proficient, and style-fine” new era aircraft maintenance personnel.

4. Systematic Practice Path of Ideological and Political Education in the Curriculum

4.1. Dig Deep and Construct a Matrix of Precisely Mapped Ideological and Political Materials

The integration of ideological and political education should be precise rather than generalized. This article delves deeply into and sorts out the ideological and political mapping points around the five major qualities, forming an ideological and political element mapping matrix that precisely covers the entire curriculum.

Loyalty and Mission: In the introduction section, by comparing major accidents caused by power supply system failures with heroic deeds of successfully handling power supply emergencies and saving national property and the lives of pilots, the trainees are shocked and moved, deeply realizing the weight of the work in their hands, and transforming “loyalty” and “mission” from abstract concepts into concrete actions.

Responsibility and rigor: When explaining common faults such as the burning of contactor contacts, introduce “Heinrich’s Law” and “Murphy’s Law”, emphasize the huge risks of minor hazards, and establish the idea that “hazards are accidents” and “details determine success or failure”.

Regulations and Bottom Line: Incorporate the provisions of the regulations regarding the maintenance of power supply systems as an integral part of the teaching content. Through case studies, demonstrate the painful consequences of violating the rules and regulations, and make the awareness of the rules and regulations deeply rooted in your mind.

Excellence and Innovation: Introducing China’s breakthrough achievements in aviation power supply technology, as well as the touching stories of front-line aircraft maintenance officers and soldiers in equipment innovation and technological breakthroughs. Inspire national pride and encourage trainees to think about the optimization space of existing maintenance processes and propose innovative solutions.

Dedication and collaboration: Intersperse stories of the dedication of aircraft maintenance personnel in harsh environments such as highlands, islands, and deserts, and incorporate comprehensive troubleshooting projects that require teamwork in the course, clarify role divisions, emphasize communication and cooperation, and cultivate students’ collectivist spirit and collaborative combat ability.

4.2. Innovate the Classroom and Create a Student-Centered, Multi-Faceted and Integrated Teaching Model

The classroom is the main battlefield for ideological and political education in courses. It is necessary to abandon the traditional one-way indoctrination model and build a new teaching ecosystem centered on students, where theory and practice are integrated and methods are diverse and interactive.

1) Adhere to the student-centered approach

Transform students from passive recipients of knowledge to active constructors

of value and co-creators of meaning (Li & Yang, 2020).

Pre-class inspiration: By Posting ideological and political issues or micro-videos closely related to the teaching content through the internal network (such as “An air crash caused by a terminal block”), guide students to independently look up information, initially think, and enter the classroom with questions and emotions.

In-class reflection: Use a “chain of questions” to drive teaching. For example, when explaining the emergency power supply system, throw out a step-by-step question: “What would be your first reaction if the main power supply failed? (On a technical level) What responsibility is behind each of your operational steps? (Value level) What could be the consequences if your operation goes wrong? (Consequence level)”. Guide students to spontaneously and profoundly understand the professional spirit in the process of solving problems.

Post-class reflection: Organize students to write a “Course ideological and Political Reflection log” to record their ideological inspirations, conceptual changes and behavioral intentions during the learning process. For example, “I learned about the generator failure case today and realized that in my future work, I must...”. Teachers form a value dialogue between teachers and students by reviewing logs, providing personalized feedback.

2) Lead with philosophical theories

Use the fundamental principles of Marxist philosophy as the theoretical lens for ideological and political education in courses, guide students to examine professional knowledge with a scientific worldview and methodology, and enhance the ideological depth of ideological and political education (Ma et al., 2021).

Use materialist dialectics: When analyzing faults in the power supply system, guide students to understand that “internal causes are the basis of change and external causes are the conditions of change”, to see both the defects of the equipment itself (internal causes) and consider external factors such as environmental temperature and humidity, operation methods, and maintenance cycles (external causes). When explaining system redundancy design (such as dual generators, dual manifold flow bars), explain the unity of the “two-point theory” and the “key point theory”, which is to ensure the efficient operation of the main system and the availability and absolute reliability of the backup system at all times.

Using systems theory: Emphasize that the power supply system is a subsystem of the aircraft’s overall system, and its operating state is affected by other systems such as engine speed, hydraulic system load, ambient temperature, and vice versa. By drawing system correlation diagrams, students are trained to have a global perspective and systematic thinking, avoiding the one-sidedness and isolation of treating symptoms rather than root causes, and learning to grasp and solve problems as a whole.

Use epistemology: Through the spiral ascending cycle of “theory-practice-re-theory-re-practice”, let students understand the origin and development of knowledge. For example, first learn the power supply logic and power-on inspection methods of the power system in the classroom, then practice on the simula-

tor, and finally return to the classroom to summarize and distill deeper rules and experiences. This leads to a deep understanding of the core Marxist epistemological idea that “practice is the sole criterion for testing truth” and internalizes it as one’s own learning and working methods.

3) Use a variety of teaching methods

Immersive case teaching: Build VR/AR virtual simulation environments based on real scenarios, allowing students to handle sudden power supply system failures “as if they were there”. For example, simulate the emergency situation where the main generator fails suddenly during the takeoff and taxiing phase of a fighter jet. Under highly realistic visual, auditory and even tactile stress, a comprehensive test of trainees’ technical skills, psychological quality, emergency decision-making ability and professional ethics. This kind of experiential learning is far more effective than verbal preaching.

Role-playing and scenario simulation: Set up “troubleshooting teams,” where participants play roles such as mechanics (responsible for overall coordination) and special equipment operators (responsible for professional troubleshooting of the power supply system) to complete a complex power supply system troubleshooting task together. During this process, qualities such as communication and collaboration, division of responsibilities, and quality awareness are naturally integrated. Through role-playing, trainees can gain a deeper understanding of the responsibilities and pressures of different positions.

“Masters in the Classroom”: Regularly invite veteran aircraft maintenance workers and front-line technical experts to the classroom to share their personal experiences, professional insights and growth stories. The power of role models is boundless, and this “living” ideological and political education, with its authenticity and appeal, can greatly inspire students’ sense of professional identity and honor.

Flipped classroom and discussion-based teaching: Some basic knowledge learning tasks are moved forward, and the precious time in the classroom is mainly used for in-depth discussion and value analysis. For example, regarding the question “Can the inspection process of the power supply system be simplified when time is tight, tasks are heavy, and superiors urge?” Debate on this highly realistic and challenging topic. Guide students to clarify their understanding in intellectual confrontations, adhere to the principle that “the safety bottom line cannot be crossed”, and cultivate their courage to uphold principles and take responsibility in complex situations.

5. Conclusion

During the 2024-2025 training program for three batches of maintenance trainees on a specific aircraft model, an exploratory practice of ideological and political education reform was implemented in the “Aircraft Power Supply System” course. Experts evaluated trainees on several competency indicators, including mission awareness, combat spirit, work ethic, craftsmanship, and dedication, while also

conducting teaching satisfaction surveys. Statistical analysis revealed high satisfaction with classroom instruction, significant learning gains, and greatly enhanced motivation among trainees. Experts awarded overall high scores for trainees' practical performance. Trainees not only acquired solid, systematic professional knowledge and proficient operational skills, but more importantly, their deep-seated professional identity, extreme sense of responsibility, reverence for regulations, and spirit of self-sacrifice were significantly enhanced.

To meet the new challenges of intelligent warfare, we must continuously deepen our understanding, innovate our methods, and refine our evaluation systems, forming a closed-loop cycle of “design-implementation-evaluation-improvement”. Only in this way can we truly forge a new-era maintenance personnel force that is absolutely loyal politically, absolutely proficient technically, and absolutely disciplined in conduct, providing robust talent support and intellectual assurance for the cause of strengthening and revitalizing the military. Although this research is rooted in a military context and constrained by its specific political requirements and the homogeneity of its trainees, making it difficult to directly replicate in civilian education with diverse values, its deeply integrated model of “professional ethics—specialized knowledge—capability development” has broad applicability. In high-risk technical fields such as civil aviation, nuclear power, and healthcare, “loyalty” can be redefined as “responsibility” or “prioritizing life”, replacing military case studies with industry accident examples. Combined with flexible methods like simulation exercises and ethical reflection, this approach achieves deep synergy between professional spirit and technical education.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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