Module 3 – Lesson 1

UAV Components and Technician Tools

Lesson Plan

GENERAL INFORMATION

Learning Acquisitions

At the end of the lesson, students will be able to:

- Recognize UAV product model information
- Explain UAV mechanical and electronic components and their functions
- Describe the items on the technician checklist in digital format for each component
- List the basic tools used for repair, disassembly and assembly of specified mechanical components and their functions
- List the electronic devices and measuring instruments used in UAV (Unmanned Aerial Vehicle) electronics (multimeter, LC meter, etc.)

Time

2 lesson hours

Methods and Techniques

Flipped Learning
Demonstration Method
Video-Based Learning
Hands-on / Experiential Learning
Project-Based Learning (PBL) (work on real-life drone repair projects to integrate theory and practice)
Questioning and Discussion Techniques

Resources, Tools, and Equipment

Computer or tablet
Video Tutorials
Sample technician checklist

Implementation of the Lesson

Introduction

Gaining Attention and Motivation

Before coming to class, students have already learned about UAV components, the functions of electronic and mechanical systems, the logic behind technician checklists, and the basic tools used by watching

videos. At the start of class, the instructor initiates a brief discussion to remind them of this prior learning: “Which component or tool was the most interesting in the videos you watched, and why do you think it is important?”

This brief interaction activates the students' prior knowledge and provides a transition to the practical activities they will perform in class. The instructor then emphasizes: "Today, we are no longer just observers, but practitioners. In a real UAV maintenance process, we will analyze components using the information we have learned, match them with checklists, and work like professional technicians by selecting the right tools." This explanation increases students' motivation for field-based learning and creates a strong foundation for active participation in the lesson.

Development

Implementation of the lesson core

- Students watch UAV product model information and usage areas training video.
- Students enter the model information of the specified UAV vehicle (Resource 1).
- Students watch UAV mechanical components and functions training video.
- Students make a mind map of the UAV mechanical components and their functions (Resource 2).
- Students watch UAV electronic components and functions training video.
- Students make a mind map of UAV electronic components and their functions (Resource 3).
- Students review sample technician checklists (Resource 4).
- Students do the checklist matching activity (Resource 5).
- Students watch “Training video introducing the basic tools used for repair, disassembly and assembly of UAV components”.
- Students list the basic tools used for repair, disassembly and assembly of UAV components and their functions (Resource 6).
- Students watch “Training video on electronic devices and measuring instruments used in UAV (Unmanned Aerial Vehicle) electronics”.
- Students list electronic devices and measuring instruments used in UAV (Unmanned Aerial Vehicle) electronics (Resource 7).

Conclusion

Summarising

At the end of the lesson, students integrate their knowledge and understanding of UAV components with practical experience. The instructor asks students in the classroom to explain mechanical and electronic

components, their functions, and the tools used for repair with examples. Then, a brief assessment is conducted using the digital checklists prepared by the students.

The instructor emphasizes the industry relevance of the students' classroom activities as follows:

“A technician's greatest strength is the ability to combine knowledge with practice. Today, you have gained the skills to identify the correct component, select the appropriate tool, and document this digitally at every step of the maintenance process.”

Finally, the outcomes of the lesson are briefly summarized:

- Identifying UAV models and components,
- Explaining the functions of mechanical/electronic components,
- Determining the functions of basic tools and measuring instruments,
- Effectively using digital technician checklists.

Assignment

Students are asked to prepare an individual mini-project to reinforce the outcomes provided at the end of the lesson.

Task: For a UAV model of your choice, prepare a short file containing the following three sections:

- Component Summary: List the 5 basic mechanical and 3 basic electronic components in your model, along with their functions.
- Tool Matching Table: Explain the basic tools used in the repair/disassembly/assembly of your two selected components and the functions of these tools.
- Checklist: Create a 10-item digital technician checklist for your selected model (example format: Google Sheets, Word table, or PDF).

Evaluation or testing

- Trainer evaluates UAV vehicle model information infographic.
- Trainer evaluates the mind map of the components and their functions in the UAV.
- Trainer evaluates the technician checklist prepared by the Learner.
- Trainer evaluates the list of basic tools and their functions for repair, disassembly and assembly of UAV components prepared by the Learner.
- Trainer evaluates the list of electronic devices and measuring instruments used in UAV (Unmanned Aerial Vehicle) electronics prepared by the Learner.

End

The instructor emphasizes that the skills students have gained in today's activities will form the basis for the next lesson. He explains to the students that the skills they have learned today—component identification, tool matching, and creating a digital checklist—will be actively used in the next lesson's practical application, “Repair and Replacement of UAV Components.”

The instructor asks students to watch the shared videos on safety protocols, repair steps, and the correct use of measuring instruments before coming to class (Module 3 – Video 6-11). This ensures that students are prepared to perform the repair, replacement, and maintenance processes of UAV components in the next lesson.

Module 3 – Lesson 2

Repair and Replacement of UAV Components

Lesson Plan

General Information

Learning Acquisitions

At the end of the lesson, students will be able to:

- Adhere to appropriate safety protocols when working with electronic components (EC)
- Disassemble and assembles UAV components
- Determine whether UAV EC are in need of «repair, replacement or maintenance» (RRM) using appropriate electronic devices and measuring instruments (MI)
- Repair damaged EC from specified components
- Determine whether UAV mechanical components (MC) are in need of RRM using appropriate mechanical devices and MI
- Repair damaged MC between specified components
- Edit custom flight settings and autonomous operating profiles

Time

7 lesson hours

Methods and techniques

Flipped Learning
Demonstration Method
Video-Based Learning
Hands-on / Experiential Learning
Project-Based Learning (PBL) (work on real-life drone repair projects to integrate theory and practice)
Questioning and Discussion Techniques

Resources, tools, and equipment

Computer or tablet

Video Tutorials

UAV parts

Basic tools for repair, disassembly and assembly of UAV components

Technician checklist

Implementation of the Lesson

Introduction

Gaining Attention and Motivation

Before coming to class, students have gained basic knowledge about the disassembly, fault detection, repair, and safety protocols of UAV components (MC and EC) by watching videos. At the beginning of the class, the instructor presents the following scenario to the students: “A UAV that arrived at the maintenance center is reported to have a system error during flight control. Your task is to identify the fault and complete the repair process in accordance with safety rules.”

This scenario captures the students' attention and prepares them for the practical work to be done in the course. The instructor explains the purpose of the course, emphasizing the importance of a safe working environment, the use of the correct measuring instruments, and teamwork. Thus, students realize that in the course, they will develop not only their technical skills but also professional work discipline and safety awareness.

Development

Implementation of the lesson core

- Students watch the tutorial video on proper safety protocols when working with EC.
- Students prepare an infographic on safety precautions to be taken when working with EC(Resource 8).
- Students watch the tutorial video on disassembling and assembling UAV MC and answer the questions in the video.
- Students watch the tutorial video on troubleshooting UAV MC and answer the questions in the video.
- Students watch the video on repairing damaged MC and answer the questions in the video.
- Students watch the UAV EC fault detection tutorial video and answer the questions in the video.
- Students watch the video on repairing damaged EC and answer the questions in the video.
- Students prepare the necessary tools for inspection, repair, disassembly and assembly of a specified component.
- Students implement UAV repair process safety protocols.
- Students evaluate the MC of the UAV vehicle using appropriate devices and measuring instruments, identify the failure and replace/repair the damaged MC.
- Students evaluate the EC of the UAV vehicle using appropriate devices and measuring instruments, identify the malfunction and replace/repair the damaged EC.

Conclusion

Summarising

At the end of the course, students gain hands-on experience with the entire process, from troubleshooting to repairing electronic and mechanical components. The instructor asks students to explain the extent to which they applied safety protocols, which tools and measuring devices they chose, and why. Then, the infographics and application results prepared by the students are reviewed as a class.

The instructor emphasizes the importance of this lesson in the UAV maintenance process as follows: “What distinguishes a real technician from others is not just performing repairs, but maintaining safety, accuracy, and system integrity at every step.” With this emphasis, students recognize the relevance of today's work to professional field applications.

Assignment

Students are asked to complete the following assignment at the end of the lesson:

Prepare a brief maintenance-repair report for a selected UAV component (e.g., motor control unit, power board, antenna module, or sensor) that includes the following elements:

- Fault Description: Explain the possible fault symptom and its probable causes.
- Repair Process: Specify the safety steps you took, the tools you used, and the measuring instruments.
- Result Evaluation: Summarize the test and control results after the repair.

The report can be prepared in digital format (Word, PDF, or Google Docs). Evaluation will be based on technical accuracy, compliance with safety protocols, clarity of explanation, and organization of documents.

Evaluation or testing

- Trainer evaluates the infographic for Safety Ptotocol.
- Trainer evaluates the tools prepared by the learner to mount, repair or deassemble a specific component.
- Trainer evaluates whether the learner followed the safety protocols while checking a specific UAV EC.
- Trainer evaluates the appropriateness of the devices and measurement tools that the learner used to check a specific UAV MC.
- Trainer evaluates the appropriateness of the devices and measurement tools that the learner used to check a specific UAV EC.
- Trainer evaluates Technician Checklist.
- Trainer evaluates repaired or replaced UAV MC.
- Trainer evaluates repaired or replaced UAV EC.

End

The instructor concludes the lesson with a brief review of today's safety protocols, fault detection, component removal and installation, proper use of tools/measuring instruments, and repair/replacement steps. He emphasizes how the notes taken by students on the MC/EC parts they worked on and the digital checklists they filled out ensure the traceability of the maintenance process; the lesson concludes with the message, “Applying knowledge safely and systematically in the field is fundamental to technician competence.”

It is noted that the title of the next lesson will be “Calibration and Test Flights.” The instructor explains that the next lesson will cover configuring special flight settings, updating autonomous operation profiles, payload definition and balance (center of gravity) management, calibration of specific parts (e.g., compass/IMU/ESC), pre-flight checklist, and test flight procedure. For preparation, students are asked to watch the calibration videos shared in advance (Module 3 – Video 12-16).

Module 3 – Lesson 3

Calibration and Test Flights

Lesson Plan

General Information

Learning Acquisitions

At the end of the lesson, students will be able to:

- Adjust special flight settings
- Configure and update autonomous operating profiles
- Describe the additional component (payload) required for UAV maintenance and repair
- Perform installation and configuration of additional components without affecting the center of gravity
- Calibrate the specified part
- Determine the checklist to be used before the flight
- Perform the necessary checks before flight
- Explain the test flight procedure
- Perform the test flight by following the required procedure

Time

3 lesson hours

Methods and techniques

Flipped Learning
Demonstration Method
Video-Based Learning
Project-Based Learning (PBL) (work on real-life drone repair projects to integrate theory and practice)
Questioning and Discussion Techniques

Resources, tools, and equipment

Computer or tablet
Video Tutorials
UAV parts
List of UAV specific flight settings
Payload introduction guide
Technician checklists

Implementation of the Lesson

Introduction

Gaining Attention and Motivation

Before coming to class, students learn how to make special flight settings on the UAV, how to configure autonomous profiles, how to define payloads (additional components), and why calibration is necessary through videos they watch. At the beginning of the class, the instructor presents a scenario that will apply this knowledge in the field: “The center of gravity of the UAV has changed due to newly installed sensors and additional payloads. Your task is to recalibrate the system and perform a safe test flight.”

This task description encourages students to actively participate in the lesson. The instructor emphasizes that proper calibration is not just a technical process, but also a fundamental requirement for safe flight. Thus, students view every activity in the lesson as part of real pre-flight preparation.

Development

Implementation of the lesson core

- Students watch the tutorial video on UAV special flight settings and answer the questions in the video.
- Students watch the tutorial video on UAV autonomous operating profiles.
- Students watch the introduction and installation video of additional components (payloads) required for UAV maintenance and repair and read the payload introduction guide.
- Students make a mind map of the additional components (payloads) required for UAV maintenance and repair (Resource 9)
- Students watch the tutorial video on UAV calibration and answer the questions in the video.
- Students watch the tutorial video on performing UAV flight.
- Students prepare an infographic of the test flight procedure (Resource 10).
- Students review the list of UAV specific flight settings and make special flight settings on the sample UAV.
- Students configure and update autonomous operating profiles, safety sensor controls on the sample UAV.
- Students perform installation and configuration of additional components on the sample UAV.
- Students calibrate the specified part on the sample UAV.
- Students determine the necessary checklist before flight on the sample UAV and perform the controls.
- Students perform a test flight with a sample UAV.

Conclusion

Summarising

At the end of the lesson, the instructor reviews the steps of the test flight process with the students: configuring special flight settings, sensor calibration, load balance control, and applying the pre-flight safety checklist. Students are asked to briefly share the calibration steps they took during their own test flights and any potential issues they encountered.

Assignment

Students are required to prepare a brief “Flight Calibration and Test Report” based on the procedures they performed during the test flight. The report will consist of the following sections:

- Flight Settings: Description of the specific settings used and the changes made.
- Calibration Process: Components calibrated (e.g., compass, IMU, ESC) and steps taken.
- Test Results: Performance observed during flight, errors, or suggestions for improvement.
- Evaluation: A brief comment on the effect of calibration on flight safety.

The report will be prepared and shared digitally (Word, PDF, or Google Docs). Evaluation will be based on the criteria of accuracy, clarity, systematic presentation, and professional reporting format.

Evaluation or testing

- Trainer evaluates the UAV snap-ins mind map.
- Trainer evaluates the infographic of test flight procedure.
- Trainer evaluates the process of participant's making custom flight settings.
- Trainer evaluates the process of participant's configuring and updating autonomous operating profiles.
- Trainer evaluates the process of participant's installing and configuring UAV additional components.
- Trainer evaluates the accuracy of the participant's calibration.
- Trainer evaluates participant's test flight.

End

The instructor concludes the lesson with a brief review of today's special flight settings, autonomous profile configurations, additional component (payload) installation and balancing, sensor/IMU/compass calibrations, pre-flight checklist implementation, and test flight steps. Students are asked to share in one sentence the performance variables they observed during the test flight (stability, vibration, position holding, RTL accuracy, etc.) and the effect of calibration on these outputs. The lesson concludes with the emphasis that “Proper calibration is the foundation of safe and repeatable flight.”

It is noted that the title of the next lesson will be “UAV Periodic Maintenance and Reporting.” The instructor explains that students will work on selecting an appropriate flight parameter list, checking/evaluating flight parameters, applying the periodic maintenance checklist, performing maintenance procedures, preparing the final repair process report, and conducting a test flight in accordance with the procedure. For preparation, students are asked to watch the previously shared UAV Periodic Maintenance and Reporting videos (Module 3 – Video 17-18).

Module 3 – Lesson 4

UAV Periodic Maintenance and Reporting

Lesson Plan

General Information

Learning Acquisitions

At the end of the lesson, students will be able to:

- Select the list of flight parameters suitable for the specified UAV vehicle
- Control and evaluates UAV flight parameters
- Apply the UAV periodic maintenance phase checklist
- Perform periodic maintenance of the specified UAV vehicle
- Prepare and records the final report of the UAV repair process
- Perform the test flight by following the required procedure

Time

2 lesson hours

Methods and techniques

Flipped Learning
Demonstration Method
Video-Based Learning
Project-Based Learning (PBL) (work on real-life drone repair projects to integrate theory and practice)

Resources, tools, and equipment)

Computer or tablet
Video Tutorials
UAV parts
Flight parameters checklist
UAV periodic maintenance phase checklist
Technician checklist
Draft of UAV repair process report

Implementation of the Lesson

Introduction

Gaining Attention and Motivation

Before coming to class, students watched videos to learn about the periodic maintenance processes of UAVs, how flight parameters are determined, and how these parameters affect flight performance. At the beginning of the class, the instructor presents the following scenario to increase student interest: “You are a member of a maintenance team, and your task today is to complete the periodic maintenance of a UAV returning from its last flight in order to renew its safety flight certificate. However, if your maintenance report contains missing or incorrect data, the device will not be taken for a test flight.”

This task description motivates students to observe carefully, collect data, and use their reporting skills meticulously. During the practical stages of the lesson, the instructor emphasizes that each student must think systematically like a technician: selecting appropriate flight parameters, filling out the maintenance checklist, conducting the test flight, and creating the final report.

Development

Implementation of the lesson core

- Students watch the Tutorial video on UAV flight parameters.
- Students fill out the specified UAV flight parameters checklist (Resource 11).
- Students watch the Tutorial video on UAV periodic maintenance.
- Students apply the UAV periodic maintenance phase checklist (Resource 12).
- Students perform a test flight with the repaired UAV and fill out the flight parameters checklist.
- Students perform periodic maintenance of the specified UAV vehicle.
- Students prepare and record the final report of the UAV repair process.

Summarising

At the end of the lesson, the instructor summarizes all maintenance and test flight steps performed with the students. Students are asked to briefly share the parameters they paid the most attention to during periodic maintenance and the test flight results. The instructor compares the different maintenance approaches used across the class and provides brief feedback on well-prepared report examples.

Assignment

Students are asked to prepare a short “Periodic Maintenance and Flight Evaluation Report” based on today's applications. The report should include the following sections:

- Flight Parameters Summary: List of parameters used and updates.
- Maintenance Process: Periodic maintenance steps performed and tools used.
- Test Flight Findings: Post-flight performance evaluation (e.g., stability, energy consumption, sensor performance).
- Conclusions and Recommendations: Recommendations for future maintenance periods or elements requiring attention.

The report is prepared digitally and submitted to the instructor. Evaluation will be based on the criteria of accuracy, clarity, compliance with maintenance procedures, and report format.

Evaluation or testing

- Trainer evaluates the flight parameters checklist.
- Trainer evaluates the UAV periodic maintenance phase checklist.
- Trainer evaluates the process of periodic maintenance performed by the participant.
- Trainer evaluates UAV repair process final report.

End

The instructor completes the final session of the module, UAV Periodic Maintenance and Reporting, by evaluating the maintenance practices performed by the students today, the results of the test flights, and the final reports they have prepared. Students are asked to briefly share the challenges they encountered during the maintenance process and the most important point they learned during this process. The instructor emphasizes how the knowledge and skills acquired throughout the module—component identification, fault detection, repair, calibration, and maintenance reporting—relate to the overall competencies of a professional technician.

A brief introduction is given to the next module, “Maintenance & Repair of Flight Controller Board, Sensors, and Remote Controller.” The instructor explains that in this module, students will perform maintenance and software updates on the UAV's flight control board, sensors, and remote controller, and will move on to advanced applications such as sensor calibration and remote controller pairing. For preparation, students are asked to watch the first 4 videos of Module 4, which were shared in advance.