NATIONAL COUNCIL FOR TECHNICAL AND VOCATIONAL EDUCATION AND TRAINING

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PROPOSED OCCUPATIONAL STANDARDS

OCCUPATION: DRONE PILOT TECHNICIAN

LEVEL: NTA 6

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ABBREVIATIONS

API	Application Programming Interface
CBET	Competency Based Education and Training
DC	Direct Curent
ESC	Electrical Speed Controller
FPV	First Person View
GPS	Global Positioning System
IMU	Inertial Measurement Unit
KV	Kilovolt
Li-po	Li-polymer Battery
MOPP	Maintenance Operation Processes and Procedures
NACTVET	National Council for Technical and Vocational Education and Training
Ni-Cd	Ni-Cd Battery
Ni-Mh	Ni-Mh Battery
NOS	National Occupational Standards
OS	Occupational Standards
PID	Proportional, Integral and Derivative Control
RC	Radio Control

RTK	Real-time Kinematic
TET	Technical Education and Training
TVET	Technical and Vocational Education and Training
UAV	Unmanned Aerial Vehicle

GLOSSARY OF TERMS

Circumstantial Knowledge:	Detailed knowledge, which allows the decision-making in regard to different circumstances and cross cutting issues.
Competence:	The ability to use knowledge, understanding, practical, and thinking skills to perform effectively to the workplace standards required in employment.
Competency:	A description of the ability one possesses when able to perform a given occupational task effectively and efficiently.
Competency-based Education:	An instructional programme that derives its content from validated tasks and bases assessment on the learner's performance.
Curriculum:	A description or composite of statements about "what is to be learned" by the trainee/student in a particular instructional programme; a product that states the "intended learning outcomes".
Educational/Training Programme:	The complete curriculum and instruction (what and how) that is designed to prepare a person for employment in a job or other particular performance situation.
Occupation:	A specific position requiring the performance of specific tasks – essentially the same tasks are performed by all employees having the same title. (Example: baker)
Occupational Area:	This is a broad grouping of related jobs. (Example: food service)
Occupational Competence:	The application of knowledge and skills that consistently meet the standards required by the work context.
Occupational Standards:	Specific requirements of competences people are expected to demonstrate in a particular occupational area, including knowledge and relevant attitudes. They also act as a performance tool of assessment of the prescribed outcomes.
Occupational/Job Analysis:	A process used to identify the tasks that are important to employees in any given occupation**.**
Performance	Indicate expected end results or outcomes in the form of evaluative

Criteria:	statements.
Skills:	The ability to perform occupational tasks with a high degree of proficiency within a given occupation. Skill is conceived of as a composite of three completely interdependent components: cognitive, affective, and psychomotor.
Standards:	A set of statements, which if proved true under working conditions, means that an individual is meeting an expected level and type of performance.
Task Analysis:	The process of analysing each task to determine the steps, circumstantial knowledge, attitudes, performance standards, tools and materials needed, as well as safety concerns required for the employees performing it.
Task:	A work activity that has a definite beginning and ending, is observable or measurable, and consists of two or more definite steps that leads to a product, service, or decision.
Underpinning Knowledge:	Crucial knowledge that an individual must acquire in order to demonstrate competences that are associated in performing a given task.
Verification Process:	The process of having experts review and confirm the importance of the task (competency) statements identified through occupational analysis. Other questions, such as the degree of task learning difficulty are also frequently asked. This process is also sometimes referred to as validation.

1.0. INTRODUCTION

Technical Education and Training (TET) is one of the most important education sub-sectors in Tanzania, responsible for developing a skilled workforce to support the country's industrialization economic agenda. Tanzania's *Development Vision 2025* intends to raise the country's economy to a middle-income status. This requires a skilled workforce that is aligned with the needs of the public and private sectors of the economy. The National Council for Technical Education has begun the job of drafting Occupational Standards that will eventually be adopted as National Occupational Standards for TET in order to ensure that it meets the needs of the labour market and the country's economic agenda.

National Occupational Standards (NOS) are performance criteria that are matched with labour market demands. Each National Occupation Standard describes functions, performance standards, and knowledge/understanding for one important function or task. They combine skills, knowledge, and attitudes to describe best practice. They are useful tools for establishing job roles, personnel recruiting, supervision, and appraisal, as well as TET standards. They're also helpful for benchmarking and harmonizing qualifications on a national and international level. Standards, in general, provide a solid framework for high-quality TET that is labour market-relevant, current, and consistent in delivery across all public and private institutions.

However, it must be noted that, Occupational Standards and Training standards/qualifications standards are different. Occupational standards are defined in terms of activities performed by a person in a selected occupation (e.g., an electrical engineer designs electrical wiring circuits, performs troubleshooting in electrical wiring, etc.) and they are usually defined by employers following procedures agreed upon by all stakeholders. Education and training standards are developed from the activities defined in occupational standards, and they include learning objectives to ensure that the necessary skills and knowledge are developed by a person to enable him or her to function at an agreed level in an occupation. Education and Training standards are used to define curricula in training institutions. It is however critical that there must be a direct link between the occupational standards and the training standards to respond to the demands of the labour market.

In TET delivery, Tanzania adopted the Competence Based Education and Training (CBET) approach. The CBET approach focuses on providing learners with the skills and knowledge required to meet

the occupational standards. Occupational standards are thus the starting point for developing competency-based training (CBET) programmes. TET institutions will be required to benchmark their curricula with relevant occupational standards.

Occupational Standards are developed based on a given occupation's current and future demands. As a result, they serve as a means of bridging the gap between the worlds of employment and technical education and training (TET).

The Drone Pilot Technician Occupation has its own set of occupational standards. The document explains how the occupational standards were developed, as well as the scope, the occupational profile in the form of DACUM charts, and the Occupational Standards.

2.0. OCCUPATIONAL STANDARD DEVELOPMENT PROCESS

The Occupational standards development process began with an examination of major documents that guide Tanzanian skill development. The *10-year National Skills Development Strategy (2016-2026)* was one of the documents reviewed, and it outlined six (6) economic sectors that should be prioritized when developing skills development programmes.

These sectors include: Transport and Logistics, Tourism and Hospitality, Agribusiness, Construction, Energy and ICT. NACTE labour market reports were also used in the literature review to determine the skills demand in the Tanzanian labour market as a whole.

After the literature review, a workshop comprised of expert workers and educators with substantial knowledge and experience in the occupation conducted an occupational analysis utilizing the DACUM approach to produce the occupational profile. The analysis resulted in DACUM Charts, which are attached as **Appendix 1** to this document.

The occupational standards were then developed. Experts in Occupational Analysis and the Development of Occupational Standards facilitated the workshop. Interviews, online surveys, and a stakeholder forum were used to validate the Occupational Standards. Engineers, supervisory technicians on the job, and experienced Drone Pilot Technicians were key informants in the survey to discover occupational trends. This information was used to gain insight from the workplaces regarding trends and changes in the profession, including how well graduates are prepared for working in the occupation. A total of ... online surveys were completed by experts from the labour

market across the country. Apart from the surveys aiding in defining the scope for the occupational analysis, they also served to engage a wide cross-section of experts in the occupation. Apart from this, the stakeholders' forum was attended by ... participants from different parts of the country representing various companies.

3.0. THE SCOPE AND OVERVIEW OF THE OCCUPATION STANDARDS FOR DRONE PILOT TECHNICIANS

The standards cover a broad range of duties and tasks that can be performed by a Drone Pilot Technician. However, the occupational standards are not meant to replace individual job descriptions. Instead, they are to be used for guidance in defining skill levels and knowledge for the technician in specific settings or positions. The Drone Pilot Technicians may perform tasks in a number of key areas of the occupational standards, but not necessarily in all areas. For example, in large operations, other individuals may be employed or designated to perform specific tasks.

The Drone Pilot Technicians shall work under the supervision of senior technicians, plan flight routes for aerial photography, inspection, as well as surveying and mapping, install and debug multi-rotor, fixed-wing and composite-wing UAVs, perform aerial photography, patrol inspection and surveying and mapping, and diagnose and eliminate faults of various unmanned aerial vehicles, power system parts and load equipment during task execution. Generally, the Drone Pilot Technician performs the following responsibilities:

a) General services for aerial photography and inspection surveying and mapping

b) Planning of flighting tasks of multi-rotor, fixed-wing and composite-wing UAVs

c) Assembly, debugging and maintenance of multi-rotor, fixed-wing and composite-wing UAVs

d) Assembly, debugging and maintenance of multi-rotor, fixed-wing and composite-wing UAV power system

e) Assembly, debugging and maintenance of multi-rotor, fixed-wing and composite-wing UAV control system

f) Assembly, debugging and maintenance of multi-rotor, fixed-wing and composite-wing UAV loading system

g) Execution of tests in line-of-sight and flight tasks of all kinds of unmanned aerial vehicles

i) Execution of over-the-horizon tests and flight tasks of all kinds of unmanned aerial vehicles

j) Maintenance of the safety system of all kinds of unmanned aerial vehicles

The Occupational Standards have been clustered into NTA qualification levels, i.e. NTA level 4, 5 and 6.

4.0. VALIDITY PERIOD

Due to the rapid development of technology, the validity period of occupational standards is 3-5 years. The review will proceed in the same manner as the one before it, with new occupational standards being developed based on current trends of the labour market.

5.0. OCCUPATIONAL STANDARDS

5.1 OCCUPATIONAL STANDARDS FOR DRONE PILOT TECHNICIAN - NTA 6

<table>
<tr><td>OCCUPATION</td><td>DRONE PILOT TECHNICIAN</td><td>OCCUPATION CODE</td><td></td></tr>
<tr><td>DUTY TITLE</td><td>TASK PLANNING</td><td>DUTY NO.</td><td>601</td></tr>
<tr><td>TASK TITLE</td><td>FORMULATION OF TASK EXECUTION PLAN AND FLIGHT PLAN REPORTING</td><td>TASK NO.</td><td>6011</td></tr>
<tr><td>PERFORMANCE CRITERIA</td><td colspan="3">The person performing this task must be able to independently design the task execution plan and conduct flight plan reporting in accordance with the requirements of the flight task, laws and regulations of low-altitude management, and equipment preparation.</td></tr>
<tr><td>RANGE STATEMENT</td><td colspan="3">The task can be performed indoors or at the flight site under the supervision of senior drone pilot technicians.
The tools and equipment to be used include:
1. Ground station control system;
2. Flight plan reporting system.</td></tr>
<tr><td colspan="4">EVIDENCE REQUIREMENT</td></tr>
<tr><td colspan="2">PRACTICAL PERFORMANCE</td><td colspan="2">UNDERPINNING KNOWLEDGE</td></tr>
<tr><td colspan="2">The person performing this task must be able to
1. Analyse the type of tasks;
2. Analyse the requirements of low-altitude management laws and regulations;
3. Develop task execution plans, including backgrounds, purposes, execution processes and precautions;
4. Fill in the flight schedule;
5. Register and log in to the flight plan reporting software;
6. Complete the flight plan reporting and fill in the flight task table.</td><td colspan="2">Detailed knowledge about:
1.0 Methods
The person performing this task must be able to explain how to:
1.1 Develop task plans;
1.2 Fill in the flight schedule;
1.3 Conduct the flight plan reporting.

2.0 Principles
The person performing this task must be able to explain the following principles:
2.1 The laws and regulations on low-altitude management;
2.2 The weather and terrain requirements of the flight task.

3.0 Theories
The person performing this task must be able to explain the following:</td></tr>
</table>

	3.1 The process of flight plan reporting and applying. **4.0 Essential Skills** 4.1 Reading comprehension skills; 4.2 Communication skills; 4.3 Mobile terminal operation skills; 4.4 Teamwork skills; 4.5 Writing skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The task execution plan is formulated and flight plan reporting is conducted in accordance with the requirements of the flight task.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Analysis of meteorological and geographical conditions; 2. Occupational health and safety.

OCCUPATION	DRONE PILOT TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	TASK PLANNING	**DUTY NO.**	601
TASK TITLE	ROUTE PLANNING OF SURVEYING AND MAPPING TASKS	**TASK NO.**	6012
PERFORMANCE CRITERIA	The person performing this task must be able to conduct route planning of surveying and mapping tasks in accordance with the requirements of different surveying and mapping tasks.		
RANGE STATEMENT	The task can be performed indoors or at the flight site under the supervision of senior drone pilot technicians. The tools and equipment to be used include: 1. Ground station radios; 2. Ground station computers; 3. Ground station software.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Select the type of UAVs; 2. Select the type of flight routes; 3. Analyse environmental and meteorological conditions; 4. Set flight and operation parameters; 5. Perform ground station simulation tasks; 6. Modify flight and operation parameters; 7. Record operation data.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Set up and debug ground station radios; 1.2 Select the type of flight routes; 1.3 Calculate flight and operation parameters; 1.4 Use route planning software to draw task routes. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 The principle of UAV selection; 2.2 The laws and regulations on low-altitude management; 2.3 Weather and terrain requirements of flight tasks. **3.0 Theories** The person performing this task must be able to explain the following:

	3.1 Factors affecting route planning; 3.2 Flight and operation parameters; 3.3 Safety operation requirements of the ground station. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Teamwork skills; 4.3 Customer service skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Route planning of surveying and mapping tasks are conducted in accordance with the requirements of the flight task.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Analysis of meteorological and geographical conditions; 2. Occupational health and safety.

OCCUPATION	DRONE PILOT TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	TASK PLANNING	**DUTY NO.**	601
TASK TITLE	PROCEDURES AND SPECIFICATIONS FORMULATION OF THE FLIGHT ACCIDENT HANDLING	**TASK NO.**	6013
PERFORMANCE CRITERIA	The person performing this task must be able to design procedures and specifications for the flight accident handling in accordance to the feedback of the flight status monitor.		
RANGE STATEMENT	The task can be performed indoors or at the flight site under the supervision of senior drone pilot technicians. The tools and equipment to be used include: 1. Computers; 2. Ground stations.		

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Monitor the flight status feedback of the ground station and remote controller; 2. Identify emergency situations and formulate corresponding emergency response plans; 3. Formulate technical terms; 4. Formulate emergency operation instructions; 5. Formulate handling procedures for unplanned emergencies; 6. Formulate handling procedures for the crashed UAVs.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Select the emergency response plan; 1.2 Use technical terms to give emergency operation instructions; 1.3 Deal with unplanned emergencies; 1.4 Implement handling procedures for the crashed UAVs. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Procedures and specifications of the flight accident handling; 2.2 Laws and regulations on airspace management. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 The information identification and evaluation methods of emergencies.

	4.0 Essential Skills 4.1 Reading comprehension skills; 4.2 Communication skills; 4.3 Computer skills; 4.4 Customer service skills; 4.5 Teamwork skills; 4.6 Writing skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Procedures and specifications of the flight accident handling are formulated in accordance with accidents that may be involved in task requirements.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Occupational health and safety; 2. Waste disposal methods.

OCCUPATION	DRONE PILOT TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	INSTALLATION AND DEBUGGING OF COMPOSITE-WING UAVS	**DUTY NO.**	602
TASK TITLE	INSTALLATION OF COMPOSITE-WING UAV	**TASK NO.**	6021
PERFORMANCE CRITERIA	The person performing this task must be able to independently use tools and equipment to install composite-wing UAVs and their load parts in accordance with the installation manual.		
RANGE STATEMENT	The task can be performed in UAV installation and debugging workshop under the supervision of senior technicians of the manufacturers of composite-wing UAVs. The tools and equipment to be used include: 1. Balancing tools; 2. Weighing tools; 3. Testing instruments; 4. Full set of UAV installation and debugging toolboxes; 5. Electric welding equipment and heat guns; 6. Different kinds of glue and connecting rods; 7. Accessories of composite-wing UAVs; 8. Electronic accessories such as steering engines, motors, electric adjusters, batteries and receivers; 9. Load equipment of surveying and mapping; 10. Transmission systems.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Check whether tools, equipment and accessories are complete; 2. Review the installation process against the operation manual; 3. Install the wings; 4. Install wing steering engines, pull rods and rudder angle indicators; 5. Install multi-rotor motors and electric adjusters; 6. Install the tail of aerial vehicles; 7. Install the composite part of the fuselage;	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Install the wings; 1.2 Install the tail of aerial vehicles; 1.3 Install the fuselage; 1.4 Install the load part; 1.5 Use tools and glue. **2.0 Principles** The person performing this task must be able to

8. Install the load part of the fuselage; 9. Connect receivers, batteries, steering engines, electric adjusters and flight control equipment; 10. Bond the whole part; 11. Reinforce the whole part; 12. Fill in the flight task table.	explain the following principles: 2.1 The structure of composite-wing UAVs. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 The features of composite-wing UAVs; 3.2 The functions of composite-wing UAV accessories; 3.3 Safety operation requirements of tools and instruments; 3.4 Safety operation requirements of consumables and accessories. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Customer service skills; 4.3 Teamwork skills; 4.4 Report writing skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The installation of composite-wing UAVs is conducted and recorded in the flight task table in accordance with the requirements of the flight schedule and installation manual.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Safe connection and use of electricity; 2. Occupational health and safety; 3. Waste disposal methods.

OCCUPATION	DRONE PILOT TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	INSTALLATION AND DEBUGGING OF COMPOSITE-WING UAVS	**DUTY NO.**	602
TASK TITLE	COMPOSITE-WING UAV DEBUGGING	**TASK NO.**	6022
PERFORMANCE CRITERIA	The person performing this task must be able to independently use tools and equipment to debug the composite-wing UAVs and their load parts in accordance with the installation and debugging manual.		
RANGE STATEMENT	The task can be performed in UAV installation and debugging workshop or at the flight under the supervision of senior technicians of the manufacturers of composite-wing UAVs. The tools and equipment to be used include: 1. Balancing tools; 2. Weighing tools; 3. Testing instruments; 4. Full set of UAV installation and debugging toolboxes; 5. Electric welding equipment and heat guns; 6. Different kinds of glue and connecting rods; 7. Charging equipment.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Test the dynamic and static balance of the propellers; 2. Test the electrical circuit; 3. Test the power plant; 4. Test the flight control module; 5. Test the load module; 6. Fill in the flight task table.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Test the balance of the propellers; 1.2 Detect the electrical circuit; 1.3 Test the power system; 1.4 Test the flight control system; 1.5 Test the loading system; 1.6 Use the tools and consumables. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Systems of composite-wing UAVs.

	3.0 Theories The person performing this task must be able to explain the following: 3.1 Role of power systems of composite-wing UAVs; 3.2 The function of the flight control system of composite-wing UAVs; 3.3 The function of the loading system of composite-wing UAVs. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Customer service skills; 4.3 Teamwork skills; 4.4 Report writing skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The debugging of composite-wing UAVs is conducted and recorded in the flight task table in accordance with the requirements of the flight schedule and installation manual.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Safe connection and use of electricity; 2. Occupational health and safety; 3. Waste disposal methods.

OCCUPATION	DRONE PILOT TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	COMPOSITE-WING AERIAL VEHICLES OPERATION	**DUTY NO.**	603
TASK TITLE	PREPARATION OF COMPOSITE-WING FLIGHT OPERATION	**TASK NO.**	6031
PERFORMANCE CRITERIA	The person performing this task must be able to independently use tools and equipment to inspect composite-wing UAVs and their load parts in accordance with task requirements and the operation manual.		
RANGE STATEMENT	The task can be performed in the indoor UAV installation and debugging workshop or on site under the supervision of senior technicians or engineers. The tools and equipment to be used include: 1. Balancing tools; 2. Weighing tools; 3. Testing instruments; 4. Full set of UAV installation and debugging toolboxes; 5. Electric welding equipment and heat guns; 6. Different kinds of glue and connecting rods; 7. Charging equipment.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Check the electrical circuit; 2. Check the whole structure; 3. Dismantle the propeller; 4. Check the steering motor; 5. Check for foreign objects and breakages; 6. Power on the transmitter and receiver; 7. Check the neutral position of the aileron and tail fin and their responses; 8. Check the main module of the flight control and install the shock absorber to the antenna; 9. Check the balance of the composite-wing UAV in functional mode; 10. Check the load equipment of surveying and mapping tasks;	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Dismantle the propeller; 1.2 Check the electrical circuit; 1.3 Check the power system; 1.4 Check the flight control system; 1.5 Check the loading system; 1.6 Check the flight route; 1.7 Use the tools and consumables. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 The preparation workflow of the composite-wing flight operation.

11. Check the flight weather and environment; 12. Plan and confirm the flight routes; 13. Fill in the flight task table.	**3.0 Theories** The person performing this task must be able to explain the following: 3.1 The operation of the composite-wing UAV system; 3.2 The importance of the preparation of the composite-wing flight operation; 3.3 The precautions and inspecting stages of composite-wing UAVs. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Customer service skills; 4.3 Teamwork skills; 4.4 Report writing skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The pre-operation preparation of composite-wing UAVs is conducted and recorded in the flight task table in accordance with the requirements of the flight schedule.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Safe connection and use of electricity; 2. Occupational health and safety; 3. Waste disposal methods.

OCCUPATION	DRONE PILOT TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	COMPOSITE-WING AERIAL VEHICLES OPERATION	**DUTY NO.**	603
TASK TITLE	THE OPERATION OF SURVEYING AND MAPPING TASK ALONG THE ROUTE OR MANUAL INTERVENTION OF TASKS	**TASK NO.**	6032
PERFORMANCE CRITERIA	The person performing this task must be able to independently conduct operations of surveying and mapping task along the route and necessary manual interventions of tasks in accordance with the flight operation requirements and the laws and regulations of the low-altitude management.		
RANGE STATEMENT	The task can be performed at the flight site under the supervision of senior technicians or engineers of composite-wing UAVs. The tools and equipment to be used include: 1. Ground station radios; 2. Ground station computers; 3. Ground station software; 4. Radio communication systems.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Use technical terms to give flight operation instructions; 2. Use control equipment to conduct a normal take-off of the composite-wing UAV; 3. Use control equipment to conduct a normal flight of the composite-wing UAV; 4. Use control equipment to conduct a normal landing of the composite-wing UAV; 5. Switch the flight mode; 6. Conduct a remote control flight of the composite-wing UAV; 7. Fill in the flight task table.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Use the UAV control equipment; 1.2 Control the UAV to take off, fly and land. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Principles of performing surveying and mapping tasks along the route; 2.2 Principles of the manual intervention of tasks; **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Requirements of flight operation instructions;

	3.2 Methods of equipment system control; 3.3 Safety operation requirements of the ground station; 3.4 Safety operation requirements of the remote control equipment. **4.0 Essential Skills** 4.1 Operation skills; 4.2 Communication skills; 4.3 Customer service skills; 4.4 Teamwork skills; 4.5 Report writing skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The operation of surveying and mapping task along the route is conducted and manual intervention of tasks are given where necessary in accordance with technical requirements and the operation manual.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Flight terminology; 2. Safe connection and use of electricity; 3. Occupational health and safety; 4. Waste disposal methods.

OCCUPATION	DRONE PILOT TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	COMPOSITE-WING AERIAL VEHICLES OPERATION	**DUTY NO.**	603
TASK TITLE	THE OPERATION OF AVOIDANCE, RETURN, AND EMERGENCY LANDING DURING THE FLIGHT OF COMPOSITE-WING UAV	**TASK NO.**	6033
PERFORMANCE CRITERIA	The person performing this task must be able to conduct the avoidance, return, and emergency landing during the flight of composite-wing UAV.		
RANGE STATEMENT	The task can be performed at the flight site under the supervision of senior technicians or engineers of composite-wing UAVs. The tools and equipment to be used include: 1. Ground station radios; 2. Ground station computers; 3. Ground station software; 4. Radio communication systems.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Use technical terms to give flight operation instructions; 2. Use technical terms to give emergency operation instructions; 3. Operate a take-off suspension or landing suspension; 4. Change the UAV flight plan during the flight; 5. Conduct avoidance, return, and emergency landing of the UAV; 6. Judge the emergency situation and take the emergency response plan; 7. Deal with unplanned emergencies; 8. Implement handling procedures for the crashed UAV; 9. Fill in the flight task table.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Give flight and operation instructions; 1.2 Use the UAV control equipment; 1.3 Change the flight plan; 1.4 Perform emergency operations during the flight; 1.5 Deal with sudden emergencies. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Principles of avoidance during the flight of the composite-wing UAV; 2.2 Principles of return during the flight of the composite-wing UAV; 2.3 Principles of emergency landing during the flight of the composite-wing UAV.

	3.0 Theories The person performing this task must be able to explain the following: 3.1 Flight operation instructions; 3.2 Methods of equipment system control; 3.3 The information identification and evaluation methods of emergencies; 3.4 Safety operation requirements of the ground station. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Customer service skills; 4.3 Teamwork skills; 4.4 Report writing skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The avoidance, return, and emergency landing of the composite-wing UAV during the operation of surveying and mapping tasks is conducted in accordance with technical requirements and the operation manual.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Flight terminology; 2. Safe connection and use of electricity; 3. Occupational health and safety; 4. Waste disposal methods.

OCCUPATION	DRONE PILOT TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	COMPOSITE-WING AERIAL VEHICLES OPERATION	**DUTY NO.**	603
TASK TITLE	THE MONITORING OF TASK OPERATION STATUS AND DATA ACQUISITION	**TASK NO.**	6034
PERFORMANCE CRITERIA	The person performing this task must be able to monitor the task status and acquire data during the flight of the composite-wing UAV in accordance with the task requirements.		
RANGE STATEMENT	The task can be performed at the flight site under the supervision of senior technicians or engineers of composite-wing UAVs. The tools and equipment to be used include: 1. Ground station radios; 2. Ground station computers; 3. Ground station software; 4. Radio communication systems; 5. Loading control system.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Monitor the flight status of the UAV; 2. Monitor the operating state of the load equipment; 3. Control the load equipment to acquire data; 4. Change parameters of the load equipment; 5. Identify and report the emergency information; 6. Fill in the flight task table.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Monitor the flight status of the UAV; 1.2 Monitor the operating state of the load equipment; 1.3 Control the load equipment to acquire data; 1.4 Change parameters of the load equipment. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 The operating principles of the load system and data acquisition of surveying and mapping task. **3.0 Theories** The person performing this task must be able to explain the following:

	3.1 Operation requirements of the load control system; 3.2 Types of surveying and mapping data; 3.3 The status of task operations; 3.4 Safety operation requirements of the ground station; 3.5 Safety operation requirements of the load control system. **4.0 Essential Skills** 4.1 Observation skills; 4.2 Communication skills; 4.3 Customer service skills; 4.4 Teamwork skills; 4.5 Report writing skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The operation status of the composite-wing UAV during surveying and mapping tasks is monitored and the data acquisition is conducted in accordance with the task plan.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Flight terminology; 2. Safe connection and use of electricity; 3. Occupational health and safety; 4. Waste disposal methods.

OCCUPATION	DRONE PILOT TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	COMPOSITE-WING AERIAL VEHICLES OPERATION	**DUTY NO.**	603
TASK TITLE	DATA EXPORT AND REVIEW	**TASK NO.**	6035
PERFORMANCE CRITERIA	The person performing this task must be able to export and check the data of the composite-wing UAV after the surveying and mapping task.		
RANGE STATEMENT	The task can be performed in the data processing classroom or at the flight site under the supervision of senior technicians or engineers of composite-wing UAVs. The tools and equipment to be used include: 1. Computers; 2. Load equipment; 3. Load storage equipment; 4. Software for indoor surveying and mapping data processing.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Download and export the surveying and mapping data; 2. Classify the data and check whether it is complete or damaged; 3. Use software for indoor surveying and mapping data processing to view data; 4. Store, transfer, and back up the task data; 5. Fill in the flight task table.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Export and classify data; 1.2 Use software for indoor surveying and mapping data processing; 1.3 Store, transfer, and back up the task data. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Principles of surveying and mapping data classification. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Knowledge of data classification and management; 3.2 Safety operation requirements of the load control system.

	4.0 Essential Skills 4.1 Observation skills; 4.2 Communication skills; 4.3 Customer service skills; 4.4 Teamwork skills; 4.5 Report writing skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The data is exported and checked in accordance with the task plan.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Flight terminology; 2. Safe connection and use of electricity; 3. Occupational health and safety; 4. Waste disposal methods.

OCCUPATION	DRONE PILOT TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	FAULT DIAGNOSIS	**DUTY NO.**	604
TASK TITLE	FAULT DIAGNOSIS OF THE COMPOSITE-WING UAV, GROUND CONTROL SYSTEMS, COMMUNICATION LINKS AND CONTROL LINKS	**TASK NO.**	6041
PERFORMANCE CRITERIA	The person performing this task must be able to diagnose the faults of the UAV, ground control systems, communication and control links in accordance with technical requirements and UAV operating status.		
RANGE STATEMENT	The task can be performed in the indoor UAV installation and debugging workshop or at the flight site under the supervision of composite-wing UAV senior technicians or engineers. The tools and equipment to be used include: 1. Equipment, instruments and tools for assembling and debugging; 2. Ground station systems; 3. Communication link systems; 4. Control link systems; 5. Loading systems.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Check the flight status of the UAV; 2. Check the operating state of the load equipment; 3. Inspect the files of surveying and mapping data; 4. Diagnose the macroscopic irregularities of the UAV, ground control systems and auxiliary equipment; 5. Diagnose the faults of the UAV, ground control systems, communication links and control links; 6. Summarize and analyse the common faults of the UAV; 7. Analyse the common faults of loading systems;	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Diagnose the macroscopic irregularities of the UAV, ground control systems and auxiliary equipment; 1.2 Diagnose the faults of the UAV, ground control systems, communication links and control links. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Flight control principles of the UAV; 2.2 Principles of communication link and control link.

8. Analyse and summarize the faults of ground control systems, communication links, and control links; 9. Summarize and analyse the common faults of auxiliary equipment systems; 10. Fill in the flight task table.	**3.0 Theories** The person performing this task must be able to explain the following: 3.1 The composition of the composite-wing UAV; 3.2 The composition of ground control systems; 3.3 Operation methods of the fault diagnosis. **4.0 Essential Skills** 4.1 Observation skills; 4.2 Communication skills; 4.3 Customer service skills; 4.4 Teamwork skills; 4.5 Report writing skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The fault diagnosis of the composite-wing UAV, ground control systems, communication links and control links is conducted in accordance with technical requirements and the operation manual.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Flight terminology; 2. Safe connection and use of electricity; 3. Occupational health and safety; 4. Waste disposal methods.

OCCUPATION	DRONE PILOT TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	FAULT DIAGNOSIS	**DUTY NO.**	604
TASK TITLE	FAULT REMOVAL OF THE COMPOSITE-WING UAV, GROUND CONTROL SYSTEMS, COMMUNICATION LINKS AND CONTROL LINKS	**TASK NO.**	6042
PERFORMANCE CRITERIA	The person performing this task must be able to fix the faults of composite-wing UAV, ground control systems, and communication links and control links.		
RANGE STATEMENT	The task can be performed in indoor UAV installation and debugging workshop or at the flight site under the supervision of senior technicians or engineers of composite-wing UAVs. The tools and equipment to be used include: 1. Equipment, instruments and tools for assembling and debugging; 2. Ground station systems; 3. Communication link systems; 4. Control link systems; 5. Loading systems.		

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE	UNDERPINNING KNOWLEDGE
The person performing this task must be able to do the following: 1. Check the flight status of the UAV; 2. Check the operating state of the load equipment; 3. Inspect the files of surveying and mapping data; 4. Summarize and analyse the common faults of the UAV; 5. Analyse the common faults of loading systems; 6. Analyse the faults of ground control systems, communication links, and control links; 7. Analyse the common faults of auxiliary equipment systems; 8. Fix the macroscopic irregularities of the UAV, ground control systems and auxiliary equipment;	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Fix the macroscopic irregularities of the UAV, ground control systems and auxiliary equipment; 1.2 Fix the faults of the UAV, ground control systems, communication links and control links. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Flight control principles of the UAV; 2.2 Principles of communication link and control link.

9. Fix the faults of the UAV, ground control systems, communication links and control links; 10. Analyse and summarize the overall faults of the composite-wing UAV, ground control systems, communication links and control links; 11. Fill in the flight task table.	**3.0 Theories** The person performing this task must be able to explain the following: 3.1 The composition of the composite-wing UAV; 3.2 The composition of ground control systems; 3.3 Operation methods of the fault diagnosis. **4.0 Essential Skills** 4.1 Observation skills; 4.2 Communication skills; 4.3 Customer service skills; 4.4 Teamwork skills; 4.5 Report writing skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The fault removal of the composite-wing UAV, ground control systems, communication links and control links is conducted in accordance with technical requirements and the operation manual.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Flight terminology; 2. Safe connection and use of electricity; 3. Occupational health and safety; 4. Waste disposal methods.

TABLE 1: DACUM CHARTS FOR DRONE PILOT TECHNICIAN - NTA 6

DUTIES	TASKS	ENABLERS
1.0 Task planning	1.1 Formulation of task execution plan and flight plan reporting. 1.2 Route planning of surveying and mapping tasks. 1.3 Procedures and specifications formulation of the flight accident handling.	**General skills and knowledge** · Cooperation with others using communication skills and submission of reports to the superiors · Use of the manufacturer's manual · Environment and flight safety · Flight task flow · Operation of ground station software **Tools and equipment** · Flight plan reporting software · Ground station radios · Ground station computers · Ground station software **Materials** · Documents and tables **Requirements for employees** · Teamwork spirit, integrity, time management and commitment
2.0 Installation and debugging of composite-wing UAVs	2.1 Installation of composite-wing UAVs. 2.2 Debugging of the composite-wing UAV.	**General skills and knowledge** · Cooperation with others using communication skills and submission of reports to the superiors · Use of the manufacturer's manual · Environment and flight safety · Skills in aerial vehicle installation and debugging · Interpretation of technical documents · Operation of debugging software **Tools and equipment**

DUTIES	TASKS	ENABLERS
		· Balancing tools · Weighing tools · Testing instruments · Full set of UAV installation and debugging toolboxes · Electric welding equipment and heat guns · Different kinds of glue and connecting rods · Accessories of composite-wing UAVs · Electronic accessories such as steering engines, motors, electric adjusters, batteries and receivers · Load equipment of surveying and mapping tasks · Transmission systems · Debugging software · Flight control software · Ground control stations · Charging equipment **Materials** · Composite-wing propellers · Composite-wing landing gears · Composite-wing reinforcing screws, straps, glue, etc. **Requirements for employees** · Teamwork spirit, integrity, time management and commitment
3.0 Composite-wing aerial vehicles operation	3.1 Preparation of composite-wing flight.	**General skills and knowledge** · Cooperation with others using communication skills and submission of reports to the superiors Use of the manufacturer's manual · Environment and flight safety · Flight task flow
	3.2 The operation of surveying and mapping task along the route or manual intervention of tasks.	
	3.3 The operation of avoidance, return, and	

DUTIES	TASKS	ENABLERS
	emergency landing during the flight of composite-wing UAV. 3.4 The monitoring of task operation status and data acquisition. 3.5 Data export and review.	· Operations of load equipment · Autonomous or semi-autonomous flight operations · Data acquisition, inspection, and export · Operation of ground station software **Tools and equipment** · Balancing tools · Weighing tools · Testing instruments · Full set of UAV installation and debugging toolboxes · Electric welding equipment and heat guns · Different kinds of glue and connecting rods · Charging equipment · Computer · Ground station radios · Ground station computers · Ground station software · Radio communication systems · Loading control systems · Software for indoor surveying and mapping data processing **Materials** · Composite-wing propellers · Composite-wing landing gears · Composite-wing reinforcing screws, straps, glue, etc. **Requirements for employees** · Teamwork spirit, integrity, time management and commitment
4.0 Fault diagnosis	4.1 Fault diagnosis of the composite-wing UAV,	**General skills and knowledge**

DUTIES	TASKS	ENABLERS
	ground control systems, communication links and control links.	· Cooperation with others using communication skills and submission of reports to the superiors · Use of the manufacturer's manual · Environment and flight safety · Fault diagnosis process · Skills in installation and debugging of aerial vehicles, power systems, control systems and loading systems · Interpretation of technical documents **Tools and equipment** · Equipment, instruments and tools for assembling and debugging · Ground station systems · Communication link systems · Control link system · Loading systems **Materials** · Antenna accessories for communication systems **Requirements for employees** · Teamwork spirit, integrity, time management and commitment
	4.2 Fault removal of the composite-wing UAV, ground control systems, communication links and control links.	