2025

BRICS Skills Competition
(BRICS Future Skills & Tech Challenge)

Drone Operation
BRICS-FS-14

Technical Description
(International Final)

July 2025

Contents

1. Introduction

1.1 Skills name and description

1.1.1 Name of skills

2025 BRICS Skills Competition (BRICS Future Skills & Tech Challenge) - Drone Operation. Skill No.: BRICS-FS-14.

1.1.2 Description of skills contest

2025 BRICS Skills Competition (BRICS Future Skills & Tech Challenge) - Drone Operation consists of UAV assembly, UAV material delivery at low altitude, and intelligent development of UAVs. All contestants are required to complete tasks such as assembling UAVs and performing material delivery via UAVs. The event is a double-member contest (Two competitors for one team).

The UAV operation professionals shall have the following skills:

(1) Understand the structure and basic operating principle of common UAVs, grasp the theoretical knowledge and specifications on UAV operation.

(2) Understand the specialized knowledge and skills relating to the technology application of UAV assembly and commissioning, select an UAV that can fly stably based on the contest equipment and provided UAV accessories in the arena, and conduct flight tests.

(3) Use the site and equipment provided in the contest arena to complete the beyond-visual-range material delivery using UAV.

(4) Complete basic programming tasks using Python.

(5) Optimize flight routes based on payload, range, and weather conditions for safe and efficient operations.

(6) Effectively communicate technical plans, delegate tasks, and collaborate

efficiently in team missions.

1.2 Relevance and importance of this document

This document contains the criteria required for this skills contest, as well as all information regarding the assessment principles, methods and procedures in the contest.

Every expert and contestant must know and understand this Technical Description.

In case of any conflict between the Technical Descriptions written in different languages, the English version shall prevail.

2. Skill specification

2.1 General descriptions of skill specification

The skill specification has specified the knowledge, understanding and specific skills. These skills are the best technical and vocational practice worldwide. The skill specification will reflect a global consensus on what the relevant work role or occupation represents in different industries and businesses.

The skills contest is designed to reflect the global best practice described by the skill specification, and the level that can be achieved by the skill specification. The skill specification is therefore a guide to the training and preparation required for the skills contest.

The skill specification is divided into different sections with headings and reference numbers.

Each section is assigned a percentage of the total score to indicate its relative importance in the skill specification. It is also referred to as “weight”. The sum of all

percentages is of 100. The weights determine the distribution of points in the scoring criteria.

Through the contest proposition, the scoring scheme only evaluates the skills listed in the skill specification. They will reflect the criteria as fully as possible within the constraints of the skills contest.

The scoring scheme will be based on the scores assigned in the criteria to the practically possible extent. A variation of 5% is permitted. However, it is not allowed to change the weights assigned by the skill specification.

2.2. Skill specification

Section		Relative importance (%)
1	**Job organization and management**	
	All contestants shall know and understand the following items: – Principles and methods for the safe execution of work; – Purpose, use, care and maintenance of all equipment and materials and their impact on safety; – Environmental and safety principles and their application in good internal affairs management during work; – Principles and methods of work organization, control and management; – Principles of communication and cooperation;	

	– Scope and limitation of single or collective roles, responsibilities and obligations of individuals and others; – Parameters to be followed when planning activities; – Principles and technologies of time management.	
	Contestants shall be able to: – Prepare and maintain a safe, clean and efficient work area; – Get ready for the task at hand, including full consideration of OHS; – Schedule work to maximize efficiency and minimize schedule disruptions; – Apply (or exceed) OSH standards related to the environment, equipment and materials; – Restore the work area to a proper state; – Provide and receive feedback and support.	
2	**Communication skills**	
	All contestants shall know and understand the following items: – Time requirements for each contest task; – Contest document structure and content; – Contest arrangement and scoring rules;	
	Contestants shall be able to:	

	– Understand all tasks; – Emphasize that the positive factor of all items is helpful. – Clarify and protect your design decisions; – Express opinions freely; – Be punctual; – Follow the contest rules.	
3	**Theoretical professional knowledge assessment**	**30**
	All contestants shall know and understand the following items: – System structure of the UAV platform; – Main functions of the UAV platform; – Basic knowledge of UAV application in common scenarios; – UAV flight control principles; – UAV flight safety operations; – Knowledge on parameter setting related to UAV autonomous flight operations; – UAV control and communication knowledge;	
	Contestants shall be able to: – Complete the theoretical examination questions on the theoretical examination platform; – Correctly answer questions related to UAV system structure;	

	– Correctly answer questions related to the application of basic knowledge in common scenarios; – Complete the examination questions of UAV flight safety operation;	
4	**UAV assembly**	**15**
	All contestants shall know and understand the following items: – System structure of the UAV platform; – Operating principles of UAV sub-systems; – Multi-rotor UAV flight platform architecture; – UAV welding technology and UAV parts fixing knowledge; – UAV assembly and commissioning process; – Precautions for UAV assembly and commissioning; – Knowledge on commissioning of UAV flight control parameters; – Knowledge on commissioning of remote controller parameters; – Knowledge and precautions for UAV flight test; – Skills of UAV flight control within visual range; – Operating principles of UAV application payload;	
	Contestants shall be able to: – Get familiar with the meaning of UAS parameters;	

	– Assemble relevant components of the UAV by using the UAV assembly and commissioning tools; – Check the standardization and correctness of UAV assembly; – Use flight control commissioning software to adjust the flight control parameters of UAV; – UAV application payload commissioning;	
5	**UAV system maintenance**	
	All contestants shall know and understand the following items: – Understand the common fault types in UAVs; – Understand the commonly used fault detection tools; – Understand the UAV maintenance process; – Understand the causes of common faults in UAVs; – Possess the knowledge of safe operation procedures; – Understand the construction of UAV systems;	
	Contestants shall be able to: – Be proficient in using detection tools to complete fault detection; – Perform fault analysis based on the operating	

	principle of each component; – Accurately determine the location of faults in UAVs based on the condition of UAVs; – Complete the overall troubleshooting of the UAV system and successfully unlock it;	
6	**UAV material transportation at low altitude**	**15**
	All contestants shall know and understand the following items: – Understand the performance of light UAVs; – Operation of UAV application load; – UAV operation skills; – Three-dimensional spatial perception ability;	
	Contestants shall be able to: – Be proficient in controlling light UAVs; – Control UAVs to complete transportation tasks; – Control of UAV to complete flight beyond visual range; – Complete the shooting of target objects;	
7	**Intelligent development of UAVs**	**35**
	All contestants shall know and understand the following items: – Understand the performance of light UAVs; – UAV shooting skills;	

	– UAV rescue process; – Operation of UAV application load; – Python language; – Linux and WINDOWS system operations; – Common command codes for programming;	
	Contestants shall be able to: – Be proficient in controlling light UAVs; – Control UAVs to complete patrol inspection tasks; – Control of UAV to complete flight beyond visual range; – Mark graphic features; – Model training; – AI automatic recognition;	

3. Scoring scheme

3.1 Scoring method

This contest will be scored by the referee group on the offline site. If any contestant makes a practice of cheating or violates other regulations during the contest, the referee will handle the contestant according to his/her actual violations. Any contestant in serious breach of relevant regulations will be excluded from the contest.

3.2 Scoring rules

1. Contestants with high overall scores will rank among the best;

2. If some contestants have the same total score, they will be sorted in the sequence of module D, module C, module B and module A. The contestant with higher score of

modules will have a higher ranking. See Article 4.2 of this document for details of each module.

If the ranking is still unclear according to the above two rules, the contestant who spends less total time during the contest will have a higher ranking.

3.3 Assessment criteria

In the process of event design, the scoring scheme and contest proposition will determine the selection of assessment criteria and methods.

Assessment criteria, including but not limited to:

- Basic knowledge and operational safety knowledge of UAV industry
- Correctness and specification of UAV flight control
- Operation specification of UAV system selection
- Meaning of UAS parameters
- Usage skills of UAV power test platforms
- Specification and correctness of UAV assembly and commissioning steps;
- Plausibility of UAV flight parameter settings and UAV flight test stability
- Basic knowledge of UAV material delivery and operation safety specification
- Skills of UAV flight beyond visual range
- Trust level in AI model training
- Ability of intelligent recognition of UAVs
- Time for completing each contest proposition

4. Contest proposition

4.1 General precautions

Regardless of a single module or a series of independent or associated modules, the contest proposition will assess the application of knowledge, skills and behaviors

defined in the skill specification.

With reference to the scoring scheme, the contest proposition is designed to provide comprehensive, balanced and true opportunities for the skill specification assessment and scoring. The relationship of contest proposition and scoring scheme with skill specification will be a key indicator of quality, just as the relationship between skill specification and actual work performance.

Any contest proportion does not include any aspect beyond the skill specification and will not affect the balance of scores within the skill specification.

The contest proposition will be used to assess the relevant knowledge and understandings only according to the application in actual work.

4.2 Contest proposition format/framework

The contest propositions consist of five modules:

Module A: theoretical professional knowledge assessment

Module B: UAV assembly

Module C: UAV system maintenance

Module D: UAV material transportation at low altitude

Module E: intelligent development of UAVs

4.3 Time distribution and score weight of contest propositions

Module	Duration (min)	Scoring point (%)
Module A: theoretical professional knowledge assessment	30	10

Module	Duration (min)	Scoring point (%)
Module B: UAV assembly	120	25
Module C: UAV system maintenance	30	20
Module D: UAV material transportation at low altitude	30	20
Module E: intelligent development of UAVs	150	25
Total	360	100

4.4 Contest contents and requirements of each module

The contest covers UAV theory and vocational ability, UAV selection, assembly and commissioning, intelligent UAV material delivery and refers to a comprehensive assessment on UAV operation application and industry application of all contestants.

Module A theoretical knowledge assessment: It takes the UAV system structure, UAV flight safety, UAV flight principle, UAV task planning, and UAV assembly and commissioning as the key assessment items;

Module B UAV assembly: It takes the UAV system structure, UAV flight safety, UAV flight principle, UAV task planning, and UAV assembly and commissioning as the key assessment items;

Module C UAV system maintenance: Analyze, judge, and repair the faults that occur in the UAV system, and complete the final fault resolution;

Module D UAV material transportation at low altitude: It takes the skills of UAV

flight control beyond visual range and UAV material delivery as the assessment items;

Module E: Intelligent development of UAVs: Complete AI inspection tasks based on light UAVs equipped with mission payload equipment;

Module No.	Module name	Main contest scope/content
A	Theoretical professional knowledge assessment	1. All contestants shall complete the examination paper containing 100 randomly selected questions on the online examination platform; 2. Follow the rules of online theory examination;
B	UAV assembly	1. Assemble UAV subsystems by using the UAV assembly and commissioning tools; 2. Check the standardization and correctness of UAV assembly; 3. Use flight control commissioning software to adjust the flight control parameters of UAV; 4. Adjust flight control parameters; 5. Conduct the flight stability test of UAV after commissioning 6. Assemble and commission the mission payload;
C	UAV system maintenance	1. Judge the faults in UAVs by referring to the fault phenomena of UAVs based on professional knowledge; 2. Detect faults in UAVs with detection tools;

		3. Determine the accurate location of faults in UAVs;
D	UAV material transportation at low altitude	1. Get familiar with the safe operation procedures for UAV material delivery; 2. Use the equipment and materials provided in the arena and UAV to complete flight beyond visual range; 3. Rationality of flight route planning for delivery areas; 4. UAV lens parameter setting; 5. UAV shooting operation;
E	UAV AI application	1. Conduct material screening and annotation; 2. Implement onboard computer development model training tasks; 3. Verify trust level in model; 4. Conduct AI inspection tasks;

4.5 Release of contest proposition

The contest proposition will be released on the official website of the contest (http://www.brskills.com/jzzy/productjs.html)) about 1 month before the event.

4.6 Changes of contest proposition

Before the formal start of this contest, about 30% of contest propositions will be changed.

5. Skill management and communication

5.1 Expert group

The skill expert group consists of chief experts, associate chief experts and expert members to further revise the technical documents for this event.

5.2 Communication and discussion

Before the contest, any contestant that has any question regarding registration, software and hardware preparation and examination environment deployment can enter the communication group related to the Drone Operation Event for communication and discussion. All training exchanges of this event and exchanges before, during and after the contest can also be implemented through the official communication group.

Online communication will be conducted using QQ/WeChat/Telgram (instant messaging tools).

6. Safety requirements

6.1. Organization

1. Set up a contest safety guarantee team, headed by the director of the Event Working Group. The safety director of each arena shall act as the team members. One person will be designated in each arena as the safety director to take responsibility of the arena safety, gather rescue teams and professional rescue personnel, and arrange personnel evacuation in case of emergency.

2. Establish a coordination mechanism with relevant departments such as public security, fire protection, judicial administration, transportation, health, food, quality inspection, etc., to ensure the contest safety, formulate emergency plans, and handle

emergencies in a timely manner. Set up special communication lines with medical personnel, fire personnel and security personnel, determine the liaison officers of other parties, and keep contact with the arena safety directors. Both the arena layout and equipment utilization shall be subject to the construction safety regulations. The arena shall be divided into different areas and evacuation passages shall be set according to specific safety requirements. Both safety evacuation passage and route diagram shall be put up on the eye-catching position of walls.

6.2 Event safety management

1. All contest equipment and facilities shall be subject to construction safety standards and all power cables and electrical equipment shall be installed according to the relevant specifications.

2. Fire extinguishers shall be arranged according to the fire safety requirements, and the designated personnel shall use them in case of emergency.

3. The event contest rules specify the national (or industry) occupational post safety specifications, regulations and qualification certificates.

4. The Event Working Group shall conduct safety training for all referees and staff before the contest. A complete safety accident prevention system shall be formulated in accordance with relevant regulations and requirements. All contestants shall receive safety training before the contest to avoid any personal injury accident.

5. The Event Expert Group will formulate a special plan to ensure the safety of the contest proposition, proposition storage, distribution, recovery and evaluation process.

6.3 Environmental safety management of the contest

1. Before the contest, the Event Working Group shall organize special persons to investigate the contest arena, accommodation places and transport support, and make

clear requirements for safety. The layout of the contest arena, appliances and equipment in the contest arena shall comply with the relevant safety regulations of the state. A simulation test can be carried out for the contest arena to detect possible problems. The organizer shall eliminate any potential safety hazard as required by the Event Working Group before the contest.

2. Cordon lines should be set up around the field to prevent irrelevant personnel from entering and having accidents. Necessary labor protection shall be provided for contestants in the contest arena in accordance with the requirements of the relevant positions. For any dangerous operation, the referee shall check and confirm that the equipment is in good condition before the contest and strictly prevent any contestant from any incorrect operation during the contest.

3. In order to ensure the smooth progress of this contest, the undertaking college shall establish the corresponding security system during the contest and such security system shall be implemented by the security, campus environment and health & medical security team.

(1) During the contest, all vehicles and personnel entering the contest area must hold the corresponding permits and show them to the security staff.

(2) Before the contest starts, all contestants must carefully read the precautions related to the contest and emergency evacuation map.

(3) The referee shall supervise the whole process of inspection before the electrical control system is powered on, and timely reminds and stops any operation with potential hazard.

(4) All contest equipment shall have separated power supply to ensure electrical safety. In the process of computer programming, the contestants shall timely save the

program to hard disk to avoid any data loss caused by sudden power failure.

(5) During the contest, all contestants shall strictly abide by the safety operation procedures, cut off power supply once an emergency occurs and evacuate the arena as instructed by the staff.

(6) All kinds of personnel must strictly abide by the contest rules, and it is strictly forbidden to bring any item prohibited by the contest into the arena.

(7) Security personnel shall timely inform the personnel in charge of the arena when they find any potential safety hazard.

(8) Smoking is strictly prohibited in the arena, and security personnel are not allowed to lend their permits to others.

(9) In case of safety problems, all personnel shall evacuate the arena along the emergency evacuation route under the command of security personnel.

4. In addition to complete signs and increased guides, the Event Working Group shall work together with the organizer to open spare passages in the arena areas with dense personnel and crossed flows of vehicles and pedestrians.

5. During the contest, the organizer shall add staff at key positions in field management and establish safety management logs.

6. When the contestants enter the position and the referees enter the workplace, the event organizer shall remind and supervise them not to carry any communication device, camera, video recorder or unauthorized recording tool, pass all their equipment through security check and perform security check to any personnel entering the key area of each arena.

6.4 Guarantee of living conditions

1. During the contest, the organizer will arrange food and accommodation for the

contestants and instructors. The organizer must respect the religious beliefs and cultural customs of contestants from ethnic minorities, and arrange the diet and daily life of these contestants and instructors in accordance with the relevant national ethnic and religious policies.

2. The accommodation place arranged during the contest shall have the qualification of hotel and accommodation business license.

3. The Event Working Group shall be responsible for the traffic safety of organized visit and observation activities during the contest. The Event Working Group and the organizer shall ensure the traffic safety of the contestants, instructors, referees and staff during the contest.

4. In addition to the necessary security isolation measures, all the personnel shall strictly abide by the relevant national laws and regulations to protect personal privacy and personal freedom.

6.5 Team responsibilities

1. Each participating unit shall, when organizing participating teams, arrange to purchase personal accident insurance for contestants during the contest.

2. After the formation of each participating team, relevant management system should be formulated, and safety education should be given to all contestants and instructors.

3. Each representative team should strengthen the safety management of the contestants and realize the connection with the safety management of the arena.

4. If any team has vehicles, the vehicles can enter and exit the arena without the permit issued by the Event Working Group. They must also run along the designated route and stop at the designated site.

6.6 Emergency treatment

If an accident occurs during the contest, the finder shall report the accident to the Event Working Group at the first time, and take measures to avoid the expansion of the situation. The Event Working Group shall immediately start the plan to handle the emergency. For any event with serious safety problems, the Event Working Group will decide whether it is suspended. After that, the Event Working Group will provide a detailed report.

6.7 Punishment measures

1. If there is a serious safety accident during the contest, the organizer will be temporarily disqualified to undertake the event.

2. If a team causes a major safety accident, he shall be disqualified from winning the prize.

3. If a team has potential danger of causing major safety accident, it may be disqualified from continuing the contest if the reminder or warning by the staff on the contest arena is invalid.

4. The staff who violates the rules shall be investigated for responsibility according to the corresponding system, and shall be investigated for the corresponding legal liabilities by judicial authorities for severe violation with major safety accident.

7. Materials and devices

7.1 List of basic devices

The list of basic devices shows all equipment and facilities to be prepared by the contestants. See *List of Basic Devices for Drone Operation in the Offline Contest of 2025 BRICS Skills Competition*.

7.2 List of contest equipment

7.2.1 Technical platform

No.	Name	Quantity	Remarks
1	Intelligent aircraft selection and assembly commissioning platform	1	
2	Mission payload kit	1	
3	Onboard computer module (TY-Nexpilot 2.0)	1	
4	Zenmuse H20T	1	
5	Matrice 350 RTK	1	
6	Manipulator load module	1	
7	Load delivery module (TY-Droper)	1	
8	UAV inspection and maintenance system (TY-ContestEDU-IAM450)	1	

7.2.2 Specifications and parameters

No.	Name	Specifications and parameters
1	Intelligent aircraft selection and assembly commissioning platform	1. It is required to provide three frame types, namely “cross”-shaped, “X”-shaped and “H”-shaped; 2. The center board components of each frame layout shall be able to meet the assembly needs of three models; 3. The platform is required to provide five

		different specifications of motors, with 4 motors of each specification and a total of 20 motors; 4. Three specifications of ESCs are required, namely 20A, 30A, and 40A, with 4 ESCs for each specification and a total of 12 ESCs; 5. Four specifications of plastic blades are required, with no less than 2 pairs of blades for each specification and a total of 8 pairs; 6. Battery specification: 4S, capacity: ≥ 5,000 mAh, discharge rate: ≥ 30C, quantity: 3; 7. The flight controller is required to support hovering hold mode, altitude hold mode, mission mode and return to home mode; 8. The flight controller is required to integrate a buzzer internally to eliminate the need for an external buzzer module, with a FLASH storage of no less than 8MB and a power supply range of 4.8-5.5V; 9. The flight controller is required to internally integrate a buzzer sensor module, an airspeed sensor module, a magnetic compass sensor module, a barometric altimeter module, a magnetic compass and altimeter module, a gyroscopic sensor module, a CAN bus module, a

		sound alarm module, a multicolor indicator light module, a low voltage difference power supply module, a flight data storage module, a level conversion module, a parameter storage module, a main controller module, and an input-output controller module; 10. The peripheral serial port of the flight controller shall include a data transmission serial port, a RTK serial port, a GPS serial port, an external compass, an optical flow serial port, and a TFMINI serial port; 11. The flight controller uses a high-performance STM32H743VIT6 processor with a main frequency of no less than 480 MHz and a dual-precision floating-point hardware processor. The flight controller system is required to have functions such as magnetic compass correction, single-parameter adjustment, multi-sensor fusion, and ultra-fast secondary development; 12. The operating frequency of the remote controller is 2,400 MHz - 2,483.5 MHz ; the number of channels is 8; support wide voltage input; support SUS.PWM signal output, with the

		system power consumption no less than 80 mA; the transmission rate is 38 kbps; the remote control system has a signal emission indicator light, the modulation mode supports GFSK mode; and the remote controller has one three-stage switch and one two-stage switch; 13. Charger: It is required to support AC 100-240V input to meet the charging requirements of LiPo, LiHV, LiFe batteries, with a charging balance accuracy of less than 0.005 V, and also support discharge function; 14. Various types of hexagon socket tool sets, needle-nose pliers, wire strippers and other tools shall be equipped to provide support for training tasks such as UAV disassembly, assembly and maintenance. The details of the tools are as follows: (1) 1 set of M1.5 socket hexagon screwdriver (2) 1 set of M2.0 socket hexagon screwdriver (3) 1 set of M2.5 socket hexagon screwdriver (4) 1 set of sleeve (5) 1 set of straight screwdriver (6) 1 set of cross screwdriver

		(7) 1 set of diagonal plier (8) 1 set of wire stripper (9) 1 set of wallpaper knife (10) 1 set of soldering iron stand (11) 1 roll of solder wire (12) 1 box of rosin (13) 1 set of 50W electric soldering iron (14) 1 set of power battery measurer (15) 1 multimeter set (16) 1 horizontal measuring cylinder (17) 1 file (18) 1 box of screw glue (19) 1 banana head soldering station (20) 1 set of test pencil (21) 1 USB parameter adjustment cable (22) 1 hot melt glue gun
2	Mission payload kit	I. TY-Load 1. Logistics module A Material: Hard aluminum alloy; Structure: Grasping mechanism; Weight: ≤45g (excluding rudder);

		Supported control mode: PWM; Maximum size of items that can be carried: 90mm. 2. Logistics module B Material: Hard aluminum alloy; Structure: Releasing mechanism; Weight ≤80g (excluding rudder); Supported control mode: PWM; Supported load capacity: 4-6 kg. 3. Aerial photography module (1) PTZ Processor: No less than 32-bit ARM computing chip; Onboard gyroscope and accelerator sensor; Support 7-channel PWM/Sum input/output; No less than 3 AUX interfaces; Support infrared led interfaces and S-Bus； Support high-precision brushless motor drive; Motor drive current: No more than 1.5 A at most; Operating voltage: 6-8 V or 2-4 S. (2) Image system

		Image resolution: 16M/14M/12M/8.3M/5M/3M; AV/HD output; Support 64GB SD card at most; Compressed image format: Support H.264; Aperture: Up to F/2.8; Angle: Up to 170 degrees; Operating voltage: ≤5 V; Operating current: ≤1 A. (3) Image transmission system a. Transmitter module: Output power: 0mW/25mW/200mW/400mW/600mW; Full-standard video format: NTSC/PAL; Wide voltage input: 7-28 V; Supported transmit frequency band: 5.8G Hz; Weight ≤30 g(excluding antenna). b. Receiving display: Display resolution: No less than 800×480 dpi; Display ratio: Support 16:9/4:3; Supported receiving frequency band: 5.8G Hz; Color system: PAL/NTSC;

		Input: Video (PAL/NTSC). II. TY-Loadv2 1. TFMINI module Measuring range: 0.1 m-12 m @90% reflectance, 0.1-7 m @10% reflectance, 0.1 m-12 m @90% reflectance (70Klux), 0.1-7 m @10% reflectance (70Klux) Accuracy: ±6cm@(0.1-6m) ±1%@(6m-12m) Distance resolution: 1 cm Frame rate: 1-10000 Hz (100 Hz by default) Resistance to ambient light: 70Klux Operating temperature: 0℃-60℃ Light source: VCSEL Central wavelength: 850 nm Eye safety class: Class1 Supply voltage: 5V±0.1v 2. Ultrasonic radar module Operating voltage: DC 2.4V-5.5V Static current: 2 mA Operating temperature: -20°-＋70° Output mode: Level or UART (jumper cap selected)

		Detection angle: Less than 15° Detection distance: 2cm-450cm Detection accuracy: 0.3cm+1% Serial port configuration in UART mode: Baud rate of 9,600, 1 start bit, 1 stop bit, 8 data bits, no odd-even check, no stream control. 3. Optical flow module Effective distance: 0cm-700cm Speed range: 0-500cm/s 4.OpenMV With STM32H743ViT6 as the core, the OV7725 camera chip is integrated (OV7725 supports multiple resolution image outputs, including VGA (640x480), QVGA (320x240)). The core machine vision algorithm is efficiently implemented in C language on a compact hardware module, and a Python programming interface is provided.
3	Onboard intelligent computer terminal	1. Power: 10-15 W; 2. Network: N/A; 3. Operating temperature -25 to 50 ℃; 4. Power input: 8 V-35 V;

		5. IP rating: IP45; 6. Memory: 8 GB 128-bit LPDDR4x 51.2 GB/S; Processor: NVIDlA Jetson Xavier NX; Interface type: DJI OSDK, DJI PSDK; Supported machine learning architecture: TensorFlow PyTorch, Caffe/Caffe2, MXNet, Keras
4	Zenmuse H20T	1. IP rating ≥ IP44, and eye safety class ≥ Class 1M; 2. The storage temperature of equipment is -20℃ to 60℃; 3. The PTZ is removable; 4. Angular jitter of PTZ ≤ ±0.01°; 5. The image sensor of zoom camera is of 1\1.7 CMOS, with effective pixels of no less than 20 million; 6. No less than two exposure modes are supported, including automatic exposure and manual exposure; 7. Two metering modes are at least supported, including spot metering and center-weighted metering. Metering lock is at least supported as well;

		8. The maximum speed of electronic shutter is no less than 8000/s; 9. ISO range of photo shooting: 100-25,600; 10. The video resolution is no less than 3,840×2,160 @ 30 fps; 11. The video shooting format of MP4 and photo shooting format of JPEG are at least supported; 12. The effective pixels of wide field camera are no less than 12 million; 13. The video shooting resolution of wide field camera is no less than 1,920×1,080 @ 30 fps; 14. The uncooled vanadium oxide (VO_x) microbolometer is used as the sensor of thermal imaging camera; 15. 1×, 2×, 4× and 8× digital zooms are at least supported; 16. The video shooting resolution of thermal imaging camera is no less than 640×512 @ 30 Hz; 17. The modes of point temperature measurement and area temperature measurement are at least supported; 18. The high temperature alarm function is at

		least supported; 19. The wave length of laser range finder is no less than 905 nm; 20. The measuring range of laser range finder is no less than 1,200 m; 21. The hybrid optical zoom of camera is no less than 23×; 22. The linkage shooting mode, as well as the function of simultaneous photo/video shooting of zoom, wide field and thermal imaging cameras are at least supported; 23. The maximum zoom is no less than 200×; 24. The point alignment function, super-clear matrix shooting function, and night shooting mode are at least supported; 25. The modes of manual focus, continuous automatic focus and single-point automatic focus are at least supported; 26. The infrared thermal imaging is provided at least with a color pallet, isothermal line, point temperature measurement, and digital zoom function.
5	Matrice 350 RTK	1. Symmetrical diagonal size of body: 650mm ≤

		diagonal size ≤1050mm; 2. Unfolding mode of arm: foldable; installation mode of tripod: quick disassembly and disassembly; unfold size: ≥810mm×670mm×430mm; 3. Maximum load of aircraft ≥ 2.7 kg, maximum takeoff weight ≥ 9 kg; 4. Operating frequency: 2.4GHz-2.4835GHz; 5.725GHz-5.580GHz; 5. Hovering accuracy: ±0.1 m (when visual positioning is working properly), or ±0.5 m (when GPS is working properly) 6. Maximum angular velocity of rotation: ≥ 300 °/s at the pitching axis, or ≥ 100 °/s at the heading axis; 7. Maximum climbing speed ≥ 6 m/s; maximum descending speed ≥ 5 m/s; maximum level flight speed ≥ 23 m/s; 8. Maximum flight altitude ≥ 5,000 m; 9. Maximum tolerable wind speed ≥ 12 m/s; 10. IP rating: ≥ IP55; 11. Maximum flight time (no-load): no less than 50 min;

		12. Maximum video transmission distance (no obstruction and interference) ≥ 15 km; 13. Operating environment temperature: -20 to 50℃; 14. The remote controller has a built-in highlight touch screen of no less than 7 inches in size; 15. It shall have Bluetooth and satellite positioning functions, and can support connection to the Internet through Wi-Fi or 4G wireless network card; 16. Support the use of the built-in battery at least, and can also support combined use of the built-in battery and the external battery to work; 17. There should be no less than three methods to use the remote controller to control the aircraft; the remote controller shall have an aircraft mode switch; 18. The type of battery of the remote controller shall be LiPo, and the battery life shall not be less than 5 hours; and the charging time shall be less than 2 hours; 19. Effective lighting distance of auxiliary light ≥ 5 m; the lighting mode is always-on;

		20. The resolution of FPV camera is no less than 960 p; frame rate ≥ 30 fps; 21. It has an automatic return flight function, no less than three return flight methods, and a landing protection function; 22. Bear the function of flight data recording. All flight data can be stored in the aircraft, and exported through the corresponding software with the aircraft activated and connected to the computer; 23. It has a built-in RTK module for the aircraft, which can provide strong anti-electromagnetic interference ability, so as to ensure reliable flight in complex strong magnetic interference environment; 24. There are no less than 3 PSDK expansion interfaces on the aircraft as required, with external power supply capacity ≥17V; 25. Support an advanced dual control mode, so that two personnel can control an aircraft at the same time; 26. Support two-way 1,080p video transmission; 27. The aircraft is equipped with a complete set

		of software APPs which support the functions of route planning and automatic operation etc. 28. The aircraft has a health management system, which contains the modules of anomaly diagnosis, log management, maintenance instruction and others; 29. The aircraft has a geofencing system, which can provide real-time airspace information, and also provide information on flight safety and flight restrictions to realize the function of flight restriction in special areas.
6	Payload of manipulator	1. Armspan: ≥600 mm; 2. Degree of freedom of arm: ≥4; 3. Maximum speed of end effector: ≥1 m/s; 4. Maximum load at end: ≥500 g; 5. It can be extended to the outside of the UAV rotor for operation without affecting the smooth hovering/flight of the UAV; 6. It supports separate control by remote controller; 7. It supports dual-channel and multi-view wireless transmission, and high-resolution, ultra-wide-angle and high-speed data acquisition

		and transmission; 8. It is equipped with real-time high-definition display screen, with high-frequency data transmission feedback and ultra remote control.
7	Load delivery module (TY-Droper)	1. Dimensions: ≥ 55×60×46 mm; 2. IP rating: ≥ IP4X; 3. Weight: ≥140 g; 4. Rated power: ≥ 10 W; 5. Mounting quantity: ≥ 6; 6. Unit mounting weight: maximum 5 kg; total mounting weight: maximum 20 kg; 7. The functions of single-point delivery and one-click overall delivery are at least supported; 8. Fast disassembly is at least supported.
8	UAV inspection and maintenance system (TY-ContestEDU-IAM450)	I. Product overview 1. Overall specifications: Length * width * height: 1640mm * 900mm * 1515mm (± 20mm excluding the indicator light and the extension part of monitoring device); 2. The equipment is equipped with four drawer type storage rooms and split type storage compartments. It is made of profiles and sheet metal, and the surface is anodized. The platform

		is configured with a foldable and expandable desktop (length * width: ≥ 598mm * 816mm), and equipped with an USB plug board, a ten-hole socket, a button box, an indicator light, an electric control box and a liftable monitoring system (an 2-megapixel infrared fixed-focus conch appearance hemispherical network camera is used). 3. The equipment consists of a training platform, an UAV assembly and commissioning module, a flight testing module, an UAV parameter configuration module, an UAV maintenance and damage assessment system, and a tool module to meet the needs of UAV assembly and commissioning, UAV maintenance, UAV flight testing, etc. II. Platform structure and composition (I) UAV assembly and commissioning module 1. Three frame types, namely "十"-shaped, "X"-shaped and "H"-shaped; 2. The center board components of each frame layout can meet the assembly needs of three models; 3. The platform provides five different

		specifications of motors, with 4 motors of each specification; 4. Three specifications of ESCs include 20A, 30A, and 40A, with 4 ESCs for each specification and a total of 12 ESCs; 5. Four specifications of plastic blades are available, with no less than 2 pairs of blades for each specification and a total of 8 pairs; 6. Battery specification: 4S, capacity: ≥ 5,000 mAh, discharge rate: ≥ 30C, quantity: 3; 7. The flight controller is required to support hovering hold mode, altitude hold mode, mission mode and return to home mode; 8. The flight controller is required to integrate a buzzer internally to eliminate the need for an external buzzer module, with a FLASH storage of no less than 8MB and a power supply range of 4.8-5.5V; 9. The flight controller internally integrates a buzzer sensor module, an airspeed sensor module, a magnetic compass sensor module, a barometric altimeter module, a magnetic compass and altimeter module, a gyroscopic sensor module, a CAN bus module, a sound

		alarm module, a multicolor indicator light module, a low voltage difference power supply module, a flight data storage module, a level conversion module, a parameter storage module, a main controller module, and an input-output controller module; 10. The peripheral serial port of the flight controller shall include a data transmission serial port, a RTK serial port, a GPS serial port, an external compass, an optical flow serial port, and a TFMINI serial port; 11. The flight controller uses a high-performance STM32H743VIT6 processor or a processor with equivalent performance or above, with a main frequency of no less than 480 MHz and a dual-precision floating-point hardware processor. The flight controller system has functions such as magnetic compass correction, single-parameter adjustment, multi-sensor fusion, and ultra-fast secondary development; 12. The operating frequency of the remote controller is 2,400 MHz - 2,483.5 MHz ; the number of channels is 12; support wide voltage input; support SBUS.PWM signal output, with

		the system power consumption ≥ 80 mA; the transmission rate ≥ 38 kbps; the remote control system has a signal emission indicator light, the modulation mode supports GFSK mode; and the remote controller has one three-stage switch and one two-stage switch; 13. Charger: It supports AC 100-240V input to meet the charging requirements of LiPo, LiHV, LiFe batteries, with a charging balance accuracy of less than 0.005 V, and also support discharge function. (III) UAV flight test module 1. The flight testing module includes a quadrotor UAV, and be equipped with a flight lifting device and a flight test cage to meet the needs of students for UAV forward, backward, left, and right tilt attitude verification and ensure safety during the flight commissioning process. 2. The size of safety protection cage is 800mm * 800mm * 700mm (± 20mm) (length * width * height); The overall fence is made of aluminum profiles, the mesh is a galvanized wire powder coated mesh, the base is a steel plate base, and the protection cage is equipped with 2 metal

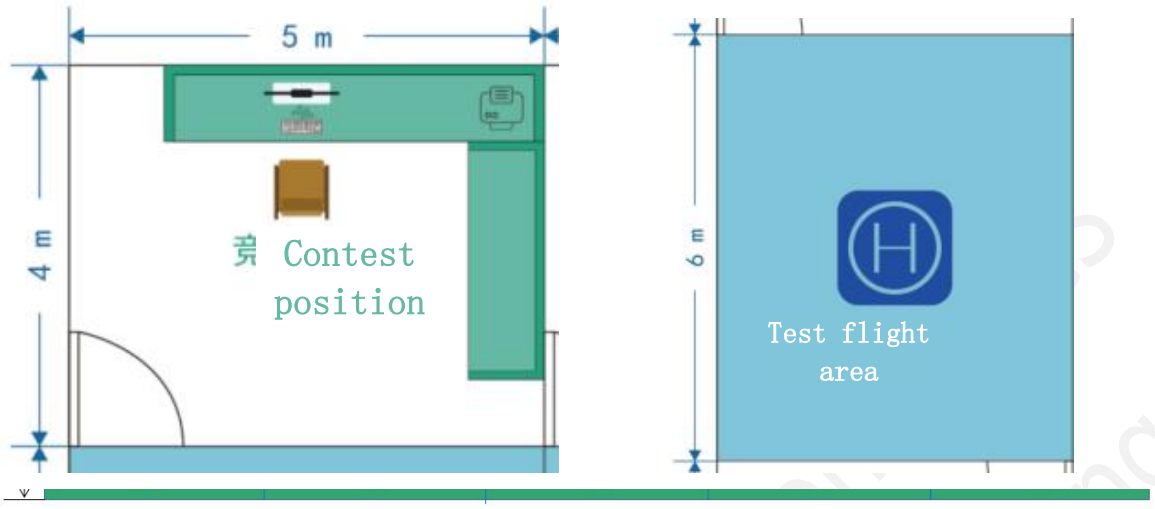
		hinged doors. 3. The UAV flight verification device is composed of customized aluminum parts, fixed on the desktop and connected to the bottom of the UAV. During UAV flight verification, it can rise no less than 5.5 cm, and when the UAV rises, it can perform forward, backward, left, and right tilt altitude verification. 4. The specific parameters for quadrotor maintenance UAVs are as follows: 1) The frame layout is "X"; the diagonal size of the body is not less than 450 mm; 2) Body material: Carbon fiber and aviation aluminum; The detachable ABS plastic shell is provided; 3) Support range of operating environment temperature: -10 - 40℃; 4) Specification of brushless motor: Stator diameter: ≥ 23 mm; height: ≥ 12 mm; KV value ≥ 1,100 KV, with right and left hand threads; 5) Blade material: Plastics; 6) Operating power supply for lower center board: 2S lithium battery, capacity: ≥ 600 mAh;

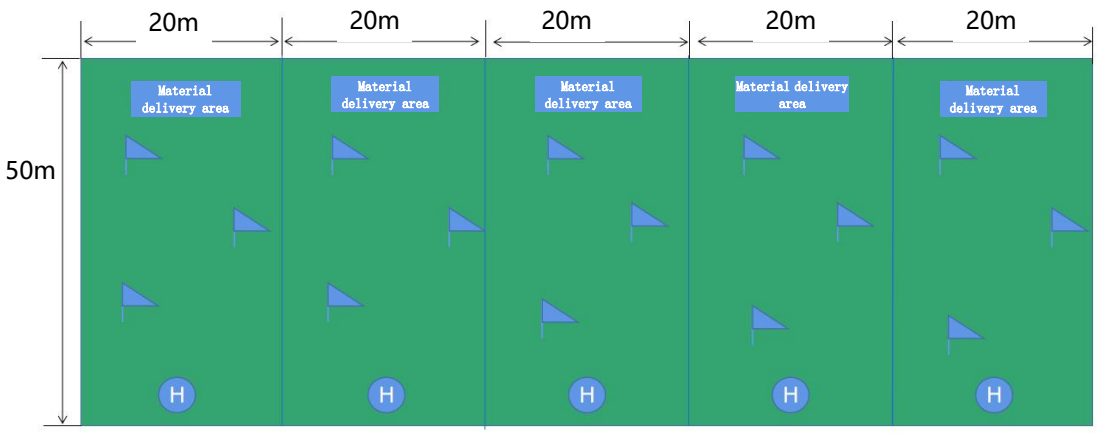
		7) Each arm is set with no less than 10 detection points; 8) The lower center board has independent power supply function, and the battery has an automatic charging interface and a protection function switch; 9) Main control chip: ESP32-D0WDQ6 or equivalent specifications or above; 10) Communication method/protocol: 2.4G wifi/MQTT; 11) The lower center board bears battery level detection and low battery indication functions;

7.3 Materials and equipment prohibited in the skills contest area

Any material and equipment carried by the contestants shall be declared (presented) to the experts. The experts can prohibit the contestants from using any item not relevant to the task execution or any item that may cause an unfair advantage to other contestants.

7.4 Recommended contestant area and workstation layout





8. Specific skill rules

Any specific skill rule shall not contradict or take precedence over the contest rules. Specific skill rules will provide details and clear descriptions of different aspects, which vary along with skills contests. They include but are not limited to personal computing devices, data storage devices, Internet access devices, work programs, and document management and distribution.

Topic / task	Specific skill rules
Applied	1) The contestants can only use the memory card provided

technology-USB and memory card	by the contest organizer. 2) Any contestant is not allowed to bring the memory card or any other portable storage device out of the workshop. 3) Memory cards or other portable storage devices must be returned to the chief expert or associate chief expert for safe storage.
Applied technology: personal laptop, tablet and mobile phone	1) Experts and interpreters have access to personal laptops, tablets and mobile phones. 2) Any contestant is not allowed to bring personal laptops, tablets or mobile phones into the workshop.
Applied technology-Personal camera	The contestants, experts and interpreters can use personal cameras and video recorders in the workshop after completing the contest propositions and obtaining the consent of the chief expert.
Evaluation of contest propositions	1) For each workstation (module), a competent expert with the highest level of expertise in the field shall be designated by the chief expert. When the contestants complete the contest propositions, the experts will control the OHS compliance and completion or incompletion of contest proposition points, which can only be assessed during the completion of tasks by the contestants. The designated experts shall be solely responsible for the fairness of the assessment on contestants.

	2) If the contestant and the expert are from the same organization on the workstation, the expert can be replaced when the module persists.
30% of the contest proportions will be changed during the contest	During the change of 30% of contest propositions (on the day of C-2), the expert must execute the following work: 1) According to the equipment and software (all modules) provided by the contest sponsor: -Update the installation and assembly drawing (or photo); -Update the electrical and pneumatic diagrams; -Update the task point instructions provided by the contest sponsor regarding the equipment software and hardware characteristics.
Contestants encounter a technical problem while achieving the task	1）In case of any technical problem (not due to the fault of the contestant) during the implementation of contest proposition, the contestant will be given additional time, which is equal to the time from the discovery of defect to the elimination of this defect. 2）If the technical problem is caused due to the fault of the contestant, the contestant will not be given additional time.
PPE (Personal Protective Equipment)	Personal protective equipment such as safety clothing, steel-toe shoes and gloves shall be provided by the contestants themselves.