ADVISORY CIRCULAR

SUBJECT:	DATE:	AC NUMBER:	VERSION:
REMOTE PILOT CERTIFICATION	2025-06-02	107-02	1.0

NOTE: THIS ADVISORY CIRCULAR IS PUBLISHED TO PROVIDE REGULATORY INFORMATION AND DESCRIBE ACCEPTABLE MEANS OF COMPLIANCE WITH THE GENERAL AUTHORITY OF CIVIL AVIATION REGULATIONS (GACAR).

CHAPTER 1 – INTRODUCTION

1.1 Purpose.

The purpose of this advisory circular is to provide information and instructions to persons seeking remote pilot certification for operations of civil Unmanned Aircraft Systems under GACAR Part 107.

1.2 Applicability.

This advisory circular is applicable to UAS operations intended to be conducted under GACAR Part 107, within the Kingdom of Saudi Arabia airspace. The scope includes remote pilot certification for operations within Standard Operating Limitations (operations in the Open category) and for advanced UAS operations (operations in the Specific category). Examples of operations in the Specific Category are:

- Night operations
- Operations over people
- Transport and/or dropping of cargo/goods
- Beyond Visual Line of Sight (BVLOS) operations
- Operations in airspace near aerodromes or heliports
- Operations with unmanned aircraft heavier than 25 kg
- Operations for humanitarian aid and emergency support
- Operations over mountainous terrain, areas with snow or above water
- Operations with multiple unmanned aircraft (e.g. for drone light shows)
- Operations in airspace designated for Unmanned Traffic Management (UTM)

1.3 Cancellation.

This is the first official version of this advisory circular and it cancels no other advisory circulars.

1.4 Related Regulatory Provisions.
GACAR Parts 48, 107

1.5 Related Reading Material.
GACA AC 107-01 Advanced Operations with Unmanned Aircraft

1.6 Definitions of Terms Used in this Advisory Circular.
GACAR Part 1 contains the main listing of defined terms and abbreviations used in the GACARs. Additional terms relevant for the Unmanned Aircraft Systems domain are defined in GACAR Part 107.

1.7 Approval.
This Advisory Circular has been approved for publication by the Executive Vice President of the Aviation Safety and Environmental Sustainability Sector of the General Authority of Civil Aviation.

1.8 Glossary.
The following terms are used throughout this document.

AAM	Advanced Air Mobility
AC	Advisory Circular
BVLOS	Beyond Visual Line Of Sight
DOC	Declaration Of Compliance
eVTOL	electric Vertical Take Off and Landing
GACA	General Authority of Civil Aviation
GACAR	General Authority of Civil Aviation Regulation
ICAO	International Civil Aviation Organization
KSA	Kingdom of Saudi Arabia
RPAS	Remotely Piloted Aircraft System
SANS	Saudi Air Navigation Services
SMS	Safety Management System
UA	Unmanned Aircraft
UAS	Unmanned Aircraft System
UTM	Un-crewed Traffic Management
VLOS	Visual Line Of Sight

CHAPTER 2 – GENERAL GUIDANCE

2.1 Types of remote pilot certifications.

The GACAR Part 107 Subpart C provides the regulatory requirements for issuing a remote pilot certificate for UAS operations to be conducted in the Open and Specific categories under GACAR Part 107.

Regulatory requirements for issuing a remote pilot certificate for basic UAS operations (i.e. in the Open Category, within Standard Operating Limitations) are provided in Subpart C of GACAR Part 107.

Advanced UAS operations require additional and operation-specific training to be conducted by (student) remote pilots at a remote pilot training organization, UAS operator or UAS manufacturer, which must have been approved by the GACA. The additional regulatory requirements for issuing a remote pilot certificate for advanced UAS operations (i.e. in the Specific Category) are provided by GACAR Part 107, § 107.91 and § 107.92.

The theoretical and practical training to be conducted by the remote pilots for UAS operations in the KSA under GACAR Part 107 should be competency-based and comply with the competency framework(s) as provided in Appendix A (for the Open Category) and Appendix B (for the Specific Category).

Note that UAS to be operated under GACAR Part 107 do not necessarily need to have an airworthiness certificate. A Declaration of Compliance (DOC) and/or approval of the UAS by the GACA will often be sufficient.

Training organizations providing remote pilot training for UAS operations under GACAR Part 107 will have to comply with several requirements in order to be granted approval by the GACA. These concern:

- Quality Assurance System
- Training and Procedures Manual
- Safety Management System (SMS)
- Training Programmes
- Facilities
- Personnel
- Any other items deemed necessary by the GACA

The stringency and level of detail required by the GACA will differ between organizations providing remote pilot training for the Open Category, for the Specific Category and/or for RPAS operations.

Domestic Advanced Air Mobility (AAM) operations with (unmanned) electric Vertical Take-Off and landing (eVTOL) aircraft that may carry passengers and international RPAS operations conducted in accordance with ICAO Annex 6 Part 4 RPAS operations are outside the scope of the GACAR Part 107. Remote pilots that wish to conduct international RPAS operations will have to comply with standards that are consistent with ICAO Annex 1 *Personnel Licensing* – Ch. 2B *Licences and ratings for remote pilots*. Remote pilots that wish to conduct operations outside the scope of GACAR Part 107 and not within the Open and/or Specific Categories of UAS operations, are requested to contact GACA for further guidance.

2.2 Process overview.

An applicant for a Remote Pilot Certificate for the Open Category (RPC-O) or for the Specific Category (RPC-S) must make the application through the GACA UAS Registration Portal, which is available at https://uas.gaca.gov.sa/uas.

Step 1 Application process

After the GACA receives the application, the applicant will be vetted through a security background check. If the vetting is successful and other requirements are fulfilled, the applicant will be able to conduct training.

Step 2 Theoretical knowledge examination

After the (student) remote pilot has obtained the required theoretical knowledge, he or she may apply for a theoretical exam with 60 questions. Proof of successful completion is issued by GACA to the applicant upon a 75% score. Retesting after failure in person at GACA is only possible at least 14 days after having failed an exam. Retesting through an online system, if available, may be done immediately after failure.

Step 3 Practical skills assessment

A practical skills assessment will be required for any UAS operation in the Specific Category as described in GACAR Part 107 Subpart D. The assessment must be done by a Designated Remote Pilot Examiner (DRPE) approved and appointed by the GACA; and must only be conducted after the applicant has successfully passed a theoretical exam and has received the associated theoretical certificate from the GACA.

2.3 Theoretical knowledge exams.

The theoretical knowledge examinations for the Open Category should be done through an online system approved by the GACA, if available. Such an online system may be offered by GACA Personnel Licensing or by an entity recognized and approved by the GACA for conducting theoretical knowledge examinations for the Open Category. GACA may also approve individual request(s) to conduct a theoretical knowledge examination for the Open Category as a face-to-face examination at the facilities of the GACA.

Theoretical knowledge examinations for the Specific Category should be conducted as a face-to-face examination at the facilities of the GACA or of an entity recognized and approved by the GACA for conducting such theoretical knowledge examinations. The certificate of successful completion of the theoretical knowledge exams will be issued by the GACA (upon achievement of a 75% score).

The theoretical knowledge examination facilities of the GACA are located in Riyadh:

General Authority of Civil Aviation (GACA)
Personnel Licensing

Aviation Safety & Environmental Sustainability Sector
GACA Headquarters – Building 1
Riyadh 13443

2.4 Validity of existing remote pilot certificates

Remote pilots in the possession of a remote pilot certificate issued under GACAR 107 Subpart E Model Aircraft may request the GACA for the issuance of RPC-O. The validity of the issued RPC-O will be until at least 1 July 2026, after which the remote pilot will have to reapply for the examination for RPC-O.

Remote pilots in the possession of a remote pilot certificate issued under GACAR Part 107 may request the GACA for the issuance of RPC-O or RPC-S. The validity of the issued RPC-O will be until at least 1 January 2028. The validity of issued RPC-S will be at least until 1 July 2026.

2.5 Practical skills assessments.

Regarding practical-skills training and assessment for remote pilots, DRPEs approved and appointed by the GACA should consider the competencies and observable behaviors that are defined in the Appendices of this Advisory Circular. The practical-skills training and assessment should be adapted to characteristics of the intended UAS operation and the functions available on the UAS.

An accreditation of completion of the practical skill training will be delivered to the (student) remote pilot by the remote pilot training organizations and UAS operators approved by the GACA, if an assessment report concludes that the student remote pilot has achieved a satisfactory level of practical skill. The issuance of such accreditation of completion of practical skills training will be notified to the GACA. The assessment report, which will be completed after the practical skill assessment and which will be archived by the DRPE having provided the training and skills assessment, contains at least:

a) student remote pilot's identification details;
b) identity of the person responsible for the practical skill assessment;
c) description of the type(s) of operation for which the practical skill assessment has been performed;
d) performance marks for each action performed by the student remote pilot;
e) an overall practical skill assessment of the student remote pilot's competencies;
f) practical skill assessment feedback providing guidance on areas for improvement where applicable;
g) date and signature by the person responsible for the practical skill assessment.

For UAS operations in the Specific Category, remote pilots only need to complete the operation-specific endorsement modules that reflect the intended UAS operation(s). For example, in case of Beyond Visual Line Of Sight (BVLOS) operations, the remote pilot should complete the endorsement training module 'BVLOS operation'; however, if the BVLOS operation concerns transport of dangerous goods, then the remote pilot should also complete the endorsement training module 'Transport of dangerous goods'.

Scenario-based training reflecting the intended UAS operation(s) should be used to fortify learning in an

operational environment and improve situational awareness. The scenarios should include realistic normal, abnormal, and emergency scenarios that are drafted considering the required competencies and behaviors.

2.6 Entities for practical skill training and assessment.

Practical-skills training and assessment may only be done by the following entities:

- Remote pilot training organizations approved by the GACA
- UAS operators approved by the GACA to deliver training

The entity approved by the GACA should document the training elements, including the following:

a) nominated personnel conducting practical skill training and assessment, including descriptions of:
   - respective personnel's competence;
   - personnel's duties and responsibilities;
   - chart of the organization showing the associated chains of responsibility.
b) procedures and processes used for practical skill training and assessment, including the training syllabus addressing the practical skills, in accordance with the Appendices A and/or B;
c) a description of the UAS and any other equipment, tools and environment used;
d) a template for the assessment report.

The practical skills training should only be provided by highly skilled experienced remote pilot instructors. The practical skills assessment should only be conducted by DRPEs, approved and appointed by GACA.

The personnel responsible for the practical skill training and practical skill assessment tasks should:

a) have the competence to conduct these tasks;
b) be impartial and shall not participate in assessments if they feel that their objectivity may be affected;
c) have relevant theoretical knowledge and practical skill training experience, complete knowledge of the requirements and remote pilot certification for the practical skill assessment tasks that they carry out;
d) have the ability to administer the declarations, records and reports that demonstrate that the relevant practical skill assessments have been carried out and to draw the conclusions of those assessments;
e) not disclose any information supplied by the remote pilot training organization, UAS operator and/or remote pilot to any person other than the GACA upon request.

Any entity that intends to be approved by the GACA for conducting practical skills training and assessment of remote pilots, will have to declare to the GACA compliance with all the requirements for the intended UAS operation(s) to be trained and assessed by submission of an Application Form obtained from GACA.

CHAPTER 3 – SUMMARY OF REQUIREMENTS

3.1 Remote pilot certification for the Open Category

107.61 Applicability.

This chapter provides guidance regarding the Remote Pilot Certification requirements and procedures for persons acting as remote pilot (in command) of Unmanned Aircraft Systems, including model aircraft, operated in the Kingdom of Saudi Arabia in the Open and Specific Categories of UAS operation.

Any individual acting as remote pilot in compliance with GACAR Part 107, must at least a) have obtained a Remote Pilot Certificate issued by GACA or b) have been registered as student remote pilot by GACA.

107.63 Offenses Involving Psychoactive Substances.

Remote pilots and student pilots will have to comply with any law relating to the growing, processing, manufacture, sale, disposition, possession, transportation, or importation of psychoactive substances.

Remote pilots and student remote pilots will have to comply with requests, from authorized Government representatives, to tests to indicate the presence of psychoactive substances in the body.

107.65 Eligibility.

The applicant will have to demonstrate the required skills by successful completion of the theoretical and practical elements of the training course(s), including any theoretical knowledge examination and practical competency assessments taken in the KSA, or hold a foreign remote pilot certificate acceptable to GACA.

After the GACA receives the application, the applicant will be vetted through a security background check. If the vetting is successful and all other requirements are fulfilled, the applicant will be able to conduct training and the GACA will issue a Remote Pilot Certificate upon successful completion of the exam(s). If the vetting is not successful, the applicant will be disqualified and no remote pilot certificate will be issued.

107.71 Aeronautical knowledge recency.

Aeronautical knowledge recency is considered to be sufficiently demonstrated by passing a relevant initial or recurrent aeronautical knowledge test covering the required areas of aeronautical knowledge within the previous 24 months. The test(s) may be taken at the GACA or at any other entity approved by the GACA.

107.73 Knowledge tests: General procedures and passing grades.

An applicant for a knowledge test must have proper identification at the time of application that contains the applicant's: photograph, signature, date of birth, permanent mailing address and/or residential address.

The minimum passing grade for all the aeronautical knowledge tests will be to have at least a 75% score.

107.79 Initial and recurrent knowledge tests.

An initial aeronautical knowledge test covers the following areas of knowledge:

(1) Applicable regulations relating to small unmanned aircraft system rating privileges, limitations, and flight operation;

(2) Airspace classification, operating requirements, and flight restrictions affecting small unmanned aircraft operation;

(3) Aviation weather sources and effects of weather on small unmanned aircraft performance;

(4) Small unmanned aircraft loading;

(5) Emergency procedures;

(6) Crew resource management;

(7) Radio communication procedures;

(8) Determining the performance of small unmanned aircraft;

(9) Physiological effects of drugs and alcohol;

(10) Aeronautical decision-making and judgment;

(11) Airport operations; and

(12) Maintenance and preflight inspection procedures.

A recurrent aeronautical knowledge test covers the following areas of knowledge:

(1) Applicable regulations relating to small unmanned aircraft system rating privileges, limitations, and flight operation;

(2) Airspace classification and operating requirements and flight restrictions affecting small unmanned aircraft operation;

(3) Emergency procedures;

(4) Crew resource management;

(5) Aeronautical decision-making and judgment;

(6) Airport operations; and

(7) Maintenance and preflight inspection procedures.

(8) Demonstrate a preflight check and successfully pass basic maneuvers of the flight for practical test.

107.81 Initial and recurrent training courses.

An initial training course covers the following areas of knowledge:

(1) Applicable regulations relating to small unmanned aircraft system rating privileges, limitations, and flight operation;

(2) Effects of weather on small unmanned aircraft performance;

(3) Small unmanned aircraft loading;

(4) Emergency procedures;

(5) Crew resource management;

(6) Determining the performance of small unmanned aircraft; and

(7) Maintenance and preflight inspection procedures.

A recurrent training course covers the following areas of knowledge:

(1) Applicable regulations relating to small unmanned aircraft system rating privileges, limitations, and flight operation;

(2) Emergency procedures;

(3) Crew resource management; and

(4) Maintenance and preflight inspection procedures.

3.2 Remote pilot certification for the Specific Category

107.92 Endorsement training for the Specific Category

The following advanced UAS operations require the remote pilot(s) to demonstrate that he/she is qualified, trained and competent through successful completion of dedicated endorsement training module(s):

1. Night operations;
2. Operations above people;
3. BVLOS operations (> 1 km);
4. Operations at aerodromes or heliports;
5. Operations in non-segregated airspace;
6. Transport and/or dropping of cargo/goods;
7. Operations with multiple and/or swarms of unmanned aircraft;
8. Operations over mountainous terrain, areas with snow or above water;
9. Transport of dangerous goods for humanitarian aid or emergency support;
10. Any UAS operation other than in accordance with Subpart B, for which the GACA considers that the risk of the operation cannot be adequately mitigated without remote pilot endorsement training.

Appendix B provides competencies and observable behaviors to be demonstrated by the applicant(s). Only the endorsement training modules for the intended UAS operations will have to be successfully completed at a GACA approved UAS operator, UAS manufacturer or remote pilot training organization.

CHAPTER 4 – FOR FURTHER INFORMATION

4.1 Responsible Department(s).

The Unmanned Aircraft Systems (UAS) Department of the GACA Aviation Safety and Environmental Sustainability Sector is responsible for remote pilot certification in the Kingdom of Saudi Arabia.

4.2 Contact Details.

The Unmanned Aircraft Systems Department can be contacted at the following coordinates:

In person or by mail:
General Authority of Civil Aviation (GACA)
Unmanned Aircraft Systems Department
Aviation Safety & Environmental Sustainability Sector
GACA Headquarters – Building 1
Riyadh 13443

By email:
uas-ops@gaca.gov.sa

Appendix A Competency framework for the Open Category

The competencies required for issuing a remote pilot certificate for the Open Category under GACAR Part 107 include aeronautical knowledge (successful completion of exam) and practical training (self-declaration).

Aeronautical knowledge topics (The minimum acceptable duration for the theory part is 16 Hours)

Applicable Regulations

- GACAR Parts 48, 107.

Airspace Classification, Operating Requirements, and Flight Restrictions

- Introduction
- Controlled Airspace
- Uncontrolled Airspace
- Special Use Airspace
- Other Airspace Areas
- Air Traffic Control and the National Airspace System
- Visual Flight Rules (VFR) Terms & Symbols
- Notices to Airmen (NOTAMs)

Aviation Weather Sources

- Introduction
- Surface Aviation Weather Observations
- Aviation Weather Reports
- Aviation Forecasts
- Convective Significant Meteorological Information (WST)

Effects of Weather on Small Unmanned Aircraft Performance

- Introduction
- Density Altitude
- Performance
- Measurement of Atmosphere Pressure
- Effect of Obstructions on Wind
- Low-Level Wind Shear
- Atmospheric Stability
- Temperature/Dew Point Relationship
- Clouds

- Fronts
- Mountain Flying
- Structural icing
- Thunderstorm Life Cycle
- Ceiling
- Visibility

Small Unmanned Aircraft Loading

- Introduction
- Weight
- Stability
- Load Factors
- Weight and Balance

Emergency Procedures

- Introduction
- Inflight Emergency

Crew Resource Management

Radio Communication Procedures

- Introduction
- Understanding Proper Radio Procedures
- Traffic Advisory Practices at Airports without Operating Control Towers

Determining the Performance of Small Unmanned Aircraft

- Introduction
- Effect of Temperature on Density
- Effect of Humidity (Moisture) on Density

Physiological Factors (Including Drugs and Alcohol) Affecting Pilot Performance

- Introduction
- Physiological/Medical Factors that Affect Pilot Performance
- Vision and Flight

Aeronautical Decision-Making and Judgment

- Introduction
- History of ADM
- Risk Management
- Crew Resource Management (CRM) and Single-Pilot Resource Management
- Hazard and Risk
- Human Factors
- The Decision-Making Process
- Decision-Making in a Dynamic Environment
- Situational Awareness

Airport Operations

- Introduction
- Types of Airports
- Sources for Airport Data
- Latitude and Longitude (Meridians and Parallels)

Maintenance and Preflight Inspection Procedures.

Practical Training Topics (The minimum acceptable duration for the practical part is 8 Hours)

Perform pre- and post-operation actions and procedures

Launch and landing areas

- Explain considerations in locating and setting-up a launch and recovery area.

Pre-operation actions and procedures

- obtain, interpret and apply information contained in the UAS operator's documented practices and procedures including information relating to the following:
  - weather forecasts;
  - local observations;
  - NOTAMs;
  - area approvals;
  - other aeronautical information such as information from GACA / SANS.
- decide whether the current and forecast weather conditions are suitable for the proposed operation;
- decide whether the UAS is serviceable for the proposed operation;
- decide whether the aircraft batteries are the correct type and serviceable.

Perform pre-flight inspection

- assemble and prepare (as needed) the UAS for operation;
- conduct a post-assembly inspection of the UAS;
- ensure that locking and securing devices, covers and bungs for the UAS are removed;
- complete a pre-operation inspection as set out in the UAS operator's documented practices and procedures;
- start the operation of the UAS in accordance with the UAS operator's documented practices and procedures for the operation of the UAS.

Weight and balance

- Use the UAS operator's documented practices and procedures to check:
  - aircraft is loaded within limits;
  - center of gravity is within limits.

Post-operation actions and procedures

- shut down aircraft in accordance with the operations manual;
- conduct post-operation inspection and secure the aircraft (if applicable);
- complete all required post-operation administration documentation;
- disassemble aircraft for transport.

Energy management

Plan energy requirements

- Use the UAS operating manual to work out the duration of the flight taking into account:
  - operational environment (various wind and temperature conditions);
  - relevant abnormal or emergency conditions, contingencies.

Manage battery system or systems

- if the energy source for the UAS is a battery or battery systems:
  - prior to launch, verify the time available for the flight given the current battery charge;
  - ensure the batteries are secured to the UAS for the operation;
  - ensure the battery connectors are connected properly and secure for the operation;
  - monitor energy usage during the operation;
  - maintain a battery log for the operation;
  - perform battery changes correctly;
- if the energy source of the remote pilot station for the UAS is a battery or battery systems — manage the remote pilot station power supply to ensure sufficient energy to complete an operation with a suitable reserve.

Recharge battery or batteries

- inspect the battery to ensure it is safe to be recharged;
- ensure the battery charger is setup correctly for the type of battery;
- correctly connect and disconnect a battery to the battery charger;
- perform battery quality and quantity checks after charging;
- calculate the time it would take to use and recharge a battery for a particular operation;
- if a battery is unsafe for an operation — recognize that the battery is unsafe for the operation;
- check that the battery has sufficient charge

Manage crew, payload and bystanders for the UAS operation

Manage bystanders

- ensure that bystanders remain a safe distance away from the operation;
- ensure bystanders are aware of, and avoid interference with, the operation and the systems controls used in the operation such as the remote pilot station;
- manage bystander safety in the event of abnormal or emergency situation arising as a result of the operation;
- demonstrate effective oral communication to bystanders in a clear, effective manner.

Manage people involved in the operation

- establish and maintain clear communication with people involved to ensure a safe operation of the UAS;
- carry-out effective and safe handovers of remote pilot responsibilities before, during and after UAS operation.

Navigation and operations

Operational "rules"

- operate the UAS in compliance with the requirements relating to operating the UAS mentioned in GACAR Part 107 "Subpart B – Operating Rules";
- identify the location and relevant parts of the UAS operator's documented practices and procedures relating to the operation of the UAS.

Operational basics

- describe different traffic patterns of manned aircraft at aerodromes;
- describe suitable vertical and horizontal separation distances between the UAS and other aircraft;
- explain when an incident or accident report must be submitted in relation to an operation of the UAS.

Orientation

- interpret a given map or chart in relation to a proposed operation of the UAS and work out its implications for the operation;
- explain the significance of track and ground speed in relation to an operation of the UAS;
- state the relevance of height, altitude and elevation in relation to different circumstances in which the UAS is operated.

Use of aeronautical charts

- On a visual navigation chart — identify, without reference to the chart legend:
  - major features, including roads, rivers, lakes;
  - Aerodromes, obstacles, spot heights, including elevation or height above terrain;
  - identify airspace boundaries and symbols;
  - interpret other symbols with reference to the chart legend.

Operations preparation

- identify the operational documentation required for a planned operation;
- read and interpret a NOTAM, using NOTAM decode information;
- obtain and comply with ATC clearances;
- be aware of "fly neighborly" areas and environmental protection;
- read and interpret a local weather forecast and determine whether it would be suitable to operate the UAS for the operation given the forecast;
- read and interpret an aeronautical weather forecast and determine whether it would be suitable to operate the UAS for the operation given the forecast.

Non-technical skills for operation

Maintain effective lookout

- Maintain obstacle and traffic separation using a systematic visual scan technique at a rate determined by location, visibility and terrain.

Maintain situational awareness

- collect information to ensure the continued safe operation of the UAS;
- non-weather hazards to operations (for example, thermal plumes, powerlines, animals).

Assess situations and make decisions

- identify problems that may affect the safe operation of the RPA;
- analyze the problems;
- identify solutions to the problems;
- assess the solutions and risks of the solutions;

- decide on a course of action;
- if appropriate — communicate the proposed course of action;
- if appropriate — allocate tasks relating to the proposed course of action;
- take actions to achieve optimum outcomes for the operation;
- monitor progress of the course of action;
- adjust the course of action to achieve the optimum outcomes for the operation.

Set priorities and manage tasks

- organise workload and priorities to ensure safe operation of the UAS;
- anticipate events and tasks that may occur during the operation;
- plan events and tasks for the operation so that the events and task occur sequentially;
- use technology to reduce workload and improve cognitive and manipulative activities during the operation.

Maintain effective communications and interpersonal relationships

- establish and maintain effective and efficient communications and interpersonal relationships with all stakeholders to ensure the optimum outcome of the operation;
- define and explain objectives to stakeholders;
- recognize hazardous attitudes and mindsets;
- demonstrate a level of assertiveness that ensures the optimum completion of the operation.

Recognize and manage threats

- identify environmental or operational threats likely to affect the safety of the operation;
- identify if competing priorities and demands may represent a threat to the safety of the operation;
- develop and implement countermeasures to manage threats;
- during the operation, monitor and assess the progress of the operation to ensure a safe outcome and modify actions accordingly;
- identify and manage fatigue.

Recognize and manage errors

- apply the sUSA operator's documented practices and procedures.
- prevent aircraft handling, procedural or communication errors;
- during the operation, identify errors in the operation of the UAS before the safety of the operation is affected;
- during the operation, monitor the following to identify potential or actual errors:
  - in the UAS using a systematic scan technique;
  - caused by the environment in which the UAS is operating;
  - by the other individuals who have been assigned duty.

Automated flight management systems for UAS.

Automated operation control

- demonstrate an automated launch and initial climb of the UAS;
- modify the pre-programmed flight path while the UAS is in flight;
- demonstrate an automated approach and landing/recovery of UAS.

Emergency procedures

- interrupt an automated operation of the UAS and redirect the UAS to a safe point;
- demonstrate a baulked landing procedure;
- demonstrate the procedure to terminate the automated operation of the UAS.

Ground operations and launch

Ground operations —taxiing

- When taxiing on the ground:
  - perform applicable taxi checks, including instrument checks as required;
  - maintain safe taxi speed and control of the UAS;
  - maintain safe spacing from obstructions, and persons;
  - avoid causing a hazard to another aircraft, objects or persons;
  - apply correct handling techniques to take wind into account;
  - use checklists at appropriate times during ground operations.

Ground operations — launch

- For hand launching of the UAS:
  - demonstrate the correct way to hold the UAS pre-launch;
  - demonstrate the necessary precautions when hand launching;
  - ensure the flight path for launching the UAS is clear of other aircraft, people and other hazards before launch;
  - work out a plan of action, in advance, to ensure the safest outcome in the event of abnormal operation.

Launch actions

- If performing the launch of a UAS:
  - demonstrate correct launch technique;
  - perform the post-launch checks mentioned in the UAS checklist set out in operator's operations manual;
  - demonstrate smooth application of power and a controlled initial climb.

Normal operations

- Straight and level
- operate the UAS in straight and level flight at the desired altitude;
- identify and avoid terrain and traffic when operating the UAS.

Climb

- operate the sUSA at a constant angle of climb;
- operate the sUSA at a constant rate of climb.

Trim

- If required, trim the UAS to maintain the desired flight path for the flight.

Turns

- operate the UAS to perform turns that are properly coordinated;
- operate the UAS to perform turns that are conducted within a nominated area;
- operate the UAS so that level turns are at a constant altitude.

Descent

- descend the UAS at a constant angle of descent;
- descend the UAS at a constant rate of descent;
- use lift/drag devices appropriately during the descent of the UAS.

Land/recover UAS

Recover UAS

- perform a rectangular circuit, minimum width 100 m, minimum length 200 m, followed by a straight-line approach to a nominated point and landing;
- allow sufficient space to align the UAS for a stabilized approach to the place at which the UAS will land or be recovered;
- maintain a constant landing position aim point for the UAS;
- if applicable, achieve a smooth, positively-controlled transition from final approach to touchdown, including the following:
  - minimize ballooning during flare;
  - touchdown at a controlled rate of descent, in the specified touchdown zone;
  - maintain positive directional control and cross-wind correction after landing, where applicable;
  - perform cross-wind landings.

Conduct a missed approach

- recognize the conditions when a missed approach should be executed;

- make the decision to execute a missed approach in a timely way;
- carry out a missed approach and reposition for landing by doing the following:
  - select power, attitude and configuration to safely control the UAS;
  - maneuver the UAS clear of the ground and conduct after launch procedures;
  - make allowance for wind velocity during go-around.

Advanced maneuvers

Enter and recover from stall

- perform pre-maneuver checks for stalling the UAS;
- recognize stall signs and symptoms;
- control the UAS by applying the required power and pitch, roll and yaw inputs as appropriate in a smooth, coordinated manner to recover from the following maneuvers:
  - incipient stall;
  - stall with full power applied;
  - stall without power;
  - stall when climbing, when descending, during an approach to land configuration and when turning;
  - perform stall recovery with the UAS as follows:
  - positively reduce angle of attack;
  - use power available and available height to maximize the aircraft energy state;
  - minimize height loss for simulated low altitude condition;
  - re-establish desired flight path, and controlled and balanced operation of the UAS.

Figure of 8

- Operate the UAS to demonstrate a figure of 8, without loss of height and with the crossover point in front of the operator.

Sideslip UAS (Depending on UAS type and if permitted for the UAS by its manufacturer)

- perform a straight, forward sideslip by:
- inducing slip to achieve increased rate of descent while maintaining track and airspeed; and
- adjusting the rate of descent by coordinating the angle of bank and applied rudder;
- recover the UAS from a sideslip and return it to controlled and balanced flight.

Control at a distance

- demonstrate accurate control and navigation at a distance of at least 200 m;
- perform a horizontal rectangular pattern at a distance of 200 m;
- demonstrate re-orientation of the UAS after it has been re-oriented by the instructor without the student watching.

Abnormal and emergency operations

Manage loss of thrust — launch

- correctly identify loss of thrust after the UAS has been launched;
- apply the highest priority to taking action to control the UAS;
- maintain control of the UAS;
- perform initial actions from memory consistent with the operator's documented practices;
- maneuver the UAS to achieve the safest possible outcome;
- confidently state the actions being performed

Recover from unusual aircraft attitudes

- identify unusual attitude of the UAS during flight.
- recover the UAS from unusual attitudes and return to controlled and balanced operation.

Loss of control link

- Operate the UAS to demonstrate the loss of link procedures.

Appendix B Competency framework for the Specific Category

GACAR Part 107.92 states that specific endorsement training module(s) must be successfully completed by remote pilots before they will be able to certain advanced UAS operations under Part 107. This includes:

- Night operations
- Operations above people
- BVLOS operations (> 1 km)
- Low altitude (< 400 feet) operations near aerodromes or heliports
- Operations in non-segregated airspace
- Transport and/or dropping of cargo/goods
- Operations with multiple and/or swarms of unmanned aircraft
- Operations over hilly or mountainous terrain
- Transport of dangerous goods for humanitarian aid or emergency support

The Tables below provide the competencies and observable behaviors for these specific training modules.

Table 1 Night operations

Competency	Observable behavior
General	• Recognize the meaning of the definition of 'night' or other similar wording that is used for night flight. • operational area, especially during the critical phases of take-off and landing. • Recognize that during night flight it is hard to estimate the distance between the UA and other obstacles if visibility is only ensured by the UA lights. • Recognize that a visual obstacle avoidance system may be less accurate in night-time operations. • Understand that if the sight of the UA is lost at night, return-to-home (RTH) should be immediately followed. • Recognize that an infrared radiation (IR) camera allows one to see enough at night. Turning off the front green flashing light might improve the view because there will be no reflection in the on-board camera. • Recognize that the IR camera does not help in case of rain/humidity, and that the IR visibility significantly decreases. • Explain the use of the green flashing light at night. • Explain the use of navigation lights, position lights, anti-collision lights, and other lights for UA controllability. • Explain the use of lights (e.g. navigation, position, or anti-collision lights) for recognising the presence of manned aircraft.
Degradation of visual acuity	• Recognize that flying the UA at night degrades visual perception. • Recognize night myopia, caused by the increasing pupil size. At low-light levels, without distant objects to focus on, the focusing mechanism of the eye may go to a resting myopic position. • If night-vision goggles are used, know how they function.
Night illusions	• Define the term 'night illusion'.

	• Recognize and overcome visual illusions that are caused by darkness, and understand the physiological conditions that may degrade night vision. • State the limitations of night vision techniques at night and by day.
Altered visual-scanning techniques	• State the limitations of the different visual-scanning techniques at night and by day.
Altered identification of obstacles	• Explain the effect of obstacles on the take-off distance that is required at night.

Table 2 Operations above people

Competency	**Observable behavior**
Identification of populated areas and assemblies of people	• Explain the definition of 'populated area' and 'assemblies of people'.
Optimising flight paths to reduce risk of exposure	• Explain the effects of the following variables on the flight path and take-off distances: – take-off procedure; – obstacle clearances both laterally and vertically; – understand the lethality of a UAS including debris area through flying parts after a crash; – recognize the importance of a defined emergency landing area.
Likely operating sites and alternative sites	• Recognize the different operating sites and alternative sites on the route of the overflight.
Adequate clearance for wind effects, especially in urban environment	• Explain how the wind changes at very low height due to its interaction with orography and buildings.
Obstructions (wires, masts, buildings, …)	• Explain the effect of obstacles on the required takeoff distance. • Interpret all available procedures, data, and information regarding obstructions that could be encountered during overflight
Avoiding third-party interference with the UA	• Explain how to avoid third-party interference with the UA.
Minimum separation distances from persons, vessels, vehicles & structures	• Explain the importance of minimum separation distances from persons, vessels, vehicles, and structures.
Impact of electromagnetic interference, i.e. high-intensity radio transmissions	• Describe the physical phenomenon 'interference'. • Explain in which situations electromagnetic interference could occur, particularly with regard to electromagnetic emissions and signal reflections peculiar to an urban environment. • Explain their impact on the UAS system (i.e. C2 link GNSS quality, etc.)
Crowd control strategies & public access	• Explain the importance of ensuring that no one is endangered within the take-off and landing area. • Describe the different crowd control strategies. • Explain the importance of having knowledge of public access.

Table 3 BVLOS operations

Competency	Observable behavior
Operation planning: airspace, terrain, obstacles, expected air traffic, and restricted areas	• Explain the operation planning for BVLOS operations: – check the flying conditions (e.g. geographical zone, NOTAM) and obstacles along the planned route; – secure the necessary documentation before the BVLOS operation; – know and comply with the local conditions in the area where the BVLOS operation takes place; – ensure communication with the air traffic controller (ATCO), depending on the type of airspace within which the BVLOS operation is planned to be conducted; – plan the BVLOS operation including flight route and response to contingency and emergency events; – in uncontrolled airspace, check the actual traffic level of manned traffic along the planned route, including low-level traffic such as paragliders, hang gliders, helicopters, model aircraft, seaplanes and other possible traffic; – in uncontrolled airspace, verify that the UAS operation has been notified to manned aviation using, e.g. NOTAM, or other means used by manned aviation; – how to employ airspace observers (AOs), when needed; – consider the C2 link limitations (e.g. maximum range and presence of obstacles); and – use of conspicuity devices or traffic information / detection of incoming aircraft – deconfliction and emergency manoeuvres.
Sensor systems and their limitations	• State the limitations of the different sensor systems.
Cooperative	• Identify the cooperative and non-cooperative detect-and-avoid (DAA) sensor/system capabilities for UA, if applicable.
Roles and responsibilities of the remote pilot to remain clear of collision	• Explain the traffic alert system and traffic collision avoidance system (TCAS) phraseologies, and how these systems work. • Identify the roles and responsibilities of the remote pilot to remain clear of collision. • Explain the collision avoidance methodology that is used in the operation to keep the UA clear of other traffic.
Command, control and communication (C3) link performance and limitations	• Know the definition of ‘C3’. • Understand the relation between communications and effective command and control (C2). • Understand the basic C3 structure. • Understand the use of true and relative motion displays. • Understand the problems inherent in C3.
Signal or communications latency for the C2 link	• Understand the impact of signal or communications latency on the C2 link. • Explain what can cause, and how to detect, a signal or communications latency.

	• Describe the actions that are required following a signal or communications latency.
Planning for the loss of C2 link or for system failure	• Understand the impact of a loss of C2 link. • Explain what can cause, and how to detect, a system failure. • Describe the actions that are required following a loss of C2 link. • Describe how to plan the contingency routes in case of a loss of the C2 link.
Interpreting separate data sources	• Interpret different data sources to identify whether during flight the UA follows the planned route.
Crew resource management (CRM)	• Explain the importance of CRM for BVLOS operations.

Table 4 Low altitude (< 400 feet) operations near aerodromes or heliports

Competency	**Observable behavior**
Air traffic management procedures	• Describe the ATM procedures for low-altitude operations.
Radio communications and phraseology	• Define the meaning of 'standard words and phrases'. • Recognize, describe, and use the correct standard phraseology for each phase of a visual flight rules (VFR) flight. • Explain the selective calling (SelCal) system and aircraft communications addressing and reporting system (ACARS) phraseologies. • Explain the traffic alert and collision avoidance system (TCAS) phraseologies.
Situational awareness	• Keep situational awareness, especially with low-level manned aircraft and, if necessary, employ airspace observers (AOs).
Advanced aviation terminology	• Explain the meaning of low-altitude operations related terminology.

Table 5 Operations in non-segregated airspace

Competency	**Observable behavior**
Clear roles and responsibilities	• Describe the relationship between the initiating causes (or threats), the hazard (top (main) event), the risk mitigations (the controls and barriers), and the potential consequential results (loss states) when conducting a flight in a non-segregated airspace.
Wake turbulence	• State the wake turbulence categories for UA.

Table 6 Transport and/or dropping of cargo/goods

Competency	**Observable behavior**
Weight and balance	• Describe the relationship between UA mass and structural stress. • Describe why mass should be limited to ensure adequate margins of strength. • Describe the relationship between UA mass and aircraft performance. • Describe why UA mass should be limited to ensure adequate aircraft performance. • Depending on the type of operation, describe the relationship between centre-of-gravity (CG) position and stability/controllability of the UA.

	• Describe the consequences if the CG is in front of the forward limit. • Describe the consequences if the CG is behind the aft limit. • Describe the relationship between CG position and aircraft performance. • Describe the effects of the CG position on the performance parameters (speed, altitude, endurance, and range). • Be familiar with the abbreviations regarding mass and balance, e.g. (maximum) take-off mass ((M)TOM), (maximum) landing mass ((M)LM), basic empty mass (BEM), dry operating mass (DOM), operating mass (OM), and zero-fuel mass (ZFM). • Describe the effects of changes in the load when dropping an object. • Describe the effects of an unintended loss of the load.
Load securing and awareness of dangerous goods	• Calculate the MTOM and the MLM. • Explain the reasons for restraining or securing cargo loads. • Describe the basic methods of restraining or securing loads. • Explain why the transport of dangerous goods by air is subject to an additional training module. • State that certain articles and substances, which would otherwise be classified as dangerous goods, may be exempted if they are part of the UA equipment.

Table 7 Operations with multiple and/or swarms of unmanned aircraft

Competency	**Observable behavior**
Limitations related to human factors	• Understand the human performance limitations in an operation with multiple UASs, including UAS swarms. • List the vital actions that the remote pilot and the persons who assist the remote pilot should perform in case of an emergency descent of the multiple/swarming UASs.
CRM	• Explain the importance of CRM for operations with multiple UASs and swarms.
Navigating multiple platforms	• Describe how to navigate multiple platforms.
Recognising system failures	• Describe the different failures that may potentially occur during multiple/swarming UAS operations. • Explain what to do in the event of a failure. • Recognize that the remote pilot can override the system in the event of a failure.
Emergency containment procedures	• List the different emergency containment procedures and describe the basic conditions for each kind of emergency. • Describe the recovery techniques in the event of engine or battery failure during multiple/swarming UAS operations.

Table 8 Operations over hilly or mountainous terrain

Competency	Observable behavior
Temperature inversions	• Describe the following: – the effect of thermic-induced turbulence near the Earth's surface; – surface effects; – diurnal and seasonal variations; – the effect of clouds; and – the effect of wind.
Orographic lifting	• Describe the effect of exploiting orographic lifting (i.e. slope or ridge) and the actions required. • Describe the vertical movements, wind shear, and turbulence, which are typical of hilly environment.
Higher winds through passes	• Describe the effects of wind shear and the actions required when wind shear is encountered at take- off and approach. • Describe the precautions to be taken when wind shear is suspected at take-off and approach. • Describe the effects of wind shear and the actions required following entry into strong downdraught wind shear. • Describe the influence of a mountainous area on a frontal passage.
Mountain waves	• Explain the origin and formation of mountain waves. • State the conditions necessary for the formation of mountain waves. • Describe the structure and properties of mountain waves. • Explain how mountain waves may be identified through their associated meteorological phenomena. • Explain that mountain wave effects may exceed the performance or structural capability of the UA. • Explain that mountain wave effects may be propagated from low to high levels. • Indicate the turbulent zones (mountain waves, rotors) on a drawing of a mountain chain.
High- and low-pressure patterns	• Describe the movements of fronts and pressure systems, and the life cycle of a midlatitude depression. • State the rules for predicting the direction and the speed of movement of fronts. • State the difference in the speed of cold and warm fronts. • State the rules for predicting the direction and the speed of frontal depressions.
Density altitude effects	• Define pressure altitude and air density altitude. • Explain the effects of all-up mass (AUM), pressure, temperature, density altitude, and humidity. • Explain the influence of density altitude on the equilibrium of forces and moments in a stable hover, if applicable.

Table 9 Transport of dangerous goods for humanitarian aid or emergency support

Competency	Observable behavior
Safe transport of dangerous goods	• Explain the terminology relevant to dangerous goods. • Be able to recognize dangerous goods and understand their labelling. • Be able to interpret the documentation related to dangerous goods. • Recognize dangerous goods by using 'safety data sheets' and the consumer labelling of the Globally Harmonized System of Classification and Labelling of Chemicals (GHS). • Explain that the provisions for the transport of dangerous goods by air are included in ICAO Doc 9284 'Technical Instructions for the Safe Transport of Dangerous Goods by Air'. • State the emergency/reporting procedures in case of an event with dangerous goods, including that in the event of a dangerous-goods-related emergency regarding the UA, the remote pilot should inform the ATC organisation of the transport of dangerous goods. • Explain the principles of compatibility and segregation of dangerous goods. • Explain the special requirements for loading radioactive materials. • Explain the use of the dangerous goods list. • Explain the procedures for collecting safety data, • e.g. reporting accidents, incidents, and occurrences with dangerous goods.

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