



**JARUS RECOMMENDATION
FOR REMOTE PILOT COMPETENCY (RPC)
FOR UAS OPERATIONS IN
CATEGORY A (OPEN)
AND
CATEGORY B (SPECIFIC)
(JARUS RECOMMENDATION UAS RPC CAT A AND CAT B)**

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Abstract					
<p>This JARUS Recommendation UAS RPC CAT A AND CAT B ultimately aims to provide recommendations for competent authorities (national authorities or Regional Safety Oversight Organizations - RSOO) to use for their own national legislation, concerning uniform remote pilot competency for operations in Category A (alias 'open') and Category B (alias 'specific'). The recommendations presented in this JARUS Recommendation UAS RPC CAT A AND CAT B document represents the culmination of best practices and procedures used in prior RPAS approvals, existing regulations, as well as input from JARUS WG1 expert members.</p>					
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**JARUS RECOMMENDATION
UAS RPC CAT A AND CAT B**

EDITION 1.0



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EXPLANATORY NOTE

1. Introduction

The Joint Authorities for Rulemaking on Unmanned Systems (JARUS) has established a remote flight crew licensing workgroup, WG 1, to develop guidance material for remote pilots.

The workgroup holds representatives from JARUS 'Member States' members and Stakeholder Consultancy Body (SCB) members.

WG1 developed the JARUS-FCL Recommendation (JAR doc 03), which was published on the JARUS website on 9 September 2015. This document aims at providing recommendations concerning uniform personnel licensing and competencies in the operation of remotely piloted aircraft system (RPAS) for Category C (certified). After this publication WG1 developed the guidance material (JAR doc 10) for this JARUS-FCL Recommendation, which was published on the JARUS website on 11 April 2017.

This JARUS Recommendation UAS RPC CAT A AND CAT B is the latest outcome of WG1. The Category A (alias 'open') and Category B (alias 'specific') are as defined in the JARUS OPS deliverables:

- a. Category A operations include the use of (uncertified UAS of less than 25 kg maximum take-off mass (MTOM), subject to proportionate operational limitations and requirements, in which the national aviation authority (NAA) is involved only for registration process. Category A is divided in 3 subcategories A1, A2 and A3 operations which are fully explained in JAR doc 14, as published on 20 July 2018, v.2.8).
- b. Category B operations include the use of UAS, subject to a process of either a declaration or authorisation, based on a risk assessment (e.g. Specific Operations Risk Assessment (SORA)).

The purpose of this JARUS Recommendation UAS RPC CAT A AND CAT B is to define a framework that can be utilised by any competent authority (national authority or Regional Safety Oversight Organizations - RSOO) for UAS remote pilot competence (RPC) operating in either Category A or B. This will ensure proportionate and sufficient levels of remote pilot competence (RPC) proposed under SORA Annex E – Integrity and assurance levels for the Operating Safety Objectives (OSO) for remote crew training.

2. Rationale

For theoretical knowledge training, WG1 developed a core list of basic theoretical knowledge any remote pilot operating in Category A2 and A3 should possess. No theoretical knowledge is recommended for Category A1 due to the low level of risk from limited size of UAS allowed in that category. This basic core is described in Part A of the Recommendation for Category A2 and A3 which outlines specific areas of theoretical knowledge which should be assessed by examination.

In Category B, an enhanced core set of theoretical knowledge (on top of the basic theoretical knowledge of Category A2 and A3) is recommended with additional operation-specific competencies that would act as endorsements on a remote pilot's RPC certificate.

The basic theoretical knowledge (Category A2 and A3) and advanced theoretical knowledge (Category B) is laid out in tabular format in Appendix A. It provides a general classification of recommended theoretical knowledge in the left column and the respective theoretical knowledge requirements that comprise the competency classification in the middle columns.

The table of operation-specific competencies for Category B operations is provided in Appendix B. These operation-specific competencies are additional theoretical knowledge that a remote pilot should possess prior to flying a particular type of operation(s) requiring a risk assessment as outlined in the SORA.

Application of practical skills is addressed in the Category A and Category B RPC rationales.

Category A RPC rationale:

Category A2 and A3 operations require the lowest level of basic RPC with subjects on theoretical knowledge with basic areas to be covered. The verification of the theoretical knowledge can be achieved via online examination, observed examination, or any other means deemed acceptable by the competent authority or the recognized assessment entity (RAE). While the majority of category A3 operations can be safely conducted with a theoretical knowledge examination alone, Category A2 operations allow flights near people so a practical skills demonstration is recommended only for these operations to ensure the remote pilot is able to manoeuvre the UAS to avoid close-proximity to non-participants in the operation.

Category B RPC rationale:

Category B operations require a higher level of theoretical knowledge and practical skill to ensure the safe operation of the UAS and may require a varied range of competencies depending on the type of operation being undertaken. Therefore, the areas to be covered under the subjects of theoretical knowledge established for Category A2 and A3 is expanded, and new areas are added to form an advanced theoretical knowledge for Category B. For this reason, remote pilots wishing to move from Category A2 and A3 operations to Category B operations would need to take the advanced theoretical examination and any appropriate operation-specific module examination prior to conducting Category B operations.

Operation-specific modules

Because Category B comprises a wide range of operation types, a wide range of RPC would be needed to safely conduct every type of operation included. Rather than recommend remote pilots be versed in every possible practical skill, this document breaks down the variety of theoretical knowledge and practical skill needed to safely conduct specific operations into operation-specific modules.

THE COMPETENT AUTHORITIES FOR CIVIL AVIATION OF CERTAIN ICAO CONTRACTING STATES (REFERRED TO AS THE JOINT AUTHORITIES FOR RULEMAKING ON UNMANNED SYSTEMS (JARUS)),

Having regard to the JARUS deliverables as published on the JARUS website, in particular JAR doc 06 – SORA and JAR doc 14 – OPS Cat A,

Having regard to existing regulations, national and international on competency for the remote pilot, thereof

Whereas:

- (1) JARUS agreed this JARUS Recommendation UAS RPC CAT A AND CAT B Recommendation) with a view to provide a harmonised basis to regulate organisations involved in the life cycle of civil UAS.
- (2) This Recommendation may be used by competent authorities (national authorities or regional safety oversight organisations (RSOs)) to develop provisions regarding in UAS activities in relation to the concept of operations in their respective states or regions.

HAS ADOPTED THIS RECOMMENDATION:

Article 1

Subject matter

This Recommendation lays down provisions for:

- (1) a minimum and adequate remote pilot competency (RPC) for unmanned aircraft system (UAS) operations in Category A2 and A3 and Category B, and
- (2) for RPC documentation in Category B,
- (3) RPC is optional in Category A1.

Article 2

Scope

- (1) This Recommendation should be applicable to remote pilots operating in Category A2 and A3 and Category B:
 - (a) remote pilots operating in Category A2 and A3 should comply with the RPC provisions set out in Annex Part A of this Recommendation.
 - (b) remote pilots operating in Category B should comply with Annex Part B of this Recommendation as well as any RPC provisions set out in the operational authorisation issued by the competent authority.
- (2) Out of scope of this Recommendation are:
 - (a) RPC for Category C, or certified operations,
 - (b) the responsibilities of the UAS operator who wants to conduct any additional training for remote crew that a competent authority may require as part of an operational approval within Category B operations,
 - (c) autonomous operations that do not allow any human intervention. This is different from automated operations that still require human RPC,
 - (d) Competence requirements for personnel other than the remote pilot.

Article 3

Definitions and abbreviations

- (1) For the purpose of this Recommendation, the following definitions apply:
 - (a) 'beyond visual line of sight' (BVLOS) means a type of UAS operation in which the remote crew, including the remote pilot and visual observers, is unable to maintain continuous unobstructed and unaided visual contact with the UA;
 - (b) 'competent authority' means any national authority or RSOO that has the legally delegated or invested authority, capacity, or power to decide to implement these recommendations.
 - (c) 'recognised assessment entity' (RAE) means an entity recognised by the competent authority as a provider for theoretical knowledge examination and practical skill assessment.

(d) 'remote pilot competency (RPC)' means a combination of skill, knowledge and attitude required to perform a task to the prescribed standard;

(e) 'remote crew' means crew supporting the UAS operation, in addition to the remote pilot;

(f) 'remote pilot' means a natural person responsible for safely conducting the flight of a UA by operating its flight controls, either manually or, when the UA flies automatically, by monitoring its course and remaining able to intervene and change its course at any time;

(g) 'UAS operator' means any legal or natural person, operating or intending to operate one or more UAS;

(h) 'unmanned aircraft system' (UAS) means an unmanned aircraft (UA) and the equipment to control it remotely.

UAS are divided into three level of control schemes:

- (i) Manual UAS. Manual UAS require the remote pilot to manipulate the flight controls for all aspects of flight.
- (ii) Automated UAS. Automated UAS may have features or programs that manipulate the flight controls for the remote pilot, but still require human input, planning or oversight.
- (iii) Completely autonomous UAS. Completely autonomous UAS are only those UAS that perform all pre-flight, in-flight and post-flight operations without possibility of interaction or control from a human being.

(i) 'visual line-of-sight (VLOS) operation' means a type of UAS operation in which the remote pilot is able to maintain continuous unobstructed and unaided visual contact with the UA allowing the remote pilot to control the flight path of the UA in relation to other aircraft, people and obstacles.

(2) For the purpose of this Recommendation, the following abbreviations apply:

- (a) 'AIC' means aeronautical information circular.
- (b) 'AIP' means aeronautical information publication.
- (c) 'ATC' means air traffic control.
- (d) 'BVLOS' means beyond visual line of sight.
- (e) 'CAT' means category.
- (f) 'EU' means European Union.
- (g) 'EVLOS' means extended visual line of sight.
- (h) 'FCL' means flight crew licence.
- (i) 'FL' means flight level.
- (j) 'GLONASS' means global orbiting navigation satellite system.
- (k) 'GNSS' means global navigation satellite system.
- (l) 'GPS' means global positioning system.
- (m) 'HALE' means high altitude long endurance.
- (n) 'HAPS' means high altitude pseudo satellite.
- (o) 'ICAO' means international civil aviation organisation.
- (p) 'IFR' means instrument flight rules.
- (q) 'JARUS' means joint authorities for rulemaking on unmanned systems.
- (r) 'LACA' means low-altitude, controlled airspace.
- (s) 'NAA' means national aviation authority.

- (t) 'NMAC' means near mid-air collision.
- (u) 'NOTAM' means notice to airmen.
- (v) 'OSO' means operation safety objectives.
- (w) 'RAE' means recognised assessment entity.
- (x) 'RPAS' means remotely piloted aircraft system.
- (y) 'RPC' means remote pilot competency.
- (z) 'SCB' stakeholder consultancy body.
- (aa) 'SORA' means specific operational risk assessment.
- (bb) 'UAS' means unmanned aircraft system.
- (cc) 'UTM' means unmanned traffic management.
- (dd) 'VLOS' means visual line of sight.
- (ee) 'VTOL' means vertical take-off and landing.
- (ff) 'WG' means working group.

Article 4

Minimum age for remote pilots

The minimum age for remote pilots in Category A and B should be determined by the competent authority of the State of operations.

Article 5

Medical fitness

- (1) The remote pilot should be in a physical and mental condition such that they would not endanger the safe operation of the UAS, other aircraft, persons, environment, animals or property.
- (2) Regarding Category B remote pilots should declare to the UAS operator that they are medically fit as determined in Specific Operations Risk Assessment (SORA).

Article 6

Requirements for theoretical knowledge examinations

- (1) The remote pilot should pass a theoretical knowledge examination provided by a competent authority, or by an RAE. The remote pilot should achieve an overall pass mark of 75% for each subject.
- (2) The competent authority should define the theoretical knowledge examination requirements.

This includes for example:

- (a) the structure of the examination which should be comprised of multiple-choice questions distributed appropriately across the subjects as recommended in the theoretical knowledge tables for Categories A2 and A3 and B;
- (b) minimum number of multiple-choice questions per subject;
- (c) theoretical knowledge examination time limit.

Article 7

Training and assessment of practical skill

The remote pilot should complete training and assessment of practical skills in Category B and Category A2, when requested by the competent authority. This can be provided by the competent authority, or by an RAE.

Article 8

Credit for previous theoretical knowledge

(1) Crediting between categories:

(a) Category A2 or A3 to Category B:

The competent authority or RAE may credit remote pilots who have obtained RPC for Category A2 or A3, as defined in Annex Part A of this Recommendation and who wish to progress to Category B. The competent authority or RAE should develop supplemental examinations that allow for graduation from Category A2 or A3 to Category B of this Recommendation by solely focusing on those theoretical knowledge areas which are not assessed in Category A, as laid out in Appendix A. Regarding Category B, the UAS operator should ensure that the remote pilot has the medical fitness that is required by SORA for the relevant specific operations.

This graduation is only valid within the original validity period of the RPC of Category A2 and A3. At the end of this period the remote pilot should complete the full RPC of Category B if this remote pilot wish to continue with Category B operations.

(b) Category B to Category A2 or A3:

Remote pilots in category B are considered fully credited for Category A.

(c) Licenced civil pilots: Civil pilots who hold nationally recognised FCL for manned aircraft should be fully credited and exempted from the theoretical knowledge examination, except for the subjects UAS regulations, UAS knowledge and operational procedures.

- (d) **Military UAS/ RPAS pilots:** Credit for theoretical knowledge remote pilots have gained from military experience should be determined by the competent authority based on the nature of the prior military experience. Credit may be given for every aspect of the theoretical knowledge examination except for the subjects UAS regulations and airspace operating principles.
- (e) **Restrictions on Credit:** No theoretical knowledge examination under this Recommendation should be credited toward certified UAS operations (Category C), or for aviation operations with a pilot on board.

Article 9

Remote pilot competency (RPC) in regard to automated and completely autonomous UAS operations

- (1) Regarding operations with automated UAS (not completely autonomous UAS), the remote pilot remains involved and is responsible for every operation that allows for human input into the pre-flight, in-flight, or post-flight operations. Therefore, there are RPC provisions for remote pilots of automated UAS. The competent authority should require an RPC in every operation that allows for human input.
- (2) Regarding operations with a completely autonomous UAS, there is no human remote pilot involved, as such there is no resulting RPC to be met.

ANNEX

Part A – Provisions for the remote pilot competency (RPC) in Category A2 and A3 (OPEN) UAS operations

JARUS.UAS.OPEN.RPC.010 Theoretical knowledge training and examination

(1) It is up to the remote pilot to acquire the required theoretical knowledge for UAS operations in Category A2 and A3 prior to the theoretical knowledge examination. Acceptable methods of theoretical training include online, classroom, or independent study. This could for example be conducted by:

- (a) the competent authority;
- (b) a training facility;
- (c) self-study.

(2) The remote pilot should pass a theoretical knowledge examination provided by a competent authority, or by an RAE.

(3) The competent authority or the RAE providing the theoretical knowledge examination should:

- (a) set up measures to ensure the identity of the examination candidate;
- (b) issue a proof of completion of the RPC.

JARUS.UAS.OPEN.RPC.020 Subjects and areas of theoretical knowledge

The theoretical knowledge for the remote pilot in Category A2 and A3 should contain the following core subjects:

- (a) UAS regulation,
- (b) Airspace operating principles,
- (c) Airmanship and aviation safety,
- (d) Human performance limitations,
- (e) Meteorology,
- (f) Navigation/charts,
- (g) UAS knowledge,
- (h) Operational procedures.

Refer to Appendix A: Theoretical knowledge requirements for a detailed list of the subject areas to be covered for each category of UAS operations.

JARUS.UAS.OPEN.RPC.030 Practical skill assessment for Category A2

(1) When flying close to people in Category A2 operations, the remote pilot should demonstrate or declare practical skill when requested by the competent authority.

(2) If the competent authority requires a practical skill assessment:

- (a) the remote pilot should demonstrate practical skill with a UAS featuring the same flight characteristics (e.g. fixed wing, rotorcraft), control scheme (manual or automated) and similar weight as the UAS intended for use in the operation;

- (b) If a UAS with both manual and automated control schemes are used, the demonstration of RPC should be performed in both schemes. If this UAS has multiple automated features, the remote pilot should demonstrate proficiency with each automated feature;
- (c) the practical skill should contain demonstrations of take-off or launch and landing or recovery, precision flight manoeuvres (e.g. banking, maintaining a pattern) remaining in a given airspace volume, hovering in all orientations or loitering around positions when applicable. In addition, the remote pilot should demonstrate an emergency and contingency procedure as stipulated in the manufacturer's operations manual (e.g. return to home, auto-landing);
- (d) the competent authority or RAE providing the practical skill assessment should set up measures to ensure the identity of the test candidate.

JARUS.UAS.OPEN.RPC.040 Duration and validity of the remote pilot competency (RPC)

(1) The RPC should be valid for a minimum of at least 2 years to a maximum of 5 years, decided by the competent authority.

(2) The renewal of RPC is subject to the demonstration of RPC in accordance with JARUS.UAS.OPEN.RPC.020 and JARUS.UAS.OPEN.RPC.030.

Part B – Provisions for the remote pilot competency (RPC) in Category B (SPECIFIC) UAS operations

JARUS.UAS.SPECIFIC.RPC.010 Theoretical knowledge and practical skill training

(1) The level of RPC required by the remote pilot should be acquired by theoretical knowledge and practical skill training, which is determined by the Specific Operational Risk Assessment (SORA), completed by the UAS operator, and found to be acceptable by the competent authority. (See SORA Annex E – Integrity and assurance levels for the Operating Safety Objectives (OSO) for remote crew training), or contained in a Standard Scenario or pre-defined risk assessment accepted by the competent authority.

(2) The theoretical knowledge should be assessed by a theoretical knowledge examination and operation-specific module examinations as applicable.

(3) The practical skill should be assessed by continuous evaluation during the entire practical skill training period with a final assessment. All assessment methods should be documented appropriately as deemed acceptable by the competent authority (e.g. logbooks, training records, assessments reports).

(4) The theoretical knowledge and practical skill training includes the following RPC for the remote pilot:

- (a) application of operational procedures (e.g. normal, contingency and emergency procedures, flight planning, pre-flight and post-flight inspections),
- (b) communication,
- (c) UA flight path management, automation,
- (d) leadership, teamwork and self-management,
- (e) problem solving and decision-making,
- (f) situational awareness,
- (g) workload management,
- (h) coordination and handover.

JARUS.UAS.SPECIFIC.RPC.020 Theoretical knowledge training and examination

(1) The remote pilot should acquire the required theoretical knowledge training for UAS operations in Category B prior to the theoretical knowledge examination. Acceptable methods of theoretical training include online, classroom, or independent study. This could for example be conducted by:

- (a) the competent authority;
- (b) a training facility;
- (c) self-study, as determined by the level of assurance required by the operational risk assessment.

(2) The remote pilot should pass the theoretical knowledge examination provided by a competent authority, or by an RAE.

(3) The competent authority or the RAE providing the theoretical knowledge examination should set up measures to ensure the identity of the examination candidate.

JARUS.UAS.SPECIFIC.RPC.030 Subjects and areas of theoretical knowledge

The theoretical knowledge for the remote pilot should contain additional content or topic areas within the same core subjects as category A2 and A3:

- (a) UAS regulation,

- (b) Airspace operating principles,
- (c) Airmanship and aviation safety,
- (d) Human performance limitations,
- (e) Meteorology,
- (f) Navigation/charts,
- (g) UAS knowledge,
- (h) Operational procedures.

(Refer to Appendix A: Theoretical knowledge requirements for a detailed list of the expanded subject areas to be covered for these higher risk operations.)

JARUS.UAS.SPECIFIC.RPC.040 Operation-specific endorsement(s) or privilege(s) modules

- (1) Prior to conducting an approved operational scenario the remote pilot may be required to obtain additional theoretical knowledge and, if applicable, the practical skill that is specific to the operation being undertaken as described in the operational scenario, which includes relevant emergency procedures.
- (2) The remote pilot need only complete operation-specific modules that reflect the approved operation.
- (3) The assurance level of the operation-specific theoretical knowledge is determined by the SORA.
- (4) Relative endorsements or privileges should be reflected in the RPC documentation.
- (5) The following operation-specific endorsement(s) or privilege(s) modules are recommended and the areas to be covered are described in Appendix B:

- (a) Night,
- (b) Overflight (flight over known populated areas, or assemblies of people in a given area of operation),
- (c) BVLOS,
- (d) Low-altitude, controlled airspace (LACA),
- (e) Non-segregated flight,
- (f) UAS traffic management (UTM),
- (g) Dispensing, dropping of articles,
- (h) Multiples and swarming,
- (i) Cargo,
- (j) Launch and recovery using special equipment,
- (k) High altitude long endurance (HALE),
- (l) High altitude pseudo satellite (HAPS),
- (m) Licenced aerodromes, airport and heliport operations,
- (n) mountainous terrain.

(Refer to Appendix B: Operation-specific endorsement(s)/privilege(s) for CAT B operations for a detailed list of the subject areas to be covered.)

JARUS.UAS.SPECIFIC.RPC.050 Practical skill

(1) In addition to the theoretical knowledge examination and operation-specific module examinations, remote pilots should demonstrate practical skill via an assessment at a competent authority or an RAE as determined in SORA, when applicable.

(2) The remote pilot should demonstrate practical skill with a UAS featuring the same flight characteristics (e.g. fixed wing, rotorcraft), control scheme (manual or automated) and similar weight as the UAS intended for use in the operation.

(3) If the remote pilot performs practical skill demonstrations with an automated UAS that does not allow for manipulation of flight controls, a restriction will be placed on the remote pilot's RPC certificate to prevent the remote pilot from operating a manual UAS.

(4) The practical skill assessment should contain demonstrations of take-off or launch and landing or recovery and precision flight manoeuvres (e.g. banking, maintaining a pattern) in all flight control schemes and features with emphasis on safety, including all necessary emergency procedures required by the applicable operation - specific modules.

(5) The remote pilot should satisfactorily demonstrate at least the following practical skill during the assessment:

(a) Pre-flight actions including:

(i) operation planning, airspace, environmental and meteorological considerations and site risk-assessment.

(ii) UA pre-flight inspection and set-up (including flight controller modes and power source hazards).

(iii) knowledge of the basic actions to be taken in the event of an UA emergency (i.e. as identified in the risk assessment) or if a mid-air collision hazard arises during the flight.

(b) In-flight procedures including:

(i) maintaining situational awareness of location in relation to other airspace users, obstacles, terrain and uninvolved persons at all times.

(ii) performing accurate and controlled flight manoeuvres at representative heights and distances (including flight in non-GNSS assisted mode or equivalent where fitted. When the applicant is seeking a BVLOS endorsement, the following manoeuvres should be performed VLOS and BVLOS as applicable, depending on the UA intended for use in the operation:

(A) Take-off or launch;

(B) Hover in position or loiter around a position, whatever is applicable;

(C) Transition from hover into any direction of flight the UA is capable of, when applicable;

(D) Climb and descent from level flight;

- (E) Turns in level flight;
 - (F) Speed control in level flight;
 - (G) Approach and landings or recovery;
 - (I) Evasive action (manoeuvres) to avoid collisions.
- (iii) Real-time monitoring of aircraft status and endurance limitations.
 - (iv) Demonstration of the system protocols following deliberate (simulated) control-link transmission failure.
 - (v) Remote crew coordination, when applicable.
 - (vi) Coordination with ATC/UTM, when applicable.
- (c) Post flight actions including:
- (i) Shutting down and securing the UA.
 - (ii) Post-flight inspection and recording of any relevant data relating to UA general condition, aircraft systems, UA components and power-sources, controller functionality and crew health and fatigue.
- (6) The competent authority or the RAE providing the practical skill assessment, should set up measures to ensure the identity of the test candidate.

JARUS.UAS.SPECIFIC.RPC.060 Remote pilot competence (RPC) documentation

- (1) Upon passing the theoretical knowledge examination and practical skill assessment elements, the remote pilot should receive one of the following RPC documentation:
 - (a) a remote pilot's RPC certificate from a competent authority or by an RAE , or
 - (b) other RPC documentation provided by an RAE, with an approved training syllabus. This other RPC documentation should clearly note the specific RPCs of the remote pilot(s) conducting the operation.
- (2) The RPC documentation contains the outcome of the theoretical knowledge examination and practical skill assessment and any operation-specific endorsement modules completed.

JARUS.UAS.SPECIFIC.RPC.070 Duration and validity of the RPC documentation

- (1) Each component of the RPC documentation should be valid for a period as specified by the competent authority in the operational authorisation, which also describes the renewal process at the end of the validity period.
- (2) Within the validity period described, the remote pilot maintains currency by:
 - (a) a minimum of 6 documented and validated flight hours within the previous ~~per~~ year; or
 - (b) a demonstration of RPC conducted by an RAE.

Appendix A: Basic theoretical knowledge requirements for CAT A2 and A3 and CAT B UAS operations

The following recommendation for basic theoretical knowledge (Category A2 and Category A3) and advanced theoretical knowledge (Category B) is laid out in tabular format. It provides a general classification of recommended theoretical knowledge in the left column and the respective theoretical knowledge requirements that comprise the competency classification in the middle columns. Applicability for CAT A2 and A3 and CAT B is established in the final two columns.

Subject	Areas to be covered (examples are not exhaustive)	Cat A2 and A3	Cat B
UAS regulation	Applicable UAS regulations	X	X
	Privacy, data protection and insurance regulations as deemed necessary by States	X	X
	Common terms (e.g. VLOS, BVLOS, UTM)	X	X
	Incident-accident reporting	X	X
Airspace operating principles	Airspace classifications	X	X
	Specific airspace types and current airspace usage (e.g. no drone zones, zone where special authorization is required, danger areas, prohibited areas, restricted areas, military areas, temporary airspace reservations)	X	X
	Airspace reservation procedures	X	X
	Aeronautical information publications (AIPs)	0	X
	Aeronautical information circulars (AICs)	0	X
	Notices to airmen (NOTAMs)	0	X
Airmanship and aviation safety	Good airmanship principles (e.g. UAS safe to operate, remote pilot fit to operate the UAS, proper planning and preparation, hazard identification)	X	X
	Aeronautical decision making (e.g. aviate, navigate, communicate)	X	X
	Aviation safety (e.g. avoiding collisions, especially with persons and other aircraft)	X	X
	Planning (e.g. flight routes, assessing the area of operation)	0	X
	Remote pilot records (e.g. logbooks and associated documentation: uses and documentation techniques)	0	X
	Air proximity (e.g. near midair collision (NMAC) reporting)	0	X
	Advanced airmanship (e.g. maneuvers and emergency procedures, stalls, spins, vertical lift limitations, autorotation, vortex ring states)	0	X
Human performance limitations	Medical fitness (e.g. health precautions, alcohol, drugs, medication, medical restrictions)	X	X
	Perception (e.g. distance, height, speed, awareness)	X	X
	Fatigue (e.g. flight durations within work hours, circadian rhythm, work stress, commercial pressure)	0	X
	Attentiveness (e.g. eliminating distractions, scan techniques)	0	X
	Environmental factors (e.g. weather effects such as temperature, winds, etc. on the remote pilot, vision changes from orientation to the sun)	0	X
Meteorology	Weather effects on the UA (e.g. wind, storms, fog and mist, rain, icing, temperature, urban effects, turbulence, variations of weather by altitude, visibility factors, wind shear, space weather phenomenon, micro-bursts, radio signal)	X	X

	Obtaining and interpreting weather information (e.g. weather reporting resources, reports, forecasts and meteorological conventions appropriate for typical UAS flight operations, local weather assessments)	0	X
	Regional weather effects (e.g. standard weather patterns in coastal, mountain or desert terrains)	0	X
Navigation/Charts	Maps and aeronautical charts reading (e.g. 1:500,000 and 1:250,000, interpretation, specialised charts, helicopter routes, UTM service areas, and understanding of basic terms)	X	X
	Vertical navigation (e.g. reference altitudes and heights, altimetry)	0	X
	Navigational aids and their limitations (e.g. GNNS)	X	X
UAS knowledge	Basic principles of flight	X	X
	Command and control (e.g. data link frequencies and spectrum, manual intervention and override, flight control modes)	X	X
	Limitations (e.g. maintain stability, effect of payload on flight, duration of power supply)	X	X
	Operating guides (e.g. flight procedures, emergencies procedures)	X	X
	Safety considerations (e.g. impact from crash and unsecure payload, cuts from rotors, fire from battery)	X	X
	Maintenance of the UAS (e.g. scheduled and ad-hoc repairs, meeting manufacturer's recommendations)	X	X
	Technical enhancements (e.g. geo-fencing, UTM, automated flight modes, detect and avoid systems, remote identification systems)	X	X
	Loss of signal and system failure protocols (e.g. understanding and planning for programmed responses such as return to home, loiter, land immediately)	X	X
	De-icing and fire suppression systems (e.g. functions of systems, when systems should be required for operations)	0	X
Operational procedures	Pre-flight (e.g. plotting of intended task, requesting needed authorizations, UAS preparations)	X	X
	Area of operation assessment (e.g. potential obstacles, airspace assessment, overflight of people, suitable weather conditions and environmental factors, congestion from other aircraft, organized open air assemblies)	X	X
	flight (e.g. normal, contingency and emergency procedures)	X	X
	Communications (e.g. operating alone, operating with remote crew, liaison with air traffic control (ATC), operating with other air users)	X	X
	Post-flight (e.g. post-flight maintenance, debrief and logging of flight details)	X	X
	Security (e.g. public access to UA and control, other security considerations as required)	X	X
	Crew Resource Management (e.g. effective leadership, working with others)	X	X

Appendix B Operation-specific endorsement(s)/privilege(s) for CAT B operations

Endorsement/Privilege	Areas to be covered
Night	Degradation of visual acuity Night Illusions Altered scanning techniques Altered identification of obstacles and weather Loss of horizon
Overflight (flight over known populated areas or assemblies of people in a given area of operation)	Optimizing flight paths to reduce risk of exposure Adequate clearance for wind effects, especially in urban environments Obstructions (wires, masts, buildings etc.) Command and control signal interference, i.e. high-intensity radio transmissions Advanced emergency procedures Avoiding third party interference with UA Crowd control strategies and public access Crew resource management Minimum separation distances from persons, vessels, vehicles and structures Likely operating sites and alternative sites Extraordinary restrictions such as segregated airspace around prisons, nuclear establishments etc. (suitable permission may be required); habitation and recreational activities
BVLOS	Operation planning: airspace, terrain, obstacles, expected air traffic and restricted areas Sensor systems and their limitations Co-operative and non – co-operative aircraft (Airspace surveillance) Roles and responsibilities for remaining well clear

	<p>of collision avoidance</p> <p>Command, control and communication link performance indications and limitations</p> <p>Signal or communications latency</p> <p>Loss of signal or system failure planning</p> <p>Interpreting separate data sources</p> <p>Managing data sources</p> <p>Crew resource management</p>
Low-altitude, controlled airspace (LACA) below 500 feet	<p>Air traffic management procedures</p> <p>Radio communications and phraseology</p> <p>Advanced aviation terminology</p>
Non-segregated flight	<p>Well clear roles and responsibilities</p> <p>Wake turbulence</p>
UTM	<p>Spectrum requirements</p> <p>Protocols</p> <p>Services, capabilities and requirements</p>
Dispensing	<p>Weight and balance</p> <p>Dispensing procedures</p> <p>Targeting exposure</p> <p>Identification of dangerous goods (Note carrying of dangerous goods is a certified operation per ICAO Annex 18)</p>
Multiples/Swarming	<p>Human factor limitations</p> <p>Crew resource management</p> <p>Navigating multiple platforms</p> <p>Recognizing system failures</p> <p>Emergency containment procedures</p>
Cargo	<p>Weight and balance</p> <p>Load securing</p> <p>Dangerous good awareness</p>
Launch and recovery (Special equipment)	<p>Operating procedures</p>

	<p>Recognizing failures</p> <p>Contingency procedures</p>
<p>High altitude long endurance (HALE) and high altitude pseudo satellite (HAPS)</p>	<p>Operations above FL-600</p> <p>Air traffic procedures</p> <p>Stratospheric weather and anomalies</p> <p>Crew resource management</p>
<p>Licensed aerodromes, airport and heliport operations</p>	<p>Ramp protocols</p> <p>Air traffic procedures</p> <p>Approach and departure paths</p> <p>Vertical take-off and landing (VTOL) sights</p> <p>Wake turbulence</p>
<p>Mountain terrain</p>	<p>Temperature inversions</p> <p>Orographic lifting</p> <p>Higher winds through passes</p> <p>Mountain wave</p> <p>High and low pressure patterns</p> <p>Density altitude effects</p>