# DANGEROUS GOODS PANEL (DGP)
# WORKING GROUP MEETING (DGP-WG/25)

**Delhi, India, 21 to 25 April 2025**

**Agenda Item 6: Dangerous goods provisions to support RPAS operations *(Ref: Job Card DGP.007.02)***

## DANGEROUS GOODS PROVISIONS TO SUPPORT REMOTELY PILOTED AIRCRAFT SYSTEMS – FEEDBACK TO DGP-WG/18, DRAFT AMENDMENTS TO THE TECHNICAL INSTRUCTIONS UNDER DEVELOPMENT AND DRAFT GUIDANCE MATERIAL

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**SUMMARY**

This information paper contains proposed draft changes to the Technical Instructions to support the carriage of dangerous goods by RPAS.

## 1. INTRODUCTION

1.1 In alignment with the report of the work conducted by the DGP Working Group on Remotely Piloted Aircraft Systems (DGP-WG/RPAS) contained in DGP-WG/25-WP/26, this information paper contains the following information:

a) results of the review conducted on current Annex 18 — *The Safe Transport of Dangerous Goods by Air* and the feedback provided to the DGP Working Group on Annex 18 (DGP-WG/Annex 18), including the decisions made during the face-to-face meeting held by this DGP-WG/Annex 18 in August 2023, in Doha, Qatar (see Appendix A of this information paper);

b) an initial approach to developing a draft proposal for new provisions to be added to the *Technical Instructions for the Safe Transport of Dangerous Goods by Air* (Doc 9284), only to those parts viewed as necessary to be changed (see Appendix B of this information paper); and

c) draft guidance material developed in alignment with the proposed draft provisions to the Technical Instructions, which may be published in the Supplement to the Technical Instructions, or alternatively, as a standalone guidance document, as

deemed appropriate or preferred by the panel (see Appendix C of this information paper).

1.2 The information contained in DGP-WG/25-IP/1 and DGP-WG/25-IP/2 helped inform the DGP-WG/RPAS in the development of the proposed draft provisions for the Technical Instructions and related guidance material produced in this information paper.

1.3 Rationales and/or justifications for decisions made and in support of the draft provisions are provided wphere appropriate to enable panel members to provide feedback and comment.

## 2. WORK OF DGP-WG/RPAS

2.1 The work contained herein was developed over the course of three face-to-face meetings and twenty-four virtual meetings held between November 2022 and March 2025.

2.2 In the review of 2023-2024 Edition of the Technical Instructions it was decided that the following parts would not need to be considered because international operations by RPAS should not require any specific changes to be made to these provisions:

a) **Part 2: Classification**

**Rationale** – Under the UN Model Regulations, the general classification of dangerous goods is the same for all modes of transport, therefore the nature of any article or substance and their hazards do not change when carried by an RPAS.

b) **Part 3: Dangerous Goods List, Special Provisions and Limited and Excepted Quantities**

**Rationale –** On an initial review, it was decided that the current columns could apply to RPAS operations without compromising the facilitation aspects on the transport of dangerous goods. It was also agreed that the current provisions of Table 3-1 offered a proportional and flexible approach to allow its applicability to RPAS operations rather than developing a separate column.

c) **Part 4: Packing Instructions**

**Rationale –** Based on the assumptions for Part 2 and Part 3 above, DGP-WG/RPAS' view was that the current packing instructions were appropriate to be applied to RPAS operations. There was no justification to support the need for development of packing instructions specific to RPAS operations.

d) **Part 6: Packaging Nomenclature, Marking, Requirements And Tests**

**Rationale –** Based on the assumptions for Part 2, Part 3 and Part 4 above, the DGP-WG/RPAS' view the current provisions appropriate to be applied to RPAS operations.

e) **Part 8: Provisions for Passengers and Crew**

**Rationale** – Not applicable to RPAS operations.

2.3 In the review of the 2023-2024 Edition of the Technical Instructions the following provisions contained in the following parts would be needed to be considered for changes to be made, to ensure that the carriage of dangerous goods could be facilitated without any issues in international operations conducted by RPAS:

a) **Foreword**

Possible need to review to include mentioning of RPAS operations.

**Rationale** – It was identified that it would be important to update the general principles to include the mention of RPAS operations when the aircraft in not carrying any occupants and to include the intent that the provisions of the Technical Instructions also ensure the safety of people handling the dangerous goods during the various stages of the transport chain by reducing the possibility of an accident, in case an incident occurs.

b) **Part 1: General: Inclusion of some of the definitions in Annex 6, Part IV**

**Rationale** – Due to the nature of RPAS operations, specific responsibilities of various states in RPAS operations stablished by Annex 6, Part IV, we should look at any possible impacts on approvals/exemptions being granted and impacts on some responsibilities inherent to the State of the Remote Station, which may not be the State of the Operator or State of Registry of the aircraft.

c) **Part 4: Packing Instructions**

Future need to review the notes contained in the Introductory Chapter

**Rationale** – No known research exists to assess if the current normal conditions of transport can be applied to unmanned operations, therefore it is not known if normal conditions of transport are valid for RPAS operations either because these cannot be met by an RPAS due to its design characteristics or by how the operation is being conducted.

It is anticipated that there may be the need for these to be re-assessed in the future and it is strongly recommended that in the next biennium efforts be made to conduct a review of the normal conditions of transport as documented today in the Technical Instructions to ascertain if there is a possibility for RPAS operations to exceed in any way the current provisions.

d) **Part 5: Shipper’s Responsibilities**

Although during the review it was decided that the shipper responsibilities would not be changed, there could be the need for some minor changes to be introduced.

**Rationale –** There may be a need to reflect the possible need for a shipper to engage with the operator when it is verified that the type of aircraft may not meet the normal conditions of transport mention in the Part 4. There were also suggestions that a specific marking should be introduced for cargo being continued an RPAS, where these conditions were not to be met, so as to not impact the carriage of a package in manned aviation.

e) **Part 7: Operator's responsibilities**

This was where most potential issues were identified relating to:

1) cargo compartment classification and the provisions for how dangerous goods are loaded in the main deck and lower deck cargo compartments;

2) transport documents and to whom they need to be made available during the flight;

3) loading and segregation;

4) reporting in case of accidents, incidents and emergency response;

5) loading requirements; and

6) provision of information.

It was also identified that RPAS operations as described in Annex 6, Part IV, include both fixed wing aircraft and helicopters, and the Technical Instructions have a separate chapter with specific provisions for helicopters, which are supported by guidance material contained in the Supplement.

2.4 The assumptions, decisions made informed the draft proposals, which are viewed by DGP-WG/RPAS as an initial starting point, and whilst a general agreement was obtained from the its members, questions remain on whether the approach taken by the working group is agreed upon by all panel members.

## 3. CONCLUSION

3.1 Action by DGP-WG/25, with the objective of providing sufficient informative feedback to enable DGP-WG/RPAS to formally recommend proposals for changes to the Technical Instructions at DGP/30, is provided in DGP-WG/25-WP/26.

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# APPENDIX A

## REVIEW OF ANNEX 18

| Chapter | Paragraph | Affected Standard/Recommendation | Justification for change | Working group comments |
|---|---|---|---|---|
| Chapter 1 – Definitions | | **Aircraft**. Any machine that can derive support in the atmosphere from the reactions of the air other than the reactions of the air against the earth's surface.<br>**Communication and Control Link (C2 Link).** The data link between the remotely piloted aircraft and the remote pilot station for the purposes of managing the flight.<br>**Remote flight crew member.** A licensed flight crew member charged with duties essential to the operation of a remotely piloted aircraft system during a flight duty period.<br>**Remotely piloted aircraft (RPA).** An unmanned aircraft which is piloted from a remote pilot station.<br>**Remotely piloted aircraft system(s) (RPAS).** Remotely piloted aircraft, its associated remote pilot station(s), the required C2 Link(s) and any other components as specified in the type design.<br>**Remote Pilot**. A person charged by the operator with duties essential to the operation of a remotely piloted aircraft and who manipulates the flight controls, as appropriate, during flight time.<br>**Remote pilot-in-command**. The remote pilot designated by the operator as being in command and charged with the safe conduct of a flight.<br>**Remote pilot station (RPS).** The component of the remotely piloted aircraft system containing the equipment used to pilot the remotely piloted aircraft. | Include definitions from Annex 6 Part IV.<br>This should be where necessary and where such terms are used in Annex 18. | Revisit when work is complete to determine if terms are referred to in Annex.<br>Define C2? |

| Chapter | Paragraph | Affected Standard/Recommendation | Justification for change | Working group comments |
|---|---|---|---|---|
| Chapter 2 APPLICABILITY | 2.1.1 | The Standards and Recommended Practices of this Annex shall be applicable to all international operations of civil aircraft, *which include RPAS operations.* | To ensure that it is understood that the same SARPS apply to RPAS | Seek feedback from DGP-WG/Annex 18<br>Should "which include RPAS operations" in a note?<br>Add helicopters/general aviation? |
| | 2.2.4 | **Recommendation.**— *There may be circumstances when full compliance with these SARPs is inappropriate or unnecessary for RPAS operations. Conversely, there may be hazards unique to RPAS operations that are not addressed by these SARPs. The State of the Operator should ensure that both are considered before approving transport operations involving the carriage of dangerous goods on RPAS. Likewise, the State where operations occur, if different, should review the approval issued by the State of the Operator.* | Inclusion of some wording from AC-102-37 | |
| | 2.3 | Guidance material on domestic civil aviation to be developed for RPAS operations. | Should include as much of AC 102-37 as possible to clarify how states should approach the development of domestic RPAS regulations. | Link to domestic operations SARP in Annex 18 |

| Chapter | Paragraph | Affected Standard/Recommendation | Justification for change | Working group comments |
|---|---|---|---|---|
| Chapter 9<br>PROVISION OF INFORMATION | 9.1 | Information to pilot-in-command<br>The operator of an aircraft in which dangerous goods are to be carried shall provide the pilot-in-command *or the remote pilot-in-command* as early as practicable before departure of the aircraft with written information as specified in the Technical Instructions.<br><br>Suggested to be inserted as a Note: | To ensure that difference between PIC and Remote PIC are captured | With respect to NOTOC, can we add a note that says it must be available at all times during flight. This would apply universally but be important for change of crews.<br><br>Where it is said universally, it is meant for non RPAS ops also<br><br>It is not enough to simply supply information prior to flight, it has to be readily accessible at all times during flight, including during emergency and abnormal situations.<br><br>Should be looking at this when considering electronic information |
| | 9.2 | Information and instructions to flight crew members<br>The operator shall provide such information in the Operations Manual as will enable the flight crew *or remote flight crew* to carry out its responsibilities with regard to the transport of dangerous goods and shall provide instructions as to the action to be taken in the event of emergencies arising involving dangerous goods.<br><br>Suggested to be inserted as a Note: | To ensure that difference between flight crew and Remote flight crew are captured. | |

| Chapter | Paragraph | Affected Standard/Recommendation | Justification for change | Working group comments |
|---|---|---|---|---|
| | 9.5 | Information from pilot-in-command to aerodrome authorities<br>If an in-flight emergency occurs, the pilot-in-command *or the remote pilot-in-command* shall, as soon as the situation permits, inform the appropriate air traffic services unit, for the information of aerodrome authorities, of any dangerous goods on board the aircraft, as provided for in the Technical Instructions.<br><br>Suggested to be inserted as a Note: | To ensure that difference between flight crew and Remote flight crew are captured. | Something for the Annex 18 WG and coordinate with ATM<br><br>Change aerodrome authorities to ATSU<br>We may be enroute when a situation occurs and would not want to repeat the information when transferred to a local controller during the busy landing phase. |
| CHAPTER 10. TRAINING PROGRAMMES | Note 3 | *Note 3. See 4.2.3 of Annex 6 — Operation of Aircraft, Part IV — INTERNATIONAL OPERATIONS — REMOTELY PILOTED AIRCRAFT SYSTEMS* | All references to Annex 6 Part I, should where applicable also include reference to Annex Part IV | |

**Decisions made by the DGP-WG/Annex18 held in Qatar in August 2023:**

A1.1 The inclusion of definitions would only be considered where specifically there could be a relationship with current existent definitions in Annex 18. Examples of this could be the inclusion of the definitions of “remote pilot in command,” “remote pilot,” “remotely piloted aircraft system,” remotely piloted aircraft, etc.

A1.2 Throughout Annex 18. where any references to Annex 6, Part I existed, it was noted that a reference to Annex 6, Part IV would also be added.

A1.3 Any other specific requirements for RPAS operations would be addressed in the Technical Instructions as needed to enable RPAS Operations.

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# APPENDIX B

## REVIEW OF THE TECHNICAL INSTRUCTIONS

### B1.1 – Provisions where the WG decided to take no action

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| Part 7; Operator Responsibilities 2.2.1.1 | Packages containing dangerous goods which might react dangerously one with another must not be stowed on an aircraft next to each other or in a position that would allow interaction between them in the event of leakage. As a minimum, the segregation scheme shown in Table 7-1 must be followed in order to maintain acceptable segregation between packages containing dangerous goods having different hazards. The scheme applies irrespective of whether the hazard is the primary or subsidiary hazard. | Does the minimum required segregation distance still apply on an RPAS?<br><br>To avoid incidents associated with lack of package segregation, it was agreed that this should be maintained.<br><br>**No Action taken. No action taken. View is that the current provisions should apply to RPAS in the same manner as for conventional aircraft.** |
| Part 7; Operator Responsibilities 2.9 | SPECIAL PROVISIONS APPLICABLE TO THE CARRIAGE OF RADIOACTIVE MATERIAL | Does the Transport Index Table 7-3 and 7.4 apply? What about 7-5, 7-6 and 7-7?<br><br>**No action taken. View is that the current provisions should apply to RPAS in the same manner as for conventional aircraft.** |
| Part 7; Operator Responsibilities 2.10 | Magnetized material must be loaded so that headings of aircraft compasses are maintained within the tolerances prescribed by the applicable aircraft airworthiness requirements and, where practical, in locations minimizing possible effects on compasses. | Does there need to be a consideration for the effects of magnetized material on any RPAS components which may affect the aircraft?<br><br>Should be if there are such components which may be affected<br><br>**No action taken. View is that the current provisions should apply to RPAS in the same manner as for conventional aircraft.**<br>**In any case the proposed provisions in Chapter 8.1.2 would capture this.** |

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| Part 7; Operator Responsibilities 2.11 | Loading of Dry Ice | Are these requirements applicable to RPAS?<br><br>There may be a need to ensure that ground staff need to know so they do not put their head into a compartment that has not been ventilated in a larger RPAS.<br>**No action taken. View is that the current provisions would apply to RPAS in the same manner as for conventional aircraft.**<br>**In any case the proposed provisions in Chapter 8.1.2 would capture this.** |
| Part 7; Operator Responsibilities 4.1.11 | The dangerous goods listed in Table 7-9 need not appear on the information provided to the pilot-in-command. | Should there be consideration regarding this list, in relation to RPAS operations?<br>**No action taken. View is that the current provisions would apply to RPAS in the same manner as for conventional aircraft.** |
| Part 7; Operator Responsibilities 4.3 | INFORMATION TO BE PROVIDED BY THE PILOT-IN-COMMAND IN CASE OF IN-FLIGHT EMERGENCY | To whom must the information be transmitted for an RPA? Same criteria?<br>We may want to capture this in S-7;4.8 of the Supp for RPAS/UAS Ops.<br>This comment relates to 4.1.1 NOTOC. Supplement has not been reviewed yet.<br><br>**No action taken. View is that the current provisions would apply to RPAS in the same manner as for conventional aircraft.**<br>**In any case the proposed provisions in Chapter 8.1.3 would capture this, or additional text in the Guidance material.** |
| Question for the Panel:<br><br>The Panel is invited to provide feedback on whether it is agreed that no further action is required for the provisions contained in this part of the Information Paper. | | |

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| Part 7; Operator Responsibilities 4.4 and 4.5 | Reporting of incidents and misdeclared DG | Although it is incumbent on the operator to report, there may be situations where people outside of the traditional aviation industry (i.e. un-involved persons) are taking delivery of items directly from an RPAS (i.e. e-commerce delivery).<br><br>Is it worth considering that the operator should have a method to collect this data from un-involved persons? Traditionally we would expect that a crewed aircraft be unloaded by persons trained to report to the operator, whereas this will not be the case for some delivery operations? |
| **Questions for the Panel:**<br><br>See Guidance material for additional reporting procedures. Does this address the issue raised? | | |

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|---|---|---|
| Part 7; Operator Responsibilities 4.9 | EMERGENCY RESPONSE INFORMATION | There is a disconnect between DOC9481 and RPAS Operations. It is something that needs to be reviewed and appropriately documented.<br><br>**No action for now but we may need to develop a Chapter in Doc 9481 just for RPAS/UAS.** |
| Question for the Panel:<br><br>Do we need to engage with RPAS Panel for this or will the updates to the guidance be undertaken by the panel? | | |

## Review of the Technical Instructions

### B1.2 Proposed new draft provisions for the Technical Instructions

**Part 1 ;**
**Chapter 1**

1.1.4 For the State of overflight, if none of the criteria for granting an exemption are relevant, an exemption may be granted based solely on whether it is believed that an equivalent level of safety in air transport has been achieved.

*Note 1.— For the purpose of approvals, "States concerned" are the States of Origin and the Operator, unless otherwise specified in these Instructions.*

*Note 2.— For the purpose of exemptions, "States concerned" are the States of Origin, Operator, Transit, Overflight and Destination. In the case of RPAS Operations, where a State has communicated to ICAO that they require to issue an exemption, the State of the Remote Station or the State of the Remote Pilot will be considered States concerned.*

| Part 1; States concerned (1.1.3) |
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| **Problem Statement:**<br>In the case of the RPAS Operator, do we need to consider that for "states concerned" the following may need to be the included?<br>• state of the Remote Piloted Station for the purpose of managing the flight (Documents/handover of control between Remote pilot in Command)?<br>• state of the Remote Pilot (same as state of the operator) (Training/Procedures/Emergency Responsibilities)? |
| **Rationale:**<br>It is important to understand the roles and responsibilities of the various States involved in issuing/approving applicable certificates. For RPAS operations, some of these roles and responsibilities remain the same as with conventional aviation, such as the State of Registry issuing certificates of airworthiness and the State of the Operator issuing the appropriate operator certificates.<br><br>But in certain circumstances, due to the unique nature of RPAS operations, the responsibilities of States have changed or have been expanded. For example, licences issued for pilots of conventional aircraft are issued (or rendered valid) by the State of Registry. However, as per Annex 1, the issuance or validation of remote pilot licences are the responsibility of the State of the Operator. Additionally, the introduction of RPAS into the aviation regulatory framework has necessitated the identification of the State of remote pilot station (RPS) service provider. |

**Part 1 ;**
**Chapter 3**

3.1 Definitions

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***External carriage***. Any load suspended from a helicopter or an UA, or in equipment attached to a helicopter or an UA.

. . .

***Remote crew member.*** A person assigned by an operator with duties connected to the operation of a remotely piloted aircraft system during a flight duty period.

***Remote flight crew member.*** A licensed flight crew member charged with duties essential to the operation of a remotely piloted aircraft system during a flight duty period.

***Remote pilot.*** A person charged by the operator with duties essential to the operation of a remotely piloted aircraft and who manipulates the flight controls, as appropriate, during flight time.

***Remote pilot-in-command.*** The remote pilot designated by the operator as being in command and charged with the safe conduct of a flight.

***Remote pilot station (RPS).*** The component of the remotely piloted aircraft system containing the equipment used to pilot the remotely piloted aircraft.

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***ROC.*** A certificate authorizing an RPAS operator to conduct specified RPAS operations (AOC).

. . .

***RPA.*** An unmanned aircraft that is piloted from a remote pilot station. They are one type of unmanned aircraft.

***RPAS.*** A remotely piloted aircraft, its associated remote pilot stations, the required command and control links and any other components as specified in the type design.

. . .

***UA.*** An aircraft that is intended to be operated with no pilot onboard. These include all unmanned aircraft, whether remotely piloted, fully autonomous or combinations thereof.

***UAS.*** An unmanned aircraft and its associated components.

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| **Part 1; Definitions 3.1** |
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| **Questions for the Panel:**<br><br>Do these additional definitions need to be considered for addition in Part 1;3 of the TI?<br>Based on the definitions, do we use the term UAS, RPAS or both in Chapter 8? |

## Part 3

| Part 3; Table 3-1 |
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| **Problem Statement:**<br>During discussions held in the WG the fact that there were multiple provisions and columns favoured the flexibility of packaging and quantities when carried by RPAS, so decision was taken to not introduce any changes to Table 3-1.<br><br>**Rationale:**<br>As mentioned in the report, several assumptions had to be made as to the nature and type of RPAS operations that will be occurring along with the types of aircraft being deployed form the start of operations. We are still at least two years ahead of commencement of any type International Operations and with the lack of knowledge of what the RPAS operations will look like and substantive evidence on why the current provisions would not apply, it will be extremely difficult to develop a DG list specifically for RPAS. |
| **Questions for the Panel:**<br><br>Should all columns apply to RPAS Operations?<br>Does this need to be reflected in Part 7;8 or should it be mentioned alternatively with a note in Part 3;2 (Arrangements of the DG List)? |
| Part 3; 4.4.1 & 4.4.2 |
| **Problem Statement**<br>This is for DG in Limited Quantities. If dropping of DG is to be considered in International Operations, the "Normal Conditions of Transport" might not be guaranteed.<br><br>**Rationale:**<br>We do not consider anything different for helicopters and Annex 6 Part IV, applies only to operations from licensed aerodromes. However, for Helicopter Operations, operation to from remote locations or uncertified aerodromes/locations is considered in the TI |
| **Questions for the Panel:**<br><br>Is Package testing and certification sufficient for this type of RPAs Operation?<br><br>1.2 metre drop test - should this be considered in relation to Part 4 "normal conditions of transport"?<br><br>Is the problem statement addressed with the proposed provisions contained in Part 7; Chapter 8.1.8? |

**Part 4**

**Part 4; Introductory Notes 2-4**

**Problem Statement :**
The "normal conditions of transport" might change dramatically with some RPAS systems, depending on the design of the aircraft. For example, we don't know if operation of aircraft without pressurized cargo compartmnets or without controlled temperature is envisioned or will occur at high altitudes, but if they do, the cargo compartment conditions will be outside of what is now considered "normal conditions of flight" in the Technical Instructions.

There are references to "normal conditions of flight" throughout the TI's and there is text pointing to the introductory notes 2-4 in Part 4 which define the "normal conditions of flight".

Pressure variations
Due to altitude, the ambient pressure experienced by a package in flight will be lower than standard atmospheric pressure at sea level. Since receptacles or packagings will generally be filled at a standard atmospheric pressure of approximately 100 kPa, this lower ambient pressure will result in a pressure differential between the contents of the receptacle or package and the cargo compartment.

Note 4 - "vibrations" in commercial aircraft are quite specific and may not be relevant to RPAS Avoidance of turbulence may not be a consideration in RPAS Ops.

Note 11 references "eg helicopter" can this be used for RPAS Operations or do we need to specify RPA as well as helicopter?

**Rationale :**
For pressurized cargo compartments, the pressure differential may be approximately 25 kPa, while for non-pressurized or partially pressurized cargo compartments, the pressure differential may be as much as 75 kPa. This pressure differential could cause discharge of liquid contents or bursting of the receptacles or packagings during flight unless each receptacle or packaging and its closures meet the packaging test requirements.

Unpressurized and uncontrolled temperature cargo compartments may pose a major issue according to some members' comments.

There are specific temperature and pressure extremes mentioned in the notes and they will be exceeded with unpressurized/uncontrolled temperature compartments at normal aircraft cruising altitudes. Additionally, a shipper will probably have no knowledge of what kind of aircraft will be used to transport their package, and one package could be flown unmanned and unmanned aircraft on the same journey.

**Questions for the Panel :**
Future research may need to be conducted to assess the impacts of the deviation from these conditions and to modify them, but in the mean time what must be done ?

Prohibition the carriage of DG in aircraft with cargo compartments that are unpressurized or are not temperature controlled ?

Will we need dedicated markings indicating "manned aircraft only" for some cargo ?

Will there be a need to introduce changes to Part 7;1,3 regarding the acceptance check" for RPAS ?

Is there a need to introduce an additional marking on the package indicating "forbidden on unpressurized RPA "?

**Are the new provisions proposed under the shipper responsibilities Part 5;1.1 and in Part 7;8.1.2.3 sufficient to address this issue for now?**

**Part 5**
**Chapter 1**

**1.1 General Requirements**

Additional Note to be added as follows:

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*Note X.— The requirement in 1.1 c) also applies to shipments offered for transport to RPAS operators. When preparing a shipment of dangerous goods which is to be transported by an RPAS, normal conditions of transport regarding temperature variations, pressure variations and vibrations may not always be guaranteed. Additional communication and coordination with the operator may be necessary to ensure that if the conditions encountered during transport shipper are different from those stipulated in these instructions, the integrity of the packaging is always maintained.*

| Part 5; Shipper Responsibilities |
| --- |
| Part 5; reviewed and no challenges or issues with the applicability of the Shipper's responsibilities for RPAS Operations were found.<br><br>**Problem Statement**<br>However, additional consideration to needs to be given to Shipper responsibilities in the event of the UAS not meeting certain cargo compartment certification such as pressurisation, temperature control or vibrations<br><br>**Rationale:**<br>The basis for maintaining the current provisions unchanged, is that when considering Facilitation as an objective, the need for standardisation in a multi-modal transport chain is crucial. |
| **Questions for the Panel:**<br>(Please see proposed Note for Part 5;1.1 and Part 7;8.1.2.3.)<br><br>Are these sufficient to address the concern raised? |

**Part 7**
**Chapter 1**

| **Chapter 1.7** |
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| **Comments from the WG:**<br>There are some specific references in this paragraph relating to Annex 6, Annex 19, Doc 9859, and 10102.<br><br>References to Annex 6 Part IV will need to be reviewed/added to Part 7;1.7.<br>The SARPS contained in Chapters 15 of Annex 6 Parts I and IV are the same. |
| **Questions for the Panel:**<br>Do we need to consider how Annex 6 Part IV fits into this paragraph and be more specific about RPAS? |

**Chapter 2**

| **Chapter 2.1.1** |
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| **Provision:**<br>Dangerous goods may be carried in a main deck cargo compartment of a passenger aircraft provided that compartment meets all the certification requirements for a Class B or a Class C aircraft cargo compartment. Dangerous goods bearing the "Cargo aircraft only" label must not be carried on a passenger aircraft.<br><br>**Problem Statement:**<br>If RPAS are not intended to carry passengers, will packages being flown by this type of aircraft always have to bear the CAO label? |
| **Questions for the Panel:**<br><br>If this does not apply to an RPAS, do we need alternative wording that may be reflective of the specific conditions that an RPAS may have?<br>Do we need specific markings for RPAS operations to be added in Part 5;? |

**Chapter 2**

| **Chapter 2.1.2** |
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| **Provision:**<br>Under the conditions specified in S-7;2.2 of the Supplement, the State of Origin and the State of the Operator may approve the transport of dangerous goods in main deck cargo compartments of passenger aircraft that do not meet the requirements in 2.1.1.<br><br>**Problem Statement:**<br>The conditions specified in S-7;2.2 of the Supplement are for aircraft which do not meet the requirements of 2.1.1. |
| **Questions for the Panel:**<br>Is this list of DG in S-7;2.2 appropriate for RPAS/UAS or do we need to develop a list that considers the specific conditions of an RPAS which does not have a Class B or C aircraft cargo compartment, considering that the accessibility is not there either?<br><br>Are the provisions of S-7;2.2 proportional for RPAS Operations considering that it does not carry |

people?

**Chapter 2 (draft proposed change)**

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2.1.4 For additional requirements concerning the loading of dangerous goods for carriage by an RPA/UA, see Part 7;8.

| **Chapter 2.1.3** |
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| **Provision:**<br>For additional requirements concerning the loading of dangerous goods for carriage by helicopters, see Part 7;7.<br><br>**Rationale:**<br>If we are introducing a Chapter 8 in Part 7 for RPAS Operations, for consistency purposes, the proposed text in 2.1.4 needs to be added. |
| **Question to the Panel:**<br>Does the Panel agree with the development of Chapter 8 and this insertion? |

**Chapter 2**
**2.4.1 Loading of cargo aircraft**

2.4.1.1 Packages or overpacks of dangerous goods bearing the "Cargo aircraft only" label must be loaded for carriage by a cargo aircraft in accordance with one of the following provisions:

. . .

e) external carriage by an RPA, or

~~e)~~f) with the approval of the State of the Operator, for helicopter operations, in the cabin (see Part S-7;2.4 of the Supplement).

| **Chapter 2.4.1** |
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| **Provision:**<br>2.4.1.1.a) in a Class C aircraft cargo compartment;<br>[..]<br>2.4.1.1 d) external carriage by a helicopter;<br>and<br>Note — When transporting goods in a non-pressurized cargo compartment, there will be a large pressure differential up to 75 kPa at cruise altitudes. Packages that are filled at a normal atmospheric pressure may not be capable of withstanding this pressure differential. Confirmation of the suitability of the packagings from the shipper should be obtained. |
| **Question for the Panel:**<br>Do RPAS require Class C cargo compartments?<br>Does the term UAS need to be included in the sentence?<br>Include "Helicopter or RPA"? or do we need to consider a rewording of the note? |

**Part 7 – Operator Responsibilities**
**Chapter 4**

4.1.1.1 Except as otherwise provided, the information required by 4.1.1 must include the following:

. . .

j) the aerodrome or location at which the package(s) is to be unloaded;

| **Chapter 4.1.1.1** |
|---|
| **Provision:**<br>a) provide the pilot-in-command with accurate and legible written or printed information concerning dangerous goods that are to be carried as cargo; and<br><br>j) the "aerodrome"...<br><br>**Problem Statement:**<br>The pilot is not on board and more than one pilot may be used for any flight, and they could be located at various stations along the routing in different states,<br><br>An RPAS may not necessarily land only at an aerodrome. |
| **Questions for the Panel:**<br>Do we need to add the definition of aerodrome, or will the above proposed change be sufficient?<br><br>Do we need to stipulate provisions such as the assurance of adequate handover procedures between RPS/RPIC to guarantee that all involved are always informed of the DG on board? If so do the draft provisions in 8.1.3 address this issue? |

## Part 7 – Operator Responsibilities

## Chapter 8

## RPAS OPERATIONS

*Note 1.— The requirements in this chapter are in addition to the other provisions of these Instructions that apply to all operators (such as Part 7 and Part 1;4).*

*Note 2.— The provisions contained in this Chapter apply to any unmanned aircraft (UA), whether remotely piloted, fully autonomous or in combinations thereof. A RPAS is a type of UA.*

*Note 3.— For the purpose of this chapter, in addition to the State of the Operator, a State concerned may be the State where the operations are being conducted (when different form the State of the Operator).*

*Note 4.— Further guidance on the provisions of this Chapter can be found in [Doc 9284 Supplement to the Technical Instructions for the Safe Transport of Dangerous Goods by Air] (Part S-7;2.X.X / Doc 10XXX)*

8.1.1 For International RPAS Operations, to the extent possible, the full scope of Annex 18 and the Technical Instructions must be complied with, when transporting dangerous goods.

8.1.2 Due to the nature of RPAS (UAS) operations, there may be circumstances when the full provisions of the Technical Instructions are not appropriate or necessary. However, there may be hazards unique to UAS operations that are not addressed by these Instructions.

8.1.2.1 When deemed appropriate, the State of the Operator may grant an approval to permit the carriage of dangerous goods without all of the normal requirements of the Technical Instructions being complied with, provided that an equivalent or greater level of safety is established in accordance with the level of risk, and that:

a)- the operator has conducted a safety risk assessment in which they demonstrate that a reasonable effort has been made to identify all hazards associated with the operation; and

b)- the safety risks associated with the foreseeable consequences have been mitigated to an acceptable level.

8.1.2.2 Hazards which are unique to RPAS (UAS) operations, that are not addressed in the Technical Instructions must also be addressed through the operator's safety risk assessment.

8.1.2.3 Where the cargo compartment of the RPAS (UAS) does not meet the classification criteria of Part 7;2.1, or where the normal conditions of transport detailed in Part 4; are not guaranteed for the duration of the flight due to the design of the aircraft, the associated hazards shall be addressed in the operator's risk assessment. When an Operator accepts the carriage of dangerous goods in such circumstances, these must be communicated to the Shipper to ensure that they are made aware that the conditions encountered during transport may vary and sufficient mitigations are put in place to ensure package integrity is not compromised during transport.

*Note 1.— The Safety Management Manual (SMM) (Doc 9859, 4th edition) contains general guidance on implementation of Annex 19 — Safety Management, including the conduct of safety risk assessments.*

*Note 2.— Doc 10102 (Guidance for Safe Operations Involving Aeroplane Cargo Compartments) provides guidance on specific safety risk assessments on the transport of items in the cargo compartments of an aeroplane, including dangerous goods, which may be useful for UA operations.*

8.1.3 The operator shall establish documented operating procedures for the safe transport of dangerous goods on RPAS (UAS), which shall include at a minimum:

a) policies and procedures for the acceptance, safe handling and loading of the dangerous goods intended to be carried when all of the conditions of Part 7;1, 7;2, 7;3 or 7;4 cannot be met,

b) assignment of responsible persons to key operator responsibilities associated with the carriage of dangerous goods,

c) adequate handover procedures between Remote Pilot Stations and Remote Pilots-in-Command as applicable, to ensure that that all involved personnel are informed of the dangerous goods being carried on board.

d) a training program in accordance with Part 1;4 which describes the training required and the level of competency that must be achieved and demonstrated, which are proportional to the level of safety risk of the operation and commensurate with the duties and responsibilities of personnel involved in the operation,

e) emergency response procedures and actions to be taken in the event of emergencies involving dangerous goods,

f) instructions for communication of information to relevant persons, related to dangerous goods being transported in the event of an accident or incident,

g) conducting a safety risk assessment with procedures to identify hazards, determine potential consequences and ensure that risks can be managed to an acceptable level,

h) instructions for the collection of safety data related to dangerous goods accidents and incidents and reporting in accordance with Part 7;4

8.1.4 Where operations are conducted in a State other than the State of the Operator, the State concerned, must determine if the risk assessment and the standard operating procedures are acceptable. When States other than the State of the Operator have notified ICAO that they require prior approval of such operations, approval must also be obtained from the States of Origin and destination, as appropriate.

8.1.5 When loading dangerous goods for open external carriage by a RPAS (UAS), consideration should also be given to the type of packaging used and to the protection of those packagings, where necessary, from the effects of airflow and weather (such as by damage from rain or extreme temperatures), in addition to the general loading provisions of 7;2.

8.1.6 When dangerous goods are carried suspended from a RPAS (UAS), the operator must ensure that consideration is given to the dangers of static discharge upon landing or release of the load.

8.1.7 If delivery of dangerous goods to or from the location of the RPAS (UAS) by other modes of transport is necessary, all appropriate provisions of the national or international regulations by those modes of transport apply.

8.1.8 Where a package containing dangerous goods is to be dropped from the RPAS (UAS), the height at which the package is released, must not exceed the drop height for which the package was tested for or certified. Dangerous goods shall not be dropped during flight, if such action creates a hazard to other persons, property or the environment.

| **Chapter 8** |
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| **Problem Statement:**<br>Based on the report contained in DGPWG.25.WP/26 and associated Information Papers, considering the assumptions made by the working group and the potential issues or gaps in the provisions, the Working Group has agreed that the above proposed changes to the provisions of the TI, may be a starting point for discussions during the DGP-WG/25.<br><br>**Rationale:**<br>This proposal was drafted based the experiences gained by the WG members in their individual states and knowledge of current RPAS Operations. Annex 6, Part IV includes all type of aircraft, i.e., aeroplanes and helicopters being operated by remote pilots, therefore the decision by the WG to develop a separate chapter to encompass |
| **Questions for the Panel:**<br><br>Does the panel agree with the view taken by the WG that Parts 2, 3, 4, 6 and 8 do not need to be changed to support RPAS Operations?<br><br>Does the panel agree that there is a need for a new Chapter 8 to support and address the specific conditions in which RPAS Operations may be conducted in the near future?<br><br>Does the panel agree that the Technical Instructions include provisions to enable the applicability of the Technical Instructions to RPAS other than Certified RPAS, and for these to be adopted by States in domestic operations?<br><br>Does the panel agree that the Technical Instructions should apply to all UAS, which includes RPAS, or should it only apply to RPAS? |

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# APPENDIX C

# GUIDANCE MATERIAL

This guidance material is aimed at assisting states in issuing approvals for carriage of dangerous goods in RPAS, when the full provisions of the technical instructions are not appropriate or needed , for lower risk operations, in which due to size, maximum take of weight or other circumstances, the RPAS is not required to meet the cargo compartment certification requirements or cargo compartment classification criteria established in Part 7; of the Technical Instructions for the Safe Transport of Dangerous Goods by Air.

## 1. UA Operator's Standard Operating Procedures for carriage of DG

This guidance provides recommended elements to be included in the UA operator's standard operating procedures manual for the transport of dangerous goods.
The SOP Manual should contain the following information:

1.1 The operator's policy for the safe transport of dangerous goods on UA.

The policy should include procedures for conducting a safety risk assessment, definition of responsibilities for risk management, identify measures to mitigate hazards.

1.2 Identify the person responsible for ensuring compliance with the DG approval and for continued compliance with the applicable regulations.

1.3 Detailed assignments of responsibilities associated with the carriage of DG.

1.4 Identify of training needs for the operator's staff and/or staff of other entities carrying out responsibilities on behalf of the operator, which are involved with activities related to the transport of DG.

1.5 Training policy for all relevant staff, commensurate with their responsibilities and in accordance with the Technical Instructions, Part 1;4 and the ICAO Guidance on a Competency-based Approach to Dangerous Goods Training and Assessment (Doc-10147). This policy should include the level of competency achieved once training is complete.

1.6 Instructions and procedures defined by the operator to ensure safe transport of dangerous goods and to ensure compliance the responsibilities of the detailed in Part 7; of the Technical Instructions, by all persons involved in the operation.

1.7 Procedures should be established by the operator that explain the instructions for effectively communicating hazards to those not familiar with dangerous goods marking and labelling and how the instructions should be attached to the shipment. These should include contact information and instructions for informing the operator, appropriate authorities, including public health authorities.

Whilst the Technical Instructions include provisions for communicating hazards of dangerous goods through marking and labelling of the package and documentation, which are well-known to those involved in their transport, individuals not involved in the operation, who may be exposed

to an RPAS (UAS) involved in an incident or accident may not be aware of these hazard communication methods.

1.8 Procedures to mitigate hazards unique to RPAS (UAS) operations should also be included to ensure the dangerous goods are capable of withstanding the conditions of transport involving the type of RPAS (UAS) being used.

1.9 Procedures and instructions for communicating to relevant persons, information related to the dangerous goods being transported, in case of an accident or incident.

1.10 Procedures and instructions for the collection and reporting of safety data related to dangerous goods accidents, dangerous goods incidents or the finding of undeclared or misdeclared dangerous goods in cargo in accordance with Part 7;4 of the TI.

1.11 Document retention policy.

## 2 - Risk Assessment

To obtain an approval to carry DG, operators should establish that intended operations do not pose a hazard to health, safety, property or the environment. Through a risk assessment process, operators should identify the hazards and the safety risks associated with the foreseeable consequences and demonstrate that these have been mitigated to an acceptable level.
The operator should conduct an operational risk assessment for the carriage of DG in accordance. At a minimum, the following aspects should be included in the risk assessment:

- The extent to which third parties, property or the environment, could be endangered by the operation and the dangerous goods being carried.
- Identification of hazards associated with the dangerous goods to persons directly involved in the handling of such goods.
- Type of operation and geographical area where the operation will be carried out.
- Containment characteristics of the RPAS (UAS) or any other means of additional protection that may be put in place to protect the integrity of the package or prevent the spillage or leakage of the dangerous goods contained in the packaging.
- Effects of the intrinsic hazard of the dangerous goods being carried, considering the capabilities of the UAS/RPAS to respond to the hazards, should an incident occur during flight.
- Packing and packaging being used for the transport of DG.
- Quantity and type of DG to be transported.
- Level of competence of those handling the DG.
- Level of confidence in the logistics chain

Whilst the safety risks posed may be reduced through appropriate training, proper packaging, communication, handling, and stowage, the scope of DG carried onboard an UAS/RPAS in the specific

category may be limited to specific items and classes depending on the hazard posed by the article or substance to health, safety, property or the environment

The risk assessment should be periodically reviewed to ensure that it remains up to date and that no further hazards which may require re-assessment and/or mitigation, have been introduced into the operation have arisen. These could be influenced by internal or external factors, or external entities in the supply chain.

**3 - Emergency Response Procedures**

Operators should document and implement and Emergency Response Plan (ERP). The ERP should include procedures and actions to be taken in the event of an incident or an accident when DG are being carried, in accordance with Part 7; 4.7 and 7; 4.9 of the Technical Instructions.

- When establishing emergency response procedures, operators should consider below guidance in the development of a contingency checklist(s) that detail the response to an incident or accident involving DG being carried on board the UAS/RPAS with the objective of providing adequate information to all of the operator's staff involved in the response.

- As a minimum the following aspects should be included in the ERP:

- Identification of emergency scenarios that may result from the Classes of DG being carried on board.

- Contingency procedures for dealing with an emergency involving DG for UAS/RPAS cargo compartments which do not have fire detection or suppression systems.

- Identification of entities which are trained and competent to adequately respond to the incident or accident on the ground and their contacts.

- When DG are being carried, operators should identify entities which may, at short notice, search for and secure an accident site before the arrival of the operator's emergency responders.

- Communicating the ERP to local entities which may be involved in the emergency response to incidents and accidents involving DG.
- Where emergency response kits are used, the operator should ensure that these are deployable and available to their emergency response staff, at the location where the incident or accident has occurred.

- Information contained in ICAO Emergency Response Guidance for Aircraft Incidents Involving Dangerous Goods (Doc-9481) may be used to assist in identifying the inherent hazards of the different classes or divisions of DG, what hazards that these may pose to the aircraft, fire-fighting agents that can be used and, where applicable, any additional hazards that may need to be taken into consideration when dealing with an emergency involving DG.

- Doc-9481 may also be used in the Safety Risk assessment when identifying the hazards posed to the aircraft when DG are being carried.

- The ERP should include a contact list for all entities that may be involved in any action related to the operator's ERP to ensure expeditious and effective communications during any accident or incident involving DG or any emergency that may occur when an aircraft is carrying DG

— END —