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DANMARK GRØNLAND OG FÆRØERNE

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AIC B 08/14. Commercial etc. use of unmanned aircraft (UAS/RPAS) in Denmark (Replaces AIC B 06/14)

The Danish Civil Aviation and Railway Authority receives many enquiries regarding flying unmanned aircraft, hereinafter referred to as UAS, for commercial purposes or for testing and/or research. UAS that are not only used for recreational purposes, sport or competition are referred to internationally as Remotely Piloted Aircraft Systems (RPAS).

As a general rule, any UAS flights with aircraft weighing up to a max. 25 kg shall comply with relevant regulations, see BL 9-4, edition 3, 9 January 2004, Regulations on aviation with unmanned aircraft not weighing more than 25 kg. However, exemption from the regulations may be granted, when such exemption is deemed compatible with the considerations on which the regulations in question are based.

If the UAS weighs more than 25 kg, the flight must generally take place in accordance with the provisions on aircraft in the Air Navigation Act, as here too specific exemption may be granted from the regulations of the Act, if this takes due account of the safety of aviation and the public in general.

There are several categories of UAS. For civil purposes, use of unmanned aircraft is only permitted if a pilot or operator can remotely control or program the UAS at all times.

Operations with UAS tethered from the ground will also be covered by the Air Navigation Act and/or BL 9-4.

FPV flying (First Person's View) may also be carried out if, besides the pilot, there is a second pilot present together with the pilot throughout the entire flight, and if the second pilot, without the use of technical aids, is to be able to maintain visual contact (within sight) with the aircraft, such that the second pilot can take over control of the aircraft and, if necessary, bring the aircraft safely into land.

Possibility for exemption

The Danish Civil Aviation and Railway Authority is aware that the current regulations in BL 9-4 and the Air Navigation Act restrict some flights with UAS, and that consideration for the safety of aviation and safeguarding general interests could be managed in some other way. Therefore, the Danish Civil Aviation and Railway Authority is prepared to grant exemption from the regulations to a certain extent and under specific conditions, see below.

Enterprises/institutions can apply for exemption from BL 9-4 and the Air Navigation Act, respectively, if the unmanned aircraft is to be used for:

- Testing and/or research

- Commercial purposes, which includes any tasks for which remuneration is received for the flight.

An exemption may only be granted if the following conditions are met:

1. The flight must be performed within the Visual Line of Sight (VLOS) of the pilot and in such a way that others' life and property are not exposed to risk and such that the surroundings are exposed to as little nuisance as possible.
2. The surrounding airspace must be monitored such that the flight can immediately be interrupted if another aircraft is approaching the area.
3. With regard to UAS flying, operations shall comply with an approved operations manual, which describes how safety considerations are to be met, including pre-flight checks and inspection, securing the area before and during flight, as well as a description of the enterprise's flight operations (see Appendix 1 for additional guidance).

The application will be invoiced in accordance with time spent, see BL 9-10 Regulations on the Danish Civil Aviation and Railway Authority's fees and charges for aviation.

The following categories of UAS/RPAS are applied for use in applications for exemption:

Category 1A

UAS with a maximum take-off weight of less than or equal to 1.5 kg, which develops maximum kinetic energy of 150 J, and which is operated VLOS.

Category 1B

UAS with a documented take-off weight of more than 1.5 kg but less than or equal to 7 kg and which develops maximum kinetic energy of no more than 1000 J, or more than 1000 J if it is documented that the aircraft is specifically designed to reduce the negative impact on persons and property in the event of a collision and which is operated VLOS.

Category 2

UAS with a maximum take-off weight of more than 7 kg and operated VLOS.

Category 3

UAS, which is operated outside the pilot's visual line of sight. Exemption may only be granted if this category is operated in reserved airspace. In addition to this, there will be stricter requirements in relation to the aircraft, data links and pilot. For more information, contact the Danish Civil Aviation and Railway Authority.

Definitions of concepts used in category 1a, 1B, 2.:

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Kinetic energy (also known as the energy of motion): The force required to stop a body in motion. In this case, it is used to calculate the collision energy and is calculated using the following formula:

$$E_k = \frac{m_{\max} \cdot (v_{\max})^2}{2}$$

m_{\max} is the maximum take-off mass and v_{\max} is the calculated collision speed. Collision speed depends on the wind speed, and therefore calculations should take this into account. Note that the mass must be expressed in kilogrammes and speed must be stated with metres per second.

Within the pilot's visual line of sight (VLOS): The maximum distance between the pilot and aircraft, where the aircraft's position and line of flight can constantly be observed visually without a camera, binoculars or other technical aids, and the aircraft can, without delay, be manoeuvred in such a way as to avert a collision with other aircraft in the air and persons or property on the ground. Other technical aids do not include glasses or contact lenses to correct sight impairments.

With regard to an exemption, specific requirements will have to be observed for each category, see below:

Category 1A UAS – requirements:

- Before a flight is carried out, the permit holder must ensure that a flight and safety area have been established. The area must correspond to a radius of 2 x flight altitude on the whole route, but with a minimum of 15 m and a maximum of up to 50 metres. If the aircraft cannot be fully controlled after loss of a motor (redundancy) during all phases of flight, persons who are part of the flight operation, except for the pilot, must not be present within the stated safety area. The safety area follows the aircraft throughout the flight such that the safety area is always centred where the aircraft is situated.
- The flight must be performed in such a way that others' life and property are not exposed to risk and such that the surroundings are exposed to as little nuisance as possible.
- A flight must take place at such altitude that the aircraft is within the visual line of sight of the pilot, and at no more than 100 metres above ground level. If the aircraft can be pre-programmed to a maximum altitude, this must be done and the altitude must be set at a maximum of 100 metres.
- The surrounding airspace must constantly be monitored and the flight must be suspended immediately if another aircraft approaches the area.
- Flights must be VLOS and within the operational range of the aircraft. Any other activity in progress, topography and any obstacles, atmospheric impacts on the radio connection, frequency disturbances, weather impacts, etc. must all be considered.
- Before a flight is carried out, it must be planned and prepared using an aeronautical chart in order to ascertain the airspace in which the flight is to be performed. Flights in controlled airspace, traffic information zones (TIZ) and traffic information areas (TIA), may only be carried out with a separate permit from the Danish Civil Aviation and Railway Authority.
- Before a flight is carried out, the operator is responsible for obtaining the relevant permits from property owners and relevant authorities, including the police.
- Flights closer than 150 metres to properties belonging to the Royal Family, police stations, prisons or detention centres, military installations etc. may only take place with written consent from these institutions.

- Flights closer than 150 metres from railways, main roads, dual carriageways and motorways must be described in the enterprise's operations manual.
- Flights may not be carried out closer than 200 meters from accident sites where the police, emergency and rescue services are at work, and the rescue authority on site may impose further restrictions.
- Photography of military installations, depots, units, weapons, equipment or similar, which are not accessible to the public, may only take place if a permit has been obtained from the Danish Armed Forces.
- Flights within a radius of 5 km from the runway/runways at a public aerodrome and 8 km from a military airbase may only take place with a separate permit from the Danish Civil Aviation and Railway Authority. A public aerodrome is an aerodrome approved as such by the Danish Civil Aviation and Railway Authority.
- Operations must not be carried out between sunset and sunrise without a special permit from the Danish Civil Aviation and Railway Authority.
- The pilot must be familiar with operation and control of the aircraft.
- The operator must appoint a pilot for each flight. UAS pilots operating pursuant to this exemption must, during the operation, be able to document having obtained the skills for the manoeuvres, type of operation, UAS model and operating instructions applicable for the operation intended to be carried out.
- The operator must ensure that the system is operated exclusively in accordance with the manufacturer's instructions, and that the status of the system is checked before the flight is performed.
- The pilot shall ensure that the system is fully functional and is operational during the flight.
- If the aircraft is equipped with automatic operation with pre-programmed flight plans, it must, at all times and without delay, be possible to take over control of the aircraft manually, so that collision with other aircraft, persons, vessels, vehicles and buildings does not occur.
- If the operation is performed by more than one UAS, a pilot must be attached to each UAS.
- Accidents or incidents that have caused damage or injury to people, animals or property on the ground or in the air must be reported to the Danish Civil Aviation and Railway Authority as soon as possible.
- Flights completed must be documented in a logbook or similar. The documentation must include the following: date, pilot, type of aircraft, take-off and landing site, flight times, total flight time, type of operation and any deviations.
- The aircraft must be labelled with the operator's name and telephone number, as well as the registration number allocated to the individual UAS by the Danish Civil Aviation and Railway Authority.
- The operator must be insured in accordance with European Parliament and Council Regulation (EC) no. 785/2004 of 21 April 2004.

Category 1B UAS - requirements:

The requirements for category 1A UAS must be met. In addition, the following requirements apply:

- The aircraft must be equipped with an on-board fail-safe system, which must be able to stop the flight in the event of lack of signal and/or if the battery reaches a point where continued flight will not be possible. If the aircraft is transferred to the fail-safe system, the aircraft must emit audible signals to make people on the ground aware of the aircraft. In such event, the aircraft must land at a vertical speed which will not injure people and/or animals.

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Category 2 UAS - requirements:

The requirements for category 1A UAS and category 1B UAS must be met. In addition, the following requirements apply:

- Before a flight is carried out, the permit holder must ensure that a

flight and safety area has been established and this must be described in the enterprise's operations manual. The area must be at least 50 metres in radius and be appropriate for the type of aircraft, speed and operation, including the number of persons taking part in the flight operation and the necessary safety distances to these people. If the aircraft cannot be fully controlled after loss of a motor (redundancy) during all phases of flight, persons who are part of the flight operation, except for the pilot, must not be present within the flight and safety area. The safety area follows the aircraft throughout the flight such that the safety area is always centred where the aircraft is situated.

Validity and application for renewal

An exemption for category 1A and 1B is valid for three years and an exemption for category 2 is valid for two years.

Applications for renewal shall be received by the Danish Civil Aviation and Railway Authority by no later than 30 days before expiry of the period of validity.

If the enterprise undertakes other tasks, including acquisition of a higher/heavier category which is not part of the exemption, a new application must be submitted to the Danish Civil Aviation and Railway Authority. The Authority must also be notified if the

enterprise ceases trading. The application must contain the following information:

- Name and the name of enterprise with CVR number (business registration number), as well as complete contact information.

(CFL)

- An enclosed operations report which describes activities for the previous years. The logbook may be used as an underlying document for the operations report.

The operations report must include the following:

- Total flight time for each aircraft and pilot.
- Type of operation
- Operational malfunctions and faults including corrective measures.

References:

BL 5-00 Regulations concerning definitions for flight operations, edition 1, 16 December 2009

BL 9-4 Regulations on aviation with unmanned aircraft not weighing more than 25 kg, edition 3, 9 January 2004

BL 9-10 Regulations on the Danish Civil Aviation and Railway Authority's fees etc., latest edition.

AIC B 21/09 Radio controlled aircraft subject of BL 9-4 paragraph 4.2. (Large models)

AIC B 23/13. Definition: "densely built-up area"

AIC B 27/13 BL 9-4 FPV - First Person's View.

Appendix 1. Criteria for the approval of an organisation

1. Organisation:

- 1.1. An applicant for an enterprise to fly with unmanned aircraft (UAS) under an approved organisation must be represented by a person responsible for the enterprise's overall activities in the area.
- 1.2. The person responsible must ensure that the enterprise's organisation and size correspond to the activity the enterprise is assuming. The person responsible has overall responsibility for the activities performed, taking into account the restrictions issued, permits, rules and resources.
- 1.3. The person responsible must ensure that persons are appointed to take operational responsibility as well as technical responsibility.

1.4. The person responsible for operations is responsible for:

- a) Ensuring that there are permits, instructions and safety procedures for flights by the enterprise and that these are followed and complied with.
- b) Requirements for pilot training, as well as evaluation and maintenance of pilots' training and practical skills with regard to the operations the enterprise performs.
- c) Ensuring that there is documentation for flight planning and performance, and that the

documentation is stored for subsequent analysis and inspection.

- d) Ensuring that procedures are prepared for reporting to the Danish Civil Aviation and Railway Authority in the event of damage or injury to people, animals or property.

1.5. The person responsible for technical aspects is responsible for:

- a) Ensuring that aircraft comply with the relevant requirements and specifications, including noise restrictions.
- b) Ensuring the enterprise's aircraft are maintained in accordance with the manufacturer's instructions, and
- c) that they are maintained by technically competent staff.

- 1.6. If the person responsible for the enterprise's overall activity resigns, the activities must be stopped until a new person has been appointed.

- 1.7. During flight, there must always be a pilot present who has the aircraft within visual line of sight and who can take over the control of the aircraft.

The organisation's operations manual must include training programmes for UAS pilots.

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The training programme must ensure that all the UAS pilots have received appropriate training. This means training in any manoeuvre and type of operation for UAS models that is used during the type of operation described in the operations manual and covered by the exemption from BL 9-4.

The training programme must ensure that the UAS pilot is prepared to deal with any planned or non-planned situation which might arise during flight with the equipment, so as to avoid any risk of damage or injury to persons, animals or the property.

The training programme must ensure that the UAS pilot masters all UAS technical functions relating to flying the UAS.

Training in relevant manoeuvres must be within the restrictions in BL 9-4.

With regard to flying UAS category 1B, the training programme must contain exercises in controlling the UAS during flight and landing when one of the aircraft's motors does not provide any thrust.

The training programme must include familiarity with the section in the operations manual about planning and performance of flights with the UAS.

The training programme must be completed with a demonstration of flying skills by the UAS pilot to the person responsible for operations, who must be qualified to fly the relevant UAS. If an organisation has no experience with the relevant UAS, the demonstration must be performed in consultation with the Danish Civil Aviation and Railway Authority.

The organisation must document completed training for all the UAS pilots who operate according to the operations manual.

When a UAS pilot has completed the required training satisfactorily, the organisation must issue a qualification certificate to the pilot in which the pilot and the organisation both certify that training has been completed.

The qualification certificate must be presented to inspectors from the Danish Civil Aviation and Railway Authority when operations entail exemption from BL 9-4.

1.8 Pilots must be legally competent.

2. Technical requirements

2.1 The aircraft must be fitted with an on-board fail-safe system, which must be able to stop the flight (only applies for categories 1B and 2), and this system must, as a minimum, comply with the following.

- Return to point of origin (via transmission from a transmitter)
- Return to point of origin with auto-land (in the event of loss of contact with the transmitter)

2.2. If the UAS is equipped with automatic operation with pre-programmed flight plans, it must, at all times and without delay, be possible to take over control of the UAS manually, so that it is always possible to perform an evasive manoeuvre if necessary.

2.3. There must be a technical manual on the UAS which describes its structure, its control system and other systems, as well as practical management of the system.

2.4. Operations must be carried out in accordance with the checklists described in the approved operations manual.

2.5. Only original spare parts may be used to replace defective components.

2.6. The operator must be able to document that the UAS is maintained in accordance with the manufacturer's instructions and that a technical check has been performed before a flight is carried out.

2.7. All bolts and nuts must be secured using either:

- self-locking nuts
- safety wire
- split pins or locking fluid such as locktight or similar

Propeller mounting bolts or nuts must be tightened with a torque wrench, if this is stated by the manufacturer, they must be self-locking and marked with a torque seal.

3. Flight operations

3.1. The operations manual must address all the headings mentioned in this guide.

3.1.1 The enterprise must prepare an operations manual containing checklists for safe planning and performance of the operation.

3.1.2. The enterprise's operations manual must be available for everyone involved in operations and maintenance. As a minimum, the operations manual must include:

- a) Description of the areas of responsibility mentioned in section 1 of the Appendix.
- b) Description of the enterprise with related operational restrictions.
- c) Instructions and checklists for preparation of a flight.
- d) Instructions and checklists for performance of a flight.
- e) Instructions for all activities including associated checklists.
- f) Description of training programmes in accordance with paragraph 1.7.
- g) An enterprise-specific risk analysis in which all significant malfunction situations are analysed with corrective measures, as well as instructions/checklists for abnormal operation.

4. Operational restrictions

4.1. The operational restrictions depend on the technical design of the aircraft, the way in which the operation is carried out, compensatory measures, etc.

5. Flight planning

5.1. Before the commencement of a flight, appropriate planning using relevant materials must be completed. If necessary, the police, the owner of the area, etc. must be contacted.

5.2. Planning must take account of the current weather data and ensure that the technical and operational restrictions on the aircraft can be observed.

5.3. Planning must ensure an appropriate distance to the surroundings, persons and animals.

5.4. Approved radio frequencies must be used or special authorisation must be obtained from the relevant telecommunications authority.

6. Performance of the flight

6.1. Weather conditions during the flight must be such that the UAS can be operated safely in all phases of the flight and so that the UAS remains within the pilot's visual line of sight.

6.2. The flight must be terminated if the weather deteriorates such that a safe flight cannot be completed.

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- 6.3. The UAS must give way to other aircraft at all times.
- 6.4. The pilot must terminate the flight if unauthorised persons enter the safety area.
- 6.5. It is not permitted to fly between sunset and sunrise without special permission from the Danish Civil Aviation and Railway Authority.

7. Reporting

- 7.1. The person responsible is responsible for reporting damage or injury to people, animals or property to the Danish Civil Aviation and Railway Authority as soon as possible.
- 7.2. Flights must be recorded in a logbook for the individual UAS, and the logbook must follow the UAS. Flights must be logged with the date, time of take-off and landing, pilot, take-off and landing area, flight time and any comments/incidents. The logbook must be kept for five years and must be made available to the Danish Civil Aviation and Railway Authority upon request.

8 Training

- 8.1. UAS pilots operating pursuant to exemption from BL 9-4 must, during the operation, be able to document having obtained the skills for the manoeuvres, type of operation, UAS model and operating instructions applicable for the operation intended to be carried out.

9. Instructions concerning the application

- 9.1. An application for approval of an organisation must contain:
 - a) Information about the enterprise (name, address, telephone number, email, etc.) and information (CV) on the person responsible for the overall activities of the enterprise.
 - b) Documentation for the person authorised to sign for the enterprise (transcript from the Danish Business Authority).
 - c) Description of the activities of the enterprise.
 - d) Description and photo of the type of UAS (name/manufacturer), dimensions and other technical specifications, as well as a statement detailing how the technical requirements will be met, see paragraph 2.
 - e) The name(s) and civil registration number(s) (CPR number) of the pilot(s), and a statement on their experience with flying the type.
 - f) A copy of third-party insurance policy, see European Parliament and Council Regulation (EC) no. 785/2004 of 21 April 2004.
 - g) The enterprise's operations manual with cross references that show how the requirements of this Appendix are met.
 - h) The application should be sent to the Danish Civil Aviation and Railway Authority, Edvard Thomsensvej 14, 2300 Copenhagen S, Denmark, or email: info@trafikstyrelsen.dk.
- 9.2. An application for renewal must include the following information:
 - a) Name, name of enterprise with CVR number (business registration number), as well as complete contact information.

- b) An enclosed operations report which describes activities for the previous years. The logbook may be used as an underlying document for the operations report.
- c) The operations report must contain total flight time for each aircraft and pilot(s).