Future regulation of civil drones
Report from an inter-ministerial working group

March 2015
Foreword

Recent years have seen massive development in drone technology, and the market for civil drones is showing exponential growth. The European Commission is forecasting the potential creation of 150,000 jobs with revenues of EUR 15 billion in Europe between now and 2050.

As with all other significant new technologies, there are a number of challenges in fully realising the potential for growth that drones bring with them. For drones, these challenges relate particularly to personal safety, invasion of privacy and preventing terrorism and espionage.

This report contains recommendations for an overall regulatory framework for civil drones that seeks to properly safeguard citizens against accidents and attack, so that drone technology may gain general acceptance in society. It also aims to create as clear and uncomplicated a regulatory framework as possible, allowing it to be used by companies and serve as guidance for them.

The report has been produced by an inter-ministerial working group consisting of the Ministry of Justice (including the Danish Security and Intelligence Service (PET) and the Danish National Police), the Ministry of Business and Growth (represented by the Danish Business Authority), the Ministry of Defence (represented by the Danish Defence Intelligence Service and the Danish Defence Acquisition and Logistics Organisation) and the Ministry of Transport, with the Danish Transport Authority chairing the working group, cf. the terms of reference in Annex 1.

The working group has concentrated on the question of regulation to the exclusion of other areas, such as research and development needs. Equally, the working group has also chosen not to address certain items open to regulation, e.g. noise, which are still being evaluated in order that they may be properly understood. In addition, the report does not deal with the regulatory needs of Greenland and the Faroe Islands, which are very different in terms of density of population. Finally, the report only addresses the scenario of drones flying below 150 metres, where the airspace is subject to national regulations.

The working group has actively involved relevant interested parties in its work, including representatives of the drone industry, universities and academic institutions and international organisations.

Following decisions regarding the recommendations to be taken further, as part of the ordinary legislative and regulatory process there will be a more detailed analysis of the corporate financial consequences of the individual initiatives.
# Contents

**Working group recommendations**  
Drones – an entirely new form of transport  

**1 Civil drones – a growth market**  
1.1 The market  
1.2 The benefit and use of drones  
1.3 Stable growth requires a clear framework  

**2 A regulatory system that is appropriate for civil drones**  
2.1 Legislation of the Ministry of Transport: Aviation legislation  
2.2 Legislation of the Ministry of Justice  
2.3 Legislation of the Ministry of Business and Growth  

**3 Regulation in countries akin to Denmark and on an international level**  
3.1 Sweden  
3.2 Norway  
3.3 The Netherlands  
3.4 The United Kingdom  
3.5 The United States  
3.6 Overall assessment: Similarities and differences  
3.7 International regulation  
3.8 Relevant international legislation in the field of human rights  

**4 Classification and triviality threshold**  
4.1 Type of operation  
4.2 Operators  
4.3 Civil drones classified by weight  
4.4 Overall assessment  

**5 Liability and drone insurance**  
5.1 The need for drone insurance  

**6 Use of frequencies for remote control and identification of civil drones**  
6.1 Civil drones and the use of frequencies  
6.2 27/35/40 MHz and the 433 MHz bands  
6.3 The 2.4, 5.150–5.350 and 5.470–5.875 GHz bands  
6.4 The aviation bands  
6.5 The 5030–5091 MHz band  
6.6 Land mobile VHF/UHF frequencies  
6.7 Frequencies for identification purposes  
6.8 Overall assessment  

**7 Technical requirements relating to drones**  
7.1 Identification of civil drones  
7.2 Logging of operations with civil drones  
7.3 Standardisation  

**8 Requirements on the operator**  
8.1 The need for a drone “driving licence”  
8.2 Framework conditions for training drone operators and recreational users  
8.3 Creation of a “drone register”  

**9 Requirements on flying drones**  
9.1 Current operational requirements  
9.2 Flight beyond the operator’s visual line of sight (BVLOS)
9.3 Flying drones indoors 73

10 Airspace and infrastructure 75
10.1 The need for airspace information 75
10.2 The NOTAM system 76

Annex 1 79
The working group’s terms of reference 79
Working group recommendations

Drones – an entirely new form of transport

Drones are above us. Not as military machines, but in civilian guise. A completely new market is growing up, along with an entirely new “form of transport”: civil drones. Or, as we simply term them in this report: drones.

From a legal point of view, drones are aircraft. No doubt this makes excellent sense for larger drones that use the same airspace as other aeroplanes, where they may correctly be described as “unmanned aircraft”. Drones of this kind are increasingly appearing on an experimental basis in other countries. The developmental prospects are massive, but it will take a lot of time before everything needed to maintain the safety of other air navigation is properly under control. This is why plans (roadmaps) have been drawn up, by the European Commission, among others, for the use of this type of drone up to the end of the 2020s. International organisations are hard at work on the complex challenges involved in piloting these in mixed airspace. There is no doubt that future international requirements on big drones will match those of general air navigation, allowing the extremely high safety standards of the latter to be maintained.

This report concentrates on the state of the market currently and in future years in regard to smaller drones (under 25 kg) that use the airspace below 150 metres. The drones can currently be bought freely from retailers. They are a popular Christmas gift for children, and Danish companies and authorities are all using the new technology for a wide variety of purposes.

It is an entirely new technology and a new form of transport, bringing great opportunities for growth and business development. In a rapidly expanding market, new companies can flourish and certain tasks can be performed in a more effective, as well as (typically) more environmentally friendly manner. If Denmark is to acquire a large share in this growth market, companies need to have framework conditions that are clear and not unnecessarily restrictive in relation to other EU Member States, and there will have to be broad acceptance of the new technology among the general populace.

There is a risk of scepticism and uncertainty becoming increasingly widespread, as drones are challenging in many different ways. We have a society and an infrastructure that are generally based on the idea of movement in two dimensions: forwards and sideways. Hedges, walls and locked gates protect us from the unwanted gaze and intrusion of others. In our towns and cities, balconies are open, upper-floor windows can be opened without cause for concern, and overhead cables are suspended not far from street level. You can sit in your garden or walk on the pavement without being afraid of anything “from above”. In the event of an accident or some other hazard, the police can simply cordon off the street.

All of this is challenged by drones. Existing regulations and standards will therefore not always “suit” drones. The question is what needs to be reworked, and to what extent smaller drones in particular need to be regulated.

Smaller drones that use the airspace below 150 metres are strictly speaking also aircraft. However, the risk they represent is completely different – they are a lot closer to road vehicles in this respect than to general aviation. If it
Crashes, a drone weighing a few kilos can cause severe damage and, in extreme cases, death. To this should be added the fact that drones represent a challenge to the protection of privacy and can act as a new tool for illegal activities (espionage, smuggling, terrorism, etc.).

This report stipulates that regulation of smaller drones in the airspace below 150 metres should match the type of risk they represent. We take a risk-based approach, eschewing over-regulation, tailoring the requirements to the dangers in question. So, for instance, very small drones are not a hazard at all – they do not usually kill. But when fitted with a camera, they can spy on private citizens, thereby representing a threat to privacy, and the smaller they are, the easier it is for them to do this. Conversely, larger drones of 20 to 25 kg can be dangerous, can fly long distances and can carry loads, both of a beneficial and illegal nature. They can also represent a serious risk to other aviation if they fly near airports etc.

On the other hand, the requirements need to be simple and clear, so that they can be communicated, understood and observed by the general public. In this context, it may be useful to draw inspiration from the regulations governing road transport.

The recommendations set out below (in Box 1) attempt to find a balance between a fully “tailored” risk approach on the one hand, and to create simple, easily understood regulations on the other.

Drone technology is likely to continue to develop apace in future years. Many new enterprises will be set up and new challenges may arise. For these reasons, the recommended regulations will probably have to be revised within the next three-five years.

**Box 1: Working group recommendations**

**a) Triviality threshold**: Very small drones, including toy drones, do not pose a problem in terms of safety. Small drones should not therefore be subject to safety regulations. A triviality threshold (weight threshold) should be introduced for drones. Any drones below this threshold will not be subject to safety requirements governing their use, the operator, insurance, etc. The proposed weight threshold is 250 g, with the option of waiving the threshold if the applicant can document that the drone is of such a design as not to be dangerous. The weight (triviality) threshold will not necessarily apply to security-related requirements, which may result in requirements also being imposed on drones weighing less than 250 g on the basis of a specific evaluation.

**b) “Number plates”**: A requirement should be introduced concerning electronic identification (“number plates”) for drones for professional use, starting with drones in a congested area. The requirement will apply both above and below the triviality threshold, in cases where drones are equipped with a camera or similar device. Given that this constitutes primarily an operational regulation, it does not accordingly involve a technical trade barrier under EU law. On policing grounds, consideration should also be given to bringing in this requirement for drones for professional use outside of a congested area, and, at a later
date, for recreational drones. The ID requirement is supplemented with a requirement for drones to carry lights so that their presence can be clearly identified. The purpose of drone “recognition” is to safeguard citizens against invasion of privacy and to allow the police greater scope in enforcing “traffic regulations” and other requirements. The specific technical solution will be developed in coordination with the industry and research institutions in 2015. It is recommended that the solution eventually be map-based, allowing identification of drones within a given area.

c) “Driving licence”: Operator skills are currently approved on an individual basis. Our proposal is to formulate clear standard requirements for drone operators, based on the drone’s weight, type and the location of its use (town/country). We propose that a drone licence (“driving licence”) in category A, B, C and D be issued for professional users. Recreational users should just have a simple “drone permit” – a self-test of the most elementary drone regulations plus confirmation that they are in possession of liability insurance.

d) Liability insurance: Currently only professional users are under an obligation to hold third-party liability insurance. General family insurance policies do not cover recreational users. It is recommended that all users of drones above the triviality threshold should hold liability insurance that covers third-party injury and material damage. The requirements should be phased in on the basis of a reasonable time schedule, in order that the insurance market can develop competitive policies that will not make insurance prohibitively expensive compared to purchasing a drone. Close consultation is therefore recommended with the insurance industry as to the formulation of the requirement.

e) Drone register: A “vehicle register” (a register of “number plates” and owners) should be established, as well as a register of drone licences. These should be accessible by the authorities, in particular for enforcement purposes (the police and the Danish Transport Authority). Registration of drones will be implemented gradually, in the first instance for professional users, with a view to the later inclusion of all drones with “number plates”.

f) “Traffic information”: Drone operators must be able to readily gain access to information about closed airspace and other restrictions, so as to prevent inadvertent drone use where it is not permitted. The most appropriate approach would be to link the design of this airspace information to the existing system for general aviation (known as the NOTAM system), where a lot of data can be reused. It is proposed that in 2015 Naviair draft a proposal for traffic information specifically designed for flying drones in a separate airspace. The proposal should include some indication of financing requirements and options. The long-term aim is that private app developers should have easy access to high-quality airspace data from Naviair, so that the market can develop user-friendly applications on its own.

g) “Traffic regulations”: It is recommended that the current “traffic regulations” for drones (Regulations for Civil Aviation BL 9-4) be
largely retained. According to these, recreational use of drones may only occur away from urban areas, sensitive areas and buildings such as prisons, military installations and similar. Professional use may take place in urban areas, but with adequate measures for safeguarding pedestrians, home owners, etc. These regulations must be communicated on a large scale, including by requiring drone importers to enclose the regulations within the packaging. A clear set of regulations should be formulated for professional drone users. As and when drones can document airworthiness and safe emergency procedures, the traffic regulations for professional users can be gradually relaxed, first as exemptions, and then as relaxed regulations. The working group does not recommend permitting recreational use in urban areas for the foreseeable future. Drones below the triviality threshold are exempted from the requirement. In special cases, however, security considerations may mean that requirements have to be imposed on drones that weigh less than 250 g. It is recommended that a clear legal basis be created for regulating the use of drones in indoor airspace to which the public is admitted (sports halls etc.) in order to ensure public safety.

h) **Tracking:** A requirement should be imposed for GPS logging of all instances of professional drone use. This is intended to safeguard citizens and for use as documentation in connection with complaints, accidents, etc.

i) **Test areas, in particular for flying beyond visual line of sight:** In the very near future, the market is expected to experience the need to test fly drones beyond visual line of sight. Here Denmark can support business development by promoting test areas, with due allowance made for safety. In the short term, it is recommended that time-restricted closure of adjacent airspace be used for test flight purposes. The framework for test flights should be made clear so that applicants know what requirements they must meet.

j) **Frequencies:** The widespread use of Wi-Fi communication with drones, together with the existing frequencies for remote control, will be sufficient in many situations, including for recreational use. For professional use there may however be some situations where access to frequencies that can offer some form of protection is required. There should therefore be individual frequencies dedicated for the use of remote control of drones in relevant geographical areas, along with the issue of licences for use of that frequency. It would appear that the land mobile VHF/UHF frequencies are best suited to this purpose. Denmark must also work at an international level towards harmonising frequencies for drone use.

k) **Drones for emergency response and police use of drones:** Drones can carry out important tasks of benefit to the community, where life, health and property are at risk, such as fire fighting, search and rescue, special police tasks, transporting emergency medicine to islands, etc. It is recommended that a new category of drones be introduced: Drones for emergency response. These are drones that are used in situations where people, animals or property have been
severely injured/damaged or are in urgent danger. In this context a slightly greater degree of risk is acceptable, since the purpose of the drones is to minimise the loss of life or property, by flying beyond visual line of sight around a fire, for instance. It is also recommended that an evaluation be made of the need for special regulations governing police use of drones in relation to the requisite compliance with the safety-related regulations for drone use.

1) **International standardisation and its impacts**: There are currently no international technical standards of note for drones. Each country is therefore free to draw up its own requirements, or indeed to have opaque requirements, both of which act as a brake on trade and exports. The development of Danish standards can lead to Denmark becoming a pioneer country in this field, but it also runs the risk that the solutions in question will not readily become current in other countries. The working group is of the view that a Danish requirement on electronic ID will have every chance of being widely accepted, but, to ensure this, active efforts in international fora will be required. Denmark is generally in a good position to be active in the field of international product standardisation, particularly when it comes to smaller drones. In the technical development of smaller drones, it may well be a good idea to use general product standardisation, e.g. under the auspices of EUROCAE and JARUS in Europe and/or IEC. If Denmark is to make its mark in international work on standardisation, resources will be needed from both the industry itself and the authorities. The authorities will prioritise resources from within own budgets or earmarked resources must be found in some other way.

Currently, drones have the legal status of a special case of general aviation. This will still be appropriate for larger drones in mixed airspace. However, the above recommendations contemplate a regulatory framework for smaller drones (flying below 150 metres) that is a lot more like that of road traffic, for which the risks involved are approximately comparable. It is therefore recommended that the framework for civil drones be given a clearer formulation within the Air Navigation Act. This should involve creating a legal basis that allows requirements to be imposed on drones on security grounds (to counter invasion of privacy and unlawful use), whereas the Air Navigation Act in its current form focuses primarily on safety.

The proposals should be implemented in stages, with priority on implementing the most urgent proposals first. The package of proposals should therefore be followed up with a specific implementation plan. Some of the proposals will require significant developmental work and investments in “infrastructure”. It will be possible for a number of the measures to be user-financed, as is currently the case in road traffic and aviation.

The overall regulatory framework recommended by us is outlined below in Table 1.
Table 1: Recommended framework for regulation of civil drones:

<table>
<thead>
<tr>
<th>Permit</th>
<th>ID</th>
<th>GPS logging</th>
<th>Liability insurance</th>
<th>Training requirement</th>
<th>Airworthiness/technical requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 250 g without camera or similar device</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Up to 250 g with camera or similar device</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Recreational</strong></td>
<td></td>
<td></td>
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<tr>
<td>0.250 kg to 1.5 kg</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
<td>Drone permit</td>
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<tr>
<td>1.5 kg to 7 kg</td>
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<td>X</td>
<td>X</td>
<td></td>
<td>Drone permit</td>
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<tr>
<td>7 kg to 25 kg</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
<td>Drone permit</td>
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<tr>
<td><strong>Commercial and emergency response</strong></td>
<td></td>
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<tr>
<td>Up to 250 g without camera or similar device</td>
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<tr>
<td>Up to 250 g with camera or similar device</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
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<tr>
<td>0.250 kg to 1.5 kg</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>Drone licence A</td>
</tr>
<tr>
<td>1.5 kg to 7 kg</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>Drone licence B</td>
</tr>
<tr>
<td>7 kg to 25.0 kg</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>Drone licence C</td>
</tr>
<tr>
<td>BVLOS up to 2.5 kg</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>Drone licence D</td>
</tr>
<tr>
<td>&gt; 25 kg</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>Case-by-case basis</td>
</tr>
</tbody>
</table>

Fejl! Ingen tekst med den anførte typografi i dokumentet.
1 Civil drones – a growth market

If the new technology is provided with the proper framework in which to evolve and operate, civil drones will in the future be able to benefit citizens, companies and the community in general. The market is expanding rapidly, and Denmark is well placed to be ahead of the field and thus generate growth and jobs. To achieve stable growth, civil drones will have to gain broad acceptance among the general public. There is therefore a need to ensure that they are safe in the air and to protect citizens from their unlawful use.

1.1 The market

Drone technology has been coming on apace in recent years, and the market for drones is showing strong growth. The European Commission compares the potential of drones to the significance of the Internet in the 1990s. It is therefore crucial that an effective European market be created for drones, as this will be essential for the aerospace industry of the future.\(^1\)

The Commission predicts that drones will account for 10% of the total aviation market within 10 years, which is to say that the market will amount to around EUR 15 billion a year.

Currently the market is dominated by the USA and Israel – particularly for drones used for military purposes, produced in these two countries. In addition, it is anticipated that Brazil, Russia, India and China will become significant players in the global drone market.

There are in total around 500 drone manufacturers globally, a third of which are located in Europe. Equally, there are more than 1,000 operators in Europe, and their number is growing rapidly. In France, for instance, there are around 500 operators, whereas Sweden and the UK have granted licences to more than 200 operators in recent years.

Similarly, we in Denmark have experienced significant growth in the number of operators in 2014. At the start of the year there were just five approved drone operators in Denmark. During the course of the year this increased to over 50.

In the light of the rapidly developing market, in the autumn of 2013 the Ministry of Higher Education and Science commissioned a technological evaluation of drones, which was carried out by the Danish Board of

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\(^1\) European Commission (2014): *Press Release: European Commission calls for tough standards to regulate civil drones*
Technology. This evaluation shed some light on aspects and perspectives particular to Denmark by means of an analysis of and in-depth discussions on drones with stakeholders and other interested parties.

The Danish Board of Technology concludes that Denmark is well placed to be ahead of the field when it comes to drones. In terms of research, innovation and production in many of the areas linked to the development of drones, Denmark is in a strong position. These involve areas like robot technology and navigation, where Denmark is well placed to lead the way. The same is true of sensors and other technologies fitted to drones. Finally, here in Denmark we have excellent know-how when it comes to wind turbines, where it may be expected that expertise on wind and blades will find application in the development of drones, to ensure the latter can be used in poor weather conditions.

The most realistic scenario for Danish companies is that they can become niche manufacturers or second-tier suppliers to the drone industry.

1.2 The benefit and use of drones

In global terms, currently more than 1,700 different types of drone are produced by known manufacturers. A third of these are produced in Europe. The drone industry itself expects that it will create up to 150,000 new jobs in Europe by 2050. In Denmark, the industry organisation UAS Denmark estimates that by 2017 there will be 750 jobs created in the sector.

Like robots, drones will be able to take over work tasks that normally require relatively straightforward manpower. In this connection, reference is often made to “the three Ds”, that is to say, work that is “Dull”, “Dirty” and/or “Dangerous”. Similarly, it will be possible to use drones to streamline current tasks, as well as perform work that is currently not carried out. Inspections of natural and industrial areas could be systematised, for instance. Such functions will be able to render Danish companies more efficient and competitive, thereby leading to the creation of more jobs in Denmark.

In particular, drones may well find extensive future use in agriculture. By fitting the correct technologies to drones, it will be possible to use them to make Danish agriculture even more efficient. Here we particularly have in

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2 The Ministry of Higher Education and Science was responding to a decision by the government and other parties to the political accord, as part of its allocation of the research reserve funds for 2014, to commission a survey and technological evaluation of current and future use of drones in Denmark by civilian operators.

3 The Danish Board of Technology (2014): Civil Drones (UAS) in Denmark – potential, challenges and recommendations


5 The Danish Board of Technology (2014): Civil Drones (UAS) in Denmark – potential, challenges and recommendations
mind sensors that can analyse soil type and plant growth, as well as technologies that can be used to protect wildlife at harvest time.

Equally, overview images can be created sufficiently frequently, and of such overall clarity and richness of detail, as to help make the use of pesticides and water more efficient.

Another area that shows significant potential is the use of drones for emergency response, where they can help improve the coordination of emergency service callouts. In addition, in an emergency response context, drones can be used to provide updated map material of incident locations, minimise the risks involved in the operations and provide an overview of search and rescue missions.

**Example: Drones are used for emergency response**

The Copenhagen Fire Brigade uses drones to form a general picture of the incident location when called out to a fire or other incident, such as a chemical spill.

The drone has a video camera fitted to it which transmits images directly to the operation managers and the Fire Brigade’s alarm centre. With these “eyes in the air”, planning of the callout operation at the incident location is enhanced, allowing the Brigade to engage more rapidly and more effectively.

The images from the drone do not just improve the chances of saving lives and property. The drone can also be used to evaluate the danger at, for instance, a chemical spill or where there is a danger of building collapse or explosion, all of which helps increase the safety of the Fire Brigade’s crews. Finally, the video images from the drone provide important documentation for use in evaluating the intervention of the Fire Brigade.

*Source: Copenhagen Fire Brigade*

Mention may also be made of the general area of inspections, where there is great potential for drones to carry out several types of task. These might be inspections of roads, utilities, thermographic surveys or structural inspections of high buildings and bridges. A common denominator of the tasks is that the use of drones allows the tasks to be performed a lot more cheaply (and with less disruption to the environment) than is the case today. One reason for this is that there is a reduced demand for helicopters or aircraft to perform the task.

A fourth area in which drones can be used in Denmark is the collection of geodata. This is relevant for land inspections, natural surveys and planning, agriculture, emergency response and engineering. Drones are for instance already in use for surveying coastal stretches and other surveying tasks. Equally drones can be used for monitoring nature and the environment. Drones have many potential uses in this field. By fitting them with sensors, accurate information can be obtained as to the natural and environmental conditions at otherwise inaccessible locations.
Example: Drones are used for environmental monitoring

The Danish Nature Agency has used drones to map the occurrence of the so-called Japanese Rose (rosa rugosa), which is so invasive as to pose a threat to the natural habitat of dune landscapes.

The drones used are equipped with a camera that produces high-resolution digital images to identify areas where this invasive plant is growing. So far a 22-kilometre stretch of coastline has been photographed.

Using the images, it has been possible to control the invasiveness of the plant more effectively.

Source: The Danish Nature Agency

If this new technology is provided with the proper framework in which to develop and operate, drones will thus be able to benefit citizens, companies and the community in general in the future.

1.3 Stable growth requires a clear framework

If we in Denmark want to achieve acceptance by the population at large and fully utilise the great potential to be had in drones, including the commercial potential, there has to be a clear framework so that citizens and companies know what to expect in the years ahead. For smaller drones in particular (i.e. drones weighing less than 25 kg), a clear framework needs to be established for companies as soon as possible.

Drone technology is however a matter of some complexity. On the one hand we must ensure the best possible opportunities for growth as far as drone companies are concerned. On the other hand, we also have to maintain aviation safety and protect our citizens from the unlawful use of drones, given that the use of drones may be open to potentially illegal activities.

There is a risk of civil drones being used as weapons, of the navigation or communications system signals of drones being jammed, and that control towers on the ground might be hijacked. Equally, drones may be used by criminals for smuggling arms, mobile phones or drugs to prison inmates, for monitoring police operations, and, in terror-related contexts, as reconnaissance and observation platforms or as delivery vehicles for offensive weapons, for instance.

There is moreover a completely separate challenge in terms of preventing invasion of privacy. There is a risk that the introduction of civil drones in Danish society may lead to a breach of basic constitutional rights, including upholding the right to privacy and a family life and the protection of personal data. The broad spectrum of potential uses of civil drones may include the collection of personal data. There are good grounds for misgivings when it comes to ethics, invasion of privacy and data protection. Furthermore, when drones are used for monitoring and the taking of photographs, safeguarding against invasion of privacy is a particular challenge.

The following chapters reveal how Denmark can manage the positive and negative challenges resulting from the increasingly widespread use of civil drones:
- **Chapter 2** examines whether integration of drones in Danish society can be dealt with using current legislation.
- **Chapter 3** turns the focus on other countries, to look at the regulatory systems of countries akin to Denmark, as well as the system at an international level, in organisations like the EU and ICAO.
- **Chapter 4** provides a classificatory outline of drones, with the recommendation of introducing what we call a triviality threshold, so that e.g. toys are distinguished from drones.
- **Chapter 5** deals with the liability and insurance aspects relevant to the use of drones.
- **Chapter 6** examines which frequencies may be used for the safe remote control of civil drones, as well as the electronic identification of drones.
- **Chapter 7** considers the minimum requirements from a technical point of view that might be imposed on drones in Denmark. The need for product standardisation is also dealt with.
- **Chapter 8** addresses the skills that will be required of individuals who pilot drones.
- **Chapter 9** consequently examines the kinds of operational requirements that ought to apply for piloting civil drones. It therefore looks at the issue of how drone traffic is to be controlled.
- **Chapter 10** provides an account of the integration of drones in Danish airspace, including the communication of air traffic information to drone operators.
2 A regulatory system that is appropriate for civil drones

Common to the acts of parliament and regulations that govern drones is the fact that none or very few of them were formulated with drones in mind. This is particularly true of aviation legislation, where it is proposed that a clear framework for the regulation of drones be created. In this context, a separate set of regulations should be formulated for commercial use of drones up to 25 kg. Our view is that other relevant legislation can accommodate the integration of civil drones in Danish society.

2.1 Legislation of the Ministry of Transport: Aviation legislation

Drones are considered as aircraft. The general framework for air navigation is determined globally by the UN organisation ICAO. Within this framework, the EU legislates at a European level, and the Air Navigation Act6 generally governs all civilian aviation within Danish airspace or using Danish aircraft, in accordance with current EU regulations.

The member states themselves regulate flights below 150 metres (with the exception of airports and aerodromes etc.), whereas airspace above 150 metres is subject to international regulations.

It is still the case that civil drones cannot be integrated in the airspace above 150 metres. Firstly, there are no international harmonised regulations for drone airworthiness and therefore the safety of other airspace users or that of third parties and their property on the ground. Secondly, there is still no documented safe technology that meets the “converging flight rules” governing airspace (so-called “detect and avoid” technology).

2.1.1 The Air Navigation Act

The Air Navigation Act is an outline act of parliament that delegates a number of powers to the Minister of Transport in terms of laying down more detailed regulations. Its primary purpose is to uphold user safety. The detailed regulations, including regulations governing the implementation of Denmark’s international obligations under the Convention on International Civil Aviation (the Chicago Convention) and EU cooperation etc. are laid down by the Danish Transport Authority in the form of executive orders and the Regulations for Civil Aviation (BL).

The provisions set out in the Air Navigation Act and the associated executive orders and Regulations for Civil Aviation relating to e.g. aircraft airworthiness,

6 Cf. Consolidated Act No. 1036 of 28 August 2013
crewing, air traffic regulations and the investigation of air accidents, etc. also apply as a starting point for civil drones.

Nevertheless, the Danish Air Navigation Act does contain the legal basis for a departure from that starting point in the form of Section 151(1):

"**Section 151. With due regard to aviation safety or public interests the Minister of Transport may, as regards aircraft without pilot or aircraft operating by means of other things than engines, or aircraft of special nature, exempt from the rules of the Act and make special provisions, however, not as regards regulations of civil law or criminal contents.**"

The powers under this provision have been delegated to the Danish Transport Authority, which, subject to the due regard as stated above, can both issue exemptions in specific cases from the provisions of the Air Navigation Act and set forth general administrative regulations that derogate from the provisions of the Act.\(^7\)

**2.1.2 General regulations governing unmanned aircraft**

The legal basis for laying down general provisions is only used for unmanned aircraft weighing a maximum of 25 kg, cf. Regulations for Civil Aviation BL 9-4, 3rd edition of 9 January 2004.

The Regulations for Civil Aviation originate from a time before drones were conceived of. It is moreover the case that the regulations were drawn up with recreational flying (model aircraft) in mind and not commercial piloting of civil drones. The regulations are accordingly inadequate in terms of technical requirements and training, as well as in operational and airspace matters.

**2.1.3 Exemption for unmanned aircraft**

Exemption may be made from the provisions of the Regulations for Civil Aviation BL 9-4 provided such an exemption is held to be consistent with the considerations on which the relevant provisions are based. In the light of the increased interest in recent years in the commercial use of civil drones, the Danish Transport Authority has published a guideline (AIC B 08/14) that sets out the instances where the Authority will be prepared to grant exemption from the Regulations for Civil Aviation BL 9-4, giving the more detailed terms governing such an exemption. In this connection, an exemption may be granted from the requirement that drones may only be flown outside congested areas.

A “congested area” means an area that is primarily used for housing, industry or leisure activities. This includes areas that on the ICAO Aeronautical Chart are indicated as “built-up areas” with more than 200 inhabitants, as well as summer cottage areas, occupied camp sites, developed industrial and port areas and residential neighbourhoods. In addition, parks, beaches or other recreational areas that are located within, integrated with or are directly adjoining a densely congested (built-up) area, are also regarded as a

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\(^7\) This does not however apply to provisions of the Act that regulate in matters of civil or criminal law.
congested area. This is because parks etc. are typically not far away from heavily used roads and buildings.

As of December 2014 the Danish Transport Authority had issued 51 exemptions.

As regards aircraft weighing more than 25 kg, the flying of such aircraft must generally be in accordance with the Air Navigation Act. Nevertheless, as mentioned above, on the basis of Section 151(1) of the Act, specific exemption may be granted from the regulations of the Act provided this is done with due regard to the safety of air navigation or public interests in general.

2.1.4 The need for new regulations
The above review of the current Danish air navigation regulations for civil drones below 25 kg shows that the regulations are not commensurate with the needs of today.

Up to now, it has been possible to address the need for commercial use of drones by means of a “tailored” exemption regime. As drone use increases, the number of applications for exemptions grows accordingly. The result is a need for a clearer framework and transparency in the way the authorities deal with the issue.

In addition to specific exemption applications, there has been a significant increase in the number of cases referred to the Danish Transport Authority relating to drones (see Figure 2). It is anticipated that the increase will continue in coming years.

**Figure 2: Number of cases referred to the Danish Transport Authority each year relating to drones**

[Graph showing an increase in cases from 2 in 2011 to 185 in 2014]

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*This figure is based on calculations as of 12 December 2014.*
It is against this background that the working group recommends that clear national regulations be drawn up for drones weighing up to and including 25 kg. It is this group of drones that will constitute by far the greater part of the market in the near future. A second area that may require regulation is the piloting of drones beyond the operator’s visual line of sight (BVLOS). No specific request in this respect has as yet been received from applicants, but significant growth is expected in this area over the next five years.

As drone regulations grow in scope, we believe that this will also result in a need to provide a better legal basis within the Air Navigation Act itself.

In those areas where the EU/EASA may not be expected in the foreseeable future to provide regulation of drones (see below), national (Danish) regulations will be needed. It would be expedient for such Danish regulations to be formulated with an eye to countries akin to Denmark and the considerations of international bodies (see Chapter 3 Regulation in countries akin to Denmark and on an international level for more information). This will increase the likelihood of Danish regulations having a longer shelf-life and being better targeted in relation to future international regulation.

It may equally be relevant to introduce requirements for smaller drones where considerations of safety (the Air Navigation Act) are secondary to the protection of privacy etc. Such requirements should be introduced into the Air Navigation Act (see Chapter 7 Drone requirements for more information).

Overall, the working group is of the view that the introduction of civil drones in Danish society will require that framework conditions for civil drones be incorporated in the Air Navigation Act.

2.2 Legislation of the Ministry of Justice

The question of invasion of privacy etc. may be relevant in the use of remote-controlled civil drones equipped with a camera or similar device, allowing the drone to take photographs, make video recordings and transmit or in some other manner collect data.

As regards these situations, the Act on Video Surveillance, the Act on Processing of Personal Data and the Criminal Code all contain regulations that may be relevant.

In terms of the relationship between the Act on Video Surveillance and the Act on Processing of Personal Data, it should generally be noted that the Act on Video Surveillance governs the actual right to undertake video surveillance. If the video surveillance allowed under the Act on Video Surveillance involves the collection of personal data, such collection and the subsequent use of the recordings made must be in accordance with the Act on Processing of Personal Data.

2.2.1 The Act on Video Surveillance

Section 1(1) of the Act on Video Surveillance prohibits private persons from undertaking video surveillance of a street, road, square or similar area used for public traffic. Nevertheless, the Act on Video Surveillance contains a
number of specific exceptions allowed on crime-prevention grounds (cf. Sections 2 and 2a of the Act).

The prohibition on private video surveillance of areas used for public traffic applies both to private individuals and private legal entities, including e.g. private companies and associations.

Under Section 1(2) of the Act, “video surveillance” means continuous or regularly repeated personal surveillance with the aid of a remote-controlled or automatically operated video camera, still camera or similar camera.

Regarding the term “video surveillance”, the drafting notes\(^9\) for the provision contain the statement that the Act is basically intended not just to cover cases where surveillance is associated with the recording of images on a video tape, film or similar medium, but also cases where the recording or taking of images in this manner does not take place and the surveillance in question therefore only involves direct observation on a monitor or similar device.

The drafting notes also show that the expression “continuous or regularly repeated personal surveillance” entails that observation or recording must be for the purposes of carrying out checks on individuals and their behaviour. Cameras that are set up to carry out checks using e.g. a mechanical function or for observing or recording the behaviour of animals in the wild do not accordingly come within the scope of the Act.

The requirement of “continuous or regularly repeated” surveillance also entails that recording or observation of some duration must be involved, and which is not limited to given events or sequences of events. The requirement will for instance be met by the use of cameras that only start operating at fixed intervals or specific times, or when people enter the field of vision.

The gist of the drafting notes is that the requirement should be taken to mean that photography and observation of a more casual and one-off nature does not come under the Act\(^10\). In this connection, reference may be made to criminal case TfK-2012-367, where the Eastern High Court pronounced that an instance of recording for approximately three hours did not come under the prohibition of Section 1(1) of the Act on Video Surveillance, as the recording did not meet the condition of being “continuous and regular”.

Finally, the camera must be “remote controlled or automatically operated”, which means that the use of cameras that are controlled in-situ, such as those for general film recordings and snapshots, are outside the scope of the Act.

A drone is a remote-controlled device that will usually be in constant motion, so that it does not in principle record at a specific location. The Ministry of


\(^10\) A tourist who uses remote control to make video recordings on the “Strøget” (main shopping street) in Copenhagen will thus not be in breach of the Act on Video Surveillance, cf. Tvoervågning, Peter Blume, 2008, page 39.
Justice does not know of any legal precedent where application of the Act on Video Surveillance has had to be considered in cases of this kind, where a camera is mounted on a remote-controlled object that is in constant motion.

The issue is whether the condition enshrined in Section 1(2) of the Act on Video Surveillance relating to “continuous and regularly repeated personal surveillance” can be deemed to be met in such cases. Whether, in a specific case, a drone has been used in connection with continuous and regularly repeated personal surveillance in the sense of the provision must depend on an evaluation of the overall circumstances relating to the observation/recording.

It may nevertheless be assumed that civil drones equipped with a camera, and used as part of more systematic observation/surveillance that is not limited to specific events, will come under the prohibition expressed in the Act on Video Surveillance under certain circumstances.

The general prohibition in Section 1 of the Act on Video Surveillance applies, as stated, only for video surveillance undertaken by private persons.

The Act on Video Surveillance does not accordingly regulate the right of public authorities to carry out video surveillance, including police surveillance of streets, roads, squares or similar areas. However, public authorities are subject to the general rules governing the handling of cases and standards of good administrative practice set out in administrative law. These include the duty to always be objective in the exercise of authority. In addition, public authorities are subject to a general principle of proportionality. Furthermore, the regulations of the Act on Processing of Personal Data also apply in relation to public authorities (see below).

2.2.2. The Act on Processing of Personal Data

2.2.2.1 The scope of the Act on Processing of Personal Data

The Act on Processing of Personal Data contains general provisions of Danish law on the processing of personal data.

Under Section 1(1) of the Act, the Act on Processing of Personal Data applies to “the processing of personal data wholly or partly by automatic means, and to the processing otherwise than by automatic means of personal data which form part of a filing system or are intended to form part of a filing system”.

Under Section 3, no. 1 of the Act, “personal data” means any information relating to an identified or identifiable natural person (“data subject”).

According to Section 3, no. 2 of the Act, “processing” means any operation or set of operations which is performed upon personal data, whether or not by automatic means. The term “processing” is to be understood in a very broad sense, to include collection, recording, systematisation, storage, adaptation or modification, selection, searches, use, disclosure by transmission, communication or any other form of handover, etc.11

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Under Section 1(8) of the Act, it applies to any processing of personal data in connection with video surveillance. This provision only covers video surveillance covered by the Act on Video Surveillance.  \(^\text{12}\)

The following is set out in Item 3.2.1 of the drafting notes on the legal position prior to insertion of the provision contained in Section 1(8):

"Section 1(1) of the Act on Processing of Personal Data entails that video surveillance by private individuals and public authorities using digital equipment (i.e. video surveillance using equipment which involves processing by automatic means) is covered by the Act on Processing of Personal Data if personal data relating to an identified or identifiable natural person is processed. This applies regardless of whether the video surveillance is performed with or without the recording of images. The practice of the Danish Data Protection Agency has been to regard images of e.g. personnel, customers and other persons present as being personal data covered by the Act.

It is the practice of the Danish Data Protection Agency not to regard video surveillance using analogue equipment as being covered by Section 1(1) of the Act. The reason cited by the Agency for this is that this form of video surveillance does not involve processing by automatic means. This means that video surveillance by public authorities using analogue equipment is outside the scope of the Act, whereas video surveillance by private persons using analogue equipment is covered by Section 1(2) of the Act on Processing of Personal Data if the video surveillance is associated with the recording of images and these recordings are stored in systematic fashion."

The provision contained in Section 1(8) entails that processing by private persons and public authorities of personal data in connection with video surveillance is covered by the Act on Processing of Personal Data, regardless of whether data processing is by automatic means and regardless of whether personal data obtained via video surveillance is to form part of a filing system or be the subject of other non-automatic processing.  \(^\text{13}\)

Apart from the cases mentioned in Section 1(8) of the Act (i.e. in cases that do not involve video surveillance in the meaning of the Act on Video Surveillance), recording of images with a camera may (depending on the specific circumstances) still constitute processing of personal data under the general scope of the Act.

The Act covers all processing of personal data, regardless of the identity of the intended beneficiary of the processing.

Under Section 2(3) of the Act on Processing of Personal Data, the Act does not apply to the processing of data undertaken by a natural person with a view to the exercise of purely personal activities.


2.2.2.2 The rules on processing of data of the Act on Processing of Personal Data

Section 5 of the Act on Processing of Personal Data contains a number of fundamental principles for the processing of data by the data controller, including rules for its collection, updating and storage, etc. Processing of data must be in accordance with good practices for the processing of data. This means that the processing must be appropriate and lawful. Collection of data may also only be made for specified, explicit and legitimate purposes and further processing must not be incompatible with these purposes.

Sections 6–8 of the Act on Processing of Personal Data contain a series of provisions governing when collection, recording and disclosure of personal data may take place. The Act on Processing of Personal Data is structured so that processing of personal data may only take place if the rules on processing of data set out in Sections 6–8 provide a legal basis for this. Nevertheless, the Act contains special rules on the processing of personal data for certain areas specified in more detail.

2.2.1.3 The Act on Processing of Personal Data and the processing of personal data that originates from a drone

Provided that recordings made using civil drones equipped with a camera are covered by the Act on Video Surveillance, the Act on Processing of Personal Data will apply (cf. Section 1(8) of the Act on Processing of Personal Data). Such recordings will likewise be covered by Chapter 6a of the Act on Processing of Personal Data, which contains a number of special provisions relating to the processing of personal data in connection with video surveillance for criminal prevention purposes.

In other cases, recordings with a camera mounted on a drone that comprise data about persons will, as stated, be covered by the Act on Processing of Personal Data under certain circumstances.

Recording will accordingly only take place if the fundamental principles of the Act on Processing of Personal Data and the aforementioned conditions set out in Sections 6–8 of the Act are met. The same applies in relation to the subsequent use of the recordings, including the making public and disclosure of images and videos that contain recognisable persons.

2.2.3 The Criminal Code

The Criminal Code contains provisions that may under certain circumstances be relevant to the use of civil drones.

Under Section 264a of the Criminal Code, any person who unlawfully photographs persons who are not in a place open to the public shall be liable to a fine or to imprisonment for a term not exceeding six months. The same shall apply to any person who, with the aid of a telescope or other equipment, unlawfully watches such persons. The provision covers the recording of both still images and film, as well as observation using an item of equipment, including in cases where the images are not stored. The prohibition set out in Section 264a of the Criminal Code is of importance for private households and private gardens. Photography or observation by means of an item of equipment of persons who are not in a place open to the public will generally be unwarranted unless consent has been given by the person photographed or observed or by the person who owns or is in charge of the location in question.
Under Section 110a(1), no. 1 of the Criminal Code, any person who, intentionally or through negligence, without being duly authorised to do so, takes photographs of Danish military defence installations, depots, units, arms, material, etc., which are not accessible to the public, or who duplicates or publishes such photographs, shall be liable to a fine or imprisonment for a term not exceeding three years. It is a condition that the person was or ought to have been aware that the item in question was an installation etc. not accessible to the public. Under (2) of the same section, any person who, intentionally or through negligence, without being duly authorised to do so, takes photographs from aircraft over territory of the Danish state or publishes such unlawfully taken photographs, shall be liable to a fine.

Under Section 263(1), no. 3 of the Criminal Code, any person who unlawfully, with the aid of equipment, secretly listens to or records statements made in private, telephone conversations or other conversations between others or negotiations in a closed meeting in which he is not himself taking part or to which he has unlawfully obtained access, shall be liable to a fine or to imprisonment for a term not exceeding six months. Section 263(1), no. 3 applies irrespective of the location, i.e. both in a private house and in places accessible to the public. Section 263(1), no. 3 entails that it will normally be prohibited to listen to or record statements or conversations with the aid of equipment, unless such listening or recording takes place with the consent of at least one of the participants in the conversation that is being listened to or recorded.

2.3 Legislation of the Ministry of Business and Growth

2.3.1. Export controls legislation

The rules governing export controls for dual-use items (i.e. items which can be used for both lawful civilian and military purposes and for development and manufacture of weapons of mass destruction) are based on EU regulations set out in Council Regulation (EC) No 428/2009, as amended by Council Regulation (EC) No 388/2012. The regulations in question are therefore common to the EU and find direct application within all member states. Equivalent regulations have also been issued by a number of countries outside the EU.

The purpose of the export control regulations is to prevent the sale of critical dual-use items to markets and customers if there is particular risk that they may be used to endanger international peace and security.

In connection with Council Regulation (EC) No. 428/2009 with later amendments, the EU has set out a so-called control list for dual-use items that require an export licence.

As regards drones (UAVs) with autonomous flight control and navigation capability or a capability of controlled-flight out of direct visual line of sight involving a human operator, these are listed in the EU’s control list under category number 9A012.a.2. This means that companies wishing to export such drones to a country outside the EU must always apply for an export licence in advance from the responsible export control authority. Danish companies must therefore apply for an export licence from the Danish Business Authority, which is the export control authority in Denmark for dual-use items.
Export controls apply to the export of dual-use items outside of the EU customs area, and therefore also for export to Greenland and the Faroe Islands. A licence is therefore required in order to send a controlled drone from Denmark to Greenland, for instance.

In most cases, licences are granted for the export of drones. However, as of the time of writing, there has been one case where an application for export licence for a drone has been turned down: the intended recipient was a military end-user in the Middle East.

2.3.2 Frequency legislation
The Act on Radio Frequencies\textsuperscript{14} regulates the use of frequencies in Denmark.

The starting point is that permission is required from the Danish Business Authority to use frequencies, unless certain defined frequencies are involved that are specifically exempted from the requirement.

The purpose of the Act on Radio Frequencies is to ensure that essential public interest considerations relating to the frequency spectrum are addressed, that competition on the frequency spectrum and therefore the telecommunications market is promoted and that efficient use of frequencies is ensured.

The Minister of Business and Growth lays down binding guidelines for the general prioritisation of the use of frequencies by the Danish Business Authority and the latter’s administration of the Act on Radio Frequencies. Within the framework of these guidelines, the Danish Business Authority lays down a frequency plan containing an overview of the framework for using and inter-prioritising all radio frequencies.

The Act on Radio Frequencies also contains provisions governing issue by the Danish Business Authority of frequency licences, including after auctions or a public tender process, as well as supervision of licence holders and user compliance with the Act and regulations issued under the Act.

The Danish Business Authority carries out supervision duties in respect of detecting specific interference caused by frequency use or other electromagnetic phenomena. In this connection, the Danish Business Authority may issue an improvement notice to owners or users of radio equipment, telecommunications terminal equipment or electrical or electronic apparatus, and in certain cases may disconnect such equipment. Prohibited use of frequencies or failure to comply with an improvement notice etc. issued by the Danish Business Authority is punishable by fine.

Under the terms of the Act on Radio Frequencies, a number of executive orders have been issued that regulate various aspects of the frequency spectrum in greater detail.

\textsuperscript{14} Act no. 475 of 12 June 2009 on radio frequencies as amended by Section 23 of Act no. 1231 of 18 December 2012
2.3.3 The Product Safety Act
Neither the Act on Product Safety (the Product Safety Act) nor the Executive Order on safety requirements for toy products (the Toy Regulation) lay down standards for the sale and use of drones in Denmark.

The Toy Regulation applies specifically to products that are exclusively or partly designed or intended for use by children under the age of 14. That is to say, the product must be marketed with the intention of selling it to children under the age of 14. If the product is marketed in a hobby shop or in a department for older children in a toy store, it is not covered by the Regulation.

Nor are there any standards in the Toy Regulation that cover drones or any criteria that may be applied in specifying a potential triviality threshold.

As far as the Product Safety Act is concerned, this too is devoid of standards for products. The Act simply lays down that products must be safe, that is to say, that products should involve no risk, or only a limited and acceptable risk, in terms of posing a safety or health hazard to consumers when the product is used under general or foreseeable circumstances and within the expected lifetime of the product. The manufacturer must provide consumers with the necessary information allowing them to assess the risks. The Act does not extend to protection of third parties.

2.3.4 The Marketing Practices Act
There is nothing in the Marketing Practices Act that prevents sellers of drones in Denmark from being required to insert a leaflet with details of Danish aviation legislation in the area.

On the contrary, certain provisions of Sections 3 and 7 of the Act require traders not to use misleading or improper statements or omit material information if this is likely to materially distort consumers’ or other traders’ economic behaviour in the market and that “when an offer is made, on entry into an agreement or (depending on the circumstances) at the time of delivery, appropriate guidance shall be given in accordance with the nature of the product or service, where this is of importance for the assessment of the character or properties of the product or service, including in particular its functional properties, durability, hazardous nature and maintainability”.

For the online purchase of goods from a supplier outside of Denmark, this option is clearly not available. In this case, the information must be provided in some other manner.
3 Regulation in countries akin to Denmark and on an international level

Common to all the countries surveyed is that the aviation authorities’ regulatory process for drone matters is not as yet particularly advanced. On the other hand, the basic conditions governing the flying of civil drones are highly uniform across national borders in terms of regulating their actual operation and flight. The comparison with the other countries leads the working group to recommend considering an increase in the maximum height at which civil drones may be flown to 120 metres in urban areas.

International aviation organisations are very active in preparing regulations and product standards, in particular for large drones that operate in mixed airspace together with general aviation. The working group recommends that, if Denmark wishes to have a major influence in international fora, resources should be set aside for this purpose.

3.1 Sweden

Sweden is one of the few countries to have drawn up dedicated drone regulations. The regulations\(^\text{15}\), which came into force on 1 December 2007, were revised in April 2013.\(^\text{16}\)

3.1.1 Operational regulations

Swedish legislation ensures that all drone operators must as a matter of principle have a licence from the Swedish authorities if they are to be able to operate commercially in Sweden. A licence is required if drones are to be used or are designed for:

1. Test flights or research
2. Commercial purposes
3. Contract flights or similar which cannot be considered as for pleasure or recreation
4. Flights undertaken outside of the visual line of sight (VLOS)

When an operation involving drones is designated as VLOS, this means that at any given time the drone is within the visual line of sight of the operator. The

\(^{15}\) The Swedish regulations may be accessed via the following link: [TSFS 2009:88](#)

\(^{16}\) The revised regulations may be accessed via the following link: [TSFS 2013:27](#)
requirement under normal circumstances is that the drone cannot be more than 500 metres away from the operator.

Other activity involving civil drones is designated as model flying, including for competition, sport, hobby and recreational purposes. The Swedish authorities recommend adhering to the regulations of the Swedish Model Flying Federation for these types of flight.

Drones are moreover categorised by weight. The weight categories are the same as in Denmark:
- **Category 1A**: Civil drones weighing less than 1.5 kg
- **Category 1B**: Civil drones weighing between 1.5 kg and 7.0 kg
- **Category 2**: Civil drones weighing more than 7.0 kg

Where Category 1A drones are flown, it is up to the operator to stipulate a safe distance from people, buildings and animals.

Category 1B drones must maintain a safety distance of 50 metres from people, buildings and animals.

Where Category 2 drones are flown, the safety distance is increased commensurate with increases in drone weight.

For all three categories of civil drone, the maximum height at which they are flown must be 120 metres. In addition, drones may only be flown above people who are involved in controlling the flight of the drone or who have given their consent.

### 3.1.2 Training

Training is required for the flying of all categories of civil drone in Sweden. The aviation authorities are responsible for assessing the skills of the operator.

For Categories 1A and 1B, the training is based on independent study by the person involved, but to acquire a licence to fly a Category 2 drone, training is required on the relevant drone type with a subsequent flying test supervised by the authorities. A distinction is made between three types of drone: fixed-wing, helicopter and multi-rotor.

If the operator does not have a private pilot’s licence (PPL), they must also take a theory test consisting of five questions, of which at least three must be answered correctly.

### 3.1.3 Differences compared to the Danish regulations

In Sweden, operators must have a general licence to fly drones commercially. The operator must also have produced an operations manual for flying civil drones weighing more than 7 kg (Category 2). In addition, there is differentiation of safety distances based on the weight of the drone, whereas in Denmark it is the same fixed safety distance for all drones. We should consider introducing this differentiation in future Danish regulations.
3.2 Norway

3.2.1 Legislation
Norway has not as yet produced any specific regulations for flying civil drones, and applications are therefore dealt with on an individual basis as in Denmark. Norwegian authorities have consequently issued guidance that includes guidelines and conditions for drone operation.\(^1\)

Anyone using a drone on a commercial basis must be in possession of the appropriate licence from the Norwegian aviation authorities.

Civil drones are not subdivided into categories as in other countries. The Norwegian approach is simple: the bigger the drone, the more stringent the requirements imposed in the approval process.

Furthermore, operators must have produced an operations manual containing a description of the operational procedures. In particular, there must be an account of how the risk to third parties is minimised.

The safety distance from people and buildings must be proportional to the height at which the drone is flown. For instance, flying at a height of 40 metres will require a safety distance of 40 metres, etc. There is however a minimum safety distance of 20 metres.

The safety distance requirement only applies to multi-rotor drones and not fixed-wing types. This is because, whereas an engine/motor fault on a multi-rotor craft will simply cause it to crash, a fixed-wing drone will continue gliding after the engine/motor cuts out, and this has to be allowed for in specifying the safety distance.

3.2.2 Training
Like Denmark, Norway has no training requirement. Nevertheless, the operator must be able to demonstrate that the person in question has an adequate level of skill to allow them to perform the operations safely.

3.2.3 Differences compared to the Danish regulations
Unlike Denmark, Norway has subdivided the aircraft into categories based on weight. In addition, the Norwegian regulations differ from the Danish ones in that in Norway shorter minimum distances from public roads and congested areas are used. In Norway the minimum distance is 20 metres, whereas in Denmark it is 150 metres.

3.3 The Netherlands

3.3.1 Legislation
Unless exemption is granted, flying of civil drones is prohibited in the Netherlands. Exemptions are granted exclusively for commercial or public use of drones. In order to obtain an exemption, the drone must have a certificate of registration, a certificate of airworthiness and be insured. Finally, the operator must be able to document that the person in question is in possession of the necessary skills to fly the drone safely.

\(^{1}\) The Norwegian guidance is available from this link: [AIC](#)
If exemption is granted, flights must be undertaken in accordance with the following guidelines:

- The drone must be within the visual line of sight of the operator;
- The maximum height at which a drone may be flown is 120 metres;
- The drone must be flown in accordance with Visual Flight Rules (VFR) (i.e. rules for flying private aircraft that do not use instruments);
- Operation of a drone may only take place between sunrise and sunset;
- A civil drone must not fly further than 500 metres from its operator;
- In principle, drones must be flown at least 150 metres away from people and buildings. This distance may however be reduced based on the characteristics of the drone, the skill of the operator, a risk assessment and an assessment of whether there is some public interest associated with the operation.

3.3.2 Training
The Dutch authorities make it a requirement that the operator be trained. The operator must accordingly have completed a manufacturer's course or other documented form of training, including a theory course with associated examination. There are however no approved organisations in the Netherlands that can supervise the training. Instead, approval is given to training that is approved by the UK aviation authorities.

3.3.3 Differences compared to the Danish regulations
The Dutch authorities make it a requirement that the operator should have completed training; this is not the case in Denmark. In addition, the Dutch regulations differ from the Danish ones in that, for commercial drone use, every instance of drone operation must be approved. Finally, unlike in Denmark, recreational use of drones is not permitted in the Netherlands.

3.4 The United Kingdom
3.4.1 Legislation
The UK aviation authorities, in the form of the Civil Aviation Authority (CAA UK), have not yet drawn up specific regulations for the use of drones weighing less than 150 kg. CAA UK has however issued guidance materials with the intention of guiding those involved with drones to develop their own safety requirements and standards for civil drones.\(^{18}\)

Civil drones weighing more than 20 kg are subject to the requirements governing UK airspace (The Air Navigation Order). If a civil drone cannot meet the requirements, an exemption may however be granted.

For instances where civil drones are flown outside reserved airspace, CAA UK has proposed a number of operational restrictions. Flying is accordingly prohibited:

\(^{18}\) The UK guidance material is available from this link: [CAP 722 Unmanned Aircraft System Operations in UK – Airspace Guidance](#)
- in controlled airspace, except with the permission of the appropriate ATC (Air Traffic Control) unit;
- in any aerodrome traffic zone except with the permission of either the appropriate ATC unit or the person in charge of the aerodrome;
- at a height exceeding 400 feet (120 metres) above the surface;
- at a distance beyond the visual range of the Remote Pilot/RPA observer of the said aircraft, or a maximum range of 500 metres, whichever is less;
- over or within 150 metres of any congested area of a city, town or settlement;
- within 50 metres of any person, vessel, vehicle or structure not under the control of the Remote Pilot; during take-off or landing, however,
- the aircraft must not be flown within 30 metres of any person, unless that person is under the control of the Remote Pilot.

However, exemption may be granted from the above requirements in the case of commercial use.

Finally, anyone wishing to operate drones on a commercial basis must be in possession of the appropriate permission from CAA UK. The requirements for obtaining permission for commercial operation are set out in the table below.

<table>
<thead>
<tr>
<th>Aircraft Mass</th>
<th>Airworthiness Approval?</th>
<th>Registration?</th>
<th>Operating Permission?</th>
<th>Pilot qualification?</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 kg and less</td>
<td>No</td>
<td>No</td>
<td>Yes(^{19})</td>
<td>Yes(^{20}), BNUC-S or equivalent(^{21})</td>
</tr>
<tr>
<td>More than 20 kg, up to and including 150 kg</td>
<td>Yes(^{22})</td>
<td>Yes</td>
<td>Yes(^{23})</td>
<td>Yes, BNUC or equivalent(^{24})</td>
</tr>
<tr>
<td>More than 150 kg</td>
<td>EASA Permit to Fly or UK Permit to Fly in accordance with “B conditions”(^{25})</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes, BNUC, CPL(A) or equivalent(^{26})</td>
</tr>
</tbody>
</table>

\(^{19}\) Applicable for civil drones used for commercial purposes ("Aerial Work purposes") if flown within a congested area or close to people or property.

\(^{20}\) Applicable for civil drones used for commercial purposes ("Aerial Work purposes") if flown within a congested area or close to people or property.

\(^{21}\) “Equivalent pilot experience will be considered on a case-by-case basis during application for an operating permission.”

\(^{22}\) “It may be possible to obtain certain exemptions from the airworthiness and registration requirements.”

\(^{23}\) “It may be possible to obtain certain exemptions from the airworthiness and registration requirements.”

\(^{24}\) “Equivalent pilot experience will be considered on a case-by-case basis during application for an operating permission.”

\(^{25}\) “It may be possible to obtain certain exemptions from the airworthiness and registration requirements.”
Operation within a congested area is only permitted if, in its operations manual the operator (“the Remote Pilot”) states “minimum separation distances from persons, vessels, vehicles and structures” and other structures based on a risk assessment.

It is also a requirement of CAA UK that all operators should have produced an operations manual.

### 3.4.2 Training

CAA UK requires that drone operators be able to demonstrate that they are in possession of the necessary skills. CAA UK has not however as yet defined any specific training requirements for flying civil drones. Nevertheless, CAA UK accepts the skills operators have achieved from a training programme drawn up by EuroUSC, which has devised a drone training course specifically designed for civil drones weighing less than 20 kg.

### 3.4.3 Differences compared to the Danish regulations

In the UK anyone using a drone in a commercial context must have permission to do so from CAA UK. In Denmark things are different, in that commercial operation is possible without permission, provided such operation is within the framework of Regulations for Civil Aviation BL 9-4.

### 3.5 The United States

#### 3.5.1 Legislation

In 2013 the US aviation authorities, the **Federal Aviation Agency (FAA)** issued a roadmap for the integration of civil drones in US airspace.

It is made clear in the roadmap that no separate airspace will be created solely for the use of civil drones. Civil drones are thus to be integrated in the currently existing airspace.\(^{27}\)

In this connection, the FAA has proposed a number of basic conditions that civil drones must meet in order to ensure their integration in US airspace:

- “UAS (civil drones) must operate safely, efficiently, and compatibly with service providers and other users of the NAS (national airspace) so that overall safety is not degraded;
- UAS will have access to the NAS, provided they have appropriate equipage and the ability to meet the requirements for flying in various classes of airspace;

\(^{26}\)“Equivalent pilot experience will be considered on a case-by-case basis during application for an operating permission.”

\(^{27}\) The so-called **European RPAS Steering Group**, set up by the European Commission to determine how civil drones can be integrated in European airspace, is also of the opinion that civil drones must be adapted to the current actors in European airspace (Source: **Roadmap for the integration of civil Remotely-Piloted Aircraft Systems into the European Aviation System, Final report from the European RPAS Steering Group**).
- UAS will comply with ATC instructions, clearances, and procedures when receiving air traffic services;
- Except for some special cases, such as small UAS (sUAS) with very limited operational range, all UAS will require design and airworthiness certification to fly civil operations in the NAS."

The FAA is working in tandem with other relevant US authorities and stakeholder organisations on the integration of civil drones in the airspace.

Four categories of unmanned aircraft systems (UAS) are distinguished in the US:

1) Model aircraft
2) Civil UAS
3) Public UAS
4) Small unmanned aircraft below 25 kg in weight

Operation of the first category (model aircraft), must be in accordance with a guidance document (an Advisory Circular)\(^{28}\).

For operations with the second category (civil UAS), operators can obtain a special experimental certificate of airworthiness ("Experimental Category") by demonstrating that the civil drone can operate safely within an allocated test area without causing damage or injury to a third party or their property.\(^{29}\) An experimental certificate of airworthiness is generally valid for up to a year and will typically be issued to commercial operators.

To obtain permission, operators must be able to describe the design, structure and manufacture of their civil drones, including the relevant technical processes, development of software and control, configuration management and quality assurance procedures.

If the FAA is of the opinion that the drone does not constitute an unreasonable safety risk, the special certificate of airworthiness in the experimental category is issued, with the operational restrictions that apply to the specific drone.

### Box 3.1: Issue of certificate of airworthiness in the experimental category

In 2013, the US aviation authorities selected six test centres where research and testing will be carried out using civil drones. In addition to using the centres for research and testing, it is the FAA’s ambition to delegate the issue of certificates of airworthiness in the experimental category to the test centres. Once the delegation becomes effective, the centres will be subject to an annual inspection designed to ensure they are fully able to address the task of issuing certificates of airworthiness in a reliable manner.

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\(^{28}\) The US guidance for model aircraft is available from this link: [http://rgl.faa.gov/Regulatory_and_Guidance_Library/rgAdvisoryCircular.nsf/0/1acfc3f689769a56862569e70077c9cc/$FILE/ATTBJMAC/ac91-57.pdf](http://rgl.faa.gov/Regulatory_and_Guidance_Library/rgAdvisoryCircular.nsf/0/1acfc3f689769a56862569e70077c9cc/$FILE/ATTBJMAC/ac91-57.pdf)

\(^{29}\) The US guidance for civil drones (civil UAS) is available from this link: [Interim Operational Approval Guidance 08-01](http://rgl.faa.gov/Regulatory_and_Guidance_Library/rgAdvisoryCircular.nsf/0/1acfc3f689769a56862569e70077c9cc/$FILE/ATTBJMAC/ac91-57.pdf)
The third category (public UAS) are civil drones that public authorities used for public (governmental) purposes. When public authorities wish to use a public UAS, the FAA issues permission for this (Certificate of Waiver or Authorization (COA)). With a COA, public authorities can use a drone for specific purposes in a defined area.

The FAA is currently working on developing the conditions that are to apply to operations with public UAS. This is to ensure that public UAS will not endanger the safety of other aviation. The aim of their work is to develop a certificate of airworthiness with terms and conditions attached that ensures a level of safety equivalent to that governing manned aircraft.

This will presumably mean that public UAS must not fly in populated areas, and that a person in a manned aircraft ("chase plane") or a person on the ground must be able to observe the UAS.

In 2012 the FAA was granted the possibility of permitting public authorities to operate drones weighing 2 kg or less, with the following restrictions:
- The drone must be flown within the operator’s visual line of sight (VLOS)
- The maximum height at which a drone may be flown is 120 metres
- It may only be flown between sunrise and sunset
- It may only be flown in uncontrolled airspace (Class G airspace)
- It must be flown at least 8 km from any airport or other locations with aviation activities.

The final category (small unmanned aircraft) covers unmanned aircraft below 25 kg in weight. For this category of unmanned aircraft, FAA policy is that individual permission must in principle be sought for each operation.

The FAA has commissioned a safety assessment of these small unmanned aircraft. In this connection, an investigation is underway to determine whether there are aircraft within this category which fly at such low speeds that any potential injury to people or damage to property will be limited in nature. On the basis of this safety assessment, the FAA will in the imminent future produce a new circular focusing on operations that cannot be described as recreational activities.

3.5.2 Training
The US aviation authorities require drone operators to be able to control a civil drone to the same level as is required for a manned aircraft. This means that an operator must either have a private pilot’s licence or the military equivalent within the aircraft category they wish to operate in unmanned form. In addition to the requirement of a private pilot’s licence, additional training is required, linked specifically to piloting drones.

Unless drones are flown within VLOS in daylight hours, outside of a congested area, five nautical miles from an airport, below 400 feet or with a maximum distance of one nautical mile between the operator and drone, the operator must be in possession of an FAA pilot’s licence.

3.5.3 Differences compared to the Danish regulations
Unlike the Danish authorities, those in the US use a dedicated category of civil drones operated by authorities for public (governmental) purposes (public UAS).
In addition, the US authorities require operators to hold a pilot’s licence and in many cases to also have completed other training specifically linked to piloting unmanned aircraft.

### 3.6 Overall assessment: Similarities and differences

The review of regulations for flying civil drones in each of Sweden, Norway, the UK, the Netherlands and the USA showed that the regulations mainly focus on the actual process of flying.

These “traffic regulations” do not differ greatly between the countries. It is also a common denominator of the countries in question that case management within the field is characterised by a tailored case-by-case approach on the part of the aviation authorities. The reason for this is the lack of detailed international regulations and standards.

There is just one point where Denmark differs from the countries surveyed: we have a lower maximum height at which drones may be flown than they do (cf. Table 3.6 below).

**Table 3.6: Maximum height at which civil drones may be flown in selected countries**

<table>
<thead>
<tr>
<th>Country</th>
<th>Maximum height</th>
</tr>
</thead>
<tbody>
<tr>
<td>Denmark</td>
<td>100 m</td>
</tr>
<tr>
<td>Sweden</td>
<td>120 m</td>
</tr>
<tr>
<td>Norway</td>
<td>120 m</td>
</tr>
<tr>
<td>The United Kingdom</td>
<td>120 m</td>
</tr>
<tr>
<td>The Netherlands</td>
<td>120 m</td>
</tr>
<tr>
<td>The USA</td>
<td>120 m</td>
</tr>
</tbody>
</table>

The current maximum height of 100 metres for flying drones is down to the fact that Defence Command Denmark routinely trains and exercises its crews in flying below 150 metres throughout the entire country, except over a congested area.

Bearing this in mind, we cannot recommend a general increase in the Danish maximum height for flying drones. At times, the Danish military flies as low as 30 metres above ground. Nevertheless consideration should be given to increasing the maximum height to that of other countries (120 metres) for professional actors flying in a congested zone. It is primarily in and around towns that drones may need to be flown at a greater height.

When flying in close proximity to high obstacles (wind turbines etc.) drones may be seen as a part of the obstacle.

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30 Before the maximum height can be increased, a risk assessment should be performed of the potential consequences for other airspace users of such an adjustment.
3.7 International regulation

At the time of writing there is no international legislation that regulates the flying of civil drones, but various initiatives are on the way, both at a global and a European level.

3.7.1 International Civil Aviation Organization (ICAO)

The UN’s ICAO agency is the global focal point for the development of common regulations for flying civil drones. In the first instance, ICAO focuses on ensuring a common terminology and set of definitions for the area.

As a consequence of the above, the ICAO established the so-called UAS Study Group (UASSG) in 2007, consisting of experts appointed by the ICAO’s member states. Its task was to help the ICAO secretariat in developing the necessary standards, recommendations, procedures and guidance material needed to ensure safe and effective integration of civil drones in non-segregated airspace.

In November 2014, the UASSG was replaced by the RPAS Panel. Whereas a ‘study group’ occupies the lowest rung in the ICAO system, the ICAO’s panels have a lot of influence on the policies adopted. In other words, the replacement of the UASSG by the RPAS Panel shows that the drone agenda is gaining increasingly in importance for the ICAO.

The ICAO focuses particularly on international operations and the measures that should be taken to ensure global interoperability. In this connection, priority is being given to the following areas.

1) Terminology
2) Airworthiness and certification
3) Licences
4) Frequency use
5) Communication requirements
6) “Detect and avoid” technology

The general view is that the ICAO should issue a manual to the member states that will contain general recommendations on the flying of civil drones – in principle for all weight classes and all purposes.

The manual must form the basis for producing dedicated international regulations for the flying of civil drones. The manual will take as its starting point the current standards for manned aircraft. It will address certification, airworthiness, technical requirements, requirements governing operator health and skills, as well as initial regulations for air navigation services.

The ICAO’s objective is to have the regulations for civil drones produced and ready for implementation in 2028.

3.7.2 The EU

In 2013 the European Commission set up a Roadmap for the integration of civil Remotely-Piloted Aircraft Systems into the European Aviation System.

The roadmap is divided into four time frames:

- 2013
- 2014–2018
- 2019–2023
2024–2028

The starting point in 2013 is based on national regulations in the individual member states, where operations in VLOS are normally permitted outside of congested urban areas and areas where many people are present. Commercial operations are also permitted in certain member states for approved drone operators.

From 2014 to 2018, the intention is to gradually harmonise the national provisions, and it is anticipated that full harmonisation will be achieved at the end of the period. Test flying of drones under IFR (instrument flight rules) will also begin in airspace Classes A to C. Similarly, tests involving BVLOS operations will be commenced at very low heights in areas of low population density and over stretches of water.

From 2019 to 2023, the aim is to allow certified personnel at approved drone operators to operate in all classes of airspace. The European Aviation Safety Agency (EASA) is to draw up common, proportional provisions for civil drones that cover all weight classes. Some classes of airspace will however still be closed to drone operations.

From 2024 to 2028 it is anticipated, based on technical and operational development, that drones will be able to operate in almost all airspace classes and non-segregated airspace together with manned aircraft in line with other aviation.

The main objective is that it should be possible to fly civil drones across national borders within the EU.

On 8 April 2014, the Commission issued a communication entitled *A new era for aviation – Opening the aviation market to the civil use of remotely piloted aircraft systems in a safe and sustainable manner*. The aim of the Commission’s strategy in the area is to create a common market for civil drones in order to reap the societal benefits of this innovative technology and at the same time address citizens’ interests and concerns.

At a meeting of the working group on horizontal transport matters on 7 January 2015, the member states and the Commission discussed the future aviation package, which will include a revision of Regulation (EC) No 216/2008. The Commission stated that the package has not been finalised, but that it would probably contain a communication about the level of competition in European aviation as well as a proposal on drones. It is anticipated that the Commission will present its case in the third quarter of 2015, but that this set of regulations will mainly relate to large drones.

3.7.3 JARUS

*Joint Authorities for Rulemaking on Unmanned Systems (JARUS)* is a group of experts from the National Aviation Authorities (NAAs) and the European Aviation Safety Agency (EASA).

The purpose of the group is “to recommend a single set of technical, safety and operational requirements for the certification and safe integration of Unmanned Aircraft Systems (UAS) into airspace and at aerodromes”.

The work is carried out by a number of working groups (WGs). The following groups have been set up:

- WG-1, Operational and Personnel Requirements Group
WG-2, Organizations’ Approvals Group
WG-3, Airworthiness Group
WG-4, Detect and Avoid Group
WG-5, Command, Control and Communication Group
WG-6, UAS System Safety Group

JARUS reviews the existing national regulations and international standards, as well as other material applicable to manned aircraft. On this basis, it drafts specific guidance material to cover the unique features of civil drones.

The working groups consist of persons with the relevant background from the aviation authorities of those countries that wish to participate in the work.

The primary output of JARUS will be recommended certification specifications and operational provisions, which can be used by national authorities to approve civil drones, operators or training organisations and which are recognised bilaterally throughout the JARUS member states.

The strategy of JARUS is to facilitate coordination of the frameworks a group develops for civil drones within existing organisational structures for aviation. This is achieved by basing the developmental work in existing work processes for manned aviation.

The work does not comprise drawing up legislation or mandatory standards. Each state or regional organisation will have to decide how the recommendations devised by JARUS are to be implemented.

It is expected that the EU will draw on JARUS’ recommendations when the EASA begins drawing up regulations for the area.

So far, JARUS has submitted a set of certification provisions for Light Unmanned Rotorcraft Systems (CS-LURS). This document states technical standards for the design of rotorcraft. In the preparation of the document, the same methods were used as are applied for small manned helicopters.

JARUS has also prepared a presentation on the establishment of approved training companies involving requirements that are completely on a par with those that apply to training companies for ordinary aircraft.

According to the presentation, for all drone categories, drone operators must take a medical examination as well as undertake theoretical and practical training. The basic idea is that the bigger the drone, the more stringent the requirements on the skills of the drone operator.³¹

3.7.4 Overall assessment of the work of the international organisations
We may conclude that there is a lot of activity on the international front as regards devising regulations and standards for civil drones, both at European and global level. Already from 2015, therefore, we may expect to see the first guidance material from the ICAO, whereas a dedicated regulatory framework designed to ensure full integration of civil drones in non-segregated airspace will not be implemented before 2028.

³¹ The draft is available on the JARUS website (www.jarus-rpas.org)
The individual countries and organisations can already play a role in the regulatory process, if they wish to affect the manner in which integration of civil drones is to proceed. If Denmark wishes to be proactive in international fora, resources should be set aside for this purpose.

At a European level, it is anticipated that measures aimed at regulating drones (most likely large drones) will be deployed in connection with the Commission’s aviation package.

In connection with the work of the Commission and of the member states, JARUS is expected to assist with recommendations (also primarily relating to large drones).

In the immediate future there will therefore be a need for national regulations as far as small drones are concerned.

In light of the European Commission’s Roadmap for the integration of civil RPAS into the European Aviation System, which contains a gradual harmonisation of the national provisions, Danish regulation should be evaluated after three-five years in order to ensure that the requirements are working as intended and that they have not become unnecessary obstacles to using drones and exploiting the commercial potential in the drone industry.

### 3.8 Relevant international legislation in the field of human rights

#### 2.2.4.1 The European Convention on Human Rights (ECHR)

Under Article 8(1) of the ECHR, “everyone has the right to respect for his private and family life, his home and his correspondence”. Case law of the European Court of Human Rights indicates that Article 8 of the Convention also involves to some degree protection of the individual’s personal relationships with others and society at large. In publically accessible places therefore, certain requirements can be imposed relating to the need to respect the privacy of the individual. In this connection, importance is attached to determining what reasonable expectations an individual may have as regards their privacy.

An equivalent provision is to be found in Article 7 of the EU’s Charter of Fundamental Rights. Moreover, Article 8 of the Charter contains a provision on the right to protection of personal data.

Any new attempt to regulate the use of drones by civil authorities or private individuals will by its very nature have to be formulated in accordance with the ECHR or the EU’s Charter of Fundamental Rights.
4 Classification and triviality threshold

Drones should be classified according to their risk profile, and the requirements must be tailored to match. Several criteria may be used for classifying civil drones. The working group recommends introducing an emergency response category for drones where a greater degree of risk will be acceptable in practice than would be the case for commercial or recreational drones. In addition, the introduction of a triviality threshold of 250 g is recommended, below which no safety requirements will be imposed on drones. This will avoid having to regulate toys, for instance.

4.1 Type of operation

Drones can be classified on the basis of several different criteria. The working group is addressing the three most widespread criteria for classification:

1) Type of operation
2) Operator
3) Weight

The first criterion is type of operation, that is to say, the specific manner in which the drone is flown.

The European RPAS Steering Group, which, on behalf of the European Commission, has devised a roadmap\(^\text{32}\) for the integration of civil drones in European airspace, splits operations involving civil drones into two main categories:

1) **Very low level (VLL):** VLL operations with civil drones take place below the normal minimum altitude for manned aviation of 150 m. This main group contains three sub-groups of operations:
   a. **Visual Line of Sight (VLOS):** Operations where at any given time the drone is within the visual line of sight of the operator. The requirement under normal circumstances is that the drone cannot be more than 500 metres away from the operator.

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\(^{32}\)Roadmap for the integration of civil Remotely-Piloted Aircraft Systems into the European Aviation System – Final report from the European RPAS Steering Group, June 2013 (the report can be downloaded from the website of the European Commission:
http://ec.europa.eu/enterprise/sectors/aerospace/uas/)
b. **Extended Visual Line of Sight (E-VLOS):** Operations where the operator is supported by one or more observers, where the group overall has the drone within their visual line of sight.\(^{33}\)

c. **Beyond VLOS (BVLOS):** Operations below the minimum altitude for manned aviation, but out of the operator’s visual line of sight, meaning that the operator is dependent on technical aids to fly the drone.

2) **VFR** (Visual Flight Rules: for flying without the use of instruments) or **IFR** (Instrument Flight Rules: for flying with the use of instruments): Operations in airspaces above the normal minimum altitude for manned aviation. That is to say, the operations take place in the airspace used by manned aircraft. These operations are subdivided into two sub-groups:

a. **IFR/VFR in radio line of sight (RLOS):** Operations in normal airspace where there is radio contact with the drone.

b. **IFR/VFR beyond RLOS (BRLOS):** Operations in normal airspace where there are periods during flight where there is no contact with the drone, meaning that long-range communication equipment, such as satellites, is used during operations.

It may be expected that it will be several years before the VFR or IFR operations of item 2) will be carried out in Denmark above the normal minimum altitude for manned aviation. Furthermore, it is the view of the working group, in line with that of the US aviation authorities and the **European RPAS Steering Group**, that if civil drones are to operate within VFR or IFR in an airspace where manned aircraft are present, the drones must meet the same requirements for airworthiness etc. as apply to manned aircraft. This is currently not the case. Therefore, in terms of the classification of civil drones in Denmark, only the VLL categories are of interest at the present moment.

Up until now it has only been possibly to fly within the operator’s visual line of sight (VLOS), but according to statements from the industry, there will very soon be a need to fly drones beyond the operator’s visual line of sight (BVLOS).

### 4.2 Operators

In most countries a distinction is drawn between *the operators* when permits to fly are issued for civil drones. However the operator categories vary from country to country.

\(^{33}\) In Denmark there has not proved to be much interest in E-VLOS operations, where the operator is supported by one or more observers. This report does not therefore address this type of operation.
In the Nordic countries (Denmark, Sweden and Norway), a distinction is made between commercial operators and recreational users. In Denmark, operators who use drones for commercial purposes and various tests fall into the commercial category.

In the USA also, commercial operators are distinguished from recreational users. The US authorities also have a third category, public UAS.

This latter category covers operators that handle tasks that are of public benefit (emergency response operations, border controls, etc.). These operators enjoy a number of advantages over others. One such advantage is that applications for permits to fly are fast-tracked.

In the Netherlands a distinction is also made between commercial operators and public operators, whereas the Dutch aviation authorities do not permit recreational use of drones.

The working group is of the opinion that the current division between commercial operators and recreational users is reasonable and appropriate. Drones are already very widespread among private individuals and are readily available in the retail trade and over the Internet.

There is also a separate objective of making new technology widely accessible. Instead, therefore, of prohibiting the use of drones by recreational users, we should focus on skill requirements and traffic regulations so as to prevent personal injury and material damage when drones are flown recreationally. Finally, the working group is of the opinion that recreational users must always keep their drones within their visual line of sight when flying them.

4.2.1 Emergency response regulations for drones in Denmark

The working group takes the view that in addition to splitting operators into a commercial and a recreational category, it will be expedient to introduce a category of drone operations in Denmark where these are used for the purposes of benefitting the general public, and in particular the saving of lives and property. For this group of operators, the authorities can countenance accepting a higher degree of risk than for the first two categories, as the operations they perform are for the benefit of the general public.

It is nevertheless not appropriate to accept a higher degree of risk for a general public category, along the lines, for instance, of the US model. For example, if authorities use civil drones for a specific surveillance operation, it is not immediately clear that one should countenance accepting a higher degree of risk. Rather, such drone operations should initially be seen as belonging to the commercial category and thereby meet the safety requirements set for this type of operation.

On the other hand, for emergency response missions, where life or property is in urgent danger, it will be appropriate to accept an increased level of risk. This may for instance involve flying closer to or, in special situations, above crowds of people.

It should accordingly be possible to allow drones that are used for fire, rescue or particular police-related tasks, where lives and property are potentially at risk, to come under the emergency response category. Here we are thinking
for instance of tasks relating to terrorist activities, dangerous crowd situations (music festivals etc.), traffic accidents, flooding and similar scenarios.

The decision as to whether a given situation is one where the use of drones for police or emergency response tasks may lead to the acceptance of an increased level of risk is one that should be taken by the actual leader of the operation in question. This is parallel to situations where operations of the police and emergency services generally involve accepting a higher level of risk; an example might be a vehicle response to an emergency call.

In the light of the above, the working group proposes that special regulations be drawn up for emergency response operations with drones, but that the Police themselves should lay down further instructions for the police use of drones.

4.3 Civil drones classified by weight

In addition to distinguishing between operators and/or type of operation, civil drones are often categorised by weight. The reason for this is that weight is a crucial factor in determining the safety risk of a civil drone. Furthermore, weight limits are easy criteria to communicate. Several countries therefore have already brought weight limits into operational application.

Examples are Denmark and Sweden, which operate with three weight classes:

1) Civil drones weighing less than 1.5 kg
2) Civil drones weighing between 1.5 kg and 7.0 kg
3) Civil drones weighing more than 7.0 kg and up to 25.0 kg

All aircraft weighing more than 25 kg are subject to the Air Navigation Act in Denmark.

In the UK the following weight categories are used:

1) 20 kg and less
2) More than 20 kg, up to and including 150 kg
3) More than 150 kg

The UK categories are not however believed to be ultimately tenable, as it is expected that civil drones weighing more than 25 kg will be regulated by Europe-wide legislation in the future. It is therefore not thought expedient to begin drawing up national regulations for heavier drones.

At European level it would appear that the EASA is on the point of ceasing to use weight as a criterion for classification. Instead, they are working with a “hazard criterion”. This hazard criterion has not however been defined as yet. In addition, European legislation will probably only cover larger drones, whereas national regulations will continue to apply to the small ones.

In view of this, the working group recommends that weight categories should still be used for civil drones below 25 kg. A classification based on weight is also easy to communicate – a factor that promotes compliance with the regulations. The working group recommends that the current weight categories be retained.

The weight thresholds are based on rotor systems. It may however be necessary to introduce a “weight supplement” for certain types of fixed-wing...
drones. This would mean that a fixed-wing drone of 1.2 kg may for example be treated on a par with a rotor drone in the 1.5 kg to 7.0 kg category. As a consequence, the treatment of applications for operations with fixed-wing drones may be rather more individually tailored than would be the case for rotor drones.

4.3.1 Introduction of a triviality threshold
Currently all drones are subject to aviation legislation, but because it must be expected that civil drones will become very widespread in the future, drones need to be distinguished from toys, to ensure that toys are not governed by aviation legislation. This is also the view of the European Commission.

The European Commission is producing new legislation for the use of civil drones. In this connection the European Aviation Safety Agency (EASA) has devised a definition of toy aircraft. The EASA draft definition runs as follows:

" 'Toy aircraft' means a product designed or intended, whether or not exclusively, for use in play by children under 14 years of age and falling under the definition of aircraft."

The definition is based on the definition of “toy” in the “Toy Regulation”, which implements EU Directive 2009/48/EC on the safety of toys in Denmark.

The Toy Regulation applies specifically to products that are exclusively or partly designed or intended for use by children under the age of 14. That is to say, the product must be marketed with the intention of selling it to children under the age of 14. If the product is marketed in a hobby shop or in a department for older children in a toy store, it is not covered by the Regulation.

According to the Danish Safety Technology Authority, there are no standards in the Toy Regulation that can be used to set a triviality threshold for civil drones (cf. Chapter 2 A regulatory system that is appropriate for civil drones).

So far no specific standards for products have been defined in the Product Safety Act. The Act simply states that a product must be “safe”. This means that, when the product is used under general or foreseeable circumstances and within the expected lifetime of the product, the product should involve no risk, or only a limited and acceptable risk, in terms of posing a safety or health hazard to consumers.

It is the duty of the manufacturer to provide consumers with the information they need to be able to assess the risks. The Act does not deal with the protection of third parties, i.e. where a product causes injury to a party other than the consumer.

The lack of a legal basis in the Toy Regulation, the EASA’s vague definition and the lack of requirements governing third-party protection in the Product Safety Act have led the working group to recommend that a triviality threshold be introduced for civil drones, so that drones which do not represent a safety risk are distinguished from other civil drones and are not made subject to aviation legislation.

34 NPA 2014-09, p. 14
It is the view of the working group that there should not be training requirements or other safety requirements for the operation of civil drones below the triviality threshold. On the other hand, it may be appropriate for an identification requirement to also apply to very small drones (that can carry a camera or other equipment for the collection of data), out of consideration for the need to counter invasion of privacy (see Chapter 7 Drone requirements).

The introduction of a triviality threshold will also mean that operating requirements will not be imposed on drones below the threshold (for instance the need to maintain a safety distance from buildings). Given that anyone may fly drones that fall below the triviality threshold wherever they choose, it does not make any sense to impose requirements on commercial users who operate drones below this threshold.

4.3.1.1 Setting the triviality threshold

In connection with the setting of the triviality threshold, the working group has obtained the assistance of what is known as the “Working Group – Regulation” of UAS Denmark, which is made up of representatives from industry and university researchers.

The Working Group – Regulation has proposed a triviality threshold based on three parameters (a drone’s weight, speed and kinetic energy) on condition five assumptions are met:

1) Indirect injury: The likelihood of injury is based solely on physical contact with the drone. No allowance is therefore made for injuries that are due to inattentiveness when watching a drone.
2) Attentiveness: It is assumed that people are not particularly aware of the drone. This means that people who are hit do not try to avoid the drone, duck, etc.
3) Injuries to several people: It is assumed that only one person is hit by the drone.
4) Unprotected: It is assumed that people are unprotected and that physical contact with the drone is via the bare head of a person.
5) Pain: No consideration is given to the pain experienced, but rather whether people are liable to sustain life-threatening injuries.

Based on extensive analysis, the Working Group – Regulation has arrived at a threshold of 250 g. The Group notes however that there are drones that weigh more than 250 g which, due to their design and/or top speed, do not represent a hazard to people on the ground.

On this basis, the working group recommends that a triviality threshold of 250 g be introduced for drones, below which threshold safety requirements for flying, operators, insurance, etc. will not be imposed. There should also be the option available of classifying heavier drones as being below the triviality threshold in specific cases and based on a recognised risk assessment, if the drone in question is not deemed to represent a hazard to people on the ground.

35 UAS Denmark’s Working Group – Regulation counts among its members representatives of Aalborg University, who have been able to contribute scientific evidence supporting setting the triviality threshold as proposed.
In connection with the risk assessment, a decision must also be taken as to whether there are security aspects that entail that drones should not be classified as falling below the triviality threshold. In special cases, security considerations may also mean that requirements have to be imposed on drones that weigh less than 250 g.

We need to be always open to new findings in this field that might result in adjustments to the triviality threshold.

### 4.4 Overall assessment

Overall, the prime criterion for classifying civil drones is the type of operation. The working group proposes the following distinction be made:

1) **Visual Line of Sight (VLOS):** Operations below the minimum altitude for manned aviation where at any given time the drone is within the visual line of sight of the operator. The requirement under normal circumstances is that the drone cannot be more than 500 metres away from the operator.

2) **Beyond VLOS (BVLOS):** Operations below the minimum altitude for manned aviation, but out of the operator’s visual line of sight, meaning that the operator is dependent on technical aids to fly the drone.

The working group recommends that recreational flying should only take place in the form of VLOS operations, as the risks associated with allowing recreational users to operate civil drones beyond their visual line of sight are too great.

A further determining factor is the distinction drawn between operators. The following operators should be distinguished:

1) **Emergency response drones:** Civil drones where the operator is a professional and handles tasks that are of public benefit, where life or property are in danger. This category also includes special police and emergency response tasks where life and property are liable to be in danger.

2) **Commercial drones:** Civil drones where the operator is a professional. This category also includes civil drones used to support police work, research and various tests.

3) **Recreational drones:** Civil drones operated by amateurs for the purposes of enjoyment.

Finally, civil drones should be differentiated by weight. The working group recommends introducing a triviality threshold for recreational users, but to otherwise retain the present categories. That is to say, the following:

1) Civil drones weighing from 0.250 kg to 1.5 kg
2) Civil drones weighing between 1.5 kg and 7.0 kg
3) Civil drones weighing from 7.0 kg to 25.0 kg
4) Civil drones weighing more than 25.0 kg

The combined classification is illustrated on the next page in Table 4.4.
Table 4.4: Classification categories for civil drones

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<tr>
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<th>VLOS</th>
<th>BVLOS</th>
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<tr>
<td><strong>Recreational</strong></td>
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<td>0.25 kg to 1.5 kg</td>
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<td>More than 25.0 kg</td>
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<td><strong>Commercial</strong></td>
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<td><strong>Emergency response</strong></td>
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<td>More than 25.0 kg</td>
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</table>
5 Liability and drone insurance

Recreational flying of drones below 7 kg is not currently covered by general family insurance policies. Commercial operators need to be covered by liability insurance. The lack of liability insurance can result in claims involving large amounts of compensation in the event of death/accident.

The working group recommends a mandatory requirement on recreational drones that they be insured. The requirement should be phased in on the basis of a reasonable time schedule, in order that the insurance market can develop competitive policies that will not make insurance prohibitively expensive compared to purchasing a drone. Close consultation is therefore recommended with the insurance industry as to the formulation of the requirement.

5.1 The need for drone insurance

Under the Air Navigation Act\textsuperscript{36}, the owner of an aircraft (including drones) is in principle obliged by law to compensate for any damage or injury caused to a third party or their property by the aircraft.\textsuperscript{37} This applies regardless of the size of the aircraft.

For the flying of civil drones that weigh 7–25 kg, as well as for unmanned aircraft that use (a) jet turbine engine(s), liability insurance must be taken out (cf. Regulations for Civil Aviation BL 9-4).

In terms of insurance, the same applies to flying commercial drones weighing up to 7 kg if these are operated under a licence/exemption issued by the Danish Transport Authority. Here the insurance requirement is part of the licence itself.\textsuperscript{38}

There is on the other hand no requirement for recreational users to take out liability insurance if the drone weighs less than 7 kg. The Danish Model Flying Association\textsuperscript{39} has however opted to take out liability insurance for drones belonging to its members.

\textsuperscript{36} Cf. Section 127

\textsuperscript{37} The owner of the aircraft is however exempt from this requirement where the injured person “himself has caused the damage intentionally or by gross negligence”.

\textsuperscript{38} For the amount of the insurance involved, see the provisions of Regulation (EC) No 785/2004 of the European Parliament and of the Council of 21 April 2004.

\textsuperscript{39} The Danish Model Flying Association (Modelflyvning Danmark [MDK]) is an association for Danish aficionados of model aircraft flying and their flying clubs. It represents around 3,600 individuals who pursue organised model aircraft flying as a sport or hobby in approximately 100 model flying clubs distributed throughout the country.
Currently ordinary family, liability or home insurance does not normally cover damage or injury that a drone might cause to a third party. There is therefore no cover for potential injury to a third party or damage to their property due to a drone below 7 kg in weight being flown recreationally if the recreational user is not a member of the Danish Model Flying Association.

In this connection it should be borne in mind that even small drones can cause significant injury or damage. This is at a time when an increasing number of people are gaining access to drones. The working group therefore recommends that all users of drones above the triviality threshold must hold liability insurance that covers third-party injury and material damage.

It is however crucial that such insurance should not become so expensive that in reality it precludes ordinary citizens from flying drones.

One option for avoiding inordinately expensive insurance might be to make the insurance premium part of the fee for obtaining a drone permit. A corresponding scheme is linked to the issue of a hunting permit. However, the working group feels that this approach is not appropriate. A market-based scheme is recommended, as the number of drone operators will probably be significantly greater than the number of hunters. Moreover, drone operators do not require monitoring in the same way that hunters do.

Instead, compulsory insurance should be introduced with reasonable advance notice, for instance one year, in order to allow the development of suitable requirements for the insurance in question and so that the insurance industry can develop competitive products.

The working group therefore recommends that compulsory insurance should be phased in on the basis of a reasonable time scale (e.g. one year’s advance notice), in order that the insurance market can develop competitive policies that will not make insurance prohibitively expensive compared to purchasing a drone. Close consultation is therefore recommended between authorities and the insurance industry as to the formulation of the requirement.

It is further recommended that the insurance companies allow flying of civil drones below a triviality threshold of e.g. 250 g to be covered by already existing insurance products, such as family, liability or home insurance policies, possibly against a small surcharge, as these drones are often used by children. Due to their low weight and speed, these drones do not represent a significant risk to third parties.

The European Commission will in the very near future identify obstacles relating to insuring civil drones. In this connection the European Commission will assess the current liability scheme and liability insurance requirements, and then take suitable steps to ensure that the area is regulated in the appropriate manner.

It is thought that the Commission will in the first instance concentrate on larger drones and that it will in any case be some considerable time before EU regulations are adopted and effective. There would accordingly be no point waiting for Europe-wide regulation before implementing a Danish insurance requirement for smaller drones.

In a Danish context the question of compulsory insurance for smaller drones has been discussed with representatives of the insurance industry and the Danish Insurance Association (DIA) – the trade association of Danish insurance companies and industry-wide pension funds.
The Danish Insurance Association (DIA) points out in this connection that consideration should be given to whether there should be compensation for a loss and to whom this compensation should be paid if the person responsible for the loss has not taken out an insurance policy or cannot be identified.

The working group is in agreement that a scheme should be produced in line with that existing within the road traffic field, ensuring that an injured party can obtain compensation for damage or injury caused by a drone being flown.
6 Use of frequencies for remote control and identification of civil drones

The working group recommends that it be possible in Denmark to dedicate individual frequencies within the land mobile frequency band to be used in the remote control of civil drones that operate below the minimum altitude for manned aviation. It also recommends that frequencies be reserved for use in the identifying of drones. Finally, the working group recommends that Denmark pursue a policy at international level of having a frequency spectrum reserved across national borders for the remote control of the larger civil drones that operate in combined airspace with manned aircraft.

6.1 Civil drones and the use of frequencies

An important parameter for the spread of civil drones is the frequencies used to control them remotely.

Particularly in relation to operations that take place beyond the operator’s visual line of sight (BVLOS), it is crucial that remote control of civil drones is reliable. This means among other things that control should not be subject to interference from other frequency users, and that the data link between operator and drone does not get hijacked by unauthorised persons.

The surest way of preventing interference from other frequency users will be to dedicate a frequency band to remote control of civil drones. The question therefore is which frequency band will be most suitable for drones to use.

For drones below 25 kg in weight there are several frequency spectra that can be used for remote control. These spectra can be split into frequencies that require permission and frequencies that can be used without permission. More specifically, the spectra in question are:

- Without permission:
  - 27/35/40 MHz
  - 433 MHz
  - 2.4 GHz (the Wi-Fi band)
  - 5 GHz (the Wi-Fi bands)

- With permission:
  - The aviation bands

The aviation bands are internationally protected frequencies extending across the following bands: 255 to 526.5 KHz, 328.6–335.4 MHz, 108–117.975 MHz, 960–1215 MHz and 5030–5150 MHz for navigational use, and 118–136.975 MHz for use when communicating between aircraft.
In Chapter 7 Drone requirements, the option of electronic identification of drones is looked at. Reliable frequencies also need to be made available for this purpose.

Studies have shown that the following frequency spectra are suitable for use in drone identification:
- 865–868 MHz
- 1880–1900 MHz
- 2446–2454 MHz

In what follows we look at the advantages and disadvantages of using the aforementioned frequency spectra. First we deal with the frequencies that may be used for remote control of civil drones. Then we take a look at frequencies that can be used for electronic identification purposes.

6.2 27/35/40 MHz and the 433 MHz bands

In Europe the 27/35/40 MHz bands and 433 MHz are used for remote control of mobile phones, model boats, model aircraft, etc. The result is that these frequency spectra have many users, both amateur and professional. The 35 MHz frequencies, however, may only be used in radio installations for the remote control of model aircraft. These frequency bands may be used without individual permission from the Danish Business Authority. This means that the Danish Business Authority does not know where the frequencies are used or the number of users.

27/35/40 MHz relate to frequency bands at the lower end of the frequency spectrum with a limited transmitting power of 100 mW effective radiated power. This means that these frequency bands are restricted to short range use, but that in some situations the frequency bands are usable for BVLOS operations.

The frequencies around 433 MHz may be used with transmitting power of up to 500 mW, but their range will not be much greater than for the low frequencies in the 27/35/40 MHz band.

Because use of the 27/35/40 MHz and 433 MHz bands does not require permission, there is the disadvantage of the significant risk of potential interference between users. Indeed, when it comes to the remote control of drones that are high above the ground, interference can occur over distances of several kilometres. In addition, analogue hijacking of the signal is possible, and there is no form of check on the received signal. The potential problems are multiplied where the bands have many users.

Overall we must draw the conclusion that the 27/35/40 MHz and 433 MHz bands are only suitable for drones for recreational use and are not suited to the remote control of civil drones for professional use, as there is a disproportionate risk of interference.
6.3 The 2.4, 5.150–5.350 and 5.470–5.875 GHz bands

Currently the 2.4, 5.140–5.350 and 5.470–5.875 GHz bands are used for a number of purposes such as Wi-Fi networks and other low power applications, including consumer electronics. The frequency bands therefore have many users. It is particularly in densely populated areas that the bands become “saturated”.

The frequencies may be used without individual permission from the Danish Business Authority, which means that the Danish Business Authority does not know where the frequencies are used or the number of users.

The frequencies must be used with limited transmitting power, which will typically be up to 100 mW. The result is that these frequencies have limited range.

When a drone is controlled remotely, the signal is transmitted digitally along with an ID check code. This means that the receiver used must recognise its “transmitter” before responding to the received signal. In other words, the transmitter and receiver must be paired up (synchronised) before the signal can “get through”. The result is that it is almost impossible to hijack control of the drone.

Mention should however be made of several disadvantages to the use of the 2.4 GHz, 5.150–5.350 and 5.470–5.875 GHz bands in the remote control of civil drones. Firstly, they involve comparatively high frequency bands, which is why the signal has a limited range. Secondly, high frequencies suffer from the drawback that the signal is attenuated due to building penetration. For this reason, these frequency bands can only be used for flying within the visual line of sight.

A further disadvantage is that the frequency bands are used for Wi-Fi networks and other low-power applications. The result is a significant risk of interference in congested areas and some risk of interference in the signal between operator and drone. The upshot of this is that these frequency bands are not suitable for operations in congested areas.

Overall, therefore, we have to conclude that the 2.4 GHz and 5.150–5.875 GHz frequency bands are only suitable for operations that occur in visual line of sight in non-congested areas.

6.4 The aviation bands

In its ITU Radio Regulations, the International Telecommunication Union (ITU), which is the UN’s agency for information and telecommunications technology, has allocated a number of frequency bands for air navigation use. In what follows, these frequency ranges are called “the aviation bands”.

The aviation bands are used for communication between the control towers and aircraft in the air and on the ground, communication between aeroplanes and airline companies, and communication between aircraft in the air.

It would be an obvious choice for frequencies in the aviation bands to be used for the remote control of civil drones, but there are a number of problems associated with this solution.
Firstly there is a risk that the remote control of civil drones will impact on other communication in the bands. Secondly the amount of space in the aviation bands is very limited. This is particularly the case in Central Europe, as Figure 6.4 illustrates.

*Figure 6.4: Illustration of free space in the aviation bands in Europe. In the black areas, the bands are now completely full in real terms.*

Overall, therefore it is felt that it is not feasible to use the aviation bands for remote control of civil drones.

### 6.5 The 5030–5091 MHz band

Every three years, the ITU holds what is known as the *World Radiocommunication Conference* (WRC), where the member states revise the international treaty that regulates the use of radio frequencies at global level.

At the 2012 WRC, the member states decided to reserve space on the 5030–5091 MHz frequency band for the use of internationally standardised aeronautical systems (including civil drones), used in the same airspace as manned aircraft. This use is termed aeronautical R (route) service. The frequency band cannot therefore be used for smaller civil drones that do not share airspace with manned aircraft.

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41 Source: EUROCONTROL
The frequency range has not so far been used for the remote control of large civil drones, as regulations and a frequency plan have not yet been devised for the frequency range.

This frequency range will not therefore be relevant in terms of smaller drones. The basic idea of reserving a frequency range for the larger civil drones is however a useful solution.

In the light of this, it is proposed that Denmark support work on devising a frequency plan for the 5030–5091 MHz frequency band. In this connection it should be mentioned that the Danish Transport Authority has a place on the forum created by Eurocontrol and the ICAO for drawing up regulations and frequency plans.

### 6.6 Land mobile VHF/UHF frequencies

Whereas it is not feasible to use the 5030–5091 MHz frequency band for small drones, individual frequencies/frequency pairs within the 146–174 MHz and 410–470 MHz frequency bands may work well for use in the remote control of smaller drones in limited geographical areas.

Use of land mobile frequency bands will however require possession of a licence to use them, thereby allowing some form of protection of such use. In addition, VHF/UHF use is not restricted to visual line of sight operations, and transmitting power significantly higher than in the case of the other frequency bands will typically be possible (typically up to 25 W).

It must however be borne in mind that the frequencies have been earmarked for land mobile communication. Where drones are flown at high altitudes, therefore, interference may occur from other land mobile services using the same frequencies in Denmark and our neighbour countries.

Operators will have to pay an annual fee for the frequency licence, which is DKK 652 per annum for a 25 kHz channel (2014).

### 6.7 Frequencies for identification purposes

In connection with the identification of drones at a distance, studies have shown that frequencies used for DECT ((Digital European/Enhanced Cordless Telecommunications) in the 1880–1900 MHz frequency band may be used. In this band a drone can actively transmit an assigned identification code that can be intercepted by the authorities.

In the 865–868 MHz and 2446–2454 MHz RFID bands (identification via radio signals), there is the possibility of fitting passive devices with identification that can be read at a distance via radio signals. The transmitting power for RFID in the 2446–2454 MHz band, used outdoors, is restricted to 500 mW, which limits the range. In the 865–868 MHz band there is the possibility of using transmitting power of 2 W. In the course of 2015 the 915–921 MHz band will also be opened up for RFID use.
6.8 Overall assessment

Our review of the frequency bands indicates that one solution for the smaller (commercial) drones would be to use the land mobile VHF/UHF frequencies and issue a licence for frequency use.

For less critical use, frequencies in the 27/35/40 MHz and 433 MHz as well as the 2400 MHz and 5.150–5.875 GHz bands could be used without any requirement for permission/a licence from the Danish Business Authority. On the other hand, quality of service cannot be guaranteed. These bands are therefore only suitable for operations that occur in visual line of sight in non-congested areas.

It is not feasible to use the aviation bands for the remote control of civil drones, as these bands are already saturated.

Finally, the basic idea of reserving a frequency range for the larger civil drones is a useful solution. For this reason we would recommend that Denmark support the work on devising a frequency plan for the 5030–5091 MHz frequency band.
7 Technical requirements relating to drones

Due regard for the protection of privacy and the general safeguarding of the population means that there is a need to be able to identify civil drones in the air. There also needs to be a requirement that professional operations be logged via GPS technology, in order to ensure documentation in the event of complaints and accidents, so that liability for the flight in question can be determined.

The working group recommends that, in the first instance, professional operators be required to use electronic identification (“number plates”) and ensure lights are carried if they are to be permitted to operate within a congested area. Once the technological solution has been fully tested, the requirement can also be extended, on policing grounds, to cover the use of professional drones outside of congested areas, as well as the use of recreational drones.

7.1 Identification of civil drones

Current practice is that civil drones weighing up to 25 kg that are used for commercial purposes can obtain an exemption to operate within a congested area.

To obtain such permission, the Danish Transport Authority requires that civil drones must have a means of identification and that the operations can be logged. In accordance with the above, it is a condition for obtaining exemption that the civil drone is marked with a registration number assigned by the Danish Transport Authority.

The background to the requirement is that citizens and authorities must be able to trace the owner in the event that the civil drone inadvertently crashes.

Registration of the drone also allows the Danish Transport Authority to retain an overview of the drones operating in Danish airspace.

The registration number is however difficult to see with the naked eye when the drone is airborne. This means that the police cannot in actual fact identify airborne drones, making it extremely difficult to enforce the regulations in the event of illegal or suspicious use.

In this context, the working group recommends the introduction of an electronic identification requirement (“number plates”) for commercial and emergency response drones that are equipped with GPS coordinate programming and control, a camera or other electronic equipment that provides documentation, and which operate within a congested area.

On policing grounds, we are also recommending that the electronic identification requirement be gradually extended in step with technological developments to also cover professional drones operating outside congested areas and drones for recreational use that are above the triviality threshold.
Similarly, the working group recommends that the electronic identification requirement be supplemented with a requirement for drones to carry lights so that they can be clearly seen with the naked eye. The purpose of drone “recognition” is to safeguard citizens against invasion of privacy and to minimise the risk of unlawful use.

Regardless of whether recreational drones are to be required to have electronic identification and carry lights, it will be a good idea to have phased implementation, where professional operators will be the first to have to meet the requirement. The working group is of the opinion that professional operators should have one year’s advance notice. The working group also takes the view that Denmark should work towards introducing this kind of requirement for ID and lights in Europe-wide product standards, to apply, as a minimum, to all commercial drones.

7.1.1 Legal considerations relating to the introduction of a national electronic identification requirement for civil drones

Ideally, the identification requirement should be introduced at European level (in product standards), but with toys definitely excluded in their entirety. If this is only likely in the longer term, consideration may be given to introducing a Danish identification requirement. This would not be for the products per se, but for the flying of them, including that of very small drones in a congested area.

The introduction of a national electronic identification requirement for all professional and/or recreational drones may be construed to be a technical regulation or standard that creates a barrier to trade. In such cases an EU information procedure must be initiated which ensures that the member states and the Commission are informed and their views heard before the technical regulations are finally implemented in the national provision. Three months must be set aside for this procedure.

The working group recommends against the introduction, in the first instance, of a requirement that covers all drones. Our recommendation is to introduce an operational requirement that only initially covers the use of professional drones in a congested area. The flying of any other drones is already precluded if the drone weighs more than the amount stipulated for the triviality threshold.

Once the technical solution has been fully tested, work can start on extending the requirement, on policing grounds, to also cover the use of professional drones outside of congested areas, as well as the use of recreational drones. The EU information procedure will have to be followed in the event of a national regulation of this kind.

Gradual introduction of the ID requirement in Denmark will also serve to strengthen Danish influence when it comes to drawing up EU regulations for smaller drones generally, as is expected.


**7.1.2 Technical solutions**

There are several different technical solutions that would allow the identification of civil drones.

One solution is to install hardware on the civil drones that transmits a beacon-like signal, for instance on the 2.4 GHz band (Wi-Fi network). This will allow the identification signal to be read as on a Wi-Fi network.

The advantage of this solution is that the frequency used is not subject to any licence requirement, and it will be possible to read the identification signal on any media using Wi-Fi – smartphones, tablets etc. The Danish Business Authority has however informed us that the range involved in such a solution is somewhere between 500 and 1000 metres and that the use of precisely 2.4 GHz may be problematic in that this band is already “saturated”.

Another solution is so-called DECT technology. DECT stands for Digital Enhanced Cordless Telecommunications and is a European standard for data and telecommunications. The equipment is licensed, but royalty-free, which is to say that it can be used free of charge. However, the equipment must be approved in terms of radiation requirements etc. The price of the equipment is on the low side, but it is not clear exactly what the range of the signal will be.

A third solution might be to use RFID, which is an abbreviation for Radio Frequency Identification.

As the name implies, the main strength of RFID technology resides in its capability of identifying different objects. RFID is also therefore popularly described as the electronic barcode or barcode of the future, as the technology shares some of the characteristics of the conventional barcode.

The advantage of this solution is that it is cheap and the technology is mature. There is nevertheless a drawback in that the signal range is very short – only up to 100 metres.

UAS Denmark has informed the working group that the drone industry, in conjunction with researchers, will carry out tests on the various technical solutions in the first half of 2015.

It is recommended (not least for police-related reasons) that, as technological development gathers pace, an attempt should be made to interlink electronic identification with a map-based positioning model. This will enable the identification of active drones covered by this report within a more detailed geographical area.

The context for the recommendation of electronic identification and a map-based positioning model involves considerations of both safety and security. In terms of safety, it is the opportunity to be able to implement future use of emergency response drones in a “safe airspace” without posing a risk to third parties as well as being able to implement preventive intervention using these drones. In terms of security, it is to allow the police, in the execution of their operational duties, the possibility of using electronic search and identification of drone activity to identify any unlawful/criminal use of one or more drones and to take suitable counter measures.
7.2 Logging of operations with civil drones

Currently the Danish Transport Authority makes it a condition of exemption that commercial operators document in a logbook or equivalent operations they have carried out.

The logbook must contain the following details:
- Date
- Name of the operator
- Type of aircraft
- Take-off and landing location
- Flying time
- Type of task
- Any deviations, if applicable

The purpose of logging, seen from an air navigation perspective, is to ensure the availability of documentation in connection with complaints or appeals. Logging is also of use in relation to accidents, with a view to accident investigation and apportionment of blame.

To make it easier for the relevant authorities to carry out accident investigation and apportion blame, as well as to safeguard the population at large, the working group recommends that the logging requirements should not just apply to the operator, but that data from the drone should also be logged.

The requirement must apply to professional operators, and logging should as a minimum include the following data:
- Position, indicated by coordinates (WGS-84)
- Height above the ground or above sea level
- Speed indicated in m/s
- Battery status
- Date with time indication in hours, minutes and seconds for the whole route of the flight at a maximum of five-second intervals

Data must be submitted to the Danish Transport Authority and other relevant authorities on demand.

When data is submitted, it must be in one of the following file formats: XLSX, XLS or CSV. The logging requirement applies to the entire flight and must be saved by the operator for three months.

7.3 Standardisation

There are currently no international standards of note for drones. Each country therefore draws up its own requirements – to the detriment of the development of the drone business.

Thus the IEC (International Electrotechnical Commission) – the global standardisation organisation for the electrotechnical field – is currently not working on drone-related standardisation. Many of the IEC’s standards are developed jointly with ISO.
As is often the case with new products that utilise known technologies in new ways, the various items of standardisation that concern drones are spread over a number of other different standardisation categories.

Drones are “compound products” containing, inter alia, cameras, rotating equipment, batteries, etc. These are all areas involving the extensive use of dedicated technical standards, but which are therefore not specifically developed with drones in mind.

The lack of any ongoing work so far on the development of official international standards for drones represents a potential opportunity for Danish developers (and authorities) to put their stamp on development globally.

Denmark can press for increased product standardisation, particularly when it comes to smaller drones. Whereas large drones in combined airspace may be perceived as aircraft, involving the stringent safety requirements relating to airworthiness etc. associated with that concept, the development of smaller drones can benefit from general product standardisation.

In setting out a strategy for work on standardisation, Denmark may choose to look at standardisation bodies other than the IEC. An example might be EUROCAE, the standardisation body that focuses exclusively on the aviation field. Unlike IEC, EUROCAE has a working group that deals specifically with civil drones.

If Denmark wishes to make her mark in standardisation work of this kind, resources from both the industry and the authorities will be required.
8 Requirements on the operator

Currently operators are approved on an individual basis by the Danish Transport Authority to fly drones. This is not appropriate in view of the strong growth in the market.

The working group recommends the introduction of standardised drone training courses for all commercial and emergency response operators. Recreational users should be subject to the requirement that they have an elementary understanding of how to fly drones. In addition, the working group recommends that a register be created of those persons who fly drones in Danish airspace.

8.1 The need for a drone “driving licence”

There is broad agreement that drones will become very widespread in the future. This means that it is inappropriate to retain the current situation where drone operators obtain permission to fly drones from the Danish Transport Authority on the basis of a case-by-case approach to applications.

If we are to successfully manage the challenges that the widespread use of drones creates, it is useful to employ the analogy of cars. In consequence we may say that a “driving licence” should be required if a person is to fly a drone. This would be a driving licence acquired on the basis of a theoretical and practical test, of the type we are familiar with from road transport.

8.2 Framework conditions for training drone operators and recreational users

In connection with the work of the working group, the Danish Transport Authority has outlined a framework for drawing up requirements relating to training and skills for persons wishing to fly drones.

The basic idea behind the system is that the requirements relating to an operator’s skill level (and therefore their training) will increase commensurately with an increase in the risk associated with the operation.

Risk assessments must therefore be produced for third parties or their property based on the following criteria:

- Drone weight
- Drone type
- Location of the flight
8.2.1 Five skill levels
Based on the above three criteria and thanks to the assistance of the UAS Denmark industry organisation, we can propose five skill levels with the associated training requirements.

Two skill levels are proposed for recreational users and four for commercial and emergency response operators.

8.2.1.1 Recreational users
The plan is that the current regulations for recreational users, set out in Regulations for Civil Aviation BL 9-4, should be retained in future (see Chapter 9 Requirements on flying drones). This entails, inter alia, that recreational users may only fly to a maximum height of 100 metres away from public highways and congested areas. That is to say that the drone must be flown at least 150 metres away from public highways and congested areas.43

If a recreational user flies a drone that is above the triviality threshold, the working group takes the view that the person in question should have a basic understanding of flying, as well as of the significance of wind conditions and similar factors.

Further to this, the working group recommends the introduction of a so-called drone permit (the idea being taken from the hunting and fishing scene). Recreational users should be in possession of a drone permit when flying drones classified above the triviality threshold.

The drone permit is obtained by passing a limited multiple-choice test and documenting that an insurance policy has been taken out for the drone.

The working group recommends the introduction of a suitable lower age limit (for instance, 16) for gaining a drone permit and therefore also liability insurance. This age limit should vary with requirements relating to flying other drone types. In this context, consideration should be given to differentiating the age limit based on drone weight.

8.1.1.2 Commercial and emergency response operators
Where drones are flown for commercial and emergency response purposes and the drones weigh less than 7 kg and are flown near public highways and congested areas, some skills will be required in the form of the ability to control the drone in wind etc., as well as avoid it crashing or other hazardous situations.

43A “congested area” means an area that is primarily used for housing, industry or leisure activities. This includes areas that on the ICAO Aeronautical Chart are indicated as “built-up areas” with more than 200 inhabitants, as well as summer cottage areas, occupied camp sites, developed industrial and port areas. In addition, parks, beaches or other recreational areas that are located within, integrated with or are directly adjoining a densely congested (built-up) area, are also regarded as a congested area.
Commercial and emergency response operators should therefore be able to document that they possess these skills. This is achieved by being in possession of a so-called *drone licence*, which, like a road vehicle driving licence, can be obtained in various categories, depending on the type of drone and the type of operation desired.

The working group recommends the introduction of a lower age limit of 18 for gaining a drone licence.

Furthermore, the working group recommends setting up four categories of drone licence:

- **Drone licence A**: For drones weighing from 0.250 kg to 1.5 kg involving operations performed within the operator’s visual line of sight (VLOS)
- **Drone licence B**: For drones weighing from 1.5 kg to 7.0 kg involving operations performed within the operator’s visual line of sight (VLOS)
- **Drone licence C**: For drones weighing from 7.0 kg to 25.0 kg involving operations performed within the operator’s visual line of sight (VLOS)
- **Drone licence D**: For drones weighing up to 25.0 kg involving operations performed beyond the operator’s visual line of sight (BVLOS)

For drone licence A and drone licence B, the licence can be obtained by undertaking and passing a theoretical training course and a practical test for the class in question (e.g. fixed-wing, helicopter or multi-rotor).

If the drone weighs from 7 kg up to 25 kg inclusive, the operator must have a drone licence C. To obtain a drone licence C, in addition to having the basic licence, the operator will have to pass a test with the specific drone model they wish to fly. The same requirements apply if an operator wants to obtain permission to fly a drone up to and including 25 kg BVLOS.

If an operator wants to fly drones weighing more than 25 kg, permission for this from the Danish Transport Authority must in the first instance depend on an individual evaluation of the skills of the operator in question. Once sufficient experience has been gained of this area, the area should also be made subject to clear regulations.

The various skill levels have been outlined on the next page in *Table 8.1* for recreational users and *Table 8.2* for professional operators.
### Table 8.1: Required skills from recreational users

<table>
<thead>
<tr>
<th>SKILL LEVEL</th>
<th>TRAINING</th>
<th>TEST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 250 g</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>0.250 kg to 1.5 kg</td>
<td>Drone permit</td>
<td>Optional</td>
</tr>
<tr>
<td>1.5 kg to 7.0 kg</td>
<td>Drone permit</td>
<td>Optional</td>
</tr>
<tr>
<td>7.0 kg to 25 kg</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Table 8.2: Required skills from professional operators

<table>
<thead>
<tr>
<th>SKILL LEVEL</th>
<th>TRAINING</th>
<th>TEST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 1.5 kg</td>
<td>Drone licence A</td>
<td>Full Multiple Choice + Practical Test</td>
</tr>
<tr>
<td>1.5 kg to 7.0 kg</td>
<td>Drone licence B</td>
<td>Theory course + Practical course</td>
</tr>
<tr>
<td>7.0 kg to 25 kg</td>
<td>Drone licence C</td>
<td>Theory course + Practical course + Model-specific test</td>
</tr>
<tr>
<td>Up to 25 kg (BVLOS)</td>
<td>Drone licence D</td>
<td>Individual assessment + Practical Test + Model-specific test</td>
</tr>
<tr>
<td>Over 25 kg</td>
<td>Individual assessment</td>
<td>Individual assessment</td>
</tr>
</tbody>
</table>
The working group recommends that, in line with other areas within air navigation, a situation should be created where interested parties can offer courses, conduct tests etc. for persons who wish to fly drones that are subject to training requirements. The training locations must always be audited by the Danish Transport Authority in order to ensure the training courses are of the appropriate quality.

8.3 Creation of a “drone register”

Analogous to the working group’s recommendation to set up a register of “number plates” for drones using Danish airspace (see Chapter 7), the working group also recommends the introduction of a requirement for a register of drone licences, which can be accessed by the Danish Transport Authority, the police and other relevant authorities.

The information can then be used by relevant authorities to clarify the circumstances relating to accidents etc. ("safety“) as well as cases of unlawful use of drones ("security“).

Consideration may also eventually be given to combining the drone licence register and number plate register in a single drone register and thereby providing a better overview for the authorities.

Registration of drones must be implemented gradually. It should be brought in first for professionals, with the aim of being extended at a later date to recreational users who fly drones that are subject to the electronic identification requirement.
9 Requirements on flying drones

The starting point for evolving operational regulations for civil drones is that they should be flown in such a manner as not to endanger the lives or property of others. To achieve this aim there need to be “traffic regulations” for civil drones of which operators are generally aware.

The working group recommends that the current regulations for recreational use of drones should also in future be covered by Regulations for Civil Aviation BL 9-4, and that the current guidance for commercial drones should constitute the core of the future dedicated provisions for commercial and emergency response operators.

9.1 Current operational requirements

The current practice is that the flying of civil drones is governed by Regulations for Civil Aviation BL 9-4: Regulations on unmanned aircraft not weighing more than 25 kg.

The regulations state that drones must be flown at a distance from congested areas (“built-up area” in the Regulation)\(^44\), major public highways\(^45\) and aerodromes that ensures that “no other persons or property are endangered”.

The working group recommends that the current requirements relating to recreational users be retained, but that provisions governing required distances from particular areas and buildings be added.

Specifically, the working group recommends that the distance from properties of the crown estate, police stations, prisons and detention centres, military installations and ministerial buildings should, for security reasons, be the same as the distance from a congested area (“built-up area”) and a public highway that already applies in Regulations for Civil Aviation BL 9-4.

\(^44\)A "congested area" means an area that is primarily used for housing, industry or leisure activities. This includes areas that on the ICAO Aeronautical Chart are indicated as “built-up areas” with more than 200 inhabitants, as well as summer cottage areas, occupied camp sites, developed industrial and port areas. In addition, parks, beaches or other recreational areas that are located within, integrated with or are directly adjoining a densely congested (built-up) area, are also regarded as a congested area.

\(^45\) Whether a road falls under the category of "major public highway" depends on a specific assessment from either the police or the Danish Transport Authority based on the amount of traffic the road in question carries.
The requirements of Regulations for Civil Aviation BL 9-4 are not however suitable for the regulation of commercial drone use, as has been made clear in Chapter 2 A regulatory system that is appropriate for civil drones. For this reason, commercial operators have been able to gain exemption from the regulations if they have satisfied the conditions contained in the guidance issued by the Danish Transport Authority via AIC B 08/14.

The guidance requires operators to describe in their operations manual how they organise and restrict the flight to a so-called “flying and safety area” (“flyve- og sikkerhedsområde”). “Flying and safety area” (“flyve- og sikkerhedsområde”) means a demarcated area where the operator in question must fly their drone. The area is established for that specific operation and is intended to ensure that any third-party risk is minimised.

If a person other than the operator is in the flying and safety area, there is a requirement that the drone can be controlled and landed in the event that at least one motor/engine is lost. The principle is therefore that commercial drones must not generally fly over a third party unless it can be documented that the drone has a given level of airworthiness and/or safe emergency procedures.

The operator is also responsible for ensuring the necessary permissions have been obtained for the flight from owners of properties within the flying and safety area.

Table 9.1 on the next page outlines the difference between using a drone within the general provisions (Regulations for Civil Aviation BL 9-4) and using it within the terms of the exemption granted to commercial operators.
### Table 9.1: Comparison of current requirements for recreational and commercial flying, respectively, of drones

<table>
<thead>
<tr>
<th>Weight class</th>
<th>Regulations for Civil Aviation BL 9-4 Distance requirements</th>
<th>AIC B08/14 Distance requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>General</td>
<td>Commercial use</td>
</tr>
<tr>
<td><strong>0–1.5 kg</strong></td>
<td>150 metres from major public highways and congested areas.</td>
<td>The flying/safety area must be equivalent to a radius of 2 x the height at which the drone is flown for the entire route, but never less than 15 metres or more than 50 metres.</td>
</tr>
<tr>
<td></td>
<td>Distance from military aerodromes: 8 km</td>
<td>Distance from military aerodromes: 8 km</td>
</tr>
<tr>
<td></td>
<td>Distance from public aerodromes: 5 km</td>
<td>Distance from public aerodromes: 2 km, if the flight takes place at a height of no more than 45 metres above the ground.</td>
</tr>
<tr>
<td><strong>1.5–7 kg</strong></td>
<td>150 metres from major public highways and congested areas.</td>
<td>The flying/safety area must be equivalent to a radius of 2 x the height at which the drone is flown for the entire route, but never less than 15 metres or more than 50 metres.</td>
</tr>
<tr>
<td></td>
<td>Distance from military aerodromes: 8 km</td>
<td>Distance from military aerodromes: 8 km</td>
</tr>
<tr>
<td></td>
<td>Distance from public aerodromes: 5 km</td>
<td>Distance from public aerodromes: 2 km, if the flight takes place at a height of no more than 45 metres above the ground.</td>
</tr>
<tr>
<td><strong>7–25 kg</strong></td>
<td>150 metres from major public highways and congested areas. The drone must only be used within an approved model flying site.</td>
<td>The flying/safety area must be a minimum of 50 metres in radius and must be adapted to the type of aircraft, speed and operation.</td>
</tr>
<tr>
<td></td>
<td>Distance from military aerodromes: 8 km</td>
<td>Distance from military aerodromes: 8 km</td>
</tr>
<tr>
<td></td>
<td>Distance from public aerodromes: 5 km</td>
<td>Distance from public aerodromes: 2 km, if the flight takes place at a height of no more than 45 metres above the ground.</td>
</tr>
</tbody>
</table>

### 9.2 Flight beyond the operator’s visual line of sight (BVLOS)

Currently in Denmark drones may only be flown if the operator has the drone within their visual line of sight (these operations being called visual line-of-sight or VLOS operations). It is therefore not possible to pre-program a drone to inspect large areas of “its own accord” (these operations being called beyond visual-line-of-sight or BVLOS operations).
Flying an unmanned aircraft below 150 metres and at a distance where the operator is not able to observe the position of the craft or the direction of flight without a telescope or other aid, as well as where the aircraft cannot be controlled without delay in such a way as to avoid collision with other aircraft in the air and persons and property on the ground may be classified as a BVLOS operation.

If an operator wishes to fly BVLOS, they must be able to ensure that the connection between them and the drone is maintained for the entire flight. If the connection is interrupted, the drone must be capable of autonomously performing manoeuvres that ensure that the drone does not expose third parties and other air navigation to unnecessary risk.

A drone that flies BVLOS must in principle meet the same certification requirements as a manned aircraft, if it is used in airspace above a height of 150 metres.

The Danish Transport Authority may grant an exemption if the drone is used for test purposes below 150 metres in a closed airspace, or if other airspace users have been warned of this activity.

Given that in the airspace up to 150 metres there is a possibility of other manned air traffic being present, it is important that drone flights are kept separate from those of other airspace users.

The following are some of the other users of airspace up to 150 metres:

- Paragliders/hang gliders
- Gliders performing field landings
- Hot air balloons
- Take off and landing of aircraft under 5700 kg in weight at unprepared sites
- Flights of Defence Command Denmark
- Air ambulances
- Other commercial flying of civil helicopters
- Parachutists

If BVLOS operations have to be performed outside of closed airspace or without advance warning to other air traffic, the drone must be equipped with certified "detect and avoid" technology, so that the drone can independently avoid obstructions and other air traffic.

“Detect and avoid” technology allows the drone to autonomously:

- Detect and avoid other traffic
- Detect and avoid all airborne objects, including gliders, hang gliders, paragliders, UL aeroplanes, balloons, parachutists, etc.
- Avoid dangerous cables
- Detect and avoid terrain and other obstacles
Detect and avoid technology is still at an early stage of development and it will be some years before we can expect to see it on the market.\textsuperscript{46}

The lack of possibilities to fly BVLOS will limit the profitability and feasibility of drone operations. Profitability is very much dependent on the autonomy allowed to drones in future years. There is therefore in the first instance a need to identify the “safety case” for BVLOS operations below 100 metres so that wider use of this type of operation may be permitted. The safety case should as a minimum identify how the necessary “detect and avoid” technology can be procured or how the risks of collision with obstacles or other air traffic can be addressed.

Denmark should therefore work towards achieving cross-border harmonisation of the regulations for BVLOS operations between the EASA member states.\textsuperscript{47}

9.3 Flying drones indoors

Drones are the first aircraft that can be used indoors. At the moment therefore there is no clear provision for flying indoors in Danish aviation legislation. The Danish Transport Authority currently applies the same requirements for flying drones indoors as for outdoor flights.

In this connection, considerations relating to the protection of third parties (corresponding to those that come under the scope of the Road Traffic Act – where the Road traffic Act applies, unless provision is made otherwise, for traffic on roads used for public traffic of one or more traffic types) may apply analogously. Case law under the Road Traffic Act has largely extended the scope of that Act to also include private areas to which there is public access involving one or more types of traffic.

In accordance with the provisions of Regulations for Civil Aviation BL 9-4, aircraft must be flown in such a manner as not to endanger the lives or property of others, not closer than 150 metres to a congested area and not above areas where a significant number of people are assembled in the open air.

The provision thus represents a contradiction in terms when it comes to flying drones indoors. The scope of the Act is also unclear, and, in the final analysis, there has been no clarification of case law in this field. For this reason, the working group is of the opinion that a clear legal basis should be provided for ensuring that the provisions relating to the flying of drones based on considerations relating to the protection of third parties should also apply to the flying of drones indoors in areas where there is public access. Here the working group specifically has in mind sports events, theatre productions,

\textsuperscript{46} The European RPAS Steering Group’s roadmap for the integration of civil drones in European airspace makes it clear that requirements for equipment used for BVLOS operations will not be established before 2018 at the earliest. In addition, the objective is for it to be possible to use BVLOS operations on a wide scale in the period from 2019 to 2023.

\textsuperscript{47} The EASA member states are the EU countries plus Norway, Switzerland, Liechtenstein and Iceland.
railway stations, airport terminals and similar locations. The legal basis must only cover the flying of drones that are categorised above the triviality threshold.

The flying of drones in private houses or in halls used by private groups, such as drone clubs, warehouses etc. should not be affected by the new provisions.
10 Airspace and infrastructure

There is a need for traffic information to be communicated to the drone operators, as the airspace may occasionally have to be closed and there will be a risk of inadvertently flying a drone into such areas. The most plausible way of providing traffic information is to adjust the so-called NOTAM system, which is currently used by the other airspace users to obtain traffic information.

The working group recommends that Naviair draw up a proposal as to how drone operators in airspace below 150 metres can receive relevant airspace information. As part of this, Naviair should also submit a proposal for the financing of such a scheme. The working group further recommends that isolated airspace be designated for testing civil drones, including testing BVLOS flights. Finally the working group recommends the maximum height for flying civil drones in towns and cities be increased.

10.1 The need for airspace information

Users of the airspace must allow for many considerations even when flying at low heights. In connection with e.g. a state visit, certain areas may be cordoned off on the ground by means of physical barriers, but the airspace above clearly cannot be physically cordoned off. For this reason, airspace users must be kept informed on an ongoing basis of restrictions in the airspace.

Information on the airspace and the air navigation infrastructure is generally published in the Aeronautical Information Publication (AIP). However, the AIP is only updated every 28 days, and it can take up to 94 days to update specific elements of the publication. This is why a NOTAM (Notice to Airmen) is issued, as and when needed, with information about temporary changes in airspace or to air navigation obstacles.

For changes in airspace and to air navigation obstacles, information is currently only issued in connection with changes that have consequences for air navigation at and around aerodromes and at heights above 100 metres. Drone operators, however, also need to be informed of various activities below 100 metres.

Examples might be in connection with inspections of masts, wind turbines, chimneys and other obstacles. Here the recommendation of the working group is that the drone should be seen as part of the existing obstacle.

Furthermore, in the case of BVLOS operations, other drone operators or pilots of low-flying aircraft must be aware of the BVLOS flight hazard, so that they might avoid it. For instance, Defence Command Denmark sometimes flies at very low altitudes, often just above the treetops, which requires very precise
knowledge of other activities that are in progress in the area below 100 metres.

In the light of this, the working group recommends that it be possible to use time-restricted closure of adjacent airspace for test flight purposes. The framework for test flights should be made clear so that applicants know what requirements they must meet.

10.1.1 Testing drones part of the Defence Agreement for 2013–2017

The parties to the Defence Agreement for 2013–2017 have agreed to strengthen cooperation between Danish companies and Defence Command Denmark in respect of civil drones, so that Danish companies may benefit from Defence Command Denmark’s knowledge etc. of drones.

This has been implemented in practice in that a memorandum of understanding has been signed in which possible future areas of cooperation have been identified. These are:

- Dialogue on the development of UAS Test Center Denmark (UAS TCD)
- Sharing knowledge relating to technological development in relation to drones
- Exchanging experience in relation to the planning and implementation of drone flights
- Production of a regulatory system for drones, including application procedures, standards, certification, classification of drones, control measures and inspections, as well as regulations for BVLOS operations.

In addition to the above, it has been decided that Defence Command Denmark is in a position to support the establishment of a Danish test centre for civil drones. This has already been implemented, in that Defence Command Denmark has supported the test centre with advice, personnel during demonstrations and the cascading of information from international drone fora.

The test centre is an example of a stakeholder that will be able to benefit from a clear framework for test flying drones in Denmark.

10.2 The NOTAM system

The NOTAM system has been developed to address a need among airspace users to receive information about changes in airspace conditions as well as air navigation infrastructure that require immediate publication. Operators and other airspace users are obliged to keep themselves informed of current NOTAMs that might be relevant to their operations.

The operational requirements for NOTAM, including syntax, layout etc. are specified by the UN’s aviation agency, the ICAO, and are described in Annex 15 to the Chicago Convention.

In Denmark, NOTAMs are issued by Naviair on behalf of the Danish state. NOTAMs can be obtained free of charge from Naviair, or by contacting Naviair’s NOTAM office, or by visiting the website of the NOTAM office.
NOTAMs obtained from the website are not however for operational use, as Naviair cannot guarantee the accuracy of the information displayed.

10.2.1 Short-term development of the NOTAM system

The sheer number of NOTAMs issued on a daily basis means that an individual NOTAM must be as short and precise as possible. This means that operators who fly commercially can quickly form a picture of the potential dangers they might expect during flight. In addition, short and precise NOTAMs ensure that information is not overlooked by the operator.

This avowed aim to keep NOTAMs short and precise has the result that the use of language is at times incomprehensible to those not in the know, making them difficult to understand for readers who do not have an operational understanding of aviation. The possibilities of effecting a change here are however highly limited.

One possibility for making the current NOTAM system more user-friendly would be to add a cartographic representation of the airspace data contained in a NOTAM. In this way, readers will be able to see a map extract that presents in visual terms the appearance of a given change in airspace, e.g. if the police close the airspace over a given area.

The above model (known as “digital NOTAM”) is currently in preparation as part of an international cooperative venture between the Europe-wide aviation organisation EUROCONTROL and the US aviation authorities (FAA). It does however require that databases with airspace, air navigation obstacles and terrain contain the necessary data and that the data is of adequate quality. Currently there can be no guarantee that this is the case.

Since, as of the time of writing, no requirements have been specified at an international level, digital NOTAM will also require that the Danish Transport Authority, in its role as authority, specify criteria and requirements for Naviair for the development and operation of a graphic presentation of NOTAM.

At all events, digital NOTAM will probably be implemented before 2020. This will partly be in the light of changes to ICAO Annex 15 and partly on the basis of Commission Regulation (EU) No 73/2010 laying down requirements on the quality of aeronautical data and aeronautical information for the single European sky (the Aeronautical Data Quality (ADQ) Regulation – of which more below). If Naviair is required to develop a system for digital NOTAM independently of investments in connection with the ADQ Regulation, financing will have to be found for this.

Financing the operation of such a system can be allocated to the en-route cost base if the task can also be said to be to the benefit of commercial airspace users, e.g. by avoiding collisions with drones. Alternatively or additionally, financing of operation must be in the form of user payment, e.g. a fixed annual fee for drone owners (similar to the ownership charge for cars). Whether these sources can finance development of the system will have to be examined in greater detail.

In the meantime, the option of Naviair carrying out minor adjustments to their “Briefing site” (the website where NOTAMs can be accessed) is being looked at. This may possibly be achieved by distinguishing between NOTAMs that are of general interest (i.e. above 150 metres, as well as aerodromes)
and NOTAMs that specifically comprise changes to airspace below 150 metres, which will only be of interest to drone operators.

Regardless of whether Naviair’s Briefing site is adjusted, or Naviair is required to develop digital NOTAM at the present time, drone operators will in the short term have to be trained in reading NOTAMs and the importance the various NOTAMs have for the operators (for more on the skills required of operators, see Chapter 8 Requirements on the operator).

**10.2.2 Long-term options for developing airspace information**

The Danish Transport Authority and Naviair are cooperating on digitising the Aeronautical Information Service (AIS), including data for use in digital NOTAM. The intention is that this should allow Naviair to create a quality-assured database containing all data that might be of interest to air navigation. The database is to be produced as part of Denmark’s compliance with Commission Regulation (EU) No 73/2010 laying down requirements on the quality of aeronautical data and aeronautical information for the single European sky (the Aeronautical Data Quality (ADQ) Regulation).

In addition to creating a database, the intention is that the entire execution of Naviair’s air navigation information should be transferred to a digital platform where airspace users will have far better options for compiling information specific to their use, including with various types of graphic representation and digital NOTAM.

In addition, data will be accessible to other users, including app developers and drone operators, in a “raw” format. It will thus be possible to develop a wide range of applications that can make use of this data. Depending on how the new applications are designed, the need for training of drone operators in reading NOTAMs will be reduced, and indeed possibly eliminated entirely.
Annex 1

The working group’s terms of reference

Terms of reference for the inter-ministerial working group on civil unmanned aircraft (drones)

In recent years, the development and operation of civil unmanned aircraft (or drones or Unmanned Airborne Vehicles (UAVs)) has been undergoing rapid change. At the same time, it is clear that the market price of these aircraft has become low enough for any citizen to purchase one from the retail trade or over the Internet. Even small drones can carry extremely advanced cameras capable of transmitting live video images or photos of high quality directly to the operator/owner.

This presents a whole range of opportunities and challenges. On the one hand, drones give rise to new commercial perspectives, and they can effectively handle a number of important tasks in the fields of inspection and surveying in agriculture, the property market, infrastructure, emergency response, exploration, etc. On the other hand, drones represent challenges in terms of, inter alia, aviation safety and the protection of privacy.

The challenge confronting the regulation and control of drones is therefore double-edged. They have to ensure that commercial opportunities and opportunities for use can be exploited by professional actors to the greatest possible extent, and that there is also appropriate room for amateur-based recreational flying. On the other hand, regulation and control must ensure the safety and privacy of citizens.

Civil drones are not currently subject to any specific controls or standards, either in Denmark or the EU, with the exception of export control regulations and the regulations governing the use of radio frequencies. They can be sold and bought freely on the market simply on the basis of the manufacturer’s general product liability obligations. In operational terms, on the other hand, drones are subject to a number of restrictions in aviation legislation (minimum distance from a congested area, maximum heights at which they may be flown, etc.), from which however professional operators may be exempted if they have taken measures to address the increased risks.

In the light of the above, an inter-ministerial working group is being set up to look at the legal, aviation safety, privacy and marketing aspects, at the same time as duly considering the commercial and use-related perspectives of civil drones.

48 In most cases, for its operation a UAV requires a ground station that transmits control signals and sensor information between the ground station and the aircraft via a data link. The UAV, ground station and data link are together called an Unmanned Aircraft System or UAS, and it often makes more sense to talk of the combined system, UAS, rather than the UAV on its own. Moreover, UAVs that are used by the military are often called drones.
Central issues are:

- Requirements governing the training and certification of operators
- Technical approval (certification) of drones, ground stations and the data link between ground station and drone, including the need to specify triviality thresholds
- Security of the data link – so that the drone cannot be hijacked by a party other than the original operator
- Radio spectrum – space on a frequency band so that drones and other frequency users do not interfere with each other

The working group is also free to look at other issues it deems relevant.

The working group includes representatives from the following authorities:

- The Ministry of Transport (the Danish Transport Authority), chair
- The Ministry of Defence
- The Ministry of Justice
- The Ministry of Business and Growth (the Danish Business Authority)

In its work, the working group is to draw on experience from relevant countries akin to Denmark as well as from the EU/EASA. During the work, the working group will engage in dialogue with relevant users and commercial actors.

The working group is to conclude its work in the form of a report with recommendations to the Ministry of Transport/the government to be submitted no later than the end of 2014.
Recent years have seen massive development in drone technology. The European Commission is forecasting the potential creation of 150,000 jobs with revenue/sales of EUR 15 billion in Europe between now and 2050. This report contains recommendations for an overall regulatory framework for civil drones that seeks to properly safeguard citizens against accidents and attack, so that drone technology may gain general acceptance in society. It also aims to create as clear and uncomplicated a regulatory framework as possible, allowing it to be used by companies and serve as guidance for them.