

# Offshore Renewables Aviation Guidance (ORAG)

Good Practice Guidelines for Offshore Renewable Energy Developments

June 2016

## **Acknowledgements**

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## **Disclaimer**

The contents of these guidelines are intended for information and general guidance only, do not constitute advice, are not exhaustive and do not indicate any specific course of action. Detailed professional advice should be obtained before taking or refraining from action in relation to any of the contents of this guide or the relevance or applicability of the information herein.

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# Foreword

The Offshore Renewables Aviation Guidance (ORAG) has been produced by a Steering Group of RenewableUK members, with expertise in offshore aviation operations, offshore Health & Safety and risk management, offshore development and offshore operations, in consultation with Regulators, Air Operators and Offshore Renewable Developers, Operators and Wind Turbine Original Equipment Manufacturers. It should be seen as industry good practice and guidance and an indicator to organisations of the documents and procedures that should be considered. Duty Holders are encouraged to take note of the guidelines.

Issue 1 aims to address the most significant topics recognised as being of particularly relevance to the industry at its current stage of development. Some areas have not been covered, such as detailed guidelines on setting up a new onshore helicopter base. It is expected these may be covered in future revisions. Readers are kindly requested to inform RenewableUK if they notice any inaccuracies or out of date references, data, information or guidelines, and equally of any other topics recommended for inclusion.

# Executive Summary

These guidelines are written primarily from and for the perspective of organisations having primary responsibilities for and control over projects in the United Kingdom. During the planning, design and construction phases, these organisations are most likely to be the Client, Developer or Principal Contractor. During operations and maintenance, they are most likely to be the Owner or Operator. Throughout these guidelines, we use 'Duty Holder' as a generic term, covering all such organisations (whilst acknowledging that other parties will also be Duty Holders, under health and safety legislation, with regard to their more specific areas of responsibility or control).

Aviation has a fundamental impact on offshore renewable development. Whether a developer intends to use aviation or not, other airspace users from oil and gas to search and rescue may affect layout and operations. As developments move further offshore, the use of aviation is expected to increase; driven by safety and efficiency grounds. Aviation must be considered integral to wind farm planning, consenting and implementation. Such work has to be conducted from the onset of offshore asset development and will require subject matter expert advice. ORAG provides a road map of activities that need to be considered, and why they should be considered, in such a process.

Helicopter operations to large offshore structures, such as air transportation, are likely to be similar to those within the oil and gas industry. Specialist operations, such as helicopter hoist that also support the transfer of personnel and equipment, are likely to be very different. The expected growth in helicopter operations within the renewable energy sector should build on current offshore experience, but start to define and align specific good practises that reflect the risk profile of the offshore wind industry in the UK.

If wind farm developers do not own and operate their own air assets, Duty Holder control and risk mitigation measures will be based on contractual and quality control systems. Duty Holder aviation safety control measures should be implemented throughout the procurement and delivery process. Contractor pre-selection, based on safety management and performance should occur before contract award and contracts should allow for audit and quality assessments. Day to day operations should be monitored and controlled by Duty Holder representatives and regular safety and quality audits should be conducted by specialists.

# Part 1: Overview

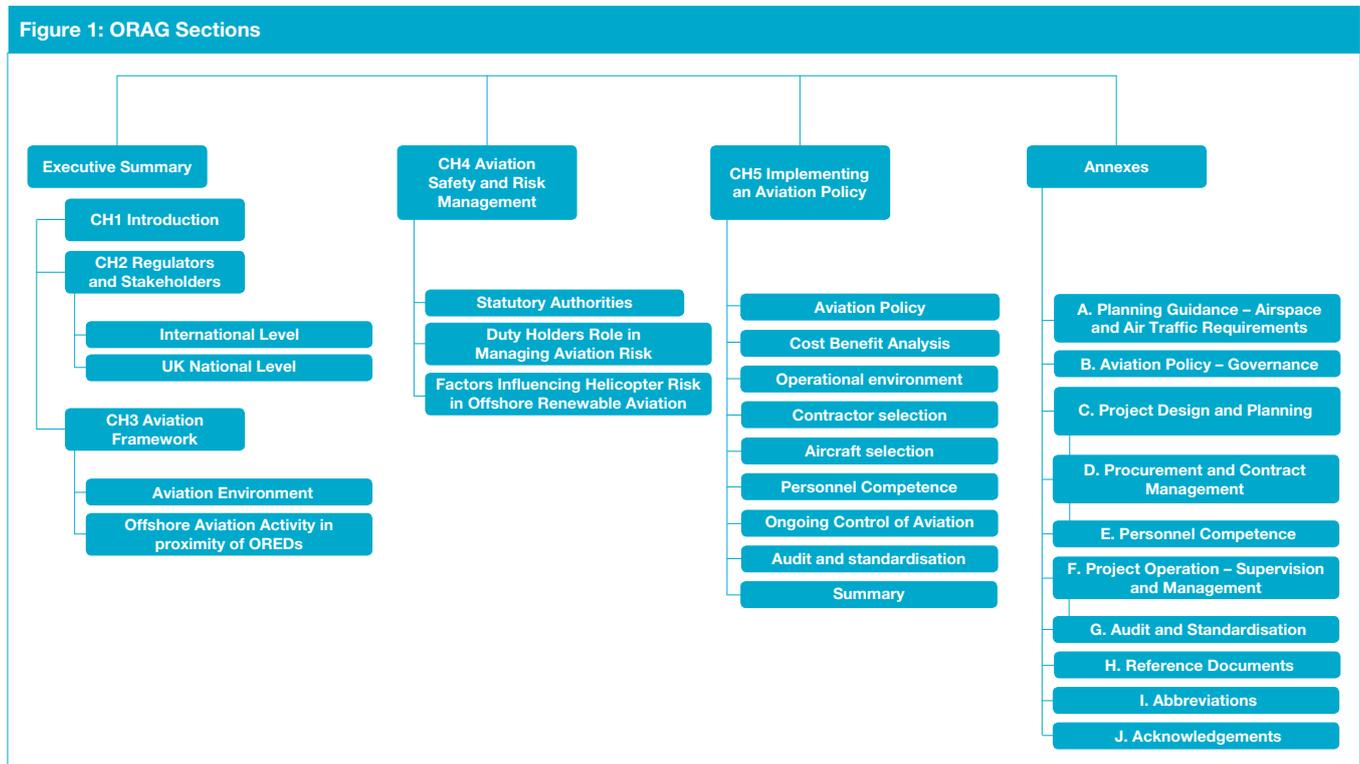
## Chapter 1: Introduction

Helicopters provide a means of covering distance quickly and allow the transfer of personnel and equipment to and from offshore structures. At one end of the spectrum this could be medical transfer of an injured technician and on the other end, it could be the delivery of a critical spare part that would enable a wind turbine generator to return to production promptly. The incorporation of aviation into any Offshore Renewable Energy Development (ORED) requires integrated planning from the commencement of product and project design. Considering aviation utilisation at the earliest opportunity is likely to be the most effective and efficient means in planning for the

deployment of these assets to avoid unnecessary and challenging retrospective adoption later in the ORED project life-cycle.

The purpose of the Offshore Renewables Aviation Guidance (ORAG) is to inform and educate Duty Holders so that they can design, integrate, and contract aviation assets into their installation and O&M operations; and act as intelligent customers and / or supervisors of aviation services.

In order to provide structure to a complex topic, the ORAG is divided into the following sections:



The main body of the text addresses the major themes which should be of interest to policy makers and supervisors. Further detail is provided in Annexes to assist those tasked with implementing aviation policy. Where information is available from Regulators or industry associations a synopsis is provided together with appropriate internet links.

The key principles that apply to aviation are:

- Management commitment.
- An understanding of the risks involved and the mitigation measures required to reduce those risks to as low as reasonably practicable (ALARP).
- A clear governance policy addressing:

- Minimum requirements on the use of aviation, such as:
  - Basic health and safety rules for helicopter operations
  - Minimum requirements for helicopters, air-operators and aircrew
  - Minimum training and personal protective equipment required to protect personnel engaged in aviation operations
- Duty Holder supervision of:
  - Contractor selection and award (Strategic)
  - Day to day tasking (Tactical)
  - Adherence to procedures (Operational)

The ORAG covers the following aspects of aviation associated with ORED Activity.

## Offshore Aviation Activity – Renewables

The following aviation roles are envisaged in support of ORED activity.

**Air Transportation** – the movement of personnel and equipment within the cabin and/or baggage compartment of a helicopter to and from an airfield or heliport, or to a helideck on a wind turbine generator, any other offshore renewable energy installation, or to a service operations vessel (SOV).

**Helicopter Hoist Operations<sup>1</sup> (HHO)** – the transfer of trained personnel and small equipment (the helicopter hoist can transfer loads normally limited to 600lbs/272kg Kg). The practical limit will be the ability of the helicopter hoist operator to manually handle the load in the cabin to and from a certified helicopter hoist platform. Transfers are conducted using an electric or hydraulic hoist fitted to the side of the helicopter, with appropriate redundancy and operated by qualified aircrew in the aircraft cabin (referred to hereafter as ‘helicopter hoist operator’ HO). HHOs require: pilots and rear crew trained and experienced in a HHO role; HHO passengers (HHOP) trained in specialist HHO and sea survival programmes.

**Under Slung Loads (USL)** – medium weight equipment can be suspended directly or ‘underslung’ in cargo nets below the helicopter and the helicopter lowered to place the load at approved locations, and can be subsequently recovered. The upper weight limit for such loads will normally be defined by the maximum load that can be placed on the helicopter hoist platform or manually handled within the wind turbine nacelle. Specialist helicopters can carry heavier loads for example to Offshore Support Platforms or SOV.

**Medical Transfer** – is the transportation of ill or injured personnel from an ORED to a medical facility for immediate medical care. This will normally be a mainland hospital or nearby heliport/airfield used to receiving casualties. As long as there are qualified personnel to assist in passenger care, escape and evacuation, injured personnel may be permitted to be carried over the sea without the requirement to wear individual personal protective equipment (PPE). The air operator must have standard operating procedures for such an event and approval must be made on a case by case basis and subject to a dynamic risk assessment by those involved. In simple terms, the benefit of the immediate transfer must justify the extra exposed risk in lack of personal protection.

**Reconnaissance/Inspections** – light helicopters, and unmanned aerial systems, can be equipped with electro-optical sensors to inspect ORED turbine components. Information may be assessed by an operator within the helicopter or transmitted to a surface operator. The ability of a helicopter to relocate quickly between structures can enable multiple inspections to be completed during one wind farm visit. Inspections may also be undertaken whilst waiting for other tasking. The use of fixed wing aircraft for survey work in the pre-development phase is not covered by these guidelines.

**Unmanned Aerial Systems (UASs)** – UASs are being used in onshore and offshore renewables, for routine survey and engineering fault analysis. This use is quickly increasing offshore, not only in renewables but also in the oil and gas sector, for a wide range of tasks, ranging from inspection, logistics delivery and data repeating.

UASs may be flown within line of sight (LOS) or independently beyond line of site (BLOS). BLOS operations generate more significant collision risks and thus need more robust de-confliction. BLOS UASs are not currently employed by the offshore renewable sector. (ORAG considers UASs only inasmuch as they may present a safety risk to offshore helicopter operations in support of ORED and O&M – a dedicated UAS guidance is being scoped).

1. <http://easa.europa.eu/system/files/dfu/Annexes%20to%20Regulation.pdf>

## Chapter 2: Regulators and Stakeholders

Duty Holders, Original Equipment Manufacturers (OEMs) and aviation providers must satisfy certain aviation-related regulatory requirements whether or not aviation is to be selected as a wind farm logistic solution. Accordingly, early dialogue with authorities in the development of a project or product is essential to ensure success and minimise retrospective activity.

A number of bodies have responsibilities for aviation activities that occur within, or in supporting, offshore wind farms. Authorities have strong working relationships and memorandums of understanding exist (see below) to clarify how activities that cross, or adjoin boundaries will be considered. The following outlines the legislative authority for the statutory authorities and key stakeholders that are concerned with aviation in and around offshore renewable energy installations. Duty Holders should be aware that offshore aviation operations need to follow global, regional and national regulations and guidance.

### International Level

This subsection outlines the roles of the key International level stakeholders: the International Civil Aviation Organization (ICAO), the International Air Transport Association (IATA) and the European Aviation Safety Agency (EASA).

#### ICAO

ICAO is an United Nations specialized agency, established by States in 1944 to manage the administration and governance of the Convention on International Civil Aviation (Chicago Convention). ICAO works with the Convention's 191 Member States and industry groups to reach consensus on international civil aviation Standards and Recommended Practices (SARPs) and policies in support of a safe, efficient, secure, economically sustainable and environmentally responsible civil aviation sector. These SARPs and policies are used by ICAO Member States to ensure that their local civil aviation operations and regulations conform to global norms, which in turn permits more than 100,000 daily flights in aviation's global network to operate safely and reliably in every region of the world. Duty Holders with operations in multiple member states should be aware of global ICAO requirements as well as any differences imposed by

regional agencies (eg Europe's EASA) and national bodies (eg UK's CAA).

#### IATA

IATA is the trade association for the world's airlines, representing some 260 airlines or 83% of total air traffic. IATA is associated with ICAO and as such provides training in procedures and regulations for all air operations. IATA can help the Duty Holders with the understanding of helicopter flights with dangerous goods, which is often an overlooked aspect of flight operations. Duty Holders should plan for packaging, manifesting, Notification to Captain (known as NOTOC), delivering, handling etc. of dangerous goods. This part of the planning can be understood through procedures, logistic and training provided by IATA.

#### EASA

EASA was established in 2002 as the European Union (EU) authority for aviation safety. The main activities of the organisation include the strategy and safety management, the certification of aviation products and the oversight of approved organisations and EU Member States. EASA tasks include

- Making implementing rules in all fields pertinent to the EASA mission
- Certifying & approving products and organisations, in fields where EASA has exclusive competence (e.g. airworthiness)
- Providing oversight and support to Member States in fields where EASA has shared competence (e.g. Air Operations, Air Traffic Management)
- Promoting the use of European and worldwide standards
- Cooperating with international actors in order to achieve the highest safety level for EU citizens globally (e.g. EU safety list, Third Country Operators authorisations)

Duty Holders should note that in particular EASA is responsible for the certification of helicopters, with relevant standards e.g. Certification 27 and 29 (C27 and C29). EASA also provides key operational regulations, with the Helicopter Offshore Operations (HOFO) being drafted for release in late 2016, which will include key points on offshore aviation, including in support of renewables. A helicopter certified as

compliant with C27 (applicable to small rotorcraft with maximum weights of 3175 kg or less and nine or less passenger seats) or C29 (applicable to large rotorcraft) will meet demanding criteria across a number of aspects of helicopter design. Aspects of particular relevance to Duty Holders are:

- a. Performance and controllability throughout the intended flight envelope, including hovering outside ground effect,
- b. Performance and controllability after malfunction, including critical engine failure,
- c. If there is any combination of height and forward speed, including hover, under which a safe landing cannot be made under the applicable power failure condition,
- d. Capability to protect occupants after emergency landing on land or water,
- e. Provision of emergency escape exits for crew and passengers,
- f. Emergency floatation devices.

Duty Holders seeking to contract an Aviation Provider can then establish a level of confidence in their performance by engaging with, and audit of, their Continuous Airworthiness Management, Part 145 Maintenance activities, Flight Operations, Safety and Quality and other departments.

### UK National level

This subsection outlines the roles of the key UK stakeholders: the Civil Aviation Authority (CAA), Air Accidents Investigation Branch (AAIB), NATS, Maritime and Coastguard Agency (MCA) and the Health & Safety Executive (HSE).

#### CAA

The CAA was established by Parliament in 1972 as an independent specialist aviation regulator and provider of air traffic services (the air traffic control body NATS was separated from the CAA in the late 1990 and became a public/private partnership organisation in 2011, see below). The CAA regulates (approximately):<sup>2</sup>

- Active professional and private pilots (50,000)
- Licensed aircraft engineers (12,400)
- Air traffic controllers (2,350)
- Commercial Air Operators, including airlines (206)
- Licensed aerodromes (141)
- Organisations involved in the design, production and maintenance of aircraft (950)
- ATOL holders (2,400)
- Aircraft registered in the UK (19,000)

Duty Holders should note that in particular, CAA is responsible for the national aviation regulations and guidance. Many specific Civil Aviation Publications (CAPs) are referenced in this document, as well as national safety and operational directives, which all air operators must follow when operating within the UKCS. There are CAPs with key points on offshore aviation, including in support of renewables, as well as CAP764 which is specific to aviation and windfarms.

#### AAIB

The UK AAIB is part of the Department for Transport and is responsible for the investigation of civil aircraft accidents and serious incidents within the UK and its overseas territories.

#### NATS

NATS operates under a licence from the Civil Aviation Authority (CAA). Under the terms of the licence, NATS is required to be capable of meeting on a continuous basis any reasonable level of overall demand, and for the design and application of safe air traffic control (ATC) procedures, e.g. to eliminate confliction between aircraft. With the authorisation of the CAA, these requirements are reflected in the design and establishment of controlled airspace appropriate to operational requirements. NATS provide en-route air traffic management and, on a commercial competitive basis, some air traffic control services at major airports. In addition to these and transatlantic services, NATS also provides:

- off-route air traffic services in the London and Scottish Flight Information Regions
- UK Aeronautical Information Service (AIS)
- air traffic services to customers with specific requirements such as helicopter companies operating in the North Sea oil fields

Duty Holders should note the last point above. This service is completed under the governance of the CAA, and any commercial air transport (CAT) helicopter operations in support of renewables within the 'North Sea Round Trip Charging Areas' will incur the related costs.

#### MCA

The MCA was established on 1 April 1998 as an Executive Agency created by the merger of the Coastguard Agency and the Marine Safety Agency. Its main functions are to develop, promote and enforce high standards of marine safety, to minimise loss of life amongst seafarers and coastal users, and to

2. CAA – [www.caa.co.uk/default.aspx?catid=2345](http://www.caa.co.uk/default.aspx?catid=2345)

minimise pollution from ships of the sea and coastline. The MCA's statutory powers and responsibilities derive primarily from the Coastguard Act 1925, the Merchant Shipping Act 1995 and the Merchant Shipping and Maritime Security Act 1997 and associated secondary legislation.

HM Coastguard, as part of the MCA, is responsible for search and rescue co-ordination in the UK Search and Rescue Region, which includes all estuarial, coastal and territorial waters. Long term contingency planning for Search and Rescue operations is a factor for consideration when developing wind farm layouts. Further details are covered in Chapter 3.

Duty Holders should note that in particular, MCA are responsible for national maritime operations regulations and guidance, with specific Marine Guidance Notifications (MGNs) referenced in this document, as well as other more specific operational guidance, such as their own offshore aviation operations within the UKCS. There are MGNs with key points on offshore aviation, including in support of renewables, including MGN543.

## **HSE**

The HSE is a statutory body, whose main function is to make arrangements to secure the health, safety and welfare of people at work and to protect the public from dangers arising from work activities. It was created by the Health and Safety at Work etc Act 1974 (HSWA), as amended by the Legislative Reform (Health and Safety Executive) Order 2008. The HSE's statutory powers and responsibilities are derived from the Health and Safety at Work etc Act 1974 (HSWA) and other related legislation. HSWA applies in Great Britain only, and to the extent covered by the Health and Safety at Work etc Act (Application Outside Great Britain) Order 2013.

ORED Duty Holders should note that in particular of the Memoranda of Understanding between the CAA and the HSE that aims to clarify responsibilities when both parties may have similar concerns and responsibilities over certain activities. The MOU between the UK HSE and the CAA Safety Regulation Group may be found at:

**HSE/CAA MOU** – [www.caa.co.uk/Our-work/About-us/The-CAA,-HSE-and-HSENI/](http://www.caa.co.uk/Our-work/About-us/The-CAA,-HSE-and-HSENI/)

# Chapter 3: Aviation Framework

## Introduction

Chapter 3 aims to explain how stakeholder activities can impact upon renewable aviation and the impacts that OREDs and renewable aviation can have on other stakeholders. It should be noted that although wind farm layout, offshore support platforms and wind turbine generators may be configured for aviation operations, a conscious decision has to be made to adopt an aviation logistic solution.

## Aviation Environment

**Airspace** – The CAA is directed by Parliament to manage UK airspace in the Transport Act 2000 and Civil Aviation Directions (Air Navigation) issued by the Department for Transport. The UK’s airspace is ‘recognised as one of the most complex and intensively used segments of airspace in the world.’<sup>3</sup> Getting a wind farm design integrated in the broader surrounding airspace is an early aviation responsibility for project managers. Detailed advice on CAA policy and guidance on the issues for wind turbine developers (onshore and offshore) are set out in detail in CAP 764 CAA Policy and Guidelines on Wind Turbines. CAP 764 should be referred to by developers during planning and consenting phases. An overview of key airspace issues specific to offshore wind farms is provided here.

Airspace is classified and regulated depending upon the way that the airspace is used. Flight rules for pilots differ significantly for different airspace types. Airspace around major airports and on the national and international airways structure is ‘controlled’ or regulated. Other airspace may be ‘uncontrolled’ and is open and accessible to all. ‘Danger Area’ airspace used by the military is often ‘restricted’, meaning civilian aircraft may not necessarily be permitted to fly through it.

At the low heights at which helicopters operate off-shore, the airspace is generally ‘uncontrolled’. This means it does not require an ATC clearance or service, and is open to anyone who wishes to use it. Generally, the airspace above and around an offshore wind farm will be uncontrolled and potentially used by a variety of civilian and military aircraft, and by UASs. Because the airspace is uncontrolled, it does not follow that there is no radar coverage. But as

a general principle, with the exception of the North Sea, the further offshore, the less likely there will be extensive radar coverage to turbine level. However, it is highly advisable to make use of any existing ATC provision due to the density of helicopter flying as well as Military and General Aviation operations. Further details on airspace may be found on at Annex A and:

- the CAA website ([www.caa.co.uk](http://www.caa.co.uk))
- the NATS website([www.nats.aero](http://www.nats.aero))

**Radar and other communication, navigation and surveillance systems** – There are a number of ways in which wind farms can have an impact on the operation or safety of the air traffic services provided by NATS, and others, such as the Ministry of Defence and airports. These include problems on Radars, Air Traffic Radar Displays such as clutter, reduced sensitivity and overloading of processing functions; as well as the degradation of voice communication facilities and en-route navigation aids. NATS offers many services to help wind farm owners, developers and the aviation industry to operate together on matters pertaining to their services. Further information can be found on:

- The NATS website for wind farms [www.nats.aero/services/information/wind-farms/](http://www.nats.aero/services/information/wind-farms/)
- Joint working group report \_ Managing the Impact of Wind Turbines on Aviation [http://airspace.safety.com/wp-content/uploads/2013/09/20130701ManagingTheImpactOfWindTurbinesOnAviation\\_Script\\_FINAL\\_V1.pdf](http://airspace.safety.com/wp-content/uploads/2013/09/20130701ManagingTheImpactOfWindTurbinesOnAviation_Script_FINAL_V1.pdf)

The height of OREDs can act as a physical barrier to low flying aircraft. Obstructions can infringe approach and departure routes from offshore oil and gas installations. Wind energy developments (including anemometer masts) located near an offshore helicopter installation could potentially introduce obstructions that would have an impact on the ability to safely conduct essential instrument flight procedures to such facilities in low visibility conditions. Such restrictions have the potential to affect not only normal helicopter operations but also threaten the integrity of offshore installation safety cases where emergency procedures are predicated on the use of helicopters to evacuate the installation. Further information can be found within:

3. See DECC’s The Aviation Plan.

- CAA Policy and Guidelines on Wind Turbines – CAP 764 (Issue 6). <http://publicapps.caa.co.uk/docs/33/CAP764%20Issue6%20FINAL%20Feb.pdf>

The geographical/airspace impact of infrastructure within a wind farm may affect helicopter Search and Rescue (SAR) operations. The MCA is responsible, through HM Coastguard, for the initiation and coordination of civil SAR throughout the UK Search and Rescue Region. Offshore wind farms create obstacles to the operation of SAR aircraft (and to surface rescue craft) and can be a flight safety hazard to SAR helicopters.

The MCA require SAR helicopters and surface rescue craft to operate around and within offshore wind farms, and recommend that developers plan for at least two lines of orientation unless it can clearly demonstrate that fewer are acceptable. As part of this process, site-specific risk assessments should be undertaken on a case-by-case basis that present sufficient information to enable the MCA to adequately understand how the risks associated with the proposed layout have been reduced to ALARP.

The construction of offshore wind farms may be dependent upon the UK Department of Environment and Climate Change (DECC) confirming, in consultation with the MCA, that the licence-holder has taken into account and adequately addressed recommendations (including SAR requirements) contained within Marine Guidance Note (MGN) 543 “Offshore Renewable Energy Installations (OREI) – Guidance on UK Navigational Practice, Safety and Emergency Response”. Further details may be found in:

- MGN 543  
[www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/502021/MGN\\_543.pdf](http://www.gov.uk/government/uploads/system/uploads/attachment_data/file/502021/MGN_543.pdf)
- Emergency Response Cooperation Plan guidance  
[www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/371636/Offshore\\_Renewable\\_Energy\\_Installations\\_4\\_11\\_14.pdf](http://www.gov.uk/government/uploads/system/uploads/attachment_data/file/371636/Offshore_Renewable_Energy_Installations_4_11_14.pdf)

### Offshore Aviation Activity in Proximity of OREDs

The following aviation operations which could operate in proximity to OREDs should also be taken into account by ORED Duty Holders.

**Search and Rescue (SAR)** – SAR is defined as the recovery of a person in distress to a place of safety and is a specialised activity conducted by specially qualified pilots and rear crew. As such, SAR operations are either conducted by specialist national SAR organisations or contractors working to specific approval which

mandates a high level of crew training and competence e.g. CAP999 in the UK. SAR operations are not constrained by geographical or landing area restrictions and can take place anywhere deemed safe by the aircraft captain. SAR pilots and rear crew regularly train in SAR procedures to mitigate the increased risks associated with winching personnel outside normal civil air transport (CAT) constraints. Because operational SAR hoisting is conducted outside normal public transport constraints, an element of distress is required before it can be authorised.

For large ORED and, subject to weight restrictions, SAR Helicopters will use existing landing decks. For Wind Turbine Generators SAR helicopters will in the first instance use helicopter hoisting decks. Prior to winching the wind turbine will have to be prepared for transfer. This will include stopping and locking the rotors and, if possible, yawing the nacelle to provide a favourable relative wind for the SAR helicopter. The height of the helicopter over the helicopter hoisting platform will be at the captain’s discretion having taken into account: hover references, blade location and effect of any rotor downdraft. Full details can be found in the IOER-R document on the RenewableUK website at [www.renewableuk.com/en/utilities/document-summary.cfm?docid=98F1F7E5-6881-43E3-9C095937C6DCD9C1](http://www.renewableuk.com/en/utilities/document-summary.cfm?docid=98F1F7E5-6881-43E3-9C095937C6DCD9C1)

**Oil and Gas** – Helicopters first operated in the offshore oil and gas sector in the early-1970s and therefore there is extensive offshore flying experience upon which to draw. In response to offshore helicopter incidents internationally, the oil and gas industry has created substantial guidance and standards on how to manage aircraft. The International Association of Oil and Gas Producers have published the following two manuals covering guidance and practices:

- OGP Aircraft Management Guidance 390  
[www.ogp.org.uk/pubs/390.pdf](http://www.ogp.org.uk/pubs/390.pdf)
- OGP Air Transportation 410 – Recommended Practices for Contracted Air Operations  
[www.ogp.org.uk/pubs/410.pdf](http://www.ogp.org.uk/pubs/410.pdf)

Specific to the UKCS operations, Oil and Gas UK have published their own detailed guidance. These are in the process of being redrafted and reissued for late 2016, and will be more closely aligned with OGP documents. RenewableUK will inform their members when these have been updated.

Duty Holders should take into the requirements within these documents as appropriate to the scope of aviation operations for the ORED and as further informed by more detailed risk assessments.

## Part 2: Safety Management

# Chapter 4: Aviation Safety and Risk Management

Aviation risk may be controlled at many levels. At the strategic level, Duty Holders need to take safety into account when considering to what extent aviation will be required, and to set up appropriate safety management systems. At the tactical level, control of the day to day tasking ensures that helicopters are not exposed to adverse condition such as inclement weather, poor visibility and low light levels. Finally operational control is vested in the aircraft captain with other crew members and passengers, as well as air traffic control where available, playing their role.

### Statutory Authorities

**CAA Role in Managing Aviation Risk** – The CAA has a fundamental role in setting standards and ensuring that these are met. Any occurrences with possible safety implications are closely scrutinised. All parts of the ‘aviation system’ are closely monitored, this includes:

- the design, manufacture, operation and maintenance of aircraft
- the operational environment including airports and air traffic control systems and
- the performance of personnel involved.

The CAA also provides Safety Management Systems Guidance for organisations involved in aviation.

- CAA SARG Guidance - [https://publicapps.caa.co.uk/docs/33/CAP795\\_SMS\\_guidance\\_to\\_organisations.pdf](https://publicapps.caa.co.uk/docs/33/CAP795_SMS_guidance_to_organisations.pdf) and [http://publicapps.caa.co.uk/docs/33/CAP%201059%20SMS%20for%20small%20organisations%20\(p\).pdf](http://publicapps.caa.co.uk/docs/33/CAP%201059%20SMS%20for%20small%20organisations%20(p).pdf)
- The CAA recommends the use of Barrier Risk Models to assist the identification and management of risk. Noteworthy is the CAA BowTie Strategy – [www.caa.co.uk/default.aspx?catid=2786&pagetype=90](http://www.caa.co.uk/default.aspx?catid=2786&pagetype=90)

**HSE Role in Managing Aviation Risk** – Responsibility for the regulation of occupational health and safety in the offshore renewable energy industry lies with the HSE. The HSE has specialist Aviation officers who are able to advise.

### Duty Holder’s Role in Managing Aviation Risk

**Introduction** – The Duty Holder is responsible for assessing, mitigating and accepting that any risk within their area of responsibility is controlled to ALARP. Contracted aviation falls within this requirement.

The offshore operational environment is a very different flying environment to that encountered onshore. A clear understanding of the unique aspects of the over-water flying environment and of the capabilities of modern offshore helicopters is essential: both to ensure that the Duty Holder has selected the right technology and the aviation operators at project planning stage; and to help Duty Holders understand the constraints on the helicopter use during real time offshore operations. Duty Holder(s) cannot take for granted that an Air Operator’s Safety Management System is sufficient without undertaking proportional and appropriate checks. In order to begin such an assessment there has to be an understanding of the Duty Holder’s risk exposure.

Guidance on the role of Duty Holders in relation to emergency response may be found in the Integrated Offshore Emergency Response – Renewables (IOER-R) Chapter 3.

### Factors Influencing Helicopter Risk in Offshore Renewable Aviation

Helicopter flying close to obstructions remains primarily a manual activity with success resting on the skill, dexterity and cooperation of the aircrew. A level of automation, comparable to commercial fixed wing aircraft can be expected on long transits. Nevertheless, approaches to and from airports, heliports and ORED are most likely to be pilot flown with reference to flight instruments. In order to understand the risks involved the following notes give the layman some guidance on the issues that aircrew encounter.

- **Height & Spatial Perception** – the visual cues available to pilots flying overwater are less reliable than overland. In low wind conditions with low sea states, it is difficult to assess aircraft height visually. This effect is sometimes referred to as ‘Gold Fish Bowl’ conditions and leads to aircrew disorientation and has been a factor in a number of offshore accidents. Such problems can be mitigated by: limiting helicopter operations to flying in day-Visual Meteorological Conditions (VMC); flying with a co-pilot or relying on CTV/SOVs for personnel transfer at night or poor visibility;
- **Flight-in-Instrument Meteorological Conditions** – flight in-cloud, and fog, poses meteorological risks, and is generally only undertaken in controlled circumstances. Cumulonimbus clouds are high risk meteorological features and are avoided due to strong downdrafts, lightning, and icing risks. When

temperatures are close to 0°C, in-cloud icing is a risk at any height. Not all helicopters have anti-icing capabilities, and there will be meteorological conditions when the forecast of, and actual, icing will stop flight operations;<sup>4</sup>

- **Wind Limitations** – provided that the flight paths are unobstructed, pilots will always approach and depart into the prevailing wind, because of the greater power margins and the improved chances of safe recovery from a single engine malfunction. Although higher wind speeds give rise to increased turbulence downwind of turbines, helicopter performance in the hover improves with increasing relative wind speed. This is because the relative wind reduces the overall hover power requirements and the loading on the tail rotor. Helicopters are able to operate in wind conditions above those of wind turbine generators' hatch opening and nacelle working restrictions. It is likely that turbine manufacturer's restrictions will limit O&M operations, rather than helicopter hover performance;
- **Night** – helicopters can fly at night, supported by ATC flight monitoring, ATC radio safety circuits, offshore systems and processes, and appropriate pilot night flying experience. CAA directs that flight approaches can only be made to and from offshore structures that satisfy regulated lighting requirements. There are hazards associated with night operations that may not apply by day. These require increased levels of technical, procedural and operational capability in addition to regulatory compliance that will significantly increase complexity and cost.<sup>5</sup>
- **Helicopter-Ship Operations** – flying to and from ships, such as wind farm SOVs, require an additional focus on ship-air integration. When operating helicopters, ships are required to have: good two-way communications with the helicopter; a heading that provides the helicopter with favourable relative wind over the hoisting/landing point; a heightened damage control and fire-fighting state, with key personnel prepared for flying operations. Detailed guidance on helicopter-ship operations is provided in Civil Aviation Publication (CAP) 437 Standards for Offshore Helicopter Landing Areas and in HCA's Helicopter Limitations List – Part C – Summary of Pitch, Roll and Heave Limitations;
- **Aircraft Escape & Personnel Recovery** – any sea survivors will be exposed to additional hazards, in particular hypothermia, drowning and difficulty in recovery by SAR assets. In the unlikely event of an aircraft malfunction leading to an aircraft landing on water, specialist survival equipment, including immersion suits, under garments together with

appropriate training is essential for both aircrew and passengers. There must also be systems in place to rapidly notify the rescue services of a downed aircraft, and minimise the time survivors spend in the water;

- **Sea State Limitations** – although sea conditions have no primary impact upon helicopter flight, helicopter offshore operations are generally limited to the lower of Sea State 6 or the capability of the helicopter emergency floatation system.<sup>6</sup> The limitation is issued because of the difficulty of recovering personnel from the sea, in the event of a forced water landing. For this reason some aviation operators may impose the more stringent operating limit of Sea State 6, which equates to 4.0m to 6.0m H<sub>s</sub>.<sup>7</sup>

Offshore Renewable Aviation hazards may be grouped into two broad categories:

- Air transport, which is seen as comparable to those found in support of other offshore industries and
- Helicoptering to offshore fixed structures which is currently unique to renewable aviation.

The following aviation BowTies give an illustrative example of the hazards that may be found and barriers that may be adopted to eliminate the risk or mitigate an unfavourable outcome. A thorough hazard identification process should however be carried out for any specific project or activity.

Duty Holders that decide not to use commercial helicopters, are not absolved from requiring a suitable aviation policy that caters for airspace, other air operators and emergency helicopter operations that could operate in proximity to their ORED.

Further information on aviation risk management may be found in Annex C. Chapter five will look at implementing an aviation logistics policy in support of offshore renewable activity.

4. The Met Office has developed forecasting tools for North Sea helicopter operators in the oil & gas industry to underpin safe flight planning.

5. Readers may find the following CAA paper on Helicopter Flight in Degraded Visual Conditions from of interest - <https://publicapps.caa.co.uk/docs/33/Paper200703.pdf>

6. CAP 1145, as amended by CAA SD001/15 [www.caa.co.uk/docs/33/SafetyDirective2015001.pdf](http://www.caa.co.uk/docs/33/SafetyDirective2015001.pdf).

7. Note though that this sea recovery challenge is common to any means of offshore transportation, including to systems such as walk-to-work that are routinely limited to Sea State 4 and below. In seeking to understand the operational limitations therein, it will be important to ensure that site specific analysis is undertaken for each wind farm, taking account of availability and response times for SAR assets, of the survival properties of the PPE in relation to the environmental conditions and the seasonal variability of environmental conditions.





## Part 3: Aviation Policy

# Chapter 5: Implementing An Aviation Policy

Once a decision is made to contract aviation, it should be properly governed by Duty Holder board members and senior executives. They should satisfy themselves that aviation is considered and adequately resourced at the outset of project design. Board and senior executives must also ensure that all those exposed to aviation risk have the training to equip them with the skills and knowledge appropriate to their level of aviation interaction.

An example of the key elements that need to be taken into account in an Aviation Policy and any supporting arrangements is at Annex B. The following sections set out the significant areas for consideration in the design and implementation of an Aviation Policy suitable for the particular ORED.

### Cost Benefit Analysis

An ORED's optimal requirement for aviation will involve balancing a number of factors: the frequency at which each turbine or other physical assets have to be visited, the loss of income from assets out of service, and the relative costs, capabilities and availabilities of aviation (and marine) solutions. Some of these points are summarised below.

Aviation may be used during ORED construction e.g. the moving of commissioning teams between turbines, the primary use is likely to be during the wind farm's operational and maintenance phase. OEMs develop wind turbine generators to minimise the occasions that turbine need to be visited. The current generation of offshore turbines are, typically, visited annually for planned maintenance, with unplanned maintenance as required in addition. Visits should be planned for low yield periods and when the weather conditions are favourable for marine transfer.

As with most complex machinery, technical issues arise on wind turbine generators and offshore support platforms that require either confirmatory inspection and/or remedial work. Conditions that produce optimum yield are likely to limit marine access and the loss of revenue could favour helicopter access. For example, the loss of revenue from an operational turbine for a day could be offset by the associated costs for deploying a suitable aviation asset to remediate a fault. The loss of the functionality of an offshore support platform could be of a higher order of magnitude. Equally, as wind farms go further offshore

Duty Holders may favour helicopter access as the most effective and efficient means of transfer to the project.

A helicopter equipped for hoisting and crewed by qualified personnel can be used to support injured personnel by providing transport within or between wind farms, or to shore. (This is a recent development following the relaxation of the requirement for injured passengers to wear full personal protective equipment.) Such an addition to a wind farm emergency response is difficult to quantify financially but such flexibility could have a positive outcome in casualty handling.

Aviation contracts can be on very varied types of cost basis, examples being:

- Dedicated full cost – where the total fixed costs (aircraft, personnel and infrastructure) together with an expected number of flying hours (consumption of aircraft life, fuel etc) are spread over a contract period being paid in increments e.g. monthly. This has the advantage of guaranteeing availability and flexibility. It also encourages flying hours as they are available.
- Fixed cost and a flying charge – as above the fixed cost are paid in increments; however, the use of the helicopter is paid by the number of hours actually flown. This enables a cost benefit analysis to be made on a daily basis i.e. where there is a cost benefit to be had the helicopter will be flown. This may lead to the sub-optimal use of the assets. i.e. insufficient tasking to keep the assets busy.
- Draw down – where a contract is established based purely on the number of flying hours flown with fixed and running costs apportioned to every hour flown. As the air operator will not know how many hours are to be flown, the fixed cost is likely to be apportioned over a relatively low number of hours leading to a high cost per hour. This may be mitigated by the customer guaranteeing a number of hour's per-annum. In such a contract the operator may wish to use their assets in support of other contracts putting availability at risk.

Once the strategic decision has been made that a level of aviation support is required, practical and operational considerations will determine some of the contract's constraints.

### Operational Environment

Suitable aviation support infrastructure is required to conduct offshore helicopter operations and needs to be factored in from the beginning.

Onshore, bases are needed to store, maintain, replenish and repair the helicopters. This is usually most cost effectively achieved at aerodromes; although dedicated facilities near to wind farm home base may be preferred operationally. Passengers require handling, with pre-flight briefing and specialist PPE suitable for the offshore marine environment.

Offshore, for HHO tasks, wind turbine generators require a helicopter hoist platform certified to meet CAP 437 (the standards and guidelines applied to all UKCS offshore installations, including wind turbines). Offshore support platforms, SOVs and substations may be fitted with helicopter hoist platforms or helidecks, which must also be certified to meet CAP 437. Where helidecks are fitted they may incorporate refuelling facilities and firefighting capabilities. In particular, SOV helidecks require: CAP 437 certification; an active deck integrated fire-fighting system (whether or not incorporating a passive (e.g. safe deck) capability) and an appropriately trained ship’s crew.

Once the decision has been made to adopt the use of aviation then the next two decisions will have the greatest impact on safety:

- The selection of the contractor (the air operator).
- The selection or approval of the air asset to be used, normally a helicopter.

In reality there will be a close relationship between contractor and air asset; the selection procedures will run in parallel. For the purpose of ORAG, each topic will be treated in isolation.

### Contractor Selection

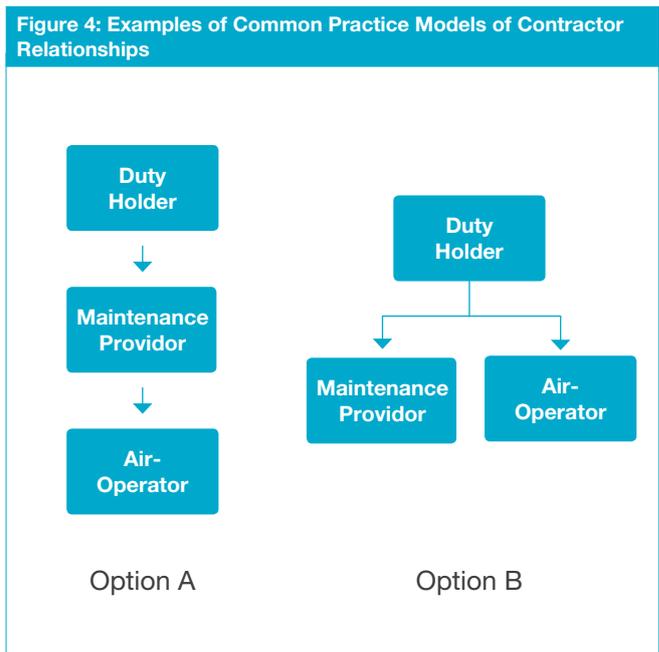
The Duty Holder is ultimately responsible for managing all risks associated with aviation support. This responsibility cannot be outsourced; however, as in the oil and gas industries, currently it is envisaged the norm will be that a wind farm operator will not become an air operator and the task will be placed with a specialist sub-contractor.

There are two examples of common practice models of contractor relationship (see Figure 4). Option A – where the Duty Holder contracts a maintenance provider who also provides logistic solutions and Option B - where the Duty Holder contracts the logistics and provides that service to the maintenance provider.

In Option A, the Duty Holder contracts the maintenance provider, who subcontracts the air operator (and, potentially, the marine operator). This gives the maintenance provider control of the air operator and enables them to monitor and control the direct risk to their employees. However, the Duty Holder will need to ensure that its aviation policy requirements are incorporated into the subcontract between the maintenance provider and the operator. The Duty Holder (or agent) must also have, and exercise, the right to audit the both the maintenance provider and the air operator. In particular, Duty Holder monitoring of the air operator is important in preventing the Duty Holder becoming too remote from, and thus vulnerable to, risks associated with the air operator’s activities.

In Option B, the Duty Holder has direct supervision of the air operator. However, the maintenance provider will need to monitor the aviation risk control of both the Duty Holder and the air operator to ensure that its employees are not being put at risk. Also, the Duty Holder must recognize that the maintenance provider, who employs the technicians and thus has a duty-of-care towards them, cannot impose its own policies and standards on the air operator. Hence it is vital that the aviation policies and standards of both Duty Holder and maintenance provider are correctly aligned, and confirmed as such by the Duty Holder.

ORAG is not attempting to state which is the preferred option, only to highlight that there is requirement for clarity of supervision and close cooperation in monitoring of aviation activity.



In selecting a contractor a number of factors will need to be considered; these include:

- Safety Management System and accident record
- Relevant experience in role and proposed procedures
- Company size and resilience
- Company structure and financial stability

Some of these factors may be in the remit of standard sub-contractor management and may be assessed by paper submission; however, some will require aviation specialists together with a physical audit to assess suitability. It is recommended that the safety assessment be considered as a pre-qualification requirement. Further details may be found in Annex D.

### Aircraft Selection

The cost of an aircraft will depend on its initial design, engines fitted and equipment specification. Infrastructure, performance requirements and cost will constrain helicopter selection. The following outlines some of the key drivers; a more complete listing will be found in Annex D.

The physical layout and dimensions of the ORED will limit aircraft selection. Examples include:

- The location of the helicopter hoist deck with reference to the wind turbine blade plane of rotation. The requirement for the helicopter to maintain a pre-determined safety margin from this plane of rotation is detailed in CAP437. This leads to a maximum helicopter rotor diameter that any wind turbine can accept.
- Helidecks fitted to offshore support platforms similarly constrain the size of helicopter that can be landed. Limits are expressed in terms of the maximum all up mass (MAUM) that a deck can support (the 't' value) and the maximum allowable helicopter dimensions (the 'D' value: a function of rotor diameter and helicopter length).

In order to maintain a safe power margin, aircraft must meet a minimum performance margin. Key examples include:

- Whilst helicopter hoisting, a helicopter should be able to maintain the hover following an engine failure for sufficient time to enable the recovery of a person on the hoist. This is normally specified in time e.g. 2:30 minutes One Engine Inoperative (OEI), as per CS27/29 Also, EASA SPA.HHO.125 further specifies HHO shall be capable of sustaining a critical engine failure with the remaining engine(s) at the appropriate power setting.
- Larger helicopters that approach, land and take-off from offshore helidecks should have sufficient performance in the event of failure of one engine,

that the helicopter is able to land within the rejected take-off distance available or safely continue the flight to an appropriate landing area, depending on when the failure occurs, this is known as Performance Class 1 (PC1). But in reality, offshore operations actually operate to PC2 with Exposure due to the size of the offshore helidecks and hostile nature of the environment. Aircraft and operators can safely conduct operations in this environment as long as the correct equipment is fitted and monitored on the aircraft and specific crew training has been carried out.

The aircraft specification and equipment fit can dramatically alter a helicopter's capability, inherent safety and efficiency. The following are factors that will require specifying:

- The applicable Regulations and guidance – where these specify or recommend a minimum standard to undertake specific roles. A recent example is CAP1145 requirements and recommendations and their related Safety and Operations Directives, which has driven offshore safety specifications including: PPE, escape routes and offshore environmental limits.
- Speed and fuel consumption.
- Number of seats, HO station, radius of action and cargo capacity.
- Equipment specification, including:
  - Number and location of hoists – a hoist positioned at the opposite side to the pilot's location will require a cross-cockpit visual hover, necessitating physical reference markers on the turbine and piloting skill. Helicopter hoist structures can incorporate more than one hoist, providing redundancy should a single hoist become compromised e.g. wire entanglement. Without such a redundancy, emergency procedures will be required to cater for technicians isolated outside of a helicopter unable to land on the turbine.
  - Autopilot and stability augmentation can reduce pilot workload and when coupled with advanced avionics allow for Instrument Flight Rules (IFR) approaches.
  - Radar altimeter and terrain warning systems can warn aircrew of impending flight into terrain/water.
  - Traffic Collision Avoidance System (TCAS) can inform of the location of other air traffic that could present a threat of collision. This can be particularly valuable offshore where there can be poor radar coverage, visibility can be poor and where other air users are likely to be operating at similar heights

As a general rule small light helicopters (for example EC135) are capable of operating up to 20 to 30 NM offshore and helicopter hoisting. Where greater range and endurance is required then a medium helicopter (for example AW169) is needed, including for helicopter hoisting. Should large loads or passengers need to be transferred between shore and helidecks, then medium/large helicopters (for example EC225/S92) are used. Passenger numbers are normally restricted to 19 or below, to avoid the requirement for a cabin attendant. Aviation supervisors will need to satisfy themselves that the aircraft offered meets the regulatory, contractual and operational criteria specified.

### Personnel Competences

Even with a high specification aircraft, offshore renewable aviation will still require aircrew to physically fly the aircraft and control the transfer of personnel. Unfortunately, some historical offshore helicopter accidents have resulted from aircrew error. Aircrew competence is based on the training undertaken and experience gained in role. The level of training can vary - widely. Civilian pilots can complete formal courses to gain basic qualification as a Commercial pilot and with experience, measured in flying hours, progress to an Air Transport pilot. Integral within this training will be an Instrument Rating allowing flight in cloud/controlled air space. Flying experience may be gained through undertaking the role of a co-pilot. Military personnel complete similar training and depending on their designated role may have considerable over water experience e.g. navy and search and rescue. Overall, pilots may have considerable flying experience (1000s of hours) although may have little, if any experience, of manually flying a helicopter over water or against structures. Accordingly, pure flying hours may not be the best measure of competence; where experience was gained needs to be considered. An aviation supervisor should ask for demonstrable competence in the role in question.

The minimum capability of the aviation solution should be determined from the risk profile faced. The hazards evident must be assessed and controls put in place which eliminate the risks identified or reduce them to ALARP. For example, there are hazards associated with environmental influences such as flight in instrument meteorological conditions (IMC), flight by night, sea state and wind strength at the hoisting point; there are hazards introduced by other aviation operations in the area; there are hazards associated with the workload faced by the aircrew etc. Many effective controls will be provided by the aircraft and others will be provided by the competence and capability of the aircrew.

In addition, aviation regulations (EASA, National Aviation Authority) may impose certain unavoidable configurations or specifications to which the aviation solution must adhere, for example a maximum sea state for helicopter operations and individual Emergency Breathing Systems (EBS). It is likely that these will be complementary to the conclusions drawn by risk assessment as the legislation will have the same foundation. Subsequently, operational and commercial considerations may be introduced which further influence the choice of aviation capability. For example, rather than mitigate an identified risk by carrying additional aircrew, which would reduce payload available, a risk may be avoided by limiting the operation (e.g. day/VMC only) and thereby maximising payload. The residual risk profile will determine the minimum capability for safe operations, overlaid by operational and commercial considerations.<sup>8</sup>

There are internationally recognised qualifications for a pilot, HO qualifications are usually determined by the air operator. The HO is not only an additional crew member assisting the pilot in aircraft operations, but also wholly responsible for the transfer of HHOP from/ to the helicopter to the turbine. The role ensures that the passenger is correctly attached to the aircraft and that hoisting does not commence until the helicopter is positioned directly over the helicopter hoist deck. In addition, through voice marshalling (telling the pilot of their location reference the helicopter hoist platform) the HO helps to ensure that the helicopter does not strike the turbine. Accordingly, this role is critical to flight safety and defining a minimum level of aircrew competence is deemed essential. This rear crew role is not common within civilian aviation and appropriate experience is likely to have been gained from either search and rescue or other rotary military activity. Should a helicopter hoist helicopter be used to transfer a casualty from offshore to a medical facility, the HO would be responsible for casualty safety and possibly for the care of the casualty. Such duties would require extra specific training.

Further details on minimum personnel requirements may be found at Annex E.

### Ongoing Control of Aviation

Safety responsibility continues throughout the life of the wind farm. As wind farm supervisory personnel are normally located onshore, helicopter integration requires levels of supervision over and above those of offshore oil and gas e.g. remote monitoring or recording of activity. The supervisory capability requires supervisory systems and supervisory personnel, capable of: integrating engineering control,

8. EASA AMC1 SPA.HHO.130(e) at [www.easa.europa.eu/system/files/dfu/Annex%20to%20ED%20Decision%202012-019-R.pdf](http://www.easa.europa.eu/system/files/dfu/Annex%20to%20ED%20Decision%202012-019-R.pdf) provides some helicopter hoist operations guidance.

marine operations, aviation operations, logistics support; liaising with other offshore sea and air users. Such activity is related closely to the role undertaken by the Marine Coordinators in marine logistic control. The quantity of flying supporting a wind farm is unlikely to justify a separate position. The key roles of a Marine/Air Coordinator are to:

- Ensure helicopters are tasked appropriately regarding environmental risk.
- Ensure passengers are qualified and briefed to fly.
- Ensure loads are within the capability of the aircraft.
- De-conflict air and marine activity.
- Monitor and instigate emergency response for air incidents.

Marine/Air coordinators will require specific experience/training to undertake such a role.

### Audit and Standardisation

The nature of air operations makes close supervision difficult. This can be mitigated through thorough audit and standardisation. Oil and Gas Duty Holders spend considerable effort on such activity and follow the guidance within IOGP 410. Auditing could be summarised as checking process and procedures including: validity of standard operating procedures, completion of engineering activity, training records and an overview of the Safety Management Systems. Standardisation (in the present context) is monitoring a sample of activity by subject matter experts participating in the activity. This could include flying in the helicopter and transferring to the turbine. With multiple Duty Holders there is a danger of an air operator being checked on excessive occasions. It is recommended that joint audit/standardisation be undertaken.

Passengers are exposed to air activity daily and their feedback can be a simple and effective way of monitoring air operator's performance. In order to sufficiently empower HHOP, whilst continuing to build experience and confidence, it should be fully understood – and communicated to the HHOP during initial HHO training - that a transfer or flight will be aborted if the HHOP has doubts over the ability to execute it safely. (This does not, however, circumvent the legal responsibility of the aircraft commander.) A simple understanding of 'what good looks like' would help passengers make a decision to proceed with a flight. A simple check list – sometimes known as a 'watch list' - can aid understanding and provide a convenient feedback on performance. An example can be found on Annex H.

### Summary

Notwithstanding the unique challenges of flying offshore, helicopters and fixed wing aircraft have been operating successfully and safely offshore for decades. Aviation planning will be mandatory to cater for other air users and emergency responders. Use of helicopters as a component of a logistic solution is well established and their use will increase as developers proceed further offshore.

The ORAG is intended to show that aviation planning must be integral to wind farm development from day one. In understanding the issues and constraints in their use, Duty Holders should appreciate the measures that can be employed to control and mitigate the hazards that aviation introduces if selected as a logistic solution.

This core section of the ORAG has aimed to inform developers, Duty Holders and management, so that specialists can be employed to produce a coherent aviation policy. The following annexes provide further detailed information and act as a guide for those specialists to follow in developing such a policy.



obstructions – such as wind turbines, SOVs, offshore support platforms or adjoining oil and gas structures. These airspace requirements must be taken into account when planning wind farm layout.

**Diversions** – overland, aircraft routinely fly a track from which they can divert to an alternate airfield, if the destination airfield is unavailable for some reason or if there is a problem on the aircraft. Overwater transits are usually made with fewer diversion options.

The offshore operational factors need to be considered in the wind farm design and the O&M strategy, by project engineers and Duty Holders, supported by offshore aviation specialists.

**Airspace Planning Guidance** – A large number of offshore oil and gas facilities in the UKCS are serviced by helicopters from the UK mainland. Where there is comprehensive coverage from ATC facilities, such service flights are usually given direct routings from their departure airfields to their offshore destination.

Service flights to/from oil and gas facilities in areas where the ATC coverage is less comprehensive may be conducted along Helicopter Main Routes (HMR). It is believed this is particularly relevant in the northern North Sea in the area to the East and North of Aberdeen. In the areas of the Moray Firth and Firth of Forth in the northern North Sea, and in the southern North Sea, HMRs are rarely followed. Where and when HMRs are used, inbound and outbound helicopter flights are height de-conflicted (by 500') to minimise the risk of collision. As the UK oil and gas exploration moves further offshore, the HMR structure is now extending into the Atlantic Rim of the UKCS.

An HMR is not a mandatory routing that helicopters must, or indeed do follow. It is a single line rather than a corridor or airway. However, the CAA guidance, in CAP 764, is that an area 2NM either side of an HMR should be maintained clear of obstacles for safety purposes. CAP 764 explains that wind turbine developments can impact significantly on HMR flying operations. The precise impacts depend on the number of wind turbine generators and the geographic extent of the wind farm. But a large wind farm development built beneath an HMR could force a transiting helicopter to fly higher to maintain minimum vertical separation height above the wind turbine generators, increasing the risk of it entering cloud.

CAP 764 also states that, in order to protect the surveillance capabilities of the Primary Surveillance Radar (PSR) network, a buffer greater than 2NM from HMRs may be needed to maintain the existing radar service provision of an Air Traffic Service (ATS) provider or Air Navigation Service Provider (ANSP).

However, as articulated above, HMRs in the vicinity of windfarms may be rarely used, if at all. Duty Holders are recommended to discuss and consult with the CAA, ANSP(s) and helicopter operators.

### Consultation Zones around Offshore Helidecks

The CAA emphasizes that developers should consider all existing and planned obstacles around offshore helicopter destinations, which could impact on the ability of pilots safely to conduct helicopter low visibility approaches. This is because of the procedures used by helicopters, when the weather conditions dictate flight in IMC.

These procedures direct how arrivals to and departures from offshore platforms are undertaken. They allow pilots to manoeuvre the helicopter at night and/or in poor visibility without compromising safety. An approach to an offshore platform under IMC can be conducted perfectly safely, providing that there is adequate horizontal visibility below the cloud layer. However, the area surrounding the helideck must be largely free of obstacles out to a certain range, to ensure that a helicopter on approach does not collide with other structures.

The CAA states that offshore wind farms can have potential safety implications for helicopter operations to oil and gas platforms if the offshore wind farm is within 9nm, where there is thus a requirement to consult. The consultation zone is not a prohibition on offshore wind farm development within the 9nm radius, but a trigger for consultation with offshore helicopter operators. This consultation is deemed essential where established oil and gas developments are within the consultation zone of planned offshore wind farms.

The obstacles presented by OREDs must also be taken into account when planning for integrated aviation-marine operational support to wind farms. Flights in IMC to and from SOV helidecks will not be possible within the wind farm area, and will instead need to take place on or outside the wind farm boundary.

### Wind Farm VFR Transit Routes

Duty Holders should scope the use of corridors within offshore wind farms to allow helicopters to conduct VFR transits. Planning consideration should be given to the creation of such VFR flight corridors early in the wind turbine array design process. CAA guidance recommends these corridors to be no less than 1NM wide. However, engagement with helicopter operators should provide greater clarification of the dimensions required on a case by case basis.

### Airborne Weather Radar in Offshore Helicopters

Many helicopter types operating in support of the offshore sectors are fitted with airborne weather radar. The radar is designed to display weather phenomena, such as rain and thunderstorm clouds, as well as obstacles such as oil or gas platforms and wind turbines. When employed with the aircraft GPS, the radar can also be used to allow instrument approaches to offshore platforms in poor visibility. Details of how weather radar can be used in this way will be found in the Air Operator's Operations Manual.

The volume of radar contacts generated by the large numbers of turbines in a wind farm will necessitate the crew flying the instrument approach to a peripheral feature to ensure clarity, then transiting clear of cloud to the destination platform. The ease with which this can be achieved will be directly influenced by the design and layout of the windfarm. Thus consultation with regulators and helicopter operators is an essential part of the wind farm consultation and design process.

### Wind Turbine Lighting Requirements in UK Territorial Waters

A holistic approach, in both scope and implementation, to aviation and marine aids to navigation is often favourable from a safety, efficiency and operational perspective. The minimum requirements of lighting schemes for offshore wind turbine generators are set out in Article 220 of CAP 393, Air Navigation: The Order and the Regulations, CAP764 and CAP437, including to support helicopter hoist operations at the wind farm. The lighting scheme should be agreed with aviation stakeholders and developed in accordance with current policy, as set by the CAA. MoD and MCA must also be consulted as they may have additional site lighting requirements, depending on wind farm project location. Considerations suggested to be taken into account include but are not limited to:

- The number of lights required given the shape of the turbine nacelle
- The flash character of the lights and if infra-red lighting is required
- Required battery backup
- Availability
- Remote monitoring and control
- Any subsidiary lighting such as turbine ID lighting

### Facilitation of Helicopter Services to and near Offshore Wind Farms

The CAA advises in CAP764 Issue 6, "in order to facilitate construction or maintenance flights within the boundaries of wind turbine developments, consideration should be given to the use of flight corridors being built into the development layout plans. Such corridors should be oriented and their width designed in consultation with the helicopter operators, given that it will be governed by the VFR performance of the aircraft in use. The layout of the turbines may also need to consider the requirements of the MCA with regards to SAR within the field." Duty Holders need to consider their use of helicopter operations, their neighbours and SAR when designing the layouts of their windfarms. Equally they need to engage with stakeholders to ensure any airspace and CNS requirements are fit for function for helicopter operations in the area of the offshore wind farm.

# Annex B to ORAG – Aviation Policy – Governance

## Aviation Governance

### Aviation Governance

The most important corporate governance lesson from other offshore aviation sectors is that two key factors are central to success when seeking to cost-effectively and safely integrate aviation into offshore operations:

- Aviation should be considered and resourced from the very outset of project design. In particular, adequate lead time should be given to contracted aviation operators for the tailored supply of suitable aircraft and appropriately trained aircrew and support personnel;
- An aviation culture based on the idea that “aviation is everyone’s business” should be adopted. All those exposed to aviation operations should be given the requisite training to equip them with the knowledge and competencies appropriate to their level of aviation interaction.

The aviation culture must be set at the top, at Board and senior project manager level, and then cascaded through the operation. Project managers and engineers should take an active lead at project level. As well as helping to minimise safety incidents and fulfilling an organisation’s legal duty-of-care to its employees, this approach maximises workforce confidence in the use of aviation.

Such an approach needs to be adopted in the design of and contracting for aviation support to a project, but also retained throughout the operation. Good practice is that aviation corporate governance is an accepted long-term process, rather than something that stops at contract award.

As such, Board members and senior executives need to ensure they understand fully the nature of the aviation operation support intended. They must be confident that there are adequate aviation due-diligence and corporate governance procedures in place to ensure the safe long-term supervision is maintained.

A risk-based approach to aviation is key. This will be critically facilitated by the existence of a sound aviation SMS, aligned with a contractual structure in which the aviation safety roles and responsibilities of the contracting parties are clear and unambiguous, with no safety gaps.

## Aviation Policy – example structure and requirements

Companies should consider the establishment of an aviation policy to provide overarching guidance for the safe, economic and efficient use of aircraft in support of company operations. Such a policy would apply equally to company and sub-contractors’ personnel.

As an example, the aviation policy could require that:

- exposure to high-risk operations should be minimised;
- preference be given to the use of operators with low accident rates. Where any doubt exists, advice should be sought from aviation specialists;
- for all aviation activities, other than scheduled airline travel, only aircraft operators and aircraft types approved for use by an offshore aviation specialist should be used;
- contracted aircraft are to be operated only by aircrew, and maintained by engineers, meeting specified minimum qualifications, and experience and currency requirements;
- aircraft operators are to meet company insurance requirements;
- specific operational restrictions may be applied, taking account of the contractor and local environment; amongst these could be a requirement to operate to public transport standards and to meet published aircraft performance criteria;
- a decision to use aircraft should be weighed against the alternatives of using other forms of travel, taking full account of operational, environmental, economic and, above all, safety implications.

In establishing an aviation policy, Boards and senior executives must recognise that, although the helicopter service will generally be a contracted service and the contractor will be responsible for safe flight operation, there will be a significant overlap with the developer’s safety responsibilities. This includes, for example, responsibility for training/competence of those being hoisted, alternative safety mitigations, control and isolation, lighting etc. of turbines.

As importantly, although the air operator is responsible for safe flight operations, the Duty Holder - and ultimately its directors and senior managers personally – always retain overall responsibility for the overall safety of the operation, including for the safe integration of its air, marine and engineering components and/or contractors. This responsibility cannot be sub-contracted.

# Annex C to ORAG – Project Design and Planning

This section provides guidance for the integration of helicopters within an ORED, from initial planning through concept development and design. Guidance related to later stages of the lifecycle, from procurement to ongoing operation, is provided in Annex D.

When a strategic decision has been made to use helicopters to support an ORED, to ensure best optimal balance of operational efficiency and safety, the aviation support requirements should be considered at the start of project design process. This entails developing an aviation concept, undertaking risk analysis and then developing the risk management process, the procurement strategy and the contract design in an integrated, iterative way. A wide range of factors will need to be considered, some of which will impose constraints on the aviation support that can be provided. Some factors will not be under the control of the Duty Holder.

The concept, design and risk analysis stages are closely linked. All of these processes need to ensure that the aviation and marine operations, and the associated risks therein, are considered in an integrated way, by a combination of project engineers, aviation experts and marine operators. Concept development will identify the scope, scale and intensity of the aviation support required for the offshore wind farm project, both during installation and O&M. Risk analysis will investigate the aviation risks involved with each support task. Taken together, these provide the basis for iterative design of the ORED, as well as development of an appropriate risk management approach, a procurement strategy; an aviation support ITT and contract award, and a contract management process.

## Factors to consider in Planning, Concept and Design

The project team, supported by offshore aviation specialists, must take account of a wide range of factors, which should include:

### Policy & Regulatory requirements:

- Duty Holder’s aviation policy and standards;
- specific national requirements (e.g. the UK sector’s adoption of CAP 1145, including the requirement for helicopter safety equipment to include Category

- A Emergency Breathing System);
- environmental impact assessment (EIA);

### Airfields & Logistic Airheads – departure point/ logistics base facilities:

- planning, resting, briefing and check-in, dangerous cargo handling facilities;
- runway/take off area/taxiways/lighting;
- ATC/navigation aids/hours of operation;
- fuel & air engineering logistics support;
- rescue and firefighting;

### Wind Farm Location, Design & Destination Facilities:

- range from airfields and logistic airheads;
- offshore renewable energy installation;
- wind turbine array design – field orientation and spacing;
- helideck (size, maximum weight of helicopter authorised);
- required HHO procedures, which will depend on helicopter type, wind turbine generator type, cargo;
- SOV aviation capabilities;

### Wind Turbine Technology:

- helicopter hoist platform;
- turbine mechanical safety interlock mechanisms (e.g. brake, feather, yaw);
- electrical safety locks;
- personnel attachment points;
- repair, maintenance and survey of securing points;
- contingency options for stranded personnel;

### Installation and O&M Strategy – including:

- the approach to meeting the requirements of the Construction (Design & Management) Regulations when the project is still classed as “under construction”, even though individual turbines have been handed over;
- scheduled intervention rates:
  - logistic lift requirements;
  - construction, O&M, decommissioning phases;
    - annual seasonal variation;
- unscheduled intervention rates:
  - logistic lift requirements;
    - troubleshooting & repairs requirements;
    - comparison between marine and helicopter logistics support options;
- The proportion of technicians that are required to fly will determine the need for HHO training.

**Aviation Operating Environment:**

- weather;
- sea state;
- ATC and CNS coverage, level of ATC service
- airspace restrictions;

**Aircraft Operators:**

- aircraft type and equipment;
- base location;
- Air Operator Certificate (AOC) and experience in role;
- accident and incident record;
- licensing and competence assurance of personnel (aircrew, maintenance and operations staff);
- existing safety management systems

**Diversions**

- range to alternate airfields (diversions) in the event of weather or other closure of the primary operating base;

**SAR Capability:**

- distance and nature of local SAR resources;
- existence of radar and communications services for alerting of emergency services;
- training state of own staff including passengers (who will require specialist offshore survival training), and planners/operations supervisors.

These factors provide a starting point for designing an aviation support concept, taking into account factors specific to the particular site or to the particular O&M strategy and wind turbine technologies to be supported.

**Risk Analysis and Risk Management**

All civil transport activities, including aviation, entail a degree of risk, which vary with the nature and intensity of the operations. Duty Holders must assess the degree of risk associated with each type of activity and, where possible, eliminate the highest risks. Where this is not possible, control measures must be applied to reduce the risk to ALARP.

This Annex outlines approaches to risk analysis and risk management as applied specifically to offshore renewable aviation. Risk assessment and risk management activities will be ongoing throughout the lifecycle, but the emphasis in these guidelines is on their use in the stages up to and including design. More specifically this Annex has a particular focus on risk management in Helicopter Hoist Operations (HHO) – this being perhaps the most distinctive aspect of offshore renewable aviation. It concludes with a summary of guidance on safety management systems, as they might be applied to offshore renewable

aviation. More general guidance on risk assessment and management and on safety management systems can be found in RenewableUK's Offshore Wind & Marine Energy H&S Guidelines.<sup>10</sup>

**Risk Analysis**

Risk assessment should consider, in particular, the answers to a range of operational questions. For example: what are the maximum operating conditions for marine and aviation support; how will weather affect scheduled and unscheduled O&M interventions over the season; what would be the maximum sea state for recovery of a helicopter crew by a wind farm SOV; how will the marine and aviation support operations be integrated and supervised.

There are a number of factors that can affect risk, which need to be reviewed by the Duty Holder, advised by offshore aviation specialists:

**Aviation Environment:**

- climate;
- seasonal weather variations (temperature, wind, sea state etc.);
- frequency of day or night flights;
- relative frequency of visual or instrument meteorological conditions (VMC or IMC);
- competence of the regulator (which will affect the safety culture);

**Aviation Risk Exposure** – number of flights, number of passengers, day versus night frequency;

**Quality of Supporting Infrastructure:**

- airfields (navigation aids, fuel, fire and rescue services, etc.);
- helidecks (size, facilities, hazards);
- SAR capability;
- medical (availability of primary care and accident and emergency facilities, in distance, time and aircraft monitoring systems);

**Aircraft type employed:**

- aircraft type and role (day/night, VFR/IFR), fixed or rotary wing;
- age and design standards of contracted aircraft type;
- engine type and number (piston or turbine) of the contracted aircraft;
- single or dual pilot operation;
- helicopter equipment (hoists, enhanced safety systems (EGPWS/TAWS, TCAS, etc.);
- helicopter range and payload;

**Aircraft Operator:**

- quality of standard operating procedures;

10. See reference at [www.renewableuk.com/en/publications/index.cfm/2013-03-13-hs-guidelines-offshore-wind-marine-energy](http://www.renewableuk.com/en/publications/index.cfm/2013-03-13-hs-guidelines-offshore-wind-marine-energy).

- experience in contracted role;
- management systems;
- safety management record;
- long-term accident/incident history, and quality of safety management systems;
- training programme (including competence assurance, flight simulation, rear crew, recurrent training programme);
- crew competence and qualification:
  - pilots;
  - rear crew;
  - maintenance staff;
  - HHO passengers training standards.
- financial stability.

These factors provide a starting point for assessing risk, taking into account site specific or technology specific factors.

### Risk Management

Once the hazards have been identified it is good practice to inform risk management using systematic tools and techniques such as ‘Bow Tie’ modelling. In essence, this captures the hazard, the preventative and recovery measures as well as any escalation factors. Software is available to record the details, and the status of the barriers can be colour coded to provide an overview of whether the risks are being properly controlled. Illustrative BowTies are shown in Chapter 4.

The overall aim of risk management is to reduce the risk to ALARP, and bow ties can help the ALARP process by helping the user to understand the safety benefits of potential additional measures. When appropriate, such measures should be incorporated in contracts and monitored using an agreed Quality Assurance (QA) process. This should include regular audits of the aircraft operator, scheduled business performance reviews, and monitoring of key performance indicators (KPIs).

### Risk Ownership & Management Structures

The helicopter service will usually be a contracted service. The aviation contractor will be responsible for safe aviation operations. But there will be a significant overlap with the developer’s safety responsibilities e.g. competence of those being hoisted, alternative safety mitigations, control isolation and lighting of turbines and so on.

All parties must understand that it is the Duty Holder who is ultimately responsible for managing the risk associated with aviation support to offshore wind farm installation and O&M. This responsibility cannot be outsourced. Contractors and subcontractors must

also play their part, by adhering to the policies and standards set by the developer, as clearly expressed in an aviation policy document.<sup>11</sup>

Establishing the correct relationship between the Duty Holder, the aircraft operator and the company contracted to provide wind farm O&M is crucial. This helps ensure efficiency and that the Duty Holder fulfils their safety responsibilities and duty-of-care to employees and sub-contractors. Two options have been outlined in Chapter 5.

### Risk Management in Helicopter Hoist Operations (HHO)

HHO operations entail two areas of heightened risk compared to other offshore flying operations. First, changing environmental or operational conditions may result in technicians being stranded on wind turbines. Second, the nature of the HHO winching operation gives rise to personnel injury risk. These risks however, may be less than those undertaken by marine transfer in comparable conditions. The balance and comparison of risk need to be considered in detail in the risk analysis and risk management processes.

### Stranding Risk

In poor weather, IMC approaches to suitably equipped oil and gas platforms are routine, but this is unlikely to be possible to individual wind turbines. Current UK approvals constrain offshore HHO to day-VMC conditions only. Thus if operational delays, worsening weather, or other unexpected delays prevent the recovery of technicians during daylight hours from wind turbines, alternative arrangements will need to be in place for their recovery, or support and safety on the wind turbine overnight or until weather conditions improve.

### Injury Risk

The frequency of HHOs will be much higher than in equivalent offshore oil and gas aviation operations. The regulatory requirements: for helicopter operations over a hostile environment, such as UKCS, are covered in EASA OPS CAT.POL.H.420. For HHOs are covered in EASA OPS CPA.HHO.100. Feu Both require ‘specific approval’ from the regulator in order to support offshore renewables. Any SOPs developed by developer and operators will need to harmonise with the requirements therein.

Because HHOs are specialist tasks, with very specific SOPs in offshore renewables, the risks therein are not well understood by those not familiar with this type of operation. HHO require appropriate aircraft types, equipment, procedures and training, which need detailed and specialist concept and risk analysis. Theoretically, HHO hazards might include, but are not limited to:

11. An example of the key components of such a policy is attached at Annex B.

collision with the offshore wind turbine nacelle or turbine blades; static electric shock as a result of static electricity generated by the helicopter and the effects of rotor downwash on the individual being transferred; falls through poor understanding of the helicopter strop design and procedures; hoist malfunction although mitigating measure should transfer fail.

Risk mitigations can include: dual hoist installation; necessity for emergency accommodation and equipment for personnel stranded on turbines; helicopter performance constraints. Appropriate SOPs need to be developed, and aircrew and passengers need to achieve defined and assessed levels of competence through formal HHO training programmes.

### CAA Approval & HHO Training Programme

Because of the associated risks, CAA approval to conduct HHO is mandatory for commercial air transport operations under and within the conditions of the operator's AOC. Before being granted such approval, a helicopter operator must have demonstrated to the national aviation authority its competence for such operations.

The existence of such approval within the operator's AOC constitutes the minimum acceptable level, but the Duty Holder may choose to impose more stringent requirements within the ITT, ideally based on the advice of offshore aviation specialists. Such requirements could include, for example, evidence of a proven track record of HHO, which might include specific numbers of HHO transfers over recent years, acceptable air accident/incident levels, and a continuing HHO training programme, either internal or sub-contracted.

A key objective is that, by the time the contract begins, the contracted aircrew (and those being winched), are 'qualified, competent and current': 'qualified' means that they have completed an approved HHO course; 'competent' means that they have reached an approved standard; 'current' means that their competency is maintained, through regular flying practice in the contracted flying roles. Like all flying skills, HHO skills are perishable, and need to be actively maintained, with a particular focus on inter-crew communications, and continuing familiarity with normal and emergency SOPs, such as intercom failures, winch emergencies, and so on.

For this reason and because of the higher frequency of HHO in offshore renewables, after contract award effective training and risk mitigation programmes are the key to safe HHO operations. It takes time to design and implement such programmes. It is thus critical that this be accounted for in the contracting

process. Contracts must be let with sufficient time<sup>12</sup> and adequate resources to ensure that all personnel will be suitably trained and prepared, by the time the HHO O&M support operation begins. It is important that that overall HHO risk exposures, and the corresponding risk mitigations, be highlighted to senior decision makers.

### Safety Management System (SMS) for offshore renewable aviation

It is good practice for Duty Holders to adopt an aviation SMS approach to deal with aviation risks.<sup>13</sup> In addition, aircraft operators are in any event required to have an SMS.

Although the HSE does not require the safety case approach that is mandatory for offshore oil and gas operations, it is nevertheless good practice for Duty Holders to adopt an aviation SMS approach to deal with aviation risks.<sup>14</sup> Aircraft operators are in any event required to have an SMS.

The Duty Holder must be satisfied that all hazards (especially those associated with HHO) have been identified and the appropriate controls put in place. This means that identified capability gaps and/or hazards have been risk assessed and an appropriate means of mitigation applied so that the risks are reduced to ALARP levels. Where appropriate, these measures should be incorporated in contractual requirements and their effectiveness checked in the QA process. This might include regular audits of the aircraft operator, scheduled business performance reviews and monitoring of KPIs.

Much can be learned about the effectiveness of the SMS if proper and open reporting of incidents and hazards is encouraged. Incident and accident reports should be analysed, thorough root-cause analyses conducted, and effective remedial actions implemented. Developing a 'just culture' is good practice, and the hallmark of all successful offshore aviation operations. A 'just culture' allows managers and supervisors to make properly informed decisions and to disseminate information (by a variety of media including video, email, websites or publications) for organizational learning. It also helps reassure the workforce that identified hazards are being consciously identified and appropriately controlled. Eurocontrol defines 'just culture' as: *"Just Culture" is a culture in which front-line operators and others are not punished for actions, omissions or decisions taken by them which are commensurate with their experience and training, but where gross negligence, wilful violations and destructive acts are not tolerated.*

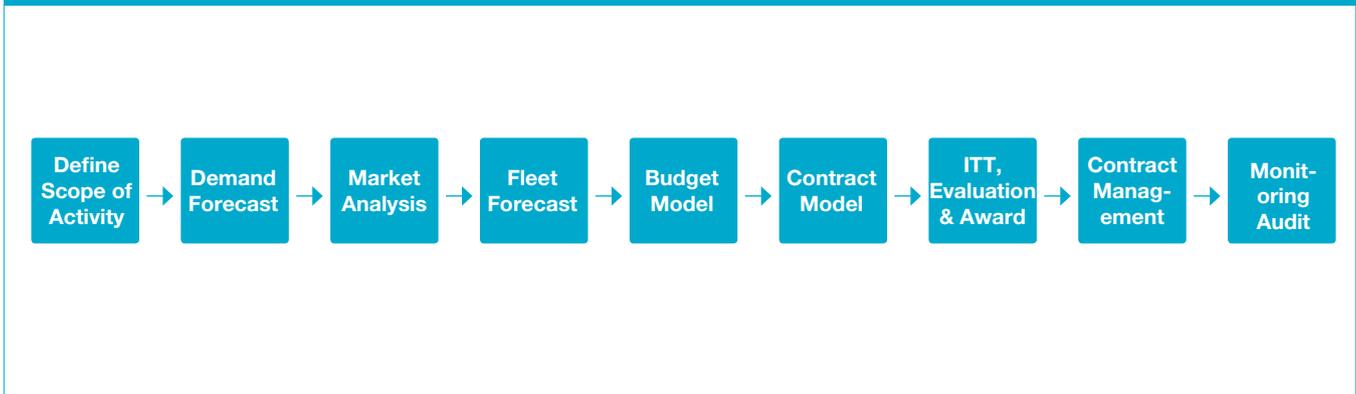
12. A minimum of 6 months should be planned, from contract award to delivery of a safe HHO service.

13. As recognised in the update of CAP 1145 in 2014.

14. As recognised in the update of CAP 1145 in 2014.

# Annex D to ORAG – Procurement and Contract Management

Figure 6: Aviation Procurement Strategy Approach



This Annex provides guidance on the stages of the lifecycle from procurement up to contract management and monitoring in ongoing operations.

## Procurement Strategy

The concept design, risk analysis and risk management processes provide the basis for designing the aviation support procurement strategy, which should follow a structured, iterative process, such as that shown in Figure 6.

### Define Scope of Activity

The scope of activity will depend on the type, scale and location of the offshore energy project, and the chosen O&M strategy. The range, payload and equipment requirements will be key factors in defining which aircraft are suitable for the task. The CAA places stringent technical requirements for offshore flights in support of oil and gas and renewable energy, and it is good practice to seek the advice of offshore aviation specialists at this stage.

It will be important to specify, at an early stage, the requirements for aircraft types suitable for the operation. A large number of factors affect these requirements, including the scope of the operation, availability of aircraft operators familiar with the aircraft type, technical specification, and performance characteristics. Figure 7 illustrates the factors to be considered.

## Aviation Demand Forecast

Aviation demand forecasting, in terms of projected passenger numbers and flights, should be relatively straightforward, provided planners understand all aspects that impact upon demand. Figure 8 illustrates the factors to be considered. Note that ‘Candidate Aircraft Performance’ features here because some aspects of demand will be iterative with performance. For example, the number of flights required will vary with the aircraft payload. The defining demand factors will be the: overall O&M strategy; forecast levels of scheduled and unscheduled maintenance; operational design decisions on the use of aviation and marine assets to support the O&M operation.

### Market Analysis

Once the demand forecasting is completed, a thorough market analysis should be undertaken to identify those aircraft operators capable of satisfying the demand. Potential contractors will need to have suitable aircraft, operating locations, procedures and personnel capable of safely achieving the designated tasks. Where the potential contractor has shortfalls, satisfactory assurance must be provided to show the shortfalls can be satisfactorily resolved, on time and within budget. Figure 9 illustrates the factors to be considered.

Figure 7: Aircraft Requirements Specification Process

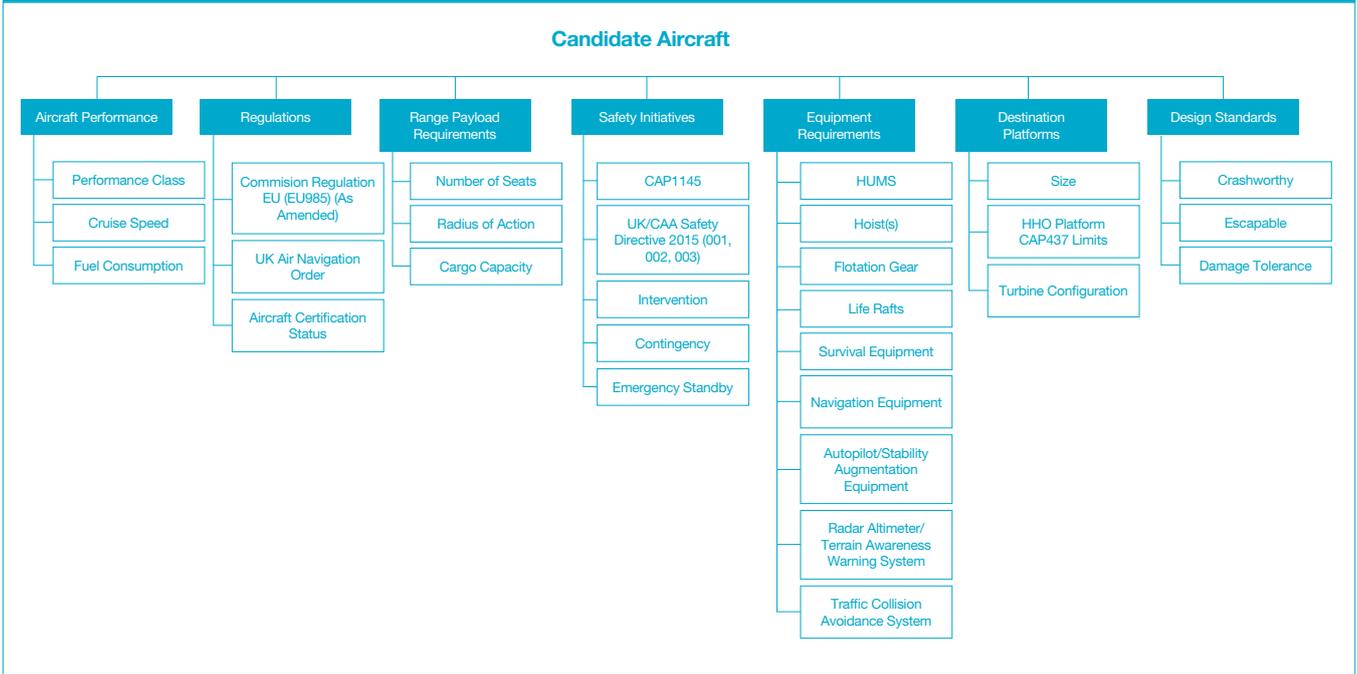


Figure 8: Aviation Demand Forecast Process

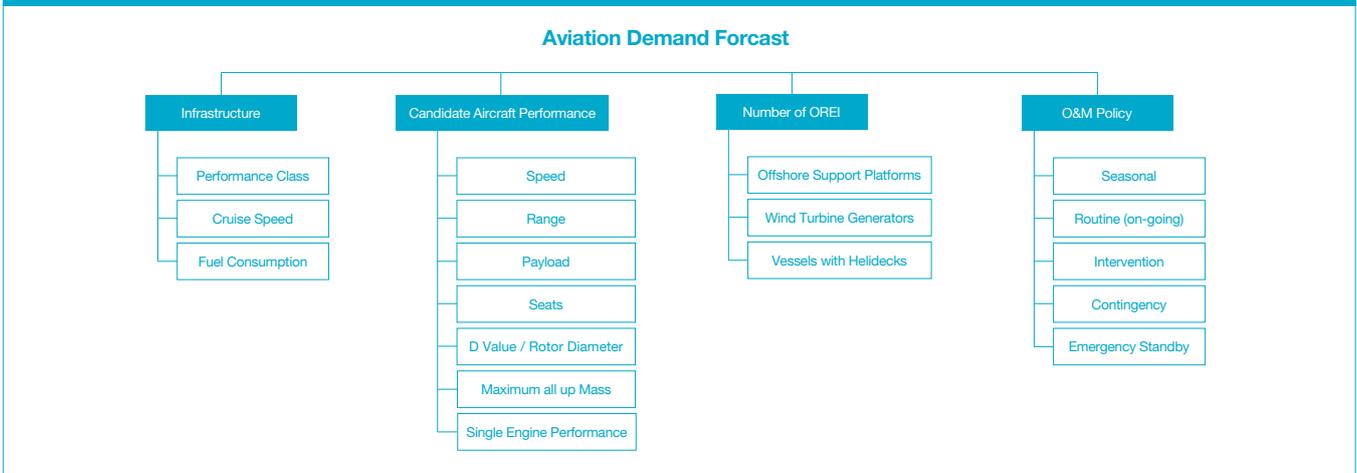


Figure 9: Aviation Market Analysis



## Fleet Forecast

Depending on the scale of the operation, it may be necessary to contract multiple aircraft, possibly based in different locations. There may be economies of scale if a single contractor is used. Equally, it will be important to consider backup options, in the event of an interruption to normal service, for example as the result of industrial action or technical grounding of an aircraft type.

## Budget Model

The Duty Holder should develop a budget model based on benchmarked costs, ideally, broken down into fixed and variable costs. Fixed costs typically include: financing aircraft purchase; corporate overheads; pilots, engineers and other employee salaries; base costs including hangar and workshop rent; tooling and ground support equipment; rates and utilities; insurance; appropriate profit margin. Variable costs typically include: hours flown; fuel and lubricants consumption; power-by-the-hour agreement, if in place; management costs of health-and-usage-monitoring-system (HUMS) and flight data monitoring (FDM) systems.

## Contract Design & Management

The principal objective in tendering for and contracting aviation support will be to obtain the correct priorities to meet the Duty Holder's objectives regarding safety, efficiency and service.

## Contract Model

A well-prepared and constructed contract document will reflect an in-depth mutual understanding of, and agreement to, the goals, expectations and requirements of both parties and should provide the basis for effective communication and contract management. Any deficiencies in the process of creating the document will manifest themselves during the contract term. The draft contract should:

- clearly define the scope and standard of the services being contracted;
- be clear, concise and comprehensive in its content and structure;
- be fully understood by both parties;
- be equitable;
- provide a basis for efficient and professional contract management including:
  - the basis for subcontracting aviation support, if appropriate;
  - KPIs.

For clarity, consistency and ease of amendment, the clauses and content in a contract document can be arranged as follows:

- items that do not change from one contract to another;
- items that are based on aviation-related regulation and so cannot be changed by the contract parties;
- items that are based on company standards/requirements that rarely change;
- items that change on a regular basis from contract to contract, i.e.:
  - scope of services;
  - technical specifications;
  - financial elements.

## ITT, Evaluation & Award

The recipients of the invitation-to-tender (ITT) will be identified during the market analysis process. Tender evaluation is best arranged as a three stage process:

- **Stage 1** – based exclusively on safety performance with clearly defined pass/fail criteria;
- **Stage 2** – based on an evaluation of the bid's operational capability (i.e. how efficiently the task can be achieved with the resources and management systems included in the bid);
- **Stage 3** – based on a financial evaluation.

Many use a simple 'lowest compliant bid' model to award the contract, but a more sophisticated process can combine Stages 2 and 3 to establish best value-for-money.

## Contract Management

It is good practice to audit the aircraft operator prior to the commencement of operations to ensure that the Duty Holder's expectations will be met. Thereafter, effective contract management should take place at several levels.

At the corporate level, there should be an annual business performance review between the client and aviation contractor. Routine day-to-day contract management typically takes the form of routine communication between the Duty Holder's representative and the contractor so that demand and aircraft availability are matched. Monitoring of KPIs should show whether the expectations expressed in the contract are being met. This is usually undertaken in routine meetings to review KPIs and any contract shortfalls and means of rectification. These meetings can also be used to discuss the results of any audits as part of the QA process.

An adequate change management process should be built into the budget and contract models, as lack of contract flexibility can result in increased operational costs and reduced efficiency. It is good practice to ensure that there is sufficient contract flexibility to respond to changes in requirements during the real time operation, be they technical, operational or supervisory.

# Annex E to ORAG – Personnel Competence

## Personnel Competence

Ultimately, it is the project personnel operating within the wind farm operational support system – Duty Holders, managers, supervisors, technicians, pilots, rear crew, air engineers, operations staff and marine operators – who deliver best efficiency and safe aviation practice. It is thus critical to ensure that the each and every person who interacts with or is exposed to aviation – in-house or sub-contractor – is trained to levels of expertise appropriate to their level of aviation exposure:

**Pilots & Rear Seat Crew** – require the knowledge, experience and skills required to safely and successfully conduct some activities. These may include transfer of personnel by HHO to and from offshore installations and by helicopter transport to and from vessels, whether stationary or underway. It should not be assumed that the requisite skills and capabilities are universal in offshore helicopter operators, for 3 reasons:

- the skills for wind farm helicopter hoist operations are different to those required for the transit tasks that are the main role of most helicopter operations to support offshore oil and gas platforms;
- rear crew are essential for safe HHO, but rarely employed by aviation operators specialising in oil and gas operations. Rear crew need to be properly trained and experienced in the standard operating procedures (SOPs) used during HHO operations. These SOPs are drawn from military/coastguard helicopter aircrew, and include specified voice procedures, winching and emergency techniques that require a high degree of cooperation between pilots and rear crew;
- pilots and rear crew with these specialist skills are routinely sourced from the military and coastguards, and already in high demand for SAR operations;

**Passengers (technicians)** – all personnel who will be transported in helicopters, whether HHO or land-on transfers to helidecks, must be adequately trained. This means general familiarisation with helicopter SOPs, and specialist training in helicopter underwater escape and sea survival procedures and techniques. This will require the wearing and knowledge in the use of specific PPE. Exact training and PPE requirements will be specified by the AOC holder and Duty Holders. See the tables in the figures 10 & 11 for an example of Helicopter Specific Training for HHOP and Crew

Transfer Passengers and an outline of the PPE requirements and helicopter passenger and HHOP training.

**Duty Holders, Contract Managers & Operations Supervisors** – the competence to manage and supervise aviation operations is required at several levels, if aviation support is to function effectively:

- first, in setting up the contract so that the project engineer's or Duty Holder's expectations on safety and efficiency are properly expressed to the contractor;
- second, once the contract is in place, in ensuring that these expectations are met;
- third, for the safe supervision and intelligent management of day-to-day operations;

This capacity is required not only in the Duty Holders, but also in companies contracted to provide O&M support. Few Duty Holders or O&M providers have extensive in-house offshore aviation expertise. Thus it is good practice to engage offshore aviation specialists during the planning and procurement phase for risk management;

**Quality Assurers** – the QA process also requires suitably qualified and experienced offshore aviation specialists to conduct audits of the aircraft operators. To avoid potential conflicts of interest, it is good practice to seek QA advice from offshore aviation specialists separate to those involved in the original concept design and contracting.

Aviation competence for all must be a key focus for project engineers and Duty Holders. This is a critical area of due diligence during tender scrutiny and contract negotiation. It is equally critical thereafter in contract management and operational supervision. Note that it is easy but quite wrong to overlook the necessity for sub-contractors to be trained to the same standards as the Duty Holder's own personnel.

Because of the current dearth of offshore aviation expertise in many if not most of the offshore renewables sub-sectors, Duty Holders will need to take a proactive approach to aviation competence in the early years. Good practice is to draw on the services of offshore aviation specialists, and on the SOPs and training approaches of other well established offshore aviation sectors, particularly oil and gas, to develop and consolidate good practice in the offshore renewable sector.

Figure 10: Example of Helicopter Specific Training for HHOP and Crew Transfer Passengers

Pre Employment Training	Special training	Recommended Training Deliverables	Training programme should include:
<p><b>Prior to completing HHOP operations, passengers must complete:</b></p> <p>Helicopter Familiarisation*</p> <p>Offshore survival*</p> <p>Helicopter Underwater Escape Training including Emergency Breathing System*</p> <p>Helicopter Hoist Operations Passenger Training</p> <p>Flight safety including Crew Resource Management</p> <p><b>Revalidation training</b></p> <p>3 HHO every 180 days</p>	<p><b>Landing on Offshore Support Platform:</b></p> <p>Training for occupying unmanned platform – if appropriate</p> <p>Fire fighting</p> <p>Refuelling</p> <p>Communications procedures and equipment usage from an OSP.</p> <p><b>External loads</b></p> <p><b>Onshore refuelling</b></p>	<p><b>On completion of training the student should:</b></p> <p>Be able to participate in the flight and be hoisted down on to the WTG and back into the helicopter.</p> <p>Be able to handle the baggage when flying and when being hoisted down onto the WTG, and back into the helicopter. Know the required actions for emergency landings on land and on water.*</p> <p>Know how to detach oneself and escape from a sinking helicopter after ditching onto water.*</p> <p>Know how to walk and work around a helicopter when the rotors are running.*</p> <p>Understand the static electricity hazard when being hoisted down to a WTG or when receiving an ‘empty’ hoist hook. Know how to handle a stretcher and anti-rotation line (tag-line) during helicopter evacuation operations.</p> <p>Be aware of all other hazards and understand the risk presented by a helicopter (noise, heat, etc).*</p> <p>Successfully complete winch training on land.</p> <p>Experience escape training from the helicopter on land.*</p> <p>Receive a lecture about how to work around a helicopter with rotors turning and communicate with the crew via hand signals.*</p>	<p><b>Ground school:</b></p> <p>Helicopter Familiarization briefings.*</p> <p>Helicopter seating, embarking, disembarking.*</p> <p>Emergency procedures.*</p> <p>HHO procedures – classroom and on helicopter.</p> <p><b>Helicopter practical session (Rotors stopped)</b></p> <p>Cabin and hoist practice.*</p> <p>Helicopter seating, embarking, disembarking.*</p> <p>Emergency procedures.*</p> <p><b>Helicopter practical session (Rotors engaged)</b></p> <p>Cabin and hoist practice.</p> <p>Helicopter seating, embarking, disembarking.*</p> <p>Emergency procedures.</p> <p>Onshore HHO to a Training Rig (3.00 hours)</p> <p>Offshore HHO to WTG (3.00 hours)</p>

\*Training for HHOP and Crew Transfer Passengers

Figure 11: Example of PPE Requirements, Helicopter Passenger and HHOP Training

PPE	Regular passenger	HHOP	According to
Undergarments	X	X	
Immersion suit	X	X	ETSO 2C403
Life jacket	X	X	ETSO 2C504
STASS	X	X	CAP 1145
Personal Locator Beacon	X	X	
Hoist harness		X	EN361
Hoist strap		X	EN354
Head protection		X	EN397
Noise protection	X	X	

# Annex F to ORAG – Supervision and Management

This section provides an overview of the key issues to be taken into account by Duty Holders when supervising aviation contractors during ongoing support operations.

## Aviation Operations

The use of helicopters in offshore wind farms requires levels of supervision and integration over and above those established in the oil and gas sector. This is because of the remoteness of the Duty Holder's supervisory personnel and systems from the wind farm site. There is thus a need to integrate remote onshore engineering control of the wind farm, with offshore aviation and marine O&M support operations.

To ensure that the aviation operation is properly supervised, Duty Holders must ensure that a satisfactory supervisory capability exists throughout the life of the project. It is good practice that such capability is designed based on the advice of offshore aviation specialists, and comprises: communication equipment and information systems; suitably qualified and experienced personnel (SQEP); well-rehearsed SOPs; a base location not overly remote from the wind farm; the capacity to integrate the whole operation. This integration capability must include: engineering control of the wind farm; control of marine operations, aviation operations, logistics operations; the capacity to liaise with other offshore stakeholders, including coastguard and SAR operators, and other offshore sea and airspace users.

Successful approaches to aviation supervision will require 2 key components, supervisory systems and supervisory personnel integrated within the SMS.

## Supervision Systems Requirements

To supervise offshore wind O&M operations, in which helicopters (and other aviation assets) are employed, it will be necessary to have the communications and IT support systems that allow remote Duty Holders to communicate with and supervise:

- Site Systems – including engineering control of wind turbines;
- Offshore Service Providers – including helicopter pilots and SOV captains and crews;
- Onshore Logistic Support Locations – including heliports, ports, and other logistics locations.

It is good practice to co-locate these communications and IT support systems with the wind farm's engineering control centre. This allows engineers, pilots, ships captains, and technicians, to coordinate O&M interventions, for example, braking a turbine that is scheduled for O&M visit. Such supervisory systems, although optimized for the primary O&M operation, also allow prompt coordinated responses to unplanned events, such as medical evacuations or SAR operations within the wind farm.

## Supervision Personnel Requirements

Control centres need to be manned by suitably qualified and experienced personnel, with sufficient knowledge and skills to be able safely integrate the O&M operations. This includes the need to respond flexibly in response to unscheduled breakdowns and to non-engineering events, such as SAR operations within the wind farm. These personnel must have to hand agreed SOPs for routine operations and for foreseeable contingencies.

## SMS Support

The supervisory capability needs to be underpinned by, and part of, the aviation SMS, as described in Chapter 4. To support the supervisory capability, the SMS system should be capable of: monitoring aviation KPIs; gathering safety data; facilitating a "just culture"; encouraging continuous improvement through lessons learned.

# ANNEX G – Audit and Standardisation

## Background

Wind farm developers, constructors, operators and maintainers who contract the deployment of helicopter services by specialist companies on contract need to consider the following points. Aviation may be contracted by any of the key stakeholders and could vary from a single task to a dedicated 365 day a year service. Reassurance that the service is safe will primarily rest with the contract holder; however, all stakeholders will wish to be reassured. This could be from the perspective of the wind farm owner to the employer of personnel flying in the air assets. Good practice from other industries using contract aviation has seen the development of a structured assessment of air operators. This can be broken down into 3 phases:

- Pre-contract assessment
- Periodic monitoring
- Regular feedback from passengers

Pre-contract assessment and periodic monitoring requires subject matter experts; these may be employees or specialist contractors. Where a number of Duty Holders have a vested interest in monitoring the air operator a combined audit would be recommended to minimise disruption and cost. This first part of this Annex provides an indication of the procedure that may be followed together with an example of the type of information that would be assessed. The last part of the Annex describes a Watch List that may be given to passengers to monitor their own safety and a means to provide prompt feedback to Duty Holders.

## Objective

The objective is to ensure safe and efficient aviation activities based on independent review of the helicopter operator. The audit is a structured process of collecting independent information on the efficiency, effectiveness and reliability of all the policies, processes, and procedures utilized by the company in relation to the helicopter operators' activities. If any safety related issues are found a plan for corrective actions are made in order to ensure that regulatory demand and possible defined Duty Holder(s) requirements are met.

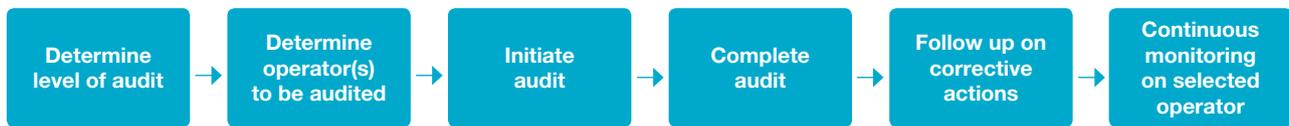
## Achievements

The audit is primarily for the Duty Holder to ensure safe activities. The audit is also beneficial for the helicopter operator as their policies, procedures and processes in relation to their operational activities are scrutinised. They should as such be used and viewed of having an impartial set of eyes on their organisation and daily operations.

## Process

The pre-selection safety audit should be completed sufficiently in advance to enable the Duty Holder and air operator to agree and implement corrective actions (technical, process or procedures) before contract award. This ensures that there are no contractual limitations that could affect safety. An example process illustrated in Figure 12 could be initiated in the evaluation process described in Annex D.

Figure 12: Audit and Standardisation Process



Once a helicopter operator has been chosen as a general supplier or for a specific project a continuous monitoring process should be established. Dependant on the level of helicopter activity the process review should occur on a regular and defined basis.

### Areas of audit

The following areas should be audited and would give a comprehensive insight in the helicopter operators' strategic and operational capabilities:

- Overall documentation and certifications according to relevant regulation
- Management setup and competence
- Internal training of air crew
- Quality and Safety Management Systems
- Continuous Airworthiness Management Organisation
- Operations Manual and Standard Operating Procedures
- Handling of Dangerous Goods
- Ground Handling Operations
- Security plans and setup
- Training of passengers (if required)
- Risk analysis
- Safety records, incidents and accidents

An operational review should be conducted in order to ensure that what the helicopter operator intends is actually executed in respect of the air crew and daily operations. For example, normal and emergency procedures should be observed by competent specialist.

## Example of Key Aspects in an Aviation Audit Questionnaire

An audit questionnaire should be completed by the air operator prior to an audit with the results used to guide and focus the physical audit.

The audit team will normally consist of an aviator with relevant flying experience, a technician qualified and experienced in aviation, together with an auditor/representative (external or internal) from the Duty Holder.

The scope of the audit should cover helicopter operations, aircraft condition, support infrastructure, stores and documentation (including flight and operating manuals)

### Questionnaire

The questionnaire may typically consist of question about the following topics:

- Questionnaire completed by....on behalf of....
- Senior Management consists of.....including:
  - Manager
  - Flight Ops Director
  - Chief Pilot
  - Training manager
  - Flight Safety Officer
  - Ground Operations Base Manager
  - Technical Director
  - Chief Engineer
  - Quality Manager
  - Safety Manager
- Documents to be provided, to include:
  - Air Operator's Certificate
  - Maintenance approval
  - Incident/Accident Reports
  - Completed Pilot Engineer details
  - Quality Assurance Accreditation
  - Insurance
  - Safety Policy
- Approvals held:
  - Regulatory authority
  - Air Operators Certificate
  - Maintenance Approvals
  - Quality Assurance Accreditation
- Insurance:
- Aircraft Information:
  - Type
  - Owned/leased/shared
  - Registration
  - Year of manufacture
  - Current hours
  - Primary use
  - Airworthiness
- Staff - numbers
- Remote operation
- Pilot recruitment
- Pilot utilisation
  - Types flown
  - Hours flown
- Technical Staff Utilisation
  - Shift system
  - Duty Periods
- Training programmes
  - New hire
  - Type conversion

**Objective** – the objective of the audit should be specified including the scope and intended outcome.

**Audit Process** – an organisation to be audited should be given sufficient time to complete the pre-audit questionnaire. The audit team should evaluate the response to develop their own detailed audit schedule. The audit should commence with a formal introductory meeting, followed by a structured programme. Findings should be presented during the close-out meeting with an agreement on how and corrective or preventive actions are to be implemented. A formal report should be provided within an agreed timescale. Any requirement for a follow up audit should be agreed during the close-out meeting.

- Base Check
- Line Check
- Simulator
- CRM training
- Personal Safety Training – e.g. HUET
- Engineer training
  - Basic
  - Type technical
  - Continuation
- Management Staff General Development
  - Management skills
  - Safety
  - Investigation
  - Dangerous goods
  - Engineers
- Safety
  - Safety Management System
  - Safety Programme
  - Safety Awareness
  - Safety Policy
  - Safety Manual
  - Safety Meetings
  - Investigation process
  - Confidential reporting
- Safety Statistics
  - Over 5 years
- Licence and Medicals
- Operations
  - Operations manual
  - Flight Safety Instructions
  - Charts
  - SAR cover
  - Hospital/medical cover
  - EASA OPS compliance
  - HUMS
  - PPE
  - Checklists in use
  - Weight and balance
  - Passenger manifests
  - Passenger briefing
  - Freight handling
- Maintenance
  - Publications
  - Inspection regime
- Facilities
  - Overhaul and repair
  - Technical library
  - Refuelling
  - Personal details – pilots, helihoist operators, engineers
  - Training of passengers
  - Training of helihoist transferees

### Example of an Aviation Watch List

The following check list is intended to detail actions that should be observed prior to, during and after a flight. A completed questionnaire can help the duty holder in monitoring the air operator's safety performance.

- Prior to flight
  - Your qualification to fly should be checked
  - You should receive a pre-flight briefing, including:
    - Weather
    - Personal protective equipment to be worn
    - Task for today
    - Emergency Procedures
    - Dangerous Air Cargo
    - Route to the helicopter
- Prior to take-off
  - You should be allocated a seat
  - Seat restraint should work
  - Escape route should be known
  - When and how to move within the aircraft should be briefed
- During flight
  - Should be informed of any divergence from brief
  - When to reposition for transfer
  - How to transfer safely
- Prior to landing
  - Where to sit and how to be secure
- On landing
  - How to depart the aircraft avoiding dangers
  - Return personal protective equipment
  - Feedback to the crew/management

# Annex H to ORAG – Reference Documents

## UK Department for Energy & Climate Change (DECC)

- **DECC** – The Aviation Plan: 2015 Update – [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/397208/Aviation\\_Plan\\_Update\\_2015\\_FINAL.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/397208/Aviation_Plan_Update_2015_FINAL.pdf)
- **UK Wind Energy and Aviation Interests Interim Guidelines** – <https://www.gov.uk/government/publications/wind-farms-aviation-interests-and-guidance-for-stakeholders>

## European Aviation Safety Agency

- **EU Commission Regulation No. 965/2012** – Air Operations Regulation – <https://easa.europa.eu/document-library/regulations/commission-regulation-eu-no-9652012>
- **EASA** – European Aviation Safety Plan 2014-2017 – [http://easa.europa.eu/system/files/dfu/sms-docs-European-Aviation-Safety-Plan-\(2014-2017\).pdf](http://easa.europa.eu/system/files/dfu/sms-docs-European-Aviation-Safety-Plan-(2014-2017).pdf)
- **EASA** – Opinion 04/2015 – Helicopter Offshore Operations (which will result in a new Subpart K of Annex V (Part-SPA) to Commission Regulation (EU) No 965/2012 by about 2018) – [https://easa.europa.eu/system/files/dfu/Annex%20to%20Draft%20Commission%20Regulation%20amending%20Regulation%20\(EU\)%20No%20965-2012.pdf](https://easa.europa.eu/system/files/dfu/Annex%20to%20Draft%20Commission%20Regulation%20amending%20Regulation%20(EU)%20No%20965-2012.pdf)
- **EASA OPS** – CAT.POL.H.420 - [https://www.easa.europa.eu/system/files/dfu/Annex%20to%20ED%20Decision%202014-015-R%20-%20Part-CAT\\_0.pdf](https://www.easa.europa.eu/system/files/dfu/Annex%20to%20ED%20Decision%202014-015-R%20-%20Part-CAT_0.pdf)
- SPA.HHO.100

## UK Civil Aviation Authority (UK CAA)

- **CAP 393** Fourth edition Amendment 1 April 2015 - Air Navigation: The Order and Regulations – <http://publicapps.caa.co.uk/modalapplication.aspx?appid=11&mode=detail&id=226>
- Standards for Offshore Helicopter Landing Areas – <http://publicapps.caa.co.uk/modalapplication.aspx?appid=11&catid=1&id=523&mode=detail&pagetype=65>
- **CAP 722** Sixth edition, 31 March 2015 – Unmanned Aircraft System Operations in UK Airspace – Guidance – <https://publicapps.caa.co.uk/docs/33/CAP%20722%20Sixth%20Edition%20March%202015.pdf>
- **CAP 764** Issue 6 – CAA Policy and Guidelines on Wind Turbines – <http://publicapps.caa.co.uk/modalapplication.aspx?appid=11&catid=1&id=5609&mode=detail&pagetype=65>
- **CAP 1145** – Safety review of offshore public transport helicopter operations in support of the exploitation of oil and gas – <http://www.caa.co.uk/Data-and-analysis/Safety-and-security/Analysis-reports/Offshore-public-transport-helicopter-review-2014/>
- **CAP 1243** – Progress report on offshore review – <http://publicapps.caa.co.uk/modalapplication.aspx?appid=11&mode=detail&id=6611>
- **CAA Guidance** – Operator Certificates – <http://www.caa.co.uk/default.aspx?catid=1196&pagetype=90>
- 1:250,000 and 1:500,000 Visual Flight Rules (VFR) Charts: <http://www.caa.co.uk/default.aspx?catid=64>
- **Safety Directive 2105005 Offshore Helicopter Operations** – <https://publicapps.caa.co.uk/docs/33/SafetyDirective2015005.pdf>
- **UK CAA/UK HSE** – MOU between the CAA Safety Regulation Group and The HSE and the HSE of Northern Ireland, - <https://www.caa.co.uk/Our-work/About-us/The-CAA,-HSE-and-HSENI/>

## International Civil Aviation Organisation (ICAO)

- **ICAO EUR DOC 15** – European Guidance Material on Managing Building Restricted Areas 2015 – <http://www.icao.int/EURNAT/EUR%20and%20NAT%20Documents/EUR%20Documents/015%20-%20Building%20Restricted%20Areas/ICAO%20EUR%20Doc%20015%20Third%20Edition%20Nov2015.pdf>
- **ICAO Annex 6** – Safety Management System – Aircraft operations, maintenance and general aviation – <http://www.icao.int/safety/ism/icao%20annexes/annex%206.pdf>
- **ICAO Annex 14** Volume 1 Aerodromes and Volume 2 – Aerodromes (Heliports) – [http://www.icao.int/APAC/Meetings/2013\\_AOP\\_WG1/WP14%20%20AI%204,%20Amendment%205%20to%20Annex%2014,%20Vol%20II.pdf](http://www.icao.int/APAC/Meetings/2013_AOP_WG1/WP14%20%20AI%204,%20Amendment%205%20to%20Annex%2014,%20Vol%20II.pdf)

### Helicopter Certification Agency (HCA)

- **Helidecks Limitations List Part C** – Summary of Pitch, Roll and Heave Limitations – <http://www.helidecks.org/download%20files/HLL%20-%20Part%20C%20-%20p%20r%20h.pdf>

### RenewableUK

- **H&S Guidelines: Offshore Wind and Marine Energy Health & Safety Guidelines** – <http://www.renewableuk.com/en/publications/index.cfm/2013-03-13-hs-guidelines-offshore-wind-marine-energy>

### Oil & Gas UK (O&GUK)

- **Aviation Operations Management Standards & Guidelines**, available for purchase at <http://oilandgasuk.co.uk/publicationssearch.cfm?page=result&keyword=aviation>
- **Guidelines for the Management of Offshore Helideck Operations Issue 5 February 2005** – [http://www.icao.int/SAM/Documents/H-SAFETY-EFF/3\\_UKOOA%20Management%20Feb%2005.pdf](http://www.icao.int/SAM/Documents/H-SAFETY-EFF/3_UKOOA%20Management%20Feb%2005.pdf)

### International Oil & Gas Producers (IOGP)

- **OGP Report 390**, July 2008, updated August 2013 – Aircraft Management Guidelines — <http://www.ogp.org.uk/pubs/390.pdf>
- **OGP Report 410**, July 2008 – Air Transportation – Recommended practices for contracted air operations – <http://www.ogp.org.uk/pubs/410.pdf>

### Maritime & Coastguard Agency (MCA)

- **MGN 543 Offshore Renewable Energy Installations (OREI)** – Guidance on UK Navigational Practice, Safety and Emergency Response [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/502021/MGN\\_543.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/502021/MGN_543.pdf)

### International Chamber of Shipping (ICS)

- **Guide to Helicopter/Ship Operations: Fourth Edition 2007**, available for purchase at <http://www.ics-shipping.org/publications/safety-and-operations>

### The Energy Institute

- **A Review of UK Search and Rescue Provision for Offshore Renewable Energy Projects** – <https://knowledge.energyinst.org/Energy-Matrix/product?product=87325>
- **Guidelines for Offshore Oil and Gas Installations that are not permanently attended: 1st Edition June 2010** – [http://publishing.energyinst.org/\\_\\_data/assets/file/0014/26024/Pages-from-Guidelines-for-offshore-oil-gas-installations-that-are-not-permanently-attended.pdf](http://publishing.energyinst.org/__data/assets/file/0014/26024/Pages-from-Guidelines-for-offshore-oil-gas-installations-that-are-not-permanently-attended.pdf)

## Annex I to ORAG – Abbreviations

<b>ALARP</b>	As Low As Reasonably Practical	<b>MOU</b>	Memorandum of Understanding
<b>ANSP</b>	Air Navigation Service Provider	<b>NATS</b>	National Air Traffic Services
<b>AOC</b>	Air Operator Certificate	<b>NUM</b>	Normally Unmanned Platform
<b>ATC</b>	Air Traffic Control	<b>OEM</b>	Original Equipment Manufacturers
<b>ATS</b>	Air Traffic Service	<b>O&amp;M</b>	Operations & Maintenance
<b>AW</b>	AgustaWestland	<b>ORAG</b>	Offshore Renewables Aviation Guidance
<b>BLOS</b>	Beyond Line of Sight	<b>ORE</b>	Offshore Renewable Energy
<b>CAA</b>	UK Civil Aviation Authority	<b>ORED</b>	Offshore Renewable Energy Development
<b>CAP</b>	Civil Aviation Publication	<b>PPE</b>	Personal Protection Equipment
<b>CAT</b>	Civil Air Transport	<b>PSR</b>	Primary Surveillance Radar
<b>CDM</b>	Construction (Design & Management) Regulations	<b>QA</b>	Quality Assurance
<b>CNS</b>	Communications, Navigation and Surveillance	<b>RUK</b>	RenewableUK
<b>DC&amp;FF</b>	Damage Control & Fire Fighting	<b>SAR</b>	Search & Rescue
<b>DECC</b>	Department for Energy & Climate Change	<b>SMS</b>	Safety Management System
<b>EASA</b>	European Aviation Safety Agency	<b>SOP</b>	Standard Operating Procedure
<b>EC</b>	Eurocopter	<b>SOV</b>	Service Operations Vessel
<b>EGPWS</b>	Enhanced Ground Proximity Warning System	<b>SQEP</b>	Suitable Qualified Experienced Personnel
<b>FDM</b>	Flight Data Monitoring	<b>TCAS</b>	Traffic Collision Avoidance System
<b>GNSS</b>	Global Navigation Satellite System	<b>TCE</b>	The Crown Estate
<b>H&amp;S</b>	Health & Safety	<b>UAS</b>	Unmanned Aerial System
<b>HHO</b>	Helicopter Hoist Operations	<b>USL</b>	Underslung Load
<b>HHOP</b>	Helicopter Hoist Operations Passengers	<b>UKCS</b>	United Kingdom Continental Shelf
<b>HO</b>	Hoist Operator	<b>VFR</b>	Visual Flying Rules
<b>HMR</b>	Helicopter Main Route	<b>VMC</b>	Visual Meteorological Conditions
<b>HSE</b>	Health & Safety Executive	<b>W2W</b>	Walk To Work
<b>HUMS</b>	Health & Usage Monitoring Systems		
<b>IFR</b>	Instrument Flying Rules		
<b>IMC</b>	Instrument Meteorological Conditions		
<b>IMO</b>	International Maritime Organisation		
<b>ITT</b>	Invitation to Tender		
<b>KPI</b>	Key Performance Indicators		
<b>LOS</b>	Line of Sight		
<b>MCA</b>	Maritime Coastguard Agency		
<b>MGN</b>	Marine Guidance Notice		
<b>MMO</b>	Marine Management Organisation		
<b>MoD</b>	Ministry of Defence		

# Annex J to ORAG – Acknowledgements

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