Morecambe Offshore Windfarm: Generation Assets

Examination Documents

Volume 9

The Applicant’s Response to Spirit Energy’s Deadline 4 Submission Appendix A: Helicopter Access

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Morecambe Offshore Windfarm Helicopter Access Deadline 5

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00	February 2025	First Issue
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02	11 March 2025	Final Version

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Abbreviations Table

Abbreviation	Definition
AltMoC	Alternative Means of Compliance
AMC	Acceptable Means of Compliance
AMSL	Above Mean Sea Level
ARA	Airborne Radar Approach
CAA	Civil Aviation Authority
CAP	Civil Aviation Publication
CAT	Commercial Air Transport
DCO	Development Consent Order
DVE	Degraded Visual Environment
EASA	European Aviation Safety Agency
ES	Environmental Statement
GM	Guidance Material
FAT	Final Approach Track
FDM	Flight Data Monitoring
ft	Feet
HTAWS	Helicopter Terrain Awareness Warning System
IFR	Instrument Flight Rules
kg	Kilogram
kt	Knots

Abbreviation	Definition
IMC	Instrument Meteorological Conditions
nm	Nautical Mile
NPI	Non-Production Installation
NUI	Normally Unmanned Installation
OEI	One Engine Inoperative
RFM	Rotorcraft Flight Manual
SERA	Standard European Rules of the Air
TEMPSC	Totally Enclosed Motor Propelled Survival Craft
VFR	Visual Flight Rules
VMC	Visual Meteorological Conditions
Vtoss	Take-off Safety Speed
Vy	Best Rate of Climb Speed

1 Executive Summary

1. It is proposed to construct the Morecambe Offshore Wind farm in proximity to the South Morecambe Gas Field, this will have an impact on Commercial Air Transport (CAT) access to the South Morecambe Platform and its associated Normally Unmanned Installations (NUI). The South Morecambe, DP-6 and DP-8 Platforms are operated by Spirit Energy. The nearby Calder Platform is owned by Harbour Energy and operated by Spirit Energy.

2. Helicopters require a sufficient obstacle free area for an approach and take-off. The take-off distance must take account of an engine failure occurring immediately the helicopter leaves the helideck. There are defined obstacle free criteria in aviation regulations. The report presents the distances calculated by the Applicant to be required for flights (approaches and take-offs) to be conducted safely in the various conditions, i.e. day Visual Meteorological Conditions (VMC), Instrument Meteorological Conditions (IMC) and at night. These are considered to be the distances required to safely undertake the approach or take-off and do not rely on the number of flights being conducted as, if the specified distance is available, each flight is considered to be able to be conducted safely.

3. This assessment has considered the proposed change by the Civil Aviation Authority (CAA) to the Acceptable Means of Compliance (AMC) and guidance material addressing CAT operations within 3 nautical miles (nm) of a wind farm. Without any mitigations, this would restrict helicopter operations within 3nm of a windfarm to day VMC only.

4. In parallel to this assessment, the Applicant has commissioned DNV to assess any associated safety aspects. Refer to the Applicant's Response to Spirit Energy's Deadline 4 Submission Appendix B: Effect of Proposed Morecambe Offshore Windfarm on Offshore Oil and Gas Operations_Rev 02 (Document Reference 9.59.2).

1.1 Helicopter Access Under Day Visual Meteorological Conditions

1.1.1 VMC Approach

5. Section 4.1.1 applies the draft Civil Aviation Publication (CAP) 764 and HeliOffshore Approach Path Guidance that a stabilisation point at a minimum distance of 0.5nm before the helideck must be established. At the stabilisation point the helicopter will be into wind, at the correct power and airspeed and configured for landing. The Applicant has applied a conservative stabilisation point at 0.75nm, i.e. 50% greater than the minimum required by the above guidance, from the helideck and allowed for a 180^{o} turn onto the point whilst avoiding all obstacles by 150m (500 feet (ft)) laterally, as required by regulation for day VMC flights. This results in a calculated distance for a day VMC approach of 1.26nm. This distance is supported by the draft CAP 764, industry guidance and the Protective Provisions for the Waveney Platform near the Dudgeon Extension Windfarm. Additionally, regular CAT flights are made to helidecks inside and adjacent to windfarms where less than 1.26nm is available. Based on CAA guidance and industry best practice, 1.26nm is a safe distance for a day VMC approach. A longer distance of 1.5nm is provided

for in the Protective Provisions in favour of both Spirit Energy and Harbour Energy in the draft Development Consent Order (DCO).

6. Spirit Energy has calculated a distance of 1.9nm for a day VMC approach. Spirit Energy has applied "professional judgement" to add an additional 1nm[1] to their calculated distance. However, this is not supported by CAA or HeliOffshore guidance or any other industry best practice.

1.1.2 VMC Take-off

7. Section 4.1.2 takes account of an engine failure occurring on take-off from a platform and the distance required to climb to 500ft above sea level before commencing a turn away from the windfarm. It has been assumed that the AW169 helicopter, used by the gas operators, will be at the maximum take-off mass of 4,800 kilograms (kg). The atmospheric and wind conditions for this assessment have been agreed with Spirit Energy. A take-off distance of 1.4nm has been calculated by the Applicant. This is shorter than the 1.5nm provided for in the Protective Provisions in favour of both Spirit Energy and Harbour Energy in the draft Development Consent Order.

8. Spirit Energy has calculated a distance of 1.76nm. Section 4.1.2.5 identifies a number of discrepancies in their calculations.

1.2 Helicopter Access Under IMC and at Night

1.2.1 IMC Approach

9. The Applicant has assumed that an obstacle free arc of 9nm is required for an IMC approach. Based on the position of the proposed wind farm relative to the South Morecambe Platform, this will still permit IMC approaches to CPC-1 from the northeast, east, west and south west of the helideck as an obstacle free arc would be available in these directions.

1.2.2 IMC Take-off

10. Section 4.2.2 takes account of an engine failure occurring on take-off from a platform and the distance required to climb to 1,000ft above sea level before commencing a turn away from the windfarm. It has been assumed that the AW169 helicopter will be at the maximum take-off mass of 4,800kg. The atmospheric and wind conditions for this assessment have been agreed with Spirit Energy. In addition to the take-off distance required, in IMC a distance of 1nm must be maintained from all obstacles. The combination of climbing at the aircraft's mass to 1,000ft, and taking account of avoiding obstacles by 1nm, requires an obstacle free take-off distance of 3.35nm. If the calculation

[1] Spirit Energy calculate 1.9 by summing the stabilisation Point at 0.5nm, with a turn radius of 0.35nm, a lateral avoidance distance of 0.08nm (150m) and then add an additional 1nm. This figure of 1.93nm is then rounded down to 1.9nm. The additional 1nm is not supported by draft CAA CAP 764 or HeliOffshore industry guidance.

is repeated at a more typical aircraft mass of 4,400kg, then the resulting distance is 2.88nm.

11. Spirit Energy has calculated a take-off distance of 3.76nm. Section 4.2.4.1 identifies discrepancies in the Spirit Energy calculations.

1.3 Operational Impact on South Morecambe and Associated NUIs

12. Section 6 identifies the operational impact on helicopter access, including cancelled flights. This assessment has utilised meteorological data and flight data supplied by Spirit Energy. The data covers the period 2018 to 2022. This part of the assessment assumes that the CAA change to AMC is implemented without any mitigations, resulting in a loss of IMC and night access to the South Morecambe Platform and associated NUIs.

1.3.1 Flights to the CPC-1 Helideck

13. The CPC-1 helideck is the principal helideck on the South Morecambe Platform, where it is located on the CPC-1 module. The Applicant has calculated that 8.5% of flights to CPC-1 would have been cancelled if the Morecambe Offshore Windfarm had been built when the flights took place (APP-081 Appendix A Tables A1-A4). The reason for cancelling the flights is a loss of both IMC and night access. The Applicant's calculations assume that if the conditions were not day VMC at the time of the flight, then the flight would be cancelled and does not consider the possibility of delaying the flight. Spirit Energy calculated that 9% of flights to CPC-1 would be cancelled and 5% delayed (RR-077 Appendix D Slide 230).

1.3.2 Access to NUIs

14. The Applicant took account of the information supplied by Spirit Energy in their REP1-116 Appendix D and updated their assessment of the helicopter access to NUIs. In particular it is agreed with Spirit Energy that a single cancelled flight to a NUI has a compound impact as two flights are necessary to insert and then extract a work party from a NUI. As well as a generic assessment of helicopter access to NUIs, the Applicant conducted a specific assessment on helicopter access to the DP-8 NUI. The major factor reducing access to the NUIs is the potential loss of night flying under the CAA change to AMC. Table 6.3 shows that Spirit Energy has calculated an overall annual loss of 13% of flights whilst the Applicant has calculated a loss of 12.2%. The Winter loss, with shorter daylight hours, has been calculated as 22% by Spirit Energy and 20.4% by the Applicant. In calculating the loss of flights, the Applicant has taken account of the need for two flights to go to a NUI on a given day, to deliver and then extract the work party. If one flight could not occur due to IMC or night, then the Applicant's assumptions is that both flights would be cancelled.[2]

[2] It is understood that Spirit Energy's definition of impact to NUIs has been revised to consider time lost offshore rather than cancelled flights. This is discussed further in the main report.

1.4 Proposed Mitigations

15. In order to mitigate the loss of flights, the Applicant has proposed removing part of the windfarm to provide a Take-off Corridor aligned with the prevailing wind direction in IMC, see Figure 7.1. A 2nm wide Take-off Corridor aligned 220^o, along with the other available take-off and approach arcs, would permit circa 50% of current IMC and night approaches and take-offs to still be conducted. This would reduce the loss of flights to CPC-1 identified above by approximately half, i.e. the available access to and from the CPC-1 platform with the Take-off Corridor would be 96%, based on actual flights flown between 2018 and 2022. It is noted that this period includes flights to the DP3 and DP4 platforms which have since been decommissioned, and therefore the number of flights is expected to be reduced compared to the period analysed. The DNV report (Document Reference 9.59.2) provides further information on the benefit of the Take-Off Corridor on impact to the NUIs.

16. Under the present aviation regulations this mitigation would be available immediately. If the CAA change to AMC and guidance material occurs, then the helicopter operator could apply for approval to continue IMC and night operations under an Alternative Means of Compliance (AltMoc): this was confirmed by the CAA in their REP3-075. Based on precedent and professional experience, it is considered that obtaining an AltMoc for continued IMC and Night VMC approaches and take-offs from helidecks adjacent to the Morecambe Wind Farm is feasible. Use of the Take-off Corridor would be permitted under current regulations, including AMC. The CAA confirmed in their REP-075 that there will be no changes to the Basic Regulations and Implementing Rules. An AltMoc would propose operations within defined approach and take-off arcs, retaining compliance with the Basic Regulations and Implementing Rules, and so demonstrate an equivalent level of safety to current operations.

17. Operations close to wind farms are not a new issue. In 2006 two 500ft high wind turbines were constructed 0.75nm away from the Beatrice A Platform. The operator flew proving flights with their CAA Operations Inspector to determine safe day and night VMC and IMC approach arcs and departures. At that time the Beatrice A was a manned platform with circa 100 personnel onboard. Shuttle operations were conducted from the Beatrice A to the Beatric B and Beatrice C NUIs, albeit on a much lower rate than shuttling from the CPC-1. Section 5 presents some other precedence for helicopter flights carried out close to wind farms.

2 Introduction

18. This Technical Note will provide a summary of the helicopter access issues resulting from the Morecambe Offshore Wind Farm proposed to be built adjacent to the South Morecambe Platform and associated assets. Figure 2.1 shows the South Morecambe Platform in relation to the Calder, DP-6 and DP-8 NUIs. The South Morecambe Platform has two helidecks, with the primary helideck mounted on its CPC-1 module. The Morecambe Unconstrained Areas represent areas within the wind farm site where Wind Turbine Generators (WTGs) may be built.

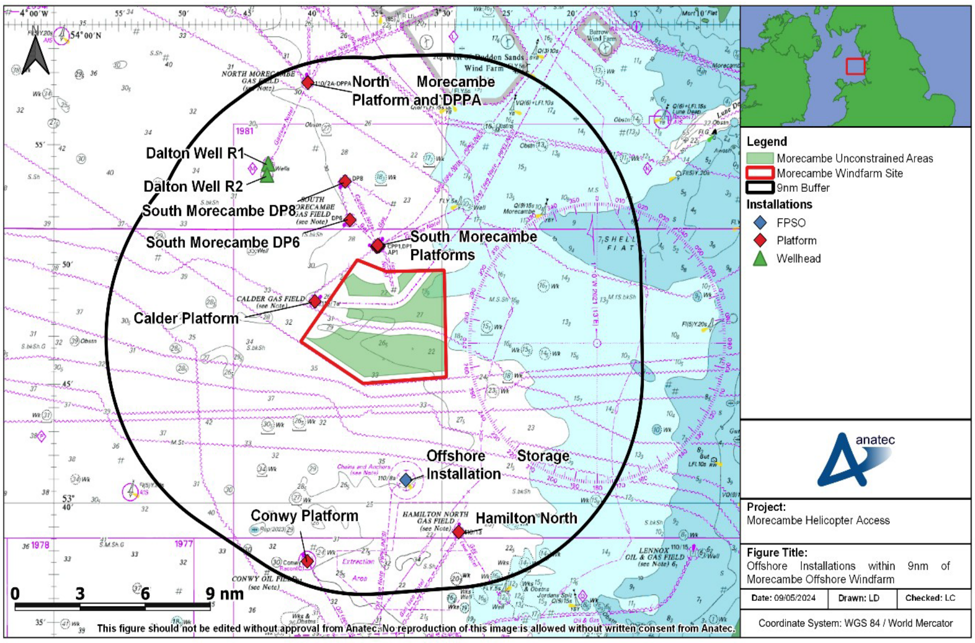

Figure 2.1 Offshore Installations within 9nm of Morecambe Wind Farm

19. During the limited discussions with Spirit Energy, some aspects of the Applicant's case has been revised. Where revisions have been made these will be identified.

20. Firstly, the report will confirm the approach and take-off distances required for helicopter access to the assets in different meteorological conditions, taking into account the aviation regulations, guidance material and industry best practice.

21. Secondly, the report will confirm the impact of the presence of the Morecambe Offshore Wind Farm on flights to the South Morecambe Field.

22. Thirdly, the report will identify mitigation to increase helicopter access under IMC and night VMC.

2.1 Authors

23. The Applicant's helicopter access documents have been prepared by Mark Prior and Dr Lucy Campbell. Their qualifications and experience are listed below. The content

of this document is the professional option of the authors. References to the Applicant's case in this document are references to the position set out in this document, and previous reports produced by Anatec and submitted into the Examination (unless otherwise stated).

2.1.1 Mark Prior

24. Mark Prior has 45 years of aviation experience. After three operational tours and a staff tour in the RAF, he was selected for training as an Experimental Test Pilot. As part of an exchange programme, he graduated from the French Test Pilot School (Ecole du personnel navigant d'essai et de reception – EPNER) in 1993. He then spent five years as the Certification Flight Commander on the Rotary Wing Test Squadron at RAF Boscombe Down. This involved running and participating in flight trials on new helicopter types, aircraft systems and research flying.

25. In 1998 he left the RAF and joined Bristow Helicopters ltd. From 2000 until 2016 he was the Bristow Group Chief Test Pilot. Alongside this role he was an industry representative on a number of rulemaking bodies, including the European Joint Aviation Authority (JAA), The European Aviation Safety Agency (EASA), International Civil Aviation Organisation (ICAO), CAA working groups and the Helideck Certification Agency's Technical Committee.

26. In 2016 he left the Bristow Group and became an independent consultant. His clients have included: the Scottish Crown and Procurator Fiscal Service, as an advisor and expert witness for two helicopter accidents; the Ministry of Defence, as lead author on handling and performance aspects during the rewrite of Def Stan 00-970 (Requirements for the Design and Airworthiness of Military Aircraft); the UK Civil Aviation Authority, including a safety assessment of helicopter automated offshore approaches and representing the CAA as Secretary to the European Committee on Aviation Equipment (EUROCAE) working group 110/RTCA Special Committee 237; numerous commissions for oil companies and offshore renewable projects. He was co-author of the HeliOffshore Approach Path Guidance and has been a contributor to the HeliOffshore work on Helicopter Terrain Awareness Warning Systems. Mark is a Fellow of the Royal Aeronautical Society and past Chair of the RAeS Rotorcraft Specialist Group.

2.1.2 Dr Lucy Campbell

27. Lucy is a Director and Principal Risk Analyst with Anatec with over 14 years of technical experience in marine risk assessment for the oil & gas, offshore renewables and marine industries.

28. Lucy has a BSc (Hons 1st) Mathematics-Physics, and PhD in Mathematics from the University of Aberdeen, UK as well as eight years of research in Mathematics including developing theorems and algorithms. She was also employed as a research scientist at the world leading Max Planck Institute in Germany.

29. She heads up the subsea risk assessment team at Anatec and has been project manager on a large number of Cable Burial Risk Assessments and Navigational Risk Assessments for subsea cables within the renewable energy and marine sectors, as well as pipeline risk assessments for the oil and gas industry, including pipeline decommissioning studies.

30. Lucy has been heavily involved in the research and development of models used to calculate risk related to subsea infrastructure, such as subsea cables and pipelines, including anchor dragging, emergency anchoring, foundering, dropped objects and fishing gear interaction and has had extensive experience in producing cable and pipeline risk assessments in UK and international waters.

31. In the last few years, Lucy has been involved in supporting analysis of the impacts to helicopter access from offshore wind farms, along with Anatec's helicopter specialist, Mark Prior, for a number of offshore wind projects in the North Sea and East Irish Sea.

3 Background

32. Under the current UK aviation regulations and AMC, night VMC and IMC approaches and departures are permitted with wind turbines within 3 nm of a helideck. The CAA is planning to consult on a change that could restrict operations within 3nm of a wind farm to day VMC only. The CAA confirmed in the response to the Examining Authority's (ExA) first set of written questions (REP3-075) that the Rule Making Task 0187 will only add AMC and/or guidance material (GM) in relation to this change (i.e. it will not introduce a new regulatory requirement) and hence it will be possible for an AltMoC to be considered. The CAA's response also noted that the target for Rule Making Task 0187 is the November 2025 SI, *"some early discussions have taken place in relation to oil & gas support operations in the vicinity of wind farms/wind turbines, but no conclusions have been reached. Thus far, there have been no proposals to apply different separation standards for wind turbines associated with oil & gas installations vs other wind turbines. Any new AMC and/or GM material will be subject to public consultation."*

33. Use of an AltMoC could permit some IMC and night VMC operations to continue within 3nm of a wind farm, even with the wind farm in place, providing an equivalent level of safety to current operations can be demonstrated. The applicability of an AltMoc is discussed further under potential mitigations (Section 7), such as a designated Take-off Corridor.

4 Approach and Take-off Distances

34. In order to access the helidecks in the South Morecambe Field, sufficient space must be available to make an approach to the helideck, and to take-off from the helideck. Approaches and take-offs are normally made into wind, and so the wind direction will determine the approach and take-off direction. On the rare occasions that winds are calm offshore, an approach and take-off can be made in any direction. Depending on the type of approach, obstacles have to be avoided by defined lateral and vertical criteria. In addition, the possibility of an engine failure taking place must be taken into account. The Applicant's Helicopter Access Study (APP-081) Section 2.2 explains the aviation regulations and guidance material relevant to this topic.

- The three approach and departure regimes, day VMC, night VMC and IMC are summarised below. Day VMC is when an approach and take-off is made predominantly using external visual cues. The pilots apply the principle of "see and avoid" to maintain a safe separation from obstacles. All obstacles, except for the landing site, must be avoided by 150m (500ft) laterally and vertically.
- IMC is when the pilots fly by sole reference to instruments, except for the final stage of an approach or take-off when sufficient visual cues are available. Obstacles must be avoided by 1nm laterally and 1,000ft vertically.
- Night VMC is defined as being a Degraded Visual Environment. Although depending on the light level it is often possible to apply similar flight profiles to day VMC, a conservative approach has been taken in this study and IMC obstacle avoidance criteria have been applied to night VMC.

4.1 Day Visual Meteorological Conditions

35. During day VMC, all obstacles other than the landing site must be avoided by 150m (500ft) laterally and vertically.

4.1.1 Day VMC Approach Distance Required

4.1.1.1 Stabilisation Point

36. Following aviation accidents to both fixed wing and helicopters, the aviation industry has adopted the principle of a stabilised approach. A stabilised approach reduces workload and the margin for error during the critical landing phase. In particular, it requires the aircraft to be on the correct flightpath, at the correct speed and power, in the correct landing configuration with all landing checks complete, at a defined point before landing. The stabilised approach concept was adopted by UK helicopter operators after a series of helicopter accidents where the helicopter had become unstable during the final approach: the last of these being the accident on approach to Sumburgh Airport in August 2013. The Applicant has followed CAA guidance and industry best practice in identifying the stabilisation point to be applied.

37. The Applicant has applied CAA guidance material in draft CAP 764[3] and industry guidance in the HeliOffshore Flightpath Management[4] document to identify minimum day VMC approach distances. Draft CAP 764 and the HeliOffshore Guidance are aligned on key points, such as the minimum distance for the helicopter to be stabilised on the approach.

38. The CAA's draft CAP 764 section 5.24.c. states:

> "*When a helideck is within a windfarm there may be operational difficulties when manoeuvring for a stabilised approach. Obstacle clearance around a helideck within a windfarm should allow aircraft to achieve Final Approach Track (FAT) and 0.5 NM stabilised approach Visual Meteorological Conditions (VMC) gate.*"

39. The HeliOffshore Flightpath Management guidelines Section 4.1.1.3 states:

> *"A helicopter should meet the stabilised approach criteria, both onshore and offshore, as early as possible on the approach, but no later than a specified point or 'gate' on the approach. The following 'stabilised gates' are recommended:*
>
> *1. Visual Flight Rules (VFR) approaches: No later than 0.5 NM from the landing site."*

40. Figure 4.1 illustrates the approach path taken, noting that a turn can be made onto the stabilised approach point.

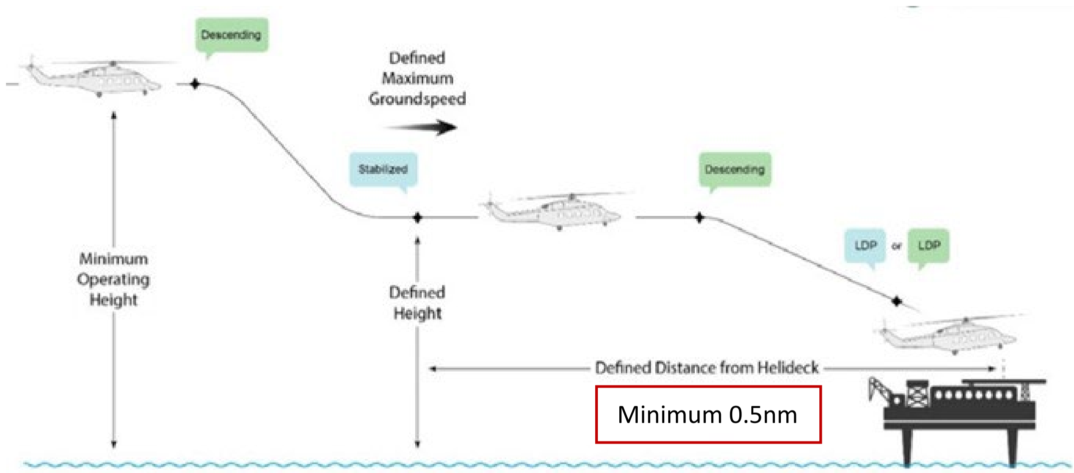

Figure 4.1 Landing Profile

41. The stabilised approach criteria are being used on a daily basis for flights into wind farms and to helidecks adjacent to wind farms. The HeliOffshore guidance on the stabilisation point has been in place for approximately five years without

3. https://consultations.caa.co.uk/policy-development/proposed-revision-to-cap-764-caa-policy-and-guidel/supporting_documents/Draft%20CAP764%20Ed7%20Red%20Underline.pdf
4. https://static1.squarespace.com/static/61545016c5513327f64b3107/t/67508cee111f2814a247e81b/1733332212239/FPM+RP+V4.pdf

modification. Since the initial issue, the overall Flightpath Guidance document has been revised three times, based on helicopter operator input. As the stabilisation point has remained at 0.5nm it is a reasonable assumption that operators are content that it is safe and effective. This is reinforced by the CAA adopting the same day VMC stabilisation point of 0.5nm in their draft CAP 764. Approach Distance Calculation

42. The required distance for an approach in day VMC can be calculated as below:

- Industry Standard Stabilisation Point **0.5nm.**

- Turn onto Stabilisation Point. Sufficient space must be available to turn onto the final approach track to arrive at the stabilisation point, with a 180° turn being a reasonable worst case. It is assumed that the turn will be at Rate 1 flown at 80 knots (kt), resulting in a radius of turn **0.43nm**.

$$r = \frac{V^2}{g \tan \emptyset}$$

where r is the radius of the turn (m)
$g = 9.81\ m/s^2$
V = true airspeed (m/s)
Ø is the angle of bank (°)

The Applicant calculation of 0.43nm is more conservative than the 0.35nm calculated by Spirit Energy.

N.B. A Rate 1 turn is a rate of turn resulting in 3^o angle change per second of the turn. It is the standard rate of turn used in instrument conditions, or when the autopilot upper modes are controlling the turn.

- Lateral Separation Distance from all obstacles, such as wind turbines – VMC Buffer **0.08nm.**

*N.B. UK Rules of the Air[5] (SERA).5005 (f)(2) requires a lateral separation distance of 150m/500ft (**0.08nm**) from obstacles.*

43. Summing the three distances, 0.5nm+0.43nm+0.08nm, results in a minimum approach distance of **1.01nm**.

44. The distance of 1.01nm is fully compliant with CAA draft guidance and industry best practice. However, it is noted that one out of the six UK offshore helicopter operators uses a stabilisation point at 0.75nm, rather than the standard 0.5nm. This worst-case figure has been applied to the Applicant's assessment, resulting in an approach distance of **1.26nm** (0.75nm+0.43nm+0.08nm). The distance of 1.26nm is shorter than the 1.5nm currently provided for in the Protective Provisions in favour

[5] https://regulatorylibrary.caa.co.uk/923-2012-pdf/PDF.pdf

of both Spirit Energy and Harbour Energy in the draft DCO_Rev 05 (Document Reference 3.1).

4.1.1.2 Comparison With the Spirit Energy Assessment

45. In the Spirit Energy REP4-064 5.10 they state:

> *"The D3 Anatec Report calculations for aircraft approach distances in day VMC on the basis of stabilisation at the very last opportunity cannot be seen to be compliant with the HeliOffshore guidance. The approach distance must be increased with an additional buffer zone to ensure the aircraft is fully stabilised prior to arrival at this 0.5 nm limit".*

46. Since the introduction of the stabilised approach procedures in late 2013, helicopter operators have adopted the HeliOffshore guidance on the increased use of automation, improved pilot training and standardisation. The CAA has mandated the use of an enhanced Helicopter Terrain Awareness Warning System (HTAWS)[6] from January 2025. The enhanced HTAWS includes a warning mode (Mode 7) to identify an unstable approach. In addition to these safety improvements, Flight Data Monitoring (FDM) is used to identify any undesired flight paths, including unstable approaches. Any events or trends identified by FDM are fed back to the operator, their pilots and their training system. The combination of improved training and standardisation, FDM, standardised approach profiles and enhanced equipment reduces the variability in pilot performance and increases compliance with defined flight profiles. This is why pilots trained and monitored to current UK standards do not require an additional 1nm[7] to align with the stabilisation point.

47. The HeliOffshore Guidance and CAA draft guidance identify a minimum of 0.5nm, which in the experience of the author is being used on a daily basis by offshore operators. This figure has not been modified since introduction circa five years ago and is seen as a safe standard. The HeliOffshore guidance, which is now supported by the draft CAP 764, takes account of the high training standards in the UK and the use of the helicopter's autopilot. The Applicant has in fact applied the worst-case stabilisation distance of 0.75nm used by one out of six UK helicopter operator (and in addition, the 1.5nm buffer currently provided in the Protective Provisions is in excess of the 1.26nm which applies the worst case 0.75nm stabilisation distance). At a typical groundspeed of 60kt when approaching the stabilisation point, the distance of 0.49nm (1.5nm minus the 1.01nm shown in paragraph 16) would provide an additional 29 seconds of flight time for the pilots. The distance of 1.26nm (and 1.5nm) not only complies with CAA draft guidance, HeliOffshore guidance and industry best practice but demonstrates that additional space, and hence time (of

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[6] https://regulatorylibrary.caa.co.uk/965-2012/Content/AMC%20GM%203/AMC1%20SPA%20HOFO%20160%20c%202%20HTAWS.htm

[7] The Spirit Energy position is that 1.9nm is required for a day VMC approach. This is the sum of stabilisation point (0.5nm) distance to turn onto the stabilisation point (0.35nm) lateral distance to avoid obstacles (0.08nm or 150m) plus an additional 1nm.

29 seconds), is available for pilots to manoeuvre and align with the stabilisation point, beyond the minimum values already being used safely on a daily basis. As such, there is no basis for the concern raised by Spirit (and noted above) that "*the approach distance must be increased with an additional buffer zone to ensure the aircraft is fully stabilised prior to arrival at this 0.5 nm limit".*

48. In the Spirit Energy REP4-064 5.13 they state the need for an additional 1nm "*safety buffer*" to provide an additional 30 to 45 seconds for the pilots to achieve the stabilisation point. Covering a distance of 1nm in 30 seconds results in a ground speed of 120kt, and so a minimum airspeed of 130kt, which is not consistent with approaching the stabilisation point at a safe speed or current best practice.

49. The additional 1nm is not supported by CAA guidance or industry best practice. In fact draft CAP 764 5.24 c. states:

"Obstacle clearance around a helideck within a windfarm should allow aircraft to achieve Final Approach Track (FAT) and 0.5 NM stabilised approach Visual Meteorological Conditions (VMC) gate. For operations in a Degraded Visual Environment (DVE) a second stabilised approach gate is introduced at 1 NM. DVE is determined to exist when visibility is below 4000m. The minimum visibility of 5000m [as required for day VMC under the proposed CAA rule change[8]] *gives a margin above DVE ensuring there is no requirement for the extended FAT."*

4.1.1.3 Summary of Day VMC Approach Distance Required

50. The Applicant has applied CAA guidance and industry best practice to calculate a day VMC approach distance of 1.26nm. In fact, a minimum distance of 1.5nm, as provided for in the Protective Provisions in favour of Spirit Energy and Harbour Energy in the draft DCO_Rev 05 (Document Reference 3.1), is available from any direction which results in a total distance in excess of any CAA or industry guidance. Shorter distances are being safely used on a daily basis for approaches to helidecks located inside and adjacent to wind farms. At a ground speed of 60kt, the additional 0.49nm (1.5nm in the Protective Provisions in favour of Spirit Energy and Harbour Energy in the draft DCO, minus 1.01nm identified in paragraph 22) provides a margin of 29 seconds, or 48%, over the minimum CAA draft CAP 764 and HeliOffshore Industry Guidance.

51. Spirit Energy and AviateQ have applied "professional judgement" to add an additional 1nm to their calculated distance. However, this is not supported by CAA or HeliOffshore guidance or any other industry best practice. The author of this document was the co-author of the HeliOffshore Approach Path Guidance and has

[8] The CAA is consulting on new day VMC meteorological limits for operations within 3nm of a wind farm. The proposed new limits are:
- the cloud base increased from the current ≥ 600ft to ≥700ft
- the minimum visibility increased from the current ≥4,000m to ≥5,000m

contributed to other HeliOffshore and industry safety initiatives, including representing the CAA as Secretary to a joint European and USA Working Group (EUROCAE Working Group 110/RTCA Special Committee 237) on Helicopter Terrain Awareness Warning Systems, which from January 2025 are mandated for UK offshore helicopter operations. The AviateQ authors do not have similar experience or expertise.

4.1.2 Day VMC Take-off Distance Required

52. The helicopter operator is required to take account of the possibility of an engine failure on take-off. Although the regulations set a target probability of 5×10^{-8} (1:20 million) or lower per take-off or landing, it is regarded as a foreseeable event. Following an engine failure the helicopter will have a reduced rate of climb, resulting in a longer distance to achieve a given height above the sea. The one engine inoperative performance can be determined from the helicopter's Rotorcraft Flight Manual. The Manual is part of the certification of the helicopter; the flight profiles and performance data will be verified by the certifying authority.

53. The Applicant's calculations of the day VMC take-off distance takes account of the helicopter type under charter to Spirit Energy, the AW169. The AW169 has a maximum take-off mass of 4,800kg, which has been used in the Applicant's updated take-off assessment.

54. As there is no offshore fuel available in the gas fields, departing Blackpool Airport with eight passengers onboard will be the heaviest the helicopter will be for the whole flight. If the AW169 helicopter departs Blackpool Airport at the maximum of 4,800kg, by the time it has burned fuel to fly to CPC-1 and changed over the 8 passengers on the helideck, it will be at a mass of 4,650kg or lower. Every subsequent landing and take-off will then be at a lower mass as fuel will continue to be burned. It is therefore considered that the majority of flights from CPC-1 or the NUIs will take off with lower mass than the 4,800kg used in the calculations, therefor requiring a shorter distance to climb to the appropriate height.

4.1.2.1 Assumptions

55. To assist the ExA, the Applicant has aligned their assumptions with those applied by Spirit Energy in their AviateQ International Limited report, dated August 2024 (Found at Appendix A of the Spirit Energy Written Representation, Document Reference: REP1-116).

- AW169 mass - 4,800kg
- Temperature - 15^{o}C
- Pressure at sea level - 1013 hPa
- Wind speed – 15 kt

56. The Applicant noted that the AW169 had a performance upgrade when its maximum take-off mass was increased from 4,600kg to 4,800kg. This upgrade provides

enhanced power following a single engine failure and is already being applied by some operators in the UK. As this is a safety upgrade, the Applicant considers that it is probable that this upgrade will be embodied by the time the Morecambe Wind Farm is constructed in 2030, and so account was taken of the improved performance. However, as the initial Spirit Energy assessment did not take account of the enhanced power, the baseline performance is also considered.

57. As the CPC-1 helideck is key to Spirit Energy operations it is used in the assessment. The one engine inoperative power take-off profile in the AW169's Rotorcraft Flight Manual has been applied, with the applicable power curves referenced. Copies of worked examples have been shared with Spirit Energy and are shown in Appendix A. Each section below references the Rotorcraft Flight Manual (RFM) graph applicable to that calculation. Figure 4.2 shows the One Engine Inoperative Continued Take-off Profile

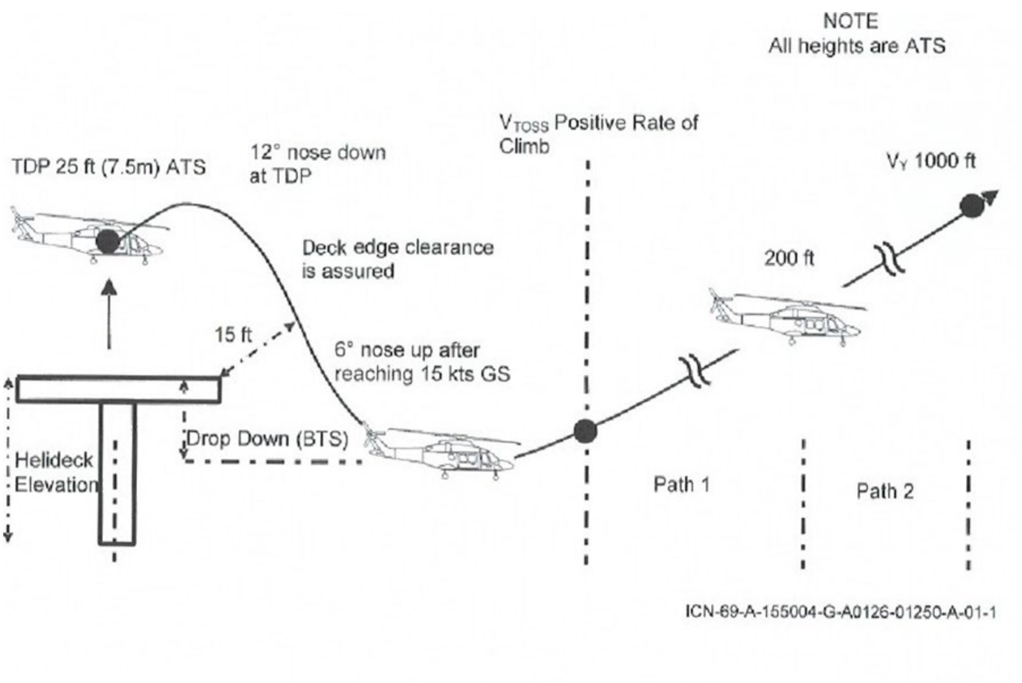


Figure 4.2 AW169 One Engine Inoperative Continued Take-off Profile

58. Figure 4.2 shows the One Engine Inoperative (OEI) Continued Take-off Profile. It is composed of the following elements:

- Calculation of dropdown below helideck height. Under some conditions, such as high aircraft mass, the helicopter has to convert height (potential energy) into forward speed (kinetic energy) by descending below the helideck.
- Acceleration to velocity-take-off safety speed (Vtoss) of 45kt airspeed using OEI 2 ½ Minute Power.
- Climb at Vtoss to 200ft above the take-off surface, i.e. the helideck using OEI 2 ½ Minute Power.

- A level acceleration phase to the best rate of climb speed (Vy) of 75kt airspeed using OEI 2 ½ Minute Power.
- A climb at Vy to 500ft above sea level (remaining below cloud) in VMC, or 1,000ft above sea level in IMC, using OEI Continues Power.
- A climbing Rate 1 turn away from the wind farm, commencing at 500ft in VMC or 1,000ft in IMC using OEI Continues Power.

4.1.2.2 Comparison with Sprit Energy Assessment – Flight Profile

59. At REP1-116 the Spirit Energy aviation advisors applied the same OEI take-off profile but commenced their turn in VMC at 500ft above helideck height (684ft in the case of CPC-1) or 1,000 ft above helideck height (1,184ft in the case of CPC-1). A height of 684ft during a VMC take-off is not practical as the minimum cloud base under the proposed CAA rule change is 700ft above sea level (currently 600ft), with a vertical clearance from cloud of 100ft necessary to remain VMC. During a meeting on 18 February 2025 between Spirit Energy, their advisor AviateQ and the Applicant, AviateQ stated that they had revised their position. They stated verbally that they had revised their calculations applying all heights above sea level. They have not yet provided any details of their revised calculations. If the profile is not followed and the Flightpath 1 is terminated at 200ft above sea level (16ft above the height of the CPC-1 helideck) and then the level acceleration phase of 0.36nm is also flown at 200ft above sea level, it is not optimising the capability of the AW169 helicopter. Furthermore, it could result in a sustained period of time at 200ft in IMC or at night with an emergency, which is unsafe.

60. The Applicant has applied the AW169 OEI continued take-off profile. It has calculated a day VMC take-off distance where a turn away from the wind farm is commenced at 500ft above sea level, where the helicopter can be levelled if the cloud base is low, or the climb continued if the cloud base is higher. In IMC the same profile is followed but a climbing turn is commenced at 1,000ft above sea level.

4.1.2.3 Day VMC Take-off Distance – Enhanced Power

Dropdown

- RFM Figure S4-D15. Dropdown 24ft minus 15kt headwind benefit of 23ft, results in a net dropdown of 1 ft.

OEI Continued Take-off Distance

- RFM Figure S4T-D14 Acceleration to Vtoss of 45kt. Fixed distance (all weights) of 350m (**0.19nm**)

Flightpath 1

- RFM Figure S4T-21 Climb to 200ft above the take-off surface (384 ft Above Mean Sea Level (AMSL) – 200ft + CPC-1 helideck height of 184ft). Drag for the sponson mounted life raft applied. The landing gear remains down until 200ft, so no additional drag penalty is required– **(0.14nm).** See AW169 RFM Supplement 4 page S4T-7

Level Acceleration from Vtoss (45kt) to Vy (75kt)

- RFM Figure S4-31 still air distance is 660m (**0.36nm**). However, as wind benefit is permitted for dropdown, Flightpath 1 and Flightpath 2, it is logical to allow it for the level acceleration phase, this is not prohibited by the RFM. Allowing for a 15kt wind at 75kt (Vy) would reduce the distance to 528m (**0.29nm**). Distances for each option are provided (see below where it is stated "*N.B. With wind benefit for the level acceleration phase, this reduces to […]*").

Flightpath 2

- As agreed in Spirit's REP3 – 102. 4.5iii, the climb will be to 500ft above mean sea level. Flightpath 2 will therefore be a climb of 116ft before a turn is commenced (500ft – FP1 200ft – helideck height 184ft).
- Drag penalties for the external life raft and fixed undercarriage have been applied as per RFM Figure S4-9. RFM Figure S4-42 shows a Flightpath 2 climb of 116ft will require a lateral distance of 440m (**0.24nm**)

Rate 1 turn at 500ft

- The turn at 500ft will be made at 75kt (Vy) using a Rate 1 turn. This will have a radius of **0.40nm**.

VMC Buffer from obstacle

- 150m (**0.08nm**) as per SERA.5005 (f)(2)

Summing the distances:

- OEI Continued take-off – **0.19nm**
- Flightpath 1 climb to 200ft above the helideck **– 0.14nm**
- Level acceleration Vtoss to Vy – **0.36nm** *(0.29nm with wind benefit)*
- Flightpath 2 climb from 384ft AMSL to 500ft AMSL – **0.24nm**
- Rate 1 turn at Vy - **0.40nm**
- VMC Buffer – **0.08nm**

Total distance required - 1.41nm

N.B. With wind benefit for the level acceleration phase, this reduces to **1.34nm**.

4.1.2.4 Day VMC Take-off Distance – Standard Power

Dropdown

- RFM Figure S4-D15. Dropdown 34ft minus 15kt headwind benefit of 25ft, results in a net dropdown of 9 ft.

OEI Continued Take-off Distance

- RFM Figure S4T-D14 Acceleration to Vtoss of 45kt. Fixed distance (all weights) of 350m (**0.19nm**)

Flightpath 1

- RFM Figure S4-21. Climb to 200ft above the take-off surface (384 ft AMSL – 200ft + CPC-1 helideck height of 184ft). Drag for the sponson mounted life raft applied. The landing gear remains down until 200ft, so no additional drag penalty is required* – **(0.15nm).** See AW169 RFM Supplement 4 page S4T-7 **Level Acceleration from Vtoss (45kt) to Vy (75kt)**
- RFM Figure S4-32 still air distance is 660m(**0.36nm**). However, as wind benefit is permitted for dropdown, Flightpath 1 and Flightpath 2, it is logical to allow it for the level acceleration phase, this is not prohibited by the RFM. Allowing for a 15kt wind at 75kt (Vy) would reduce the distance to 528m (**0.29nm**). Distances for each option are provided.

Flightpath 2

- As agreed in Spirit's REP3 – 102. 4.5iii, the climb will be to 500ft above mean sea level. RFM Figure S4-42 Flightpath 2 will be a climb of 116ft before a turn is commenced (500ft – FP1 200ft – helideck height 184ft).
- Drag penalties for the external life raft and fixed undercarriage have been applied as per RFM Figure S4-9. Figure S4-9 shows a Flightpath 2 climb of 116ft will require a lateral distance of 440m (**0.26nm**)

Rate 1 turn at 500ft

- The turn at 500ft will be made at 75kt (Vy) using a Rate 1 turn. This will have a radius of **0.40nm**.

VMC Buffer from obstacle

- 150m (**0.08nm**) as per SERA.5005 (f)(2)

Summing the distances:

- OEI Continued take-off – **0.19nm**
- Flightpath 1 climb to 200ft above the helideck **– 0.15nm**

- Level acceleration Vtoss to Vy – **0.36nm** *(0.29nm with wind benefit)*
- Flightpath 2 climb from 384ft AMSL to 500ft AMSL – **0.26nm**
- Rate 1 turn at Vy - **0.40nm**
- VMC Buffer – **0.08nm**

Total distance required - 1.44nm

N.B. With wind benefit for the level acceleration phase, this reduces to **1.37nm**.

61. It should be noted that the figure of 1.44nm is a worst-case distance allowing for the AW169 helicopter taking off at the maximum mass of 4,800kg and having not received the engine performance upgrade, which is fundamentally a safety upgrade, by 2030.

4.1.2.5 Comparison With the Spirit Energy Assessment

62. In their REP1-116 paragraph 2.13, Spirit Energy state that 1.9nm is required for both a VMC approach and take-off. Spirit Energy have applied "professional judgement" to add an additional 1nm to their calculated approach distance. However, this is not stated in CAA or HeliOffshore guidance or any other industry best practice. Spirit Energy's REP1-116 Appendix A section 8.3 calculates that a distance of 1.76nm is required for a one engine inoperative take-off in VMC. A number of errors are made in this calculation, most notably it calculates a climb to 500ft above helideck height (684ft in the case of CPC-1), rather than 500ft above sea level. It is understood that Spirit Energy has recalculated the distance but has not shared the revised calculations with the Applicant.

63. In paragraph 4.1.1 it is demonstrated that 1.5nm exceeds the approach distances shown in the CAA's draft CAP 764 and HeliOffshore guidance and is therefore sufficient for continued safe operations.

64. Paragraph 4.1.2 demonstrates that 1.5nm exceeds the distance required for a continued take-off in day VMC following a single engine failure.

4.1.3 Summary of Day VMC Approach and Take-off Distances Required

65. Applying CAA draft guidance, industry guidance and best practice results in a Day VMC approach distance required of 1.01nm. Allowing for one operator that uses a longer stabilisation point, at 0.75nm rather than 0.5nm in the guidance, results in a distance of **1.26nm.** As this is shorter than the 1.5nm,, as provided for in the Protective Provisions in favour of Spirit Energy and Harbour Energy in the draft DCO_Rev 05 (Document Reference 3.1), it is sufficient for an approach.

66. It is of note that the Applicant's position is supported by Perenco, an Interested Party operating a gas platform in proximity to the Dudgeon and Sheringham Shoals Extension Project NSIP, where Perenco stated: *"Perenco maintains that 1.26nm is*

required for VMC access in any wind direction based upon a 0.75nm stabilised approach distance of the future helicopter operator [Bond Helicopters]*."*

67. Applying the same assumptions as Spirit Energy in their AviateQ Report, a one engine inoperative take-off distance from the CPC-1 helideck requires 1.40nm using Enhanced Power or 1.44nm using Standard Power. This is less than the 1.5nm, as provided for in the Protective Provisions in favour of Spirit Energy and Harbour Energy in the draft DCO_Rev 05 (Document Reference 3.1) available in any direction, and so 1.5nm is a sufficient distance in day VMC.

68. The CPC-1 helideck has been used as the basis for this calculation. The Calder NUI is 1.5nm from the Morecambe Offshore Wind Farm Unconstrained Area, although this would be more than 2nm when taking into consideration the proposed mitigation of the Take-off Corridor, see Section 7. As Calder has 1.5nm, and potentially more, available for take-off and landing, this NUI will not have any additional constraints compared to CPC-1. The DP-6 and DP-8 NUIs are further from the Morecambe Offshore Windfarm than CPC-1 and so the access restrictions will be similar or lesser.

69. The issues addressed in this section are not new. Helicopters are conducting safe approaches and take-offs to helidecks located inside and adjacent to wind farms under the same CAT Regulations as those applied to the Morecambe Bay Operation. It should also be noted that the AW169 is used by another operator that fly on a daily basis into the Hornsea One and Two wind farms with wind turbines as close as 1,000m (0.54nm) from the helidecks. The daily offshore helicopter flight schedules, showing times and destinations, are published on the operators' websites. If these distances were unsafe, the CAA as the safety regulator, would intervene.

4.2 Instrument Meteorological Conditions

70. In IMC all obstacles must be avoided by at least 1nm laterally and 1,000ft vertically. The lateral avoidance distance of 1nm is due to a combination of the accuracy of aircraft navigation systems and the discrimination of the helicopter's onboard radar.

4.2.1 Instrument Meteorological Conditions Approach Distance

71. In the Environmental Statement (ES) Chapter 17, Appendix 17.1 – Helicopter Access Study (APP-081) Section 2.2.6, the profile for an offshore Airborne Radar Approach (ARA) is identified. The Applicant has assumed that a 9nm unobstructed approach arc is required for an approach in IMC. Spirit Energy's REP1-116 2.22.2 states that: "*3.9nm - Minimum distance for safe CAT operations for both platform approach and OEI take off in IMC conditions using Instrument Flight Rules (IFR)*". In the opinion of the Applicant 3.9nm is an insufficient distance for an approach in IMC, and so a 3.9nm buffer to the south would still not permit an IMC approach with a northerly wind.

72. Both day and night IMC have the same requirements, except that the Minimum Descent Altitude is 300ft (or deck height +50ft) at night and 200ft (or deck height +50ft) by day.

4.2.2 Instrument Meteorological Conditions Take-off Distance – Maximum Take-off Mass 4800 kg

73. As for a take-off in VMC, the helicopter operator must take account of an engine failure on take-off. In IMC the same profile is followed initially, but due to the increased pilot workload in IMC, a turn will not be made until 1,000ft above sea level. In the case of Enhanced Power, and applying the assumptions listed in section 4.1.2.1 to align with Spirit Energy's assumptions, such as only considering take-off at the helicopter's maximum mass of 4,800kg, will result in a take-off distance of 2.35nm plus a 1nm IMC buffer (see paragraph 60), requiring an obstacle free take-off path of 3.35nm.

74. The distances are summarised below with full calculations provided in Appendix B:

- OEI Continued take-off – **0.19nm**
- Flightpath 1 climb to 200ft above the helideck **– 0.14nm**
- Level acceleration Vtoss to Vy – **0.36nm** *(0.29nm with wind benefit)*
- Flightpath 2 climb from 384ft AMSL to 100ft AMSL – **1.26nm**
- Rate 1 turn at Vy - **0.4nm**
- IMC Buffer – **1nm**

Total distance required – 2.35nm plus the 1nm IMC buffer = 3.35nm.

N.B. With wind benefit[9] for the level acceleration phase, this reduces to **2.28nm plus the 1nm IMC buffer = 3.28nm**.

4.2.3 Instrument Meteorological Conditions Take-off Distance – Maximum Take-off Mass 4800 kg - Standard Power

75. Although it is anticipated that the helicopter operator will upgrade their AW169 helicopters to Enhanced Power by 2030, an absolute worst case is that they will

[9] Taking off into wind results in a groundspeed lower than the airspeed (groundspeed = airspeed ± wind speed). At a lower ground speed the distance required to climb to a given height at a defined airspeed (75kt in the case of the AW169 engine failure profile) is reduced when flying into wind. The same principle applies to the level acceleration phase, a lower groundspeed will result in a shorter distance to accelerate from 45kt to 75kt.

retain Standard Power. Therefore, the take-off distance required as summarised below, with detailed calculations shown in Appendix B.

- OEI Continued take-off – **0.19nm**
- Flightpath 1 climb to 200ft above the helideck **– 0.15nm**
- Level acceleration Vtoss to Vy – **0.36nm** *(0.29nm with wind benefit)*
- Flightpath 2 climb from 384ft AMSL to 500ft AMSL – **1.37 nm**
- Rate 1 turn at Vy - **0.40nm**

Total distance required – 2.46nm plus the 1nm IMC buffer = 3.46nm

N.B. With wind benefit for the level acceleration phase, this reduces to **2.39nm plus the 1nm IMC buffer = 3.39nm**.

4.2.4 Instrument Meteorological Conditions Take-off Distance – Maximum Take-off Mass 4400 kg

76. The Applicant considers that operations at 4,800kg will be less common than stated by Spirit Energy and have therefore calculated the distance required for a take-off mass of 4,400kg, assuming that the helicopter is upgraded to Enhanced Power.

77. The distances at a take-off mass of 4,400kg are summarised below:

- OEI Continued take-off – **0.19nm**
- Flightpath 1 climb to 200ft above the helideck **– 0.10nm**
- Level acceleration Vtoss to Vy – **0.36nm** *(0.29nm with wind benefit)*
- Flightpath 2 climb from 384ft AMSL to 100ft AMSL – **0.84nm**
- Rate 1 turn at Vy - **0.40nm**
- IMC Buffer – **1nm**

Total distance required – 1.88nm plus the 1nm IMC buffer = 2.88nm.

N.B. With wind benefit for the level acceleration phase, this reduces to **1.81nm plus the 1nm IMC buffer = 2.81nm**

4.2.4.1 Comparison With the Spirit Energy Assessment

78. The Spirit Energy calculation of 3.76nm required for a climb in IMC following an engine failure differs from the Applicant's calculations in a number of areas. The most notable difference is that REP1-116 Appendix A section 9.6 calculates the distance required for a climb to 1,000ft above the CPC-1's helideck, so 1,184ft. It is

understood that Spirit Energy has recalculated their take-off distance but has not yet shared the calculations with the Applicant.

79. The Applicant has aligned with the Spirit Energy assumptions (except where they deviate from the RFM[10] and calculated a take-off distance of 3.28nm at the maximum take-off mass of 4,800kg and a distance of 2.88nm at a mass of 4,400kg. Both figures use Enhanced Power, which as a safety upgrade, is reasonably expected to be embodied in the AW169 by 2030. To show a direct comparison with the Spirit calculations, the calculation using standard power at a mass of 4,800kg is also shown.

4.3 Night Visual Meteorological Conditions

80. It has been noted in the Vantage POB flight data provided by Spirit Energy that the number of night flights has declined in recent years.

4.3.1 Night Visual Meteorological Conditions Approach Distance

81. Night operations are designated as being in a DVE. Therefore, the additional 1nm Final Approach Track described in draft CAP764 is applicable. Adding 1nm to the 0.5nm stabilisation point, plus allowing sufficient space for a turn onto final approach results in a minimum night VMC approach distance of 2.01nm. This is the distance of 1.01nm, calculated in Section 4.1.1.1 with an additional 1nm added.

4.3.2 Night Visual Meteorological Conditions Take-off Distance

82. Night VMC applies with a cloud base of 1,200ft or higher and a visibility of 5,000m or greater. Night operations are regarded as being in a DVE and so a longer stabilisation distance is required for the approach. Due to the increased pilot workload at night, a worst-case assumption would be to assume that following an engine failure the pilots would climb to 1,000ft above sea level, i.e. follow an IMC flight profile. Therefore, the take-off distance required will be as shown in Section 4.2.2. As it is more difficult to judge distances at night, a conservative approach would be to adopt a 1nm lateral avoidance of obstacles, as is applied to IMC.

- [10] Spirit Energy has applied an additional drag penalty due to the undercarriage during the Flightpath 1 climb to 200ft above the helideck height. This penalty is already accounted for in the performance graphs and so it double accounts for this drag component.
- Spirit Energy has revised its calculations to use 2 ½ minute emergency power to 200ft above sea level, so 16 ft above the height of the CPC-1 helideck. This is despite the RFM stating that Flightpath 1 is above Take-off Surface. So the climb using 2 ½ minute emergency power should be to 200ft above helideck height, 384ft in the case of CPC-1 (deck height 184ft +200ft). See Appendix A scanned page S4T-D13 checklist item 4.

4.3.2.1 Comparison With the Spirit Energy Assessment

83. Spirit Energy has not identified any specific night approach or take-off requirements in their submissions. The Applicant has adopted a conservative view and assumed that IMC approach and take-off criteria will be applied to night VMC operations.

5 Precedence for Helicopter Flights near Wind Farms

84. Helicopter operations close to wind farms are not a new issue. This section discusses examples of helicopter flights being undertaken close to offshore wind farms with the distances quoted being considered safe for helicopter operations.

5.1 Beatrice Complex

85. In 2006 two 500ft high wind turbines were constructed 0.75nm away from the Beatrice A platform. The operator flew proving flights with their CAA Operations Inspector to determine safe day and night VMC and IMC approach arcs and departures. At that time the Beatrice A was a manned platform with circa 100 personnel onboard. Shuttle operations were conducted from the Beatrice A to the Beatrice B and Beatrice C NUIs, albeit on a lower rate than shuttling from the CPC-1.

5.2 Blyth Platform

86. The Blyth NUI is located approximately 1200m from the nearest WTGs at the Dudgeon Offshore Wind Farm. There have been multiple rig operations at the Blyth platform since the wind farm was constructed.

5.3 Helidecks within Hornsea Wind Farms

87. Current VMC operations include landing on platforms inside the Hornsea One and Two Wind Farms, with wind turbines 0.65nm (1,200m) from the helideck: these flights use a combination of AW169 and AW139 helicopters.

5.4 Walney Extension

88. The Whitehaven and Rhyl wells are located between 1.1nm and 1.3nm from the nearest WTGs associated with the Walney extension OWF. During rig operations when there is a Non-Production Installation (NPI) working over the wells, multiple flights will be required to access the NPI.

5.5 Waveney Platform and Dudgeon Extension

89. The Protected Provisions for the Waveney Platform, adjacent to the Dudgeon Extension Wind Farm, provide for an obstacle free distance of 1.26nm around the platform. The Waveney is a NUI visited on a regular basis.

5.6 Johnston Wellheads and Hornsea Four

90. The Protected Provisions for the Johnston Wellheads, adjacent to the Hornsea Four Wind Farm, provide for a 1,400m wide access corridor and an obstacle free radius of 1,600m around each wellhead. The Johnston Wellheads will require a jack-up rig to work over them for maintenance work or to decommission the assets.

6 Impact on South Morecambe Field

91. Five years of Vantage POB[11] data provided by Spirit Energy was cross referenced with meteorological data for the same period provided by Spirit Energy and civil twilight times to determine whether a flight was day, night, VMC and/or IMC using meteorological limits that are defined in APP-081 Section 2.2.2.

92. Account has been taken of the proposed CAA increased meteorological limits[12]. Therefore, to conduct a day VMC approach or take-off from an offshore installation within 3nm of a wind farm, the minimum visibility is 5,000m and the minimum cloud base 700ft.

93. This section presents the impact on flights to CPC-1 and NUIs on the assumption that flights at night or in IMC are not permitted with the wind farm in place.

6.1 Cancelled Flights to CPC-1

94. Table 6.1 compares the Spirit Energy and Applicant's assessment of the percentage of cancelled flights to CPC-1 should the wind farm exclude flying at night or in IMC. The assessments are both based on five years of POB Vantage data and meteorological data provided by Spirit Energy.

Table 6.1 Cancelled Flights to CPC-1

	Spirit Energy	Applicant
Reference	RR-077 Appendix D Slide 23	APP-081 Appendix A Tables A1-A4
% Cancelled Flights CPC-1	9%	8.5%
% Delayed Flights CPC-1	5%	N/A

95. The Applicant's assessment assumes that if the conditions were not day VMC at the time of the flight, then the flight would be cancelled and does not consider the possibility of delaying the flight. Spirit Energy, in contrast, state that 9% of flights would be cancelled with an additional 5% delayed.

[11] https://logic-energy.org/vantagepob/#:~:text=Vantage%20POB%20is%20LOGIC's%20shared,the%20UKCS%20for%2020%20years

[12] This takes account of the proposed CAA change to day VMC limits within 3nm of a wind farm. This is a conservative assumption, as the current limits are lower, with a minimum cloud base of 600ft and minimum visibility of 4,000m.

96. The Applicant's assessment considered each landing/take-off from CPC-1 as a separate flight. It is understood that Spirit Energy considered the whole flight from Blackpool to Blackpool, including all legs to various NUIs. The following section considers the impact to NUIs taking into consideration that if one flight to or from the NUI is not available, then the corresponding return or outgoing flight would also not be undertaken, as two flights are needed to insert and extract a work party.

6.2 Updated NUI Assessment

97. In their REP4-069 Spirit Energy provided a revised access assessment for NUIs, where the impact assessed is in terms of time lost offshore as opposed to cancelled flights (in comparison to the CPC-1 analysis above which considers cancelled flights). In slide 7 (page 40/124) they have reduced their assessment of annual impact to NUI flights from an annual figure of 23% lost flights to 13% lost time offshore, with the winter impact reducing from 39% to 22%. The loss of night flying remains the major factor in the reduced access. It is understood from Spirit Energy's REP4-069 slide 7 that most of the improved access they have calculated is due to updating their Sunset and Sunrise times to align with aviation standards and a revision to the methodology to consider lost time offshore instead of cancelled flights for the NUIs.

98. The Applicant's assessment has taken a binary approach to identify if a flight could have taken place at the time shown in the Vantage data or had to be cancelled because of IMC or night conditions. In many cases it would have been possible to delay a flight until the weather improved, or bring a flight forward to avoid night. Delaying a flight or bringing forward a night flight would shorten the shift length on a NUI: this is assessed in the DNV Report (Document Reference 9.59.2).

99. In REP4-069 slide 8 (page 41/124) Spirit Energy state they have applied an additional restriction as they consider 1.5nm is insufficient to take-off even in VMC conditions in certain wind directions (note that AviateQ's assertion that a 1.9nm buffer is needed to allow for continued day VMC access is explained to be inappropriately conservative in section 4.1 above). They conclude that this would result in an additional 22% impact on NUI operations, resulting in a cumulative impact of 44%. However, as demonstrated in Section 4.1.2 even at the maximum take-off mass of 4,800kg 1.5nm is sufficient for a take-off with an engine failure occurring at the worst possible point, i.e. on rotation from the helideck.

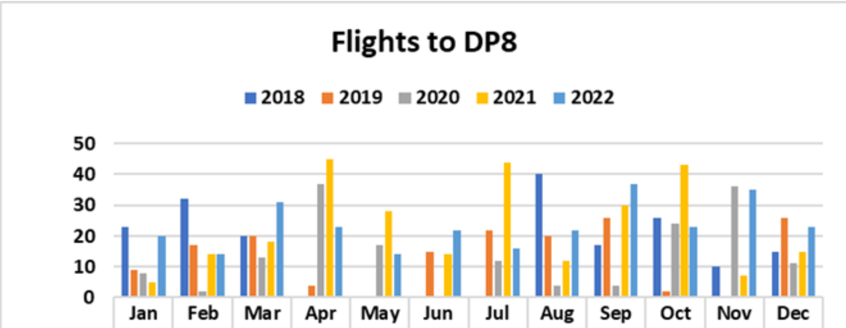
6.3 Applicant's Updated NUI Assessment

100. The Applicant has taken account of Spirit Energy's comments in REP 1-116 Appendix D and conducted a NUI specific assessment to identify the impact on an annual and monthly basis. For this study the DP-8 NUI was selected, as this is a major asset that is certified for night operations. It can be assumed that as CPC-1 and the NUIs are all located in a small area, access to DP-8 is an analogue for access to any other NUI in the local area, which also includes DP-6 and Calder. The Applicant's assessment of flights to DP-8 has been shared with Spirit Energy. As with the

Helicopter Access Study (APP-081), meteorological data and Vantage flight data provided by Spirit Energy was used for the assessment.

6.3.1 Flights to DP-8

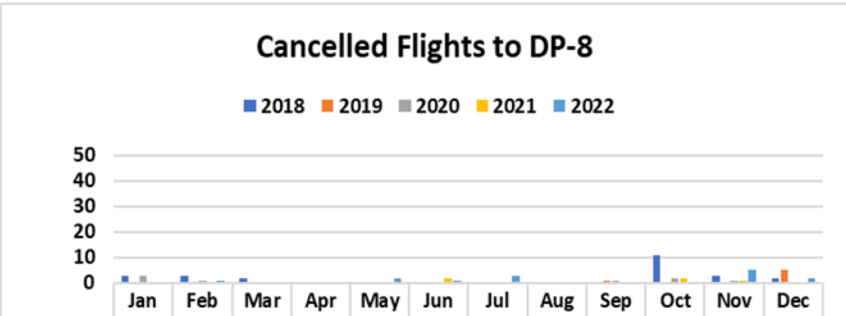
101. Figure 6.1 shows the breakdown of flights to DP-8 by month and year. It can be seen that the number of flights per month varies.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2018	23	32	20	0	0	0	0	40	17	26	10	15
2019	9	17	20	4	0	15	22	20	26	2	0	26
2020	8	2	13	37	17	0	12	4	4	24	36	11
2021	5	14	18	45	28	14	44	12	30	43	7	15
2022	20	14	31	23	14	22	16	22	37	23	35	23

Figure 6.1 Flights to DP-8 2018 to 2022

102. Figure 6.2 shows the number of cancelled flights to DP-8. They would be considered cancelled if the landing time was at night or if the conditions were IMC. No rescheduling was considered, such as bringing forward the timings of a flight so that it occurred in daylight and not at night. Therefore, this can be considered an absolute worst-case assessment.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2018	3	3	2	0	0	0	0	0	0	11	3	2
2019	0	0	0	0	0	0	0	0	1	0	0	5
2020	3	1	0	0	0	0	0	0	1	2	1	0
2021	0	0	0	0	0	2	0	0	0	2	1	0
2022	0	1	0	0	2	1	3	0	0	0	5	2

Figure 6.2 Cancelled Flights to DP-8 2018 to 2022

103. It can be seen that the largest number of cancelled flights occurred in 2018, which aligns with a higher number of night flights being conducted in 2018 by Spirit Energy. It is agreed with Spirit Energy that a single cancelled flight to a NUI has a compound impact as two flights are necessary to insert and then extract a work party from a NUI. Table 6.2 doubles each cancelled flight and then shows the compounded impact by year and month.

Table 6.2 Compounded Impact on DP-8 by Month and Year – 2018 to 2022

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	%
2018	6	6	4	0	0	0	0	0	0	22	6	4	48	**26%**
2019	0	0	0	0	0	0	0	0	2	0	0	10	12	**7%**
2020	6	2	0	0	0	0	0	0	2	4	2	0	16	**10%**
2021	0	0	0	0	0	4	0	0	0	4	2	0	10	**4%**
2022	0	2	0	0	4	2	6	0	0	0	10	4	28	**10%**
Total	12	10	4	0	4	6	6	0	4	30	20	18		
%	**18%**	**13%**	**4%**	**0%**	**7%**	**12%**	**6%**	**0%**	**4%**	**25%**	**23%**	**20%**		

104. It can be seen that the largest annual impact was in 2018, when a higher number of night flights were conducted (APP-081 Appendix A Table A.3). If the annual percentage impacts in Table 6.2 are averaged, then the mean annual impact is 10.7%.

105. The Applicant has repeated the analysis above for all the NUIs (DP-8, DP-6 and Calder). Table 6.3 summarises the Spirit Energy annual average and winter average and compares it to the Applicant's assessment of DP-8 and all the NUIs overall.

Table 6.3 Annual Impact on NUI Operations

	Spirit Energy	Applicant	Applicant
Reference	REP4-069 slide 7	DP-8 Analysis	All NUIs Analysis
Average NUI Annual Impact[13]	13%	10.7%	12.2%
Winter NUI Impact (October to March)	22%	17.3%	20.4%

[13] Impact = lost time offshore for Spirit Energy analysis compared to cancelled flights for Applicant's analysis

106. The annual and winter impact for all NUIs calculated by the Applicant is similar to the impact stated by Spirit Energy in their REP4-069. However, it is a skewed mean due to the higher rate of night flying in 2018. A similar case can be made for the impact on Winter operations, as the 22% impact stated by Spirit Energy is skewed by the higher number of night flights in 2018. The Applicant's analysis shows that although there is an impact on NUIs, the historic impact on flights has declined since 2018 due to a reducing number of night flights.

107. It is noted that this does not consider the additional impact stated by Spirit Energy due to reduced access in day VMC, as the Applicant does not consider there to be any additional impact on day VMC flights.

108. The DNV Report (Document Reference 9.59.2) includes an assessment of the impact to NUIs based on Spirit Energy's lost time offshore approach for comparison.

7 Proposed Mitigation

7.1 Take-Off Corridor

109. CPC-1 contains the principal helideck for both crew change flights to the South Morecambe Platforms, where circa 170 personnel can be accommodated, and the hub for helicopter shuttling operations to the Calder, DP-6 and DP-8 Platforms. As impact is greatest on the CPC-1 helideck, then means to mitigate the impact on the crew change flights and shuttling operations to NUIs was considered. REP2-032 identified that IMC access to CPC-1 would be constrained, as in IMC a lateral distance of 1nm has to be maintained from all obstructions. The 1nm buffer around the Morecambe Wind Farm is shown in Figure 7.1.

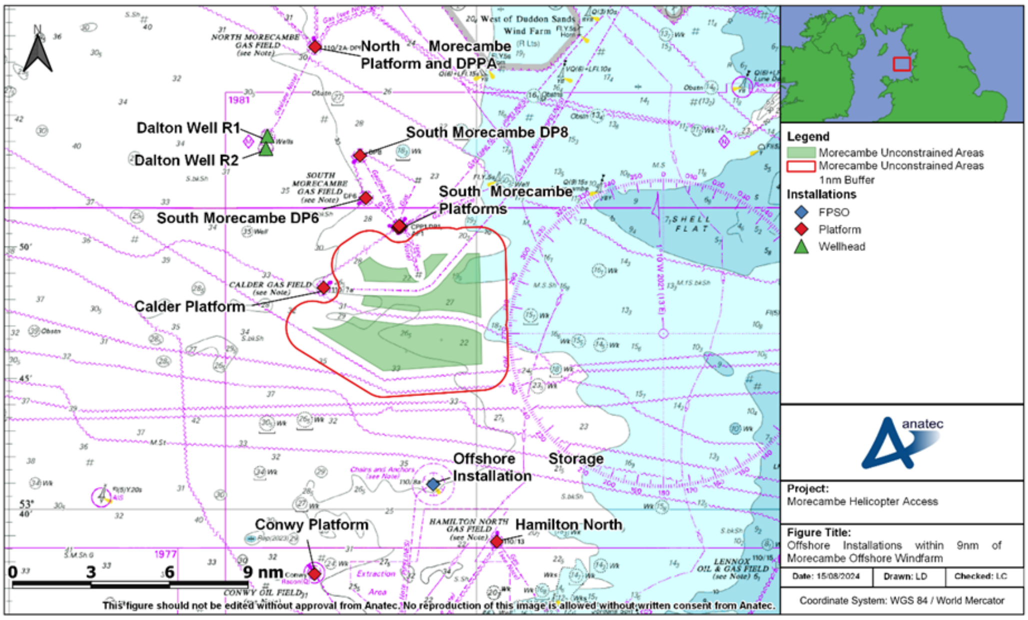


Figure 7.1 Morecambe Unconstrained Areas with a 1nm Buffer

110. Meteorological data shows that the prevailing wind direction for day IMC is from the south-west, both for day and night IMC.

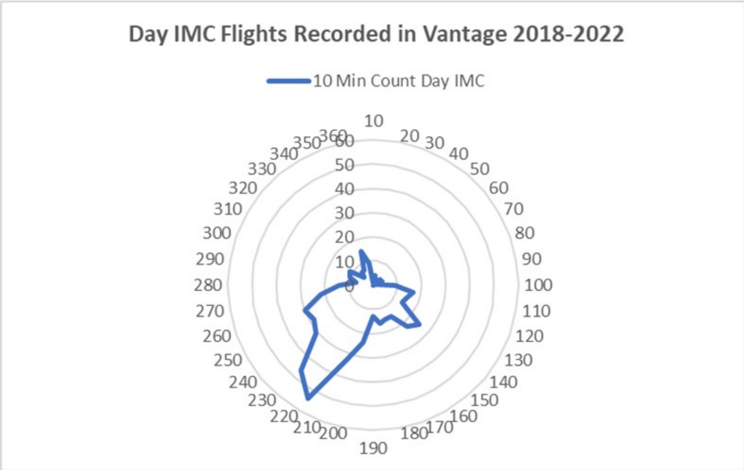


Figure 7.2 Wind Directions for Day IMC Flights Recorded in Vantage

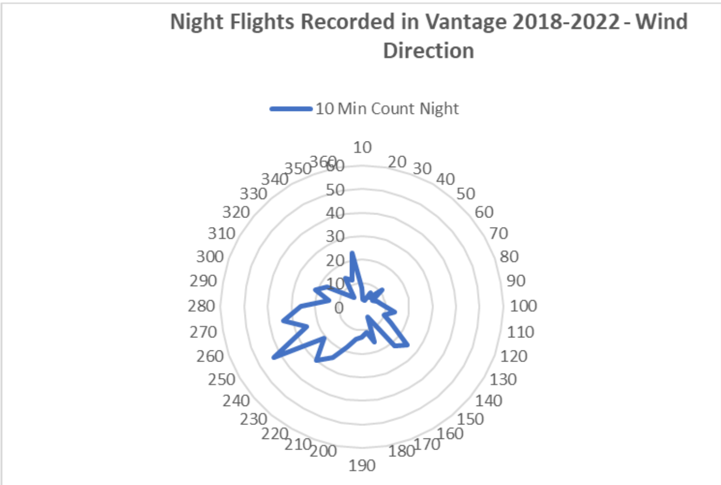


Figure 7.3 Wind Directions for Night Flights Recorded in Vantage

111. If a take-off area from CPC-1 was provided into the prevailing wind, then IMC access for CPC-1 would be increased and the impact on the Morecambe Wind Farm would be reduced, compared to providing a 360° obstacle free area. An example obstacle free corridor with a width of 2nm (1nm either side of a 220° bearing from CPC-1) and a length of 4nm is shown in Figure 7.4. This distance would be sufficient for a one-engine inoperative climb, even taking Spirit's position that 3.76nm is required, as more than 3.76nm will be available, orientated into the prevailing wind.

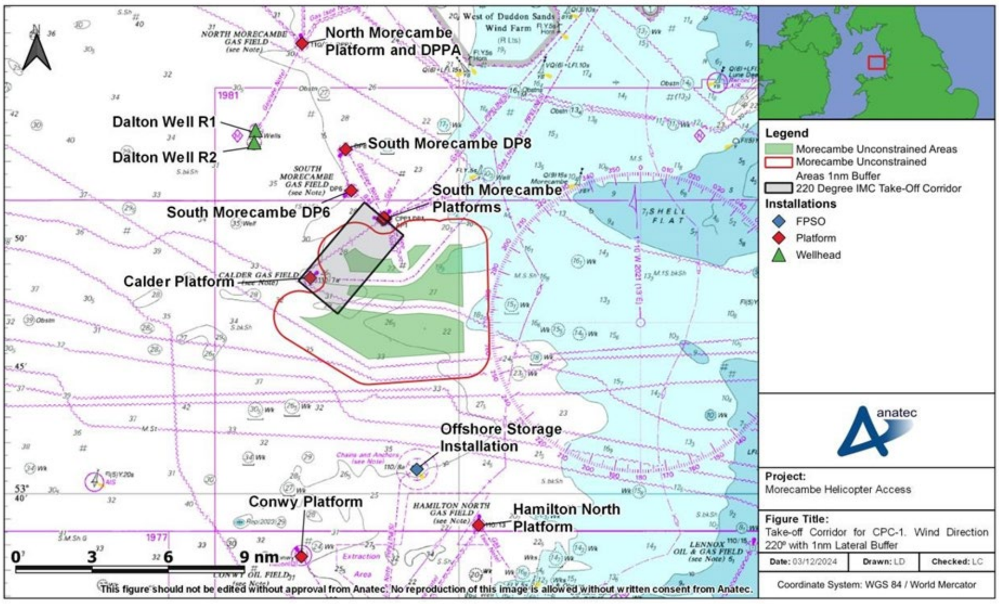


Figure 7.4 Take-off Corridor for CPC-1. Wind Direction 220º with 1nm Lateral Buffer

112. In addition to providing an IMC take-off path into the prevailing IMC wind direction, the Take-off Corridor would have the added benefit of increasing night VMC access and increase the obstacle free radius around the Calder Platform.

113. If a helicopter corridor was aligned 040º / 220º, with a 1nm obstacle free buffer to the east, it would permit an increased number of take-offs and approaches in IMC. The available take-off arc would be 220º clockwise to 090º. ARA can be flown up to 30º out of wind, subject to a maximum crosswind of 10º, because the helicopter is turned into wind after the Missed Approach Point. The take-off case is more wind critical due to performance considerations.

7.1.1 Analysis of Spirit Energy's Commentary

114. Spirit Energy has calculated an IMC take-off distance of 3.76nm. The IMC Take-off Corridor shown in Figure 7.4 would accommodate their required distance into the prevailing south-westerly wind. Spirit Energy has requested an obstacle free radius of 3.76nm around CPC-1 but this would provide a minor additional benefit as it is uncommon for the wind direction to be southerly when the conditions are IMC or night. Additionally when it is IMC and the wind is northerly, 3.76nm is an insufficient distance for an IMC approach (ARA) as a 9nm obstacle free arc is required to position and then fly the approved profile.

7.1.2 Summary of mitigation effects of Take-Off Corridor

115. For an IMC take-off, an obstacle free arc of 4nm or greater is available from 220º clockwise to 090º. This assumes that all take-offs are directly into wind. For an IMC approach a 9nm arc free from obstacles must be available. It has been agreed

previously with operators that an IMC approach up to 30⁰ out of wind may be conducted. Taking into account the Morecambe Offshore Wind Farm, and maintaining a lateral clearance of 1nm from obstacles, this permits IMC approaches from arcs between 220⁰ clockwise to 300⁰ and 010⁰ clockwise to 090⁰. These arcs are the limiting factor when assessing when both an IMC approach and an IMC take-off may be made.

116. Table 7.1 shows the number of flights that could be flown with the Take-Off Corridor in place, i.e. number of day VMC flights, as well as the day IMC and night flights allowed by the Take-Off Corridor. This is based on individual landings/take-offs at CPC-1.

Table 7.1 Available Access with Take-off Corridor – Individual CPC-1 Flights

	All Flights	Day VMC Flights	Day IMC Flights Allowed by Take-off Corridor	Night Flights Allowed by Take-off Corridor	Percentage of Access with Take-off Corridor
2018	2879	2470	72	135	93%
2019	2440	2282	60	36	98%
2020	1094	1021	33	9	97%
2021	1491	1399	33	16	97%
2022	2118	2003	27	29	97%
Total	**10022**	**9175**	**225**	**225**	**96%**

117. Approximately 50% of all day IMC and night flights could have occurred, halving the impact in these conditions without the corridor in place. These figures take account of when flights actually took place. In the Applicant's REP2-032 the assessment showed that over all day conditions the increased IMC access would have been 62.9%.

118. It is also noted that the 2018-2022 period includes flights to the DP3 and DP4 platforms which have since been decommissioned, and therefore the number of flights is expected to be reduced compared to the period analysed.

119. In summary, the Take-off Corridor would enable a significant number of IMC and night flights to continue if the Morecambe Offshore Windfarm is constructed. This mitigation retains significant access during the final years of the South Morecambe gas fields whilst reducing the impact a 360⁰ obstacle free radius of 3.76nm would have on the wind farm.

120. The DNV report (Document Reference 9.59.2) provides further information on the benefit of the Take-Off Corridor on impact to the NUIs.

7.2 CAA Rule Change – AltMoc

121. Under the current regulations, use of the Take-off Corridor would be available immediately. Post a CAA rule change regarding flights within 3nm of wind turbines, IMC operations would have to be conducted under an AltMoc. In the CAA response to the ExA's first set of written questions (REP3-075) the CAA acknowledged applying for an AltMoc for continued IMC and night operations to the Morecambe Platforms would be considered. The use of AltMocs is standard aviation practice that is dependent on the application demonstrating equivalent or higher standards of safety compared to current operations. The corridor would result in an equivalent level of safety to current operations, where use of the corridor is permitted, as it would provide an obstacle free take-off zone with a lateral displacement from obstructions of 1nm or more, i.e. the current criterion applied to IMC take-offs from CPC-1.

7.2.1 Feasibility of Obtaining an AltMoc

122. As a change to any AMC cannot impose additional requirements on an operator (REP3-071 section 4), then identifying safe approach and departure arcs compliant with the Basic Regulations and Implementing Rules will meet the requirements of an AltMoc. The principal difference between current and future operations will be a reduction in the size of the approach and take-off arcs. As the approach and take-off arcs will comply with all the required lateral and vertical avoidance criteria, and take account of OEI conditions, they will be fully compliant with the Basic Regulations and their Implementing Rules.

123. Based on precedent and professional experience, it is considered that obtaining an AltMoc for continued IMC and Night VMC approaches and take-offs from helidecks adjacent to the Morecambe Wind Farm is feasible. Operations close to wind farms are not a new issue. In 2006 two 500ft high wind turbines were constructed 0.75nm away from the Beatrice A platform. The operator flew proving flights with their CAA Operations Inspector to determine safe day and night VMC and IMC approach arcs and departures. At that time the Beatrice A was a manned platform with circa 100 personnel onboard. Shuttle operations were conducted from the Beatrice A to the Beatrice B and Beatrice C NUIs, albeit on a lower rate than shuttling from the CPC-1.

Appendix A One Engine Inoperative Continued Take-off Performance Graphs

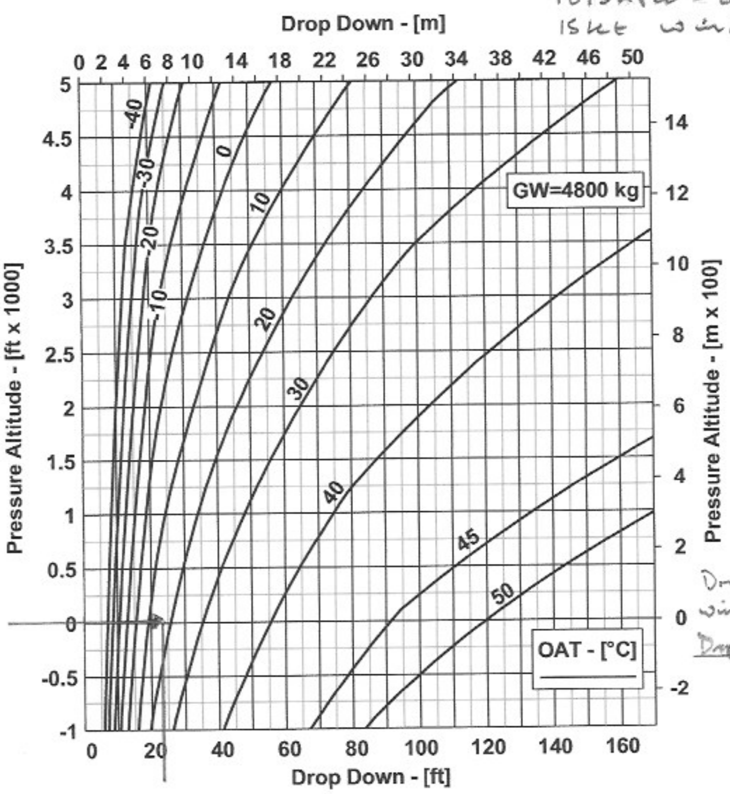
124. The following performance graphs were used to calculate the OEI climb performance, and hence the distances required, shown in Section 4.

(A)

DROP DOWN
OFFSHORE / ELEVATED HELIDECK PROCEDURE
Enhanced Performance

PLUS MODE

15°C
1013hPa = 0 P.A.
15kt wind



Dropdown 24 ft
wind benefit 23 ft
Dropdown 1 ft

Headwind [kt]	5	10	15	20	25	30	35	40	45	50
benefit [ft]	1	9	(23)	40	61	83	106	127	146	161
benefit [m]	0	3	7	12	19	25	32	39	45	49

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Figure S4T-D15 Drop Down Offshore Procedure - Clean Air Intake - 4800 kg

B

SECTION 4 - PERFORMANCE DATA

WAT CHARTS

The Offshore/Elevated Helideck Procedure Weight Limitations chart are shown in Figure S4T-D6 thru Figure S4T-D7B.

OEI CONTINUED TAKE-OFF DISTANCE

The OEI Continued Take-Off distance 350m

OEI CONTINUED TAKE-OFF DROP DOWN

Maximum drop down BTS during CTO.... Figure S4T-D8 thru Figure S4T-D39

WIND EFFECT

For Crosswind and Headwind Component computation for CTO Drop Down Correction refer to Wind Component Chart (Figure S4-33).

TAKE-OFF FLIGHT PATH 1

MEAN HEIGHT GAINED IN 100 FT (30 M) HORIZONTAL DISTANCE

The mean height gained in 100 ft (30 m) of horizontal distance travelled during an OEI climb at V_{TOSS} at 2.5 min power is shown from Figure S4-13 thru Figure S4-30 for various altitudes, temperatures, weights and headwind.

The charts apply from the end of the CTO distance to a height of 200 ft (60 m) ATS.

LEVEL FLIGHT ACCELERATION

The distance for the level flight acceleration from V_{TOSS} at the end of the PATH 1 climb to V_Y the start of the PATH 2 Climb is shown Figure S4-31 thru Figure S4-32B.

(C)

TAKE OFF FLIGHT PATH 1
OEI 2.5 min
ENHANCED PERFORMANCE

ROTOR SPEED: 103%
Vtoss/blss: 45 kts

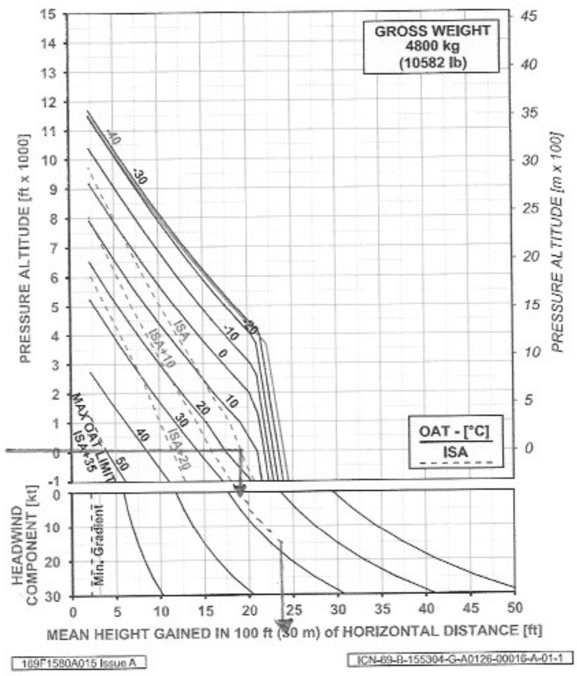

Figure S4-21 PATH 1 Gradient, OEI 2.5 min -
Gross Weight 4800 kg

C1

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Cat.A FLIGHT PATH 1
DRAG FACTORS vs GRADIENT REDUCTION

Ref S4-18
Life rafts drag factor 0.2
Total 0.2

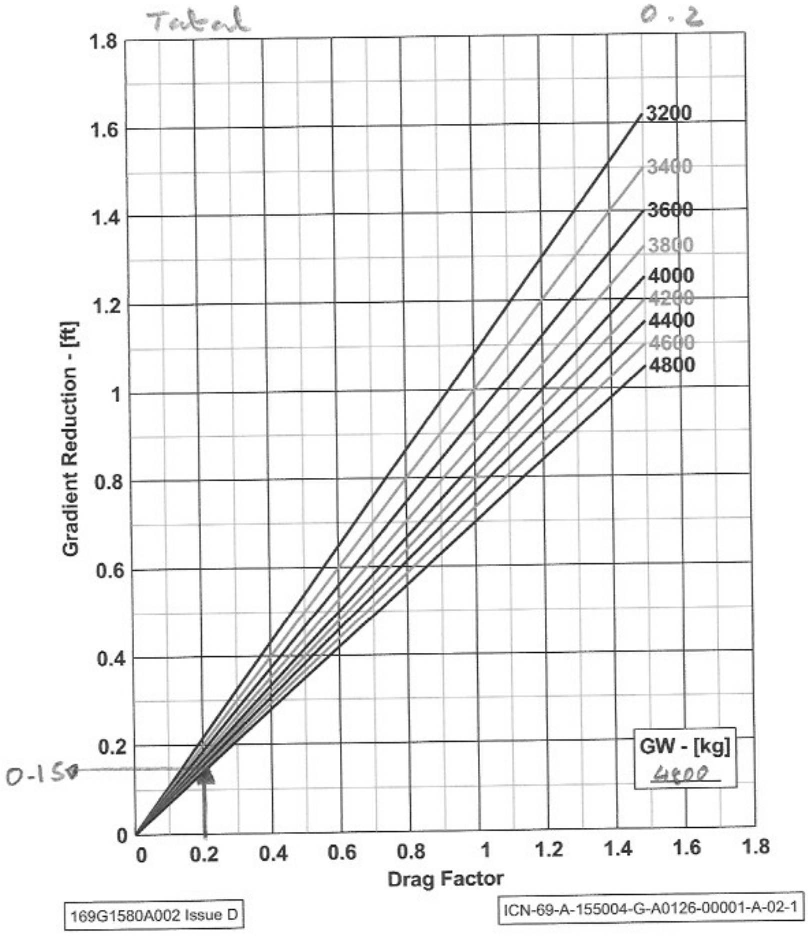

Figure S4-7 Gradient Reduction for PATH 1

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D

DISTANCE REQUIRED for LEVEL ACCELERATION from $V_{TOSS} \backslash V_{BLSS}$ to V_Y ENHANCED PERFORMANCE

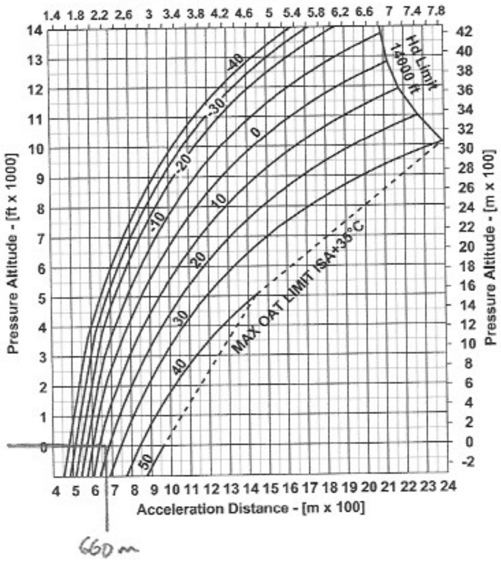

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Figure S4-31 DISTANCE REQUIRED for LEVEL ACCELERATION from $V_{TOSS} \backslash V_{BLSS}$ to V_Y

TAKE OFF FLIGHT PATH 2
OEI CONTINUOUS POWER
ENHANCED PERFORMANCE

ROTOR SPEED: 103 %
Vy: 75 KIAS DECREASE 1 kt EACH 1000 ft ABOVE 10000 ft Hp

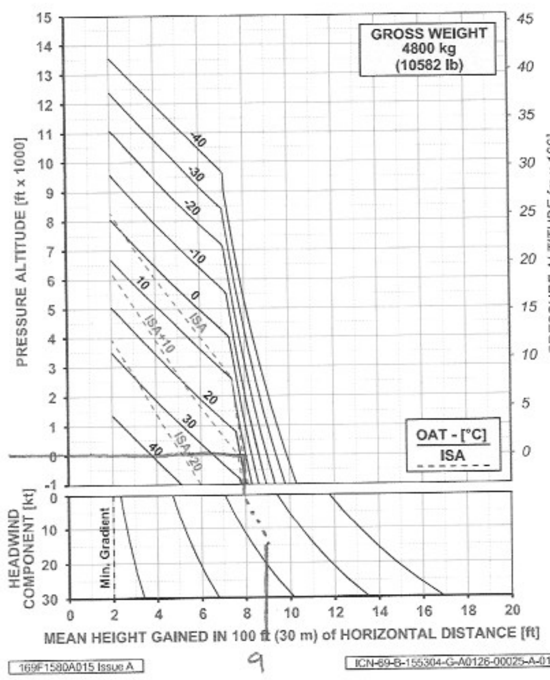

Figure S4-42 PATH 2 Gradient, Continuous OEI Power - Gross Weight 4800 kg

E1

AW169 | AW169 - RFM Document N° 169F0290X001 | Supplement 4 CAT A Operations General

Cat.A FLIGHT PATH 2
DRAG FACTORS vs GRADIENT REDUCTION

Ref S4-18 Fixed gear drag factor 0.4
Life rafts " " 0.2
Total 0.6

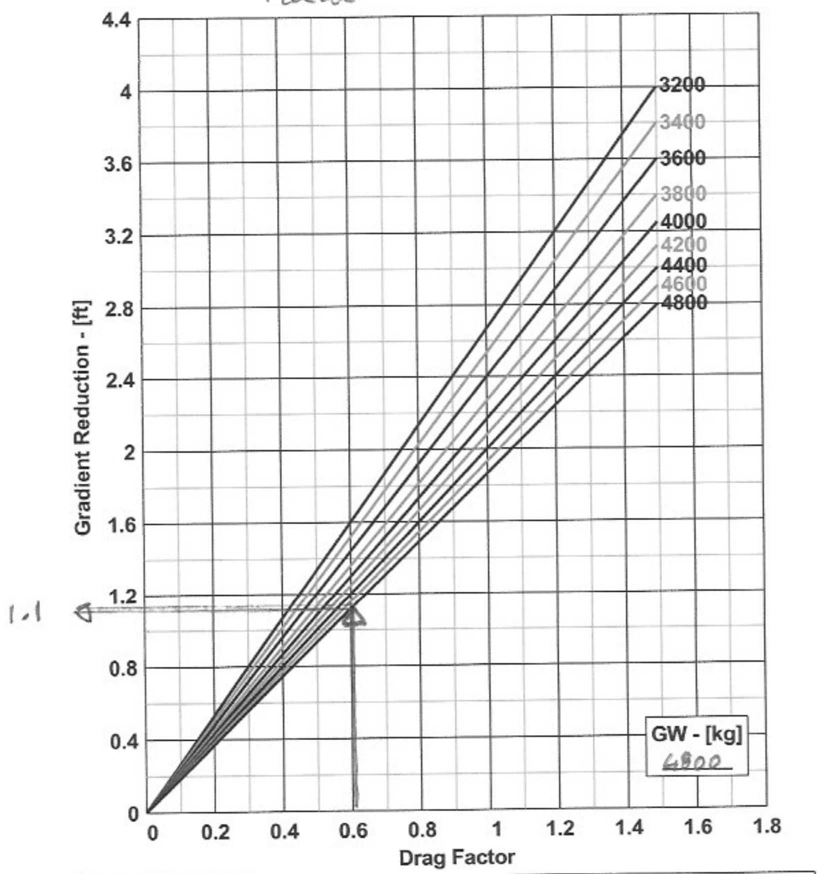

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Figure S4-9 Gradient Reduction PATH 2

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1.	Collective/Cyclic	— Continue rotation to 12° nose down to achieve 15 kts GS using collective to maintain NR close to 93%.
2.	Acceleration/climb	— Increase attitude to 6° nose up and continue acceleration up to V_{TOSS}. When a positive rate of climb is achieved lower collective to recover NR to 101%.
3.	Climb	— When the aircraft achieves VTOSS (45 KIAS) adjust pitch attitude to maintain speed. Continue climb to 200 ft (60 m) ATS, using OEI 2.5 min power rating.
4.	At 200 ft (60 m) ATS ∴ FPI LG IS DOWN AND FACTORED INTO THE DATA.	— Landing Gear UP while accelerating to V_Y using OEI 2.5 min power rating. At V_Y adjust cyclic to maintain speed to continue climb to 1000 ft (300 m) ATS or cruise level whichever comes first, reducing power to OEI continuous rating (148% PI), when convenient before expiry of the OEI 2.5 min power rating.
5.	PARK BRAKE	— Release. Confirm PARK BRK ON advisory extinguishes on CAS.
6.	At 1000 ft (300 m) ATS	— On affected engine, carry out ENGINE SHUTDOWN IN EMERGENCY procedure, Basic RFM page 3-31.
7.	AFTER TAKE-OFF checks (Refer basic RFM page 2-29)	— Complete.
8.	PFD menu	— Select MAG as required.
9.	Refer SINGLE ENGINE PROCEDURE, Basic RFM page 3-96.	

Drag Factor for Optional Kit (only Kit with effect on Performance are reported)		
Kit	**Sup.**	**Drag Factor**
Hoist Goodrich	5	0.30
Extended Landing Gear (Basic Configuration)	-	0.40
Fixed Landing Gear	9	0.40
Life Raft on extended sponson	11	0.20
Electric Pax Footstep	21	0.20

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Figure S4-6 Correction Table for Installed Kits

Appendix B Take-off Performance Calculations

Table B.1 Day VMC Take-off: 4,800kg Enhanced Performance Turning at 500ft AMSL

Enhanced Performance-4800kg	Height gained per 30m laterally	Height(ft)	Distance (m)	Distance (nm)	Cumulative Height Above Sea Level	Notes
Conditions						
Pressure 1013 hPA = 0 ft Pressure Altitude						
Temperature 15 degrees C						
Wind 15 kts						
Aircraft mass 4800kg						
CPC- Helideck Height					184	CPC-1 Helideck 184 ft AMSL HCA Plate - https://www.helidecks.org/certificates/CPC-1%20-%20Plate.pdf
Dropdown		1			183	Figure S4-D15. Dropdown 24ft minus 15kt headwind benefit 23ft Resultant dropdown 1 ft
OEI Continued Take-off Distance			350	0.19		Fixed Value Page S4T-D14
Flightpath 1 Climb Performance(height gained per 30m)	23.5				183	Figure S4-21
Drag reduction penalty (height penalty per 30m)	0.15					Figure S4-7. Only liferaft drag applied
Net rate of climb per 100m laterally (height gained per 30m)	23.35					
Lateral distance to climb to 200ft above helideck height			258.24	0.14		200ft+1 ft dropdown
Level acceleration from Vtoss (45 Kt0 to Vy (75kt) Still Air			660	0.36	384	
Level acceleration from Vtoss (45 Kt) to Vy (75kt) With 15 kt wind			528	0.29	384	
Flightpath 2 Climb Performance(height gained per 30m)	9					Figure S4-42 Figure S4-9 Drag factor of 0.6 includes fixed landing gear and external liferafts
Drag reduction penalty (height penalty per 30m)	1.1					
Net rate of climb per 100m laterally (height gained per 30m)	7.9					
Climb from 384 ft (CPC-1 helideck height +200ft) to 500ft			440.51	0.24	500	
Radius of turn for a Rate 1 turn (3 deg/sec) at 75kt				0.4	500	Rate 1 turn at 75 kt
Minimum Separation distance from obstacles			150	0.08		
Distance required - no wind benefit for level acceleration				1.32		
Distance required - wind benefit for level acceleration				1.25		

Table B.2 Day VMC Take-off: 4,800kg Basic Performance Turning at 500ft AMSL

Basic Performance - 4800kg									
Conditions									
Pressure 1013 hPA = 0 ft Pressure Altitude									
Temperature 15 degrees C									
Wind 15 kts									
Aircraft mass 4800kg									
	Height gained per 30m laterally	Height(ft)	Distance (m)	Distance (nm)					Notes
						Cumulative Height Above Sea Level			
CPC- Helideck Height						184			CPC-1 Helideck 184 ft AMSL HCA Plate - https://www.helidecks.org/certificates/CPC-1%20-%20Plate.pdf
Dropdown		9				175			Figure S4T-D15. Dropdown 34ft minus 15kt headwind benefit 25ft Resultant dropdown 9 ft
OEI Continued Take-off Distance			350	0.19					Fixed Value Page S4T-D14
Flightpath 1 Climb Performance(height gained per 30m)	22.5					175			Figure S4-21
Drag reduction penalty (height penalty per 30m)	0.15								Figure S4-37. Only liferaft drag applied
Net rate of climb per 100m laterally (height gained per 30m)	22.35								
Lateral distance to climb to 200ft above helideck height			280.54	0.15					200ft+9 ft dropdown
Level acceleration from Vtoss (45 Kt0 to Vy (75kt) Still Air			660	0.36		384			
Level acceleration from Vtoss (45 Kt) to Vy (75kt) With 15 kt wind			528	0.29		384			
Flightpath 2 Climb Performance(height gained per 30m)	8.4								Figure S4-42 Figure S4-9 Drag factor of 0.6 includes fixed landing gear and external liferafts
Drag reduction penalty (height penalty per 30m)	1.1								
Net rate of climb per 100m laterally (height gained per 30m)	7.3								
Climb from 384 ft (CPC-1 helideck height +200ft) to 500ft			476.71	0.26		500			
Radius of turn for a Rate 1 turn (3 deg/sec) at 75kt				0.4		500			Rate 1 turn at 75 kt
Minimum Separation distance from obstacles			150	0.08					
Distance required - no wind benefit for level acceleration				1.44					
Distance required - wind benefit for level acceleration				1.36					

Table B.3 IMC Take-off: 4,800kg Enhanced Performance Turning at 1000ft AMSL

Enhanced Performance - 4800kg									
Conditions									
Pressure 1013 hPA = 0 ft Pressure Altitude									
Temperature 15 degrees C									
Wind 15 kts									
Aircraft mass 4800kg									
	Height gained per 30m laterally	Height(ft)	Distance (m)	Distance (nm)					Notes
						Cumulative Height Above Sea Level			
CPC- Helideck Height						184			CPC-1 Helideck 184 ft AMSL HCA Plate - https://www.helidecks.org/certificates/CPC-1%20-%20Plate.pdf
Dropdown		1				183			Figure S4-D15. Dropdown 24ft minus 15kt headwind benefit 23ft Resultant dropdown 1 ft
OEI Continued Take-off Distance			350	0.19					Fixed Value Page S4T-D14
Flightpath 1 Climb Performance(height gained per 30m)	23.5					183			Figure S4-21
Drag reduction penalty (height penalty per 30m)	0.15								Figure S4-7. Only liferaft drag applied
Net rate of climb per 100m laterally (height gained per 30m)	23.35								
Lateral distance to climb to 200ft above helideck height			258.24	0.14					200ft+1 ft dropdown
Level acceleration from Vtoss (45 Kt0 to Vy (75kt) Still Air			660	0.36		384			
Level acceleration from Vtoss (45 Kt) to Vy (75kt) With 15 kt wind			528	0.29		384			
Flightpath 2 Climb Performance(height gained per 30m)	9								Figure S4-42 Figure S4-9 Drag factor of 0.6 includes fixed landing gear and external liferafts
Drag reduction penalty (height penalty per 30m)	1.1								
Net rate of climb per 100m laterally (height gained per 30m)	7.9								
Climb from 384 ft (CPC-1 helideck height +200ft) to 1000ft			2339.24	1.26		1000			
Radius of turn for a Rate 1 turn (3 deg/sec) at 75kt				0.4		1000			Rate 1 turn at 75 kt
Distance required - no wind benefit for level acceleration				2.35		1nm IMC buffer to add			
Distance required - wind benefit for level acceleration				2.28		1nm IMC buffer to add			

Table B.4 IMC Take-off: 4,800kg Standard Performance Turning at 1000ft AMSL

Baseline Performance - 4800kg									
Conditions									
Pressure 1013 hPA = 0 ft Pressure Altitude									
Temperature 15 degrees C									
Wind 15 kts									
Aircraft mass 4800kg									
	Height gained per 30m laterally	Height(ft)	Distance (m)	Distance (nm)					Notes
						Cumulative Height Above Sea Level			
CPC- Helideck Height						184			CPC-1 Helideck 184 ft AMSL HCA Plate - https://www.helidecks.org/certificates/CPC-1%20-%20Plate.pdf
Dropdown		9				175			Figure S4T-D15. Dropdown 34ft minus 15kt headwind benefit 25ft Resultant dropdown 9 ft
OEI Continued Take-off Distance			350	0.19					Fixed Value Page S4T-D14
Flightpath 1 Climb Performance(height gained per 30m)	22.5					175			Figure S4-21
Drag reduction penalty (height penalty per 30m)	0.15								Figure S4-37. Only liferaft drag applied
Net rate of climb per 100m laterally (height gained per 30m)	22.35								
Lateral distance to climb to 200ft above helideck height			280.54	0.15					200ft+9 ft dropdown
Level acceleration from Vtoss (45 Kt0 to Vy (75kt) Still Air			660	0.36		384			
Level acceleration from Vtoss (45 Kt) to Vy (75kt) With 15 kt wind			528	0.29		384			
Flightpath 2 Climb Performance(height gained per 30m)	8.4								Figure S4-42 Figure S4-9 Drag factor of 0.6 includes fixed landing gear and external liferafts
Drag reduction penalty (height penalty per 30m)	1.1								
Net rate of climb per 100m laterally (height gained per 30m)	7.3								
Climb from 384 ft (CPC-1 helideck height +200ft) to 500ft			2531.51	1.37		500			
Radius of turn for a Rate 1 turn (3 deg/sec) at 75kt				0.4		500			Rate 1 turn at 75 kt
Distance required - no wind benefit for level acceleration				2.46		1nm IMC buffer to add			
Distance required - wind benefit for level acceleration				2.39		1nm IMC buffer to add			

Table B.5 IMC Take-off: 4,400kg Enhanced Performance Turning at 1000ft AMSL

Enhanced Performance - 4400kg									
Conditions									
Pressure 1013 hPA = 0 ft Pressure Altitude									
Temperature 15 degrees C									
Wind 15 kts									
Aircraft mass 4400kg									
	Height gained per 30m laterally	Height(ft)	Distance (m)	Distance (nm)					Notes
						Cumulative Height Above Sea Level			
CPC- Helideck Height						184			CPC-1 Helideck 184 ft AMSL HCA Plate - https://www.helidecks.org/certificates/CPC-1%20-%20Plate.pdf
Dropdown		0				184			Figure S4T-D13. Dropdown 3t minus 15kt headwind benefit 15ft Resultant dropdown 0 ft - no credit taken for remaining above deck height
OEI Continued Take-off Distance			350	0.19					Fixed Value Page S4T-D14
Flightpath 1 Climb Performance(height gained per 30m)	33								Figure S4-19
Drag reduction penalty (height penalty per 30m)	0.15								Figure S4-7. Only liferaft drag applied
Net rate of climb per 100m laterally (height gained per 30m)	32.85								
Lateral distance to climb to 200ft above helideck height			182.65	0.10		384			200ft - nil dropdown
Level acceleration from Vtoss (45 Kt0 to Vy (75kt) Still Air			660	0.36		384			Figure S4-31 No credit for wind
Level acceleration from Vtoss (45 Kt) to Vy (75kt) With 15 kt wind			528	0.29		384			Apply wind factor
Flightpath 2 Climb Performance(height gained per 30m)	13								Figure S4-40 Figure S4-9 Drag factor of 0.6 includes fixed landing gear and external liferafts
Drag reduction penalty (height penalty per 30m)	1.1								
Net rate of climb per 100m laterally (height gained per 30m)	11.9								
Climb from 384 ft (CPC-1 helideck height +200ft) to 1000ft			1552.94	0.84		1000			
Radius of turn for a Rate 1 turn (3 deg/sec) at 75kt				0.4		1000			Rate 1 turn at 75 kt
Distance required - no wind benefit for level acceleration				1.88		1nm IMC buffer to add			
Distance required - wind benefit for level acceleration				1.81		1nm IMC buffer to add			