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Dear Kay, K-J

Please find attached the 16th instalment of documents.

Best regards,

Dr Dominika Chalder PIEMA
Environment and Consent Manager

[redacted]

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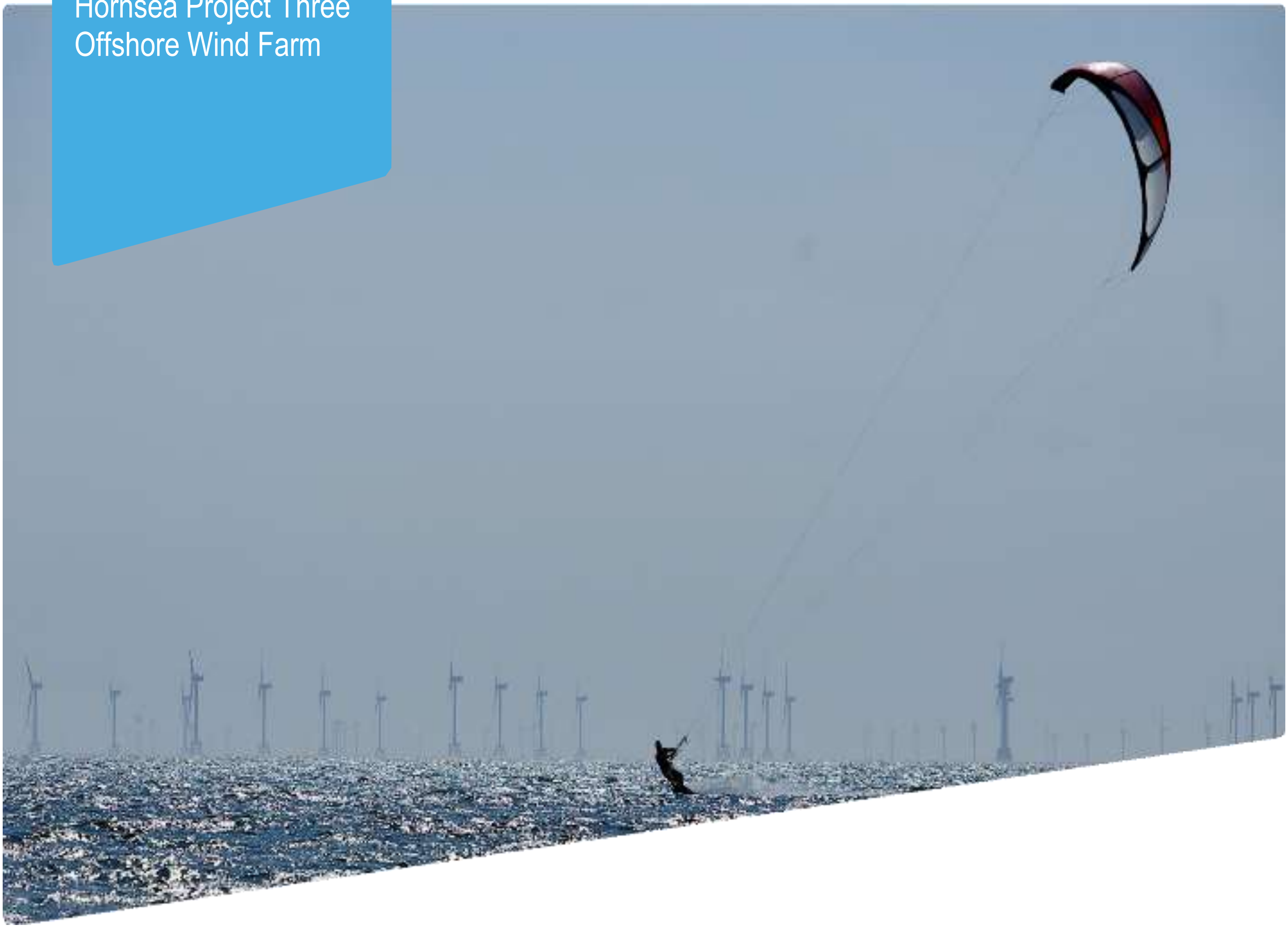
Hornsea Project Three
Offshore Wind Farm



Hornsea Project Three

Offshore Wind Farm

Appendix 76 to Deadline 4 Submission – HeliOffshore 2017 (Approach Path Management Guidelines)

Date: 15th January 2019

Hornsea 3
Offshore Wind Farm

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Front cover picture: Kite surfer near a UK offshore wind farm © Ørsted Hornsea Project Three (UK) Ltd., 2019.

Issue 1 Version 3.0: July 2017

Operational Effectiveness

Approach Path Management Guidelines

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HeliOffshore

Safety Through Collaboration

Contents

This manual has been prepared and reviewed by the Approach Path Management Workgroup and approved by HeliOffshore

Section 1
Introduction

1.1 Introduction

The Flight Safety Foundation (FSF) Approach and Landing Accident Reduction Task Force (ALAR) determined that non stabilised approaches for fixed wing aircraft were causal factors in 66 % of 76 approach related accidents that occurred between 1984 and 1997 (Flight Safety Digest, 1998). These accidents could be represented by two groups: the low and slow approach that resulted in a reduced ground clearance CFIT event and the fast high approach that concluded with loss of control or runway excursions.

In a similar context, offshore helicopter accidents involving CFIT and loss of control events have been attributed to varying levels of approach mismanagement and as such the trend has been to adopt fixed wing stabilised approach principles in an attempt to eliminate offshore approach incidents.

The adoption and adaptation of fixed wing principles has in no small way contributed to a safety enhancement of offshore helicopter approaches. However, in implementing approach criteria based simply upon airspeed (IAS), rate of descent (ROD) and bank angles, the opportunity to directly consider the energy state of the aircraft on approach to an offshore helideck has not been addressed.

This guidance, in seeking to expand the considerations more appropriate to offshore helicopter operations, reviews 5 key elements that are fundamental to the conduct of a safe stabilised approach in the offshore environment whilst expanding upon the well-defined principles inherited from the fixed wing industry.

These 5 key elements are:

1. Energy state
2. Approach briefing
3. Go-around management
4. Monitoring procedures
5. Use of automation

The aim of this paper is to formalise industry best practice guidance and recommendations for approach path management for offshore helicopter operations.

This guidance is intended to be read in conjunction with the HeliOffshore paper on Automation Guidance; it expands on the principles explained in the HeliOffshore automation videos. Reference is also made to the latest version of the IOGP AMG.

1.2 Background

1.2.1 Fixed wing approach criteria

Although some variation exists amongst commercial fixed wing operators, the fundamental principle of a stabilised approach focuses on approach 'gates' or a point in the approach by which certain criteria must be achieved. These are generally accepted to be 1000 feet AGL in IMC and 500 feet AGL in VMC (see for example Airbus Flight Operations Briefing Notes (FOBN) and Boeing Flight Crew Operating Manuals (FCOM) and recommendations by the Flight Safety Foundation).

The principles stipulated by Airbus in their FOBN are indicative of the widely accepted criteria to be achieved by these heights on approach.

a. Aircraft on the correct lateral and vertical Flight path

b. Small changes in heading and pitch to maintain flight path

c. Landing configuration

d. Thrust above idle and stable to maintain required speeds

e. Landing checklist complete

f. Flight parameters within limits.

The flight parameter limitations are further expanded as follows:

a. Airspeed Vapp +10 / - 5 knots

b. Vertical speed less than 1000 fpm unless briefed

c. Pitch attitude +- specified degrees (aircraft-dependent)

d. Approach aid deviation (G/S, LOC) within specified limits

e. Unique procedures or abnormal conditions require specific briefings.

Deviation from these parameters below the specified gates requires an immediate Go-around.

The FSF have recently revised their guidance to allow more freedom around the 1000 feet point but to introduce a further gate at 300 feet, with a view to making a final decision on the stability of the approach and the necessity or otherwise of flying a go-around. The philosophy is that the aircraft should be configured by 1000 feet above the surface (first "gate" and first configuration crosscheck), but shall be configured at the latest by 500 feet above the surface (second "gate", configuration and stabilisation crosscheck). Continuing past the related gate should only occur if meeting the objective of the next gate is achievable; otherwise, go around. If the approach is not quite stable at 500 feet, but the aircraft is just outside the parameters and obviously correcting, the approach may be continued to 300 feet above the surface (final "gate" and stabilisation crosscheck). At this point, a go-around is mandatory if not stabilised.

The basic parameters for stabilisation, including aircraft attitude, configuration, power and speed, remain the same, but specific boundaries are introduced for each approach type:

- **CAT I ILS:** within 1-dot deviation of glide path and localiser
- **RNAV:** within ½-scale deflection of vertical and lateral scales and within RNP requirements
- **LOC/VOR:** within 1-dot lateral deviation; and
- **Visual (to a runway):** within 2.75 and 3.25 degrees of visual approach path indicators, and lined up with the runway centreline no later than 300 feet.

The FSF further recommends that the stabilised approach gates should be observed, and active communication calls made during each approach. Normal bracketing corrections in maintaining stabilised conditions occasionally involve momentary overshoots made necessary by atmospheric conditions; such overshoots are acceptable. Frequent or sustained overshoots are not.

Previous guidance for the 1000-foot gate required that a go-around must be conducted if the flight was not fully stable in IMC. With respect to the physics of a go-around, safety is the same in both IMC and VMC; in this context, differentiation of a go-around at 1000 feet in IMC and at 500 feet in VMC is not required. The new functional significance of the 1000-foot mark is that it is the last suitable point along the approach to ensure that final landing configuration is selected and verified by the flight crew. The gear transition, deceleration to final approach speed and power stabilisation *should* occur before the aircraft reaches the next gate at 500 feet AGL. It should be emphasised that initial configuration should occur before reaching the 1,000-foot gate; this gate is the last point at which final landing configuration should be selected and confirmed.

Previous guidance for the 500-foot gate required that a go-around *must* be conducted if the flight was not fully stable in VMC. The revised guidance retains the recommendation that the approach should be fully stable at this gate; however, the mandate to go around has been removed. Although a go-around may be considered at this gate, not mandating a go-around reduces the overall number of potential go-arounds by allowing low-risk unstable approaches to continue while at a safe altitude. The 500-foot gate is a suitable point in the approach for flight crew to verify all stable approach criteria. It is a familiar demarcation for flight crews. Being stable at this point in the approach allows for subsequent developing instabilities to be compared against a state of constant energy reduction. Improved collective situational awareness at this gate is also achieved through procedural active communication between flight crew.

The 300-foot gate is new. Establishing this gate clearly marks the boundary between higher altitudes where a stable approach is strongly recommended and the point where continuing an unstable descent reduces the margin of safety. It differentiates between approach stability and a go-around decision. It should be understood that the 300-ft AGL value is not intended to be absolute; it can be approximated to take advantage of aircraft automatic callout systems. For example, it could be synchronised with the 100- feet-to-go call many operators use when approaching DA/MDA. Descending in an unstable state below the 300 foot gate should be a warning to flight crews that the level of risk is increasing and action is required, whether the aircraft is unstable at this gate or becomes unstable below 300 feet.

The awareness of the increased need for action can be improved by heightening the definition of the aircraft's condition, from being in an *unstable condition* to being in a *condition to go around*. This can prompt the flight crew to make the correct decision – to go around. To further emphasise the point, the 1,000-foot to 300-foot window can be viewed as the *stable approach zone*, with the focus on ensuring that the aircraft is fully stabilised In comparison with these analyses, a gate of 300 feet AGL to execute a go-around provides adequate altitude margin for even the most extreme low-energy unstable approach.

Gate	PM call	PF response
1000 feet AGL	"1000, configured / not configured" or "Gear"	"Roger"
500 feet AGL	"500 stabilised / not stabilised" or "Speed [parameter]"	"Roger" or "Correcting"
300 feet AGL	"300 stabilised or go around"	"Roger" or "Going around"
100 feet to DA/MDA	"100 to go stabilised" or "100 go around"	"Roger" or "Going Around"

1.2.2 Helicopter approach criteria

IOGP AMG Section 5 represents, as an example, the criteria specified by many Oil and Gas Operators and as such is required content in the operations manuals of offshore operators. To permit a direct comparison of helicopter and fixed wing stabilised approach criteria, Section 3.1.3 of part 5 is included here:

1.2.2.1 IOGP Stabilised Approach criteria

IOGP AMG 590 paragraph 3.1.3 Flight Operations Profiles, states:

Operators should establish flight profile guidance in their Operations and Training Manuals / Checklists for critical phases of flight operations (inclusive of taxi, take-off, cruise, and landing). As part of this flight profile guidance, operators will develop procedures for the use of stabilised approach procedures for all flights. Detailed guidance is available from several regulatory authorities for review as necessary.

These procedures will be based on the following requirements, or equivalent, which define when an approach is considered stabilised:

a. The aircraft is on the correct flight path and the correct navigational data has been confirmed as entered into the navigation system for final approach to the desired airport, heliport, or helideck and the aircraft is stabilised for the approach.

b. Only small changes in heading/power are normally required to maintain the correct flight path, unless the environmental conditions on a particular day may require power changes larger than normal.

c. All briefings and checklists have been completed, except for the final landing check.

d. The aircraft is in the correct landing configuration.

e. The sink rate is no greater than 750 fpm upon arrival at the altitudes prescribed in "f." below, or as recommended by the manufacturer. If an approach will require a rate of descent greater than 750 feet per minute, a special briefing should be conducted.

f. All flights should be stabilised by 1000 feet above landing elevation in IMC and by 500 feet above landing elevation in VMC unless the following flight profiles are in use:

   – For helicopters where the transit height is less than 500 feet above landing elevation, the aircraft should be stabilised by 300 feet and 60 knots ground speed above the landing surface.

   – For some operations, such as seismic work involving a high level of low altitude external load operations and remote landing sites where it is necessary to complete an overhead flight reconnaissance before landing the typical profile may require modification by the operator.

g. Anytime an approach becomes “unstabilised” (out of compliance with the above guidelines) a go-around / missed approach should be executed immediately, unless the operator has established a limited number of deviation protocols that can be safely used to return to the stabilised profile.

h. Once the approach minimums (altitude, time, etc.) are achieved the correct airport, heliport, and helideck is confirmed.

Some of the criteria are the same (for example ROD, landing configuration and checklists completed) and others are also required for helicopters by other rules even though not mentioned specifically in the AMG (for example approach aid deviations, which are mentioned in the reserved FSF guidance). However, the requirements for fixed wing and helicopters are based on somewhat different criteria for energy management.

Aeroplanes need to be stabilised on approach to ensure that they will be able to land and stop within the runway space available; helicopters need to be stabilised on approach to ensure they will be able to stop at the correct place and then land, which means to arrive at the end of the approach at the correct parameters for the Landing Decision Point (LDP). Management of speed, pitch attitude and flight path vector is therefore important for aeroplanes for different reasons than for helicopters; control of speed in relation to power / collective, and pitch attitude (which affects both speed and perspective) are both fundamental factors for helicopters.

1.3 Helicopter energy state

A recent report resulting from research conducted by the UK CAA and “FlightDataPeople” (Clapp and Howson, 2015) into the viability of modifications to HTAWS warning envelopes, concluded that increased warning periods can be expected from flight envelope changes made specifically to the commonly used Honeywell Mk22 HTAWS system. Notably the report also concluded that an additional envelope based upon total torque and airspeed, i.e. energy state, would enhance the warning criteria available during the approach phase of flight.

Establishment of energy state criteria as part of an Approach Management policy, is considered an essential element and should be incorporated in Operations Manual guidance.

It should be noted that direction provided to aircrew in terms of energy state management will vary according to type (Clapp and Howson, 2015), making it essential to develop procedures customised for each aircraft model. The energy state boundary referred to above is a “hard” warning envelope; specific criteria in terms of airspeed, power and rate of descent will need to be defined for each type to provide “soft” boundaries within which the aircraft can be considered to be on an acceptable flight path.

Section 2
Approach management guidance

2.1 Guidance introduction

In reviewing the stabilised approach criteria in current use by helicopter operators and the potential enhancements likely to become available through modifications to warning systems, the following guidance is provided under the heading of Approach Management. This is considered to be more encompassing than simple approach gates and the compliance with a fixed wing style stabilised approach. The principle of **Approach Path Management** requires the consideration of a range of elements, each providing a specific barrier to a risk experienced during the approach phase by any helicopter.

2.2 Energy state

Although previously derived stabilised approach criteria have often considered minimum airspeeds and maximum rates of descent, the concept of combining airspeed, ROD, aircraft pitch attitude and collective position (torque applied) to determine an energy state has rarely been addressed in operations manual guidance. As previously discussed, current research is working towards a warning system, integrated into future TAWS systems, that will warn flight crew of an impending low energy state. These systems will however, only provide warnings where a situation has already started to develop, making it necessary to establish flight practices and company guidance to prevent, where possible, the development of low energy state conditions.

2.2.1 Standardised approach profiles

The use of standard repeatable approach profiles, tailored for specific types where required, enhances the ability of crews to monitor and detect deviations.

HeliOffshore members provided three alternative examples of standardised offshore approaches. The first, developed for the AW139, makes use of a 5 degree profile that can easily be monitored by the PM, through the use of the FMS and a pseudo glide slope indicator. It is not intended to be flown as an instrument style approach but rather provides enhanced monitoring tools to ensure a standardised approach is flown both day and night in VMC.

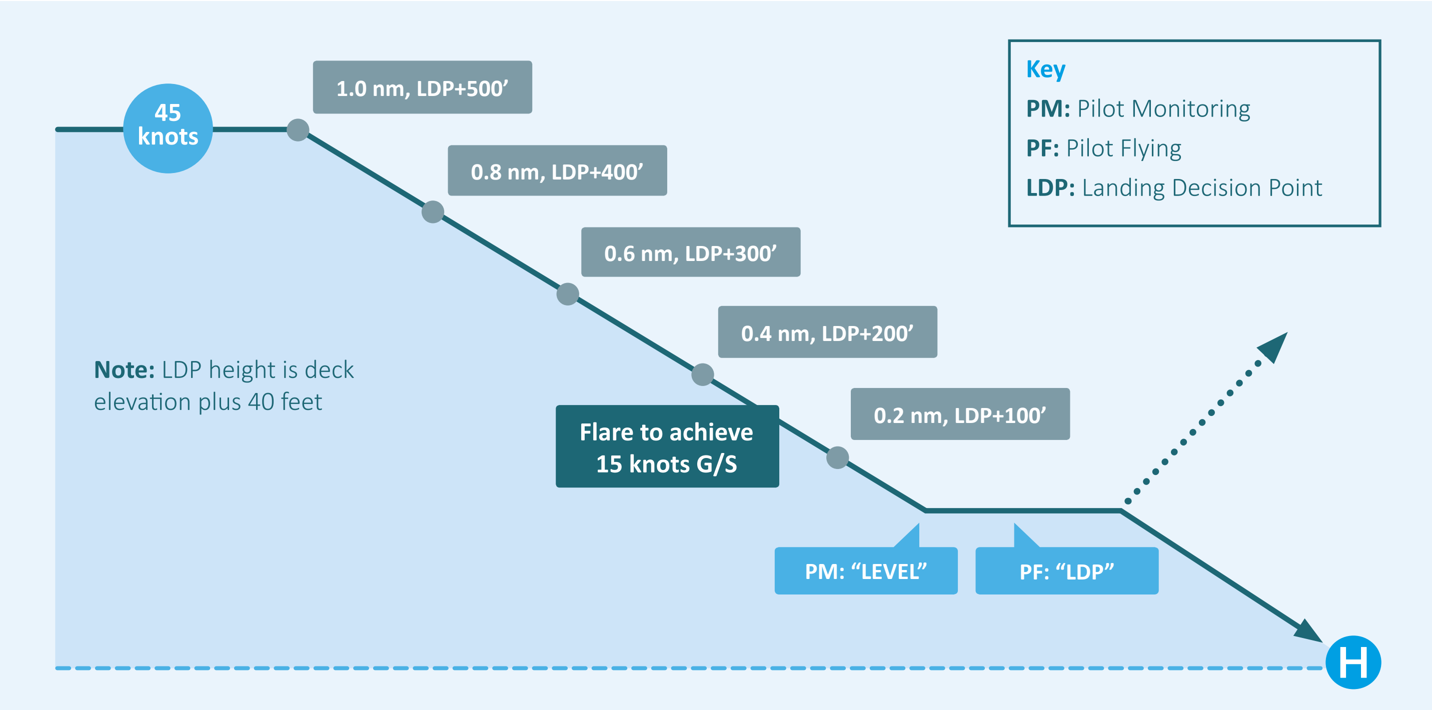
The second example is a more generic approach to the topic, providing guidance that could be applicable to more than a single type of aircraft.

Both styles of guidance are valid but both require that the approaches are always flown the same way to the same gates and airspeeds regardless of the platform being approached and regardless of day or night operations. Repeatability is the key to ensuring that the aircraft achieves the LDP at the same criteria every time.

It should be emphasised that there is a significant difference between day VMC, and night and DVE conditions. Approaches in day VMC should be based primarily on a standard “sight picture”, whereas night and DVE approaches require a more formalised structure of gates and checkable parameters, although these should be minimised for simplicity and repeatability, and to reduce pilot workload. However there is no reason why all approaches, even in day VMC and in shuttle operations, cannot comply with a basic stabilised gate position at half a mile established on the final approach track.

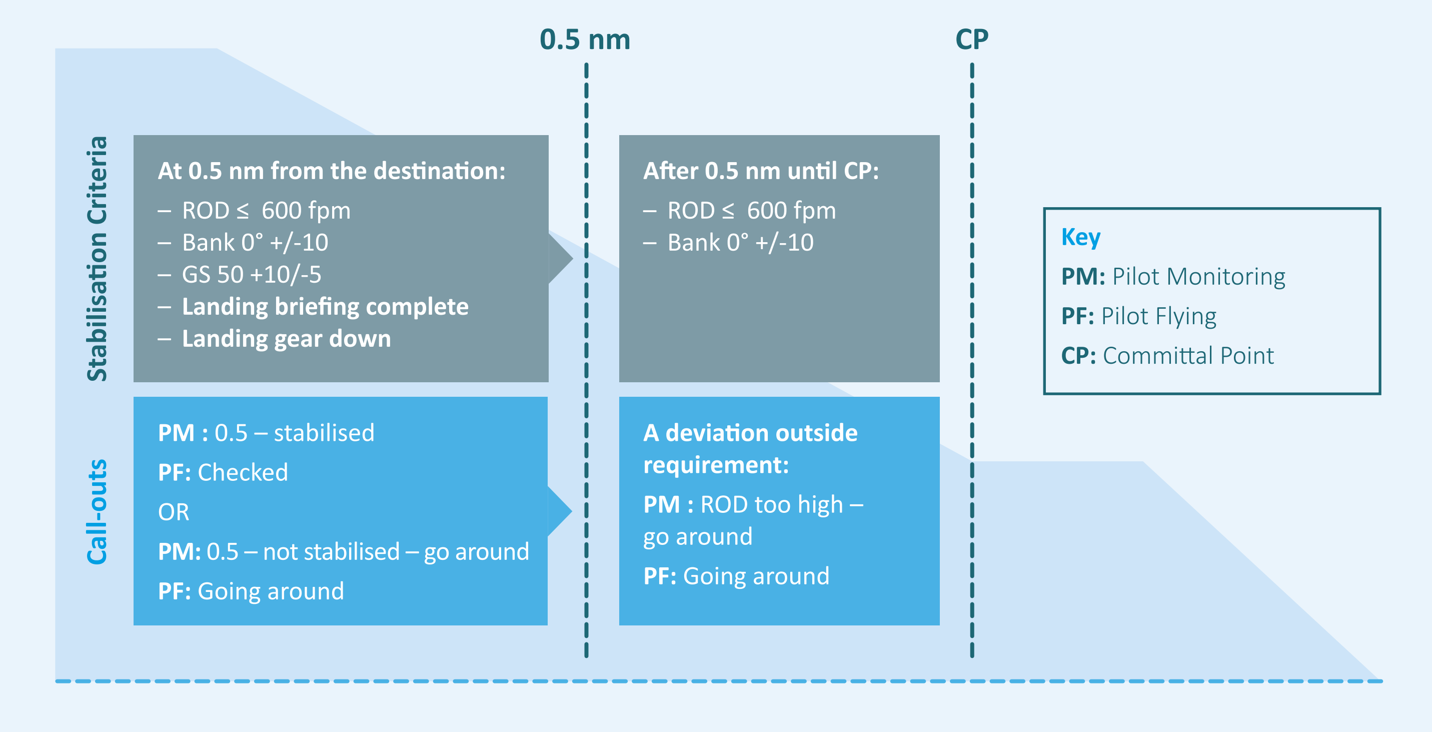
See examples on the following pages >

2.2.1.1 Example 1: Defined 5° Profile

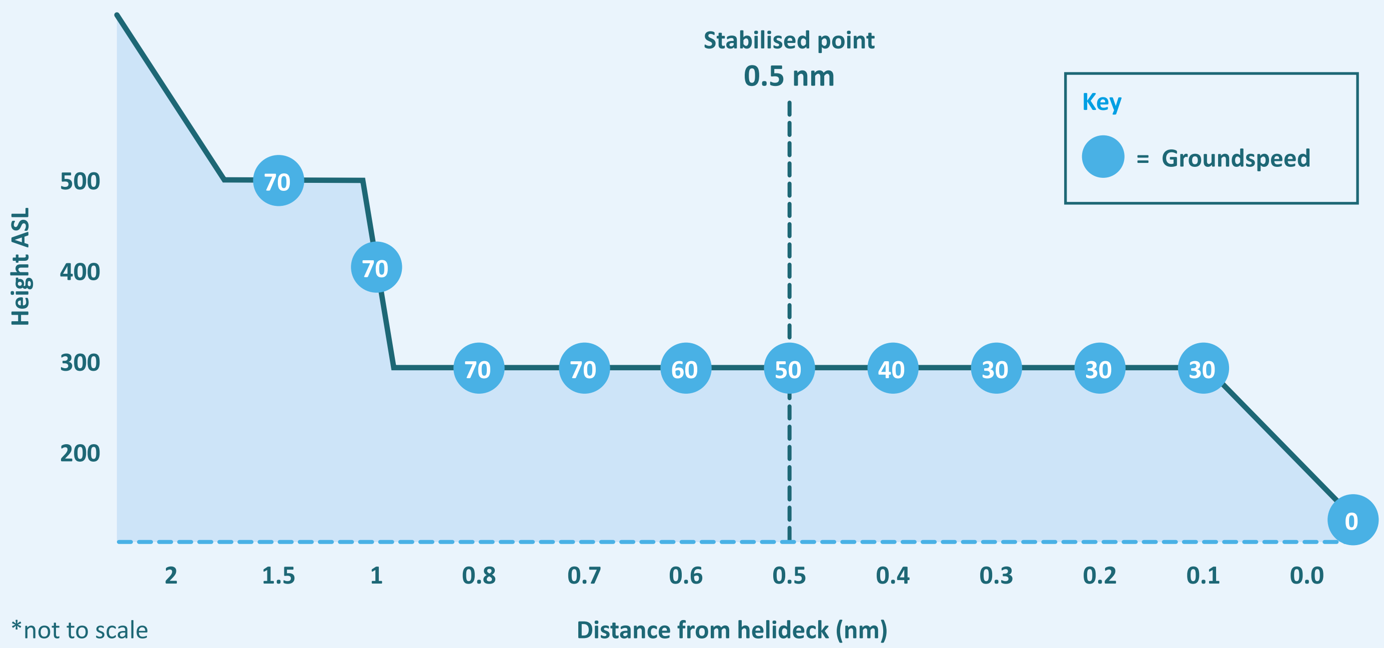


Height Profile: The required profile heights are referenced to LDP (i.e. Deck Height plus 40’). The circuit height is 500’ above LDP. The profile is based upon a 1 in 2 calculation such that dividing the distance by 2 results in a simple calculation of height above target height, i.e. 0.8 NM is 400’ above LDP.

2.2.1.2 Example 2: Standardised Approach criteria



2.2.1.3 Example 3: Day DVE or night offshore approach*



*not to scale

The stabilised point is at 0.5nm with the aircraft fully configured for landing. Descent to 300 feet (or deck height plus 50 feet if higher) is carried out fully coupled. Use of the coupler is maintained as long as possible; if necessary, the cyclic channels (speed, heading) may be decoupled if the aircraft configuration requires, but RADALT/ALT hold should be retained as long as possible. Speed reduction should be carried out by selecting a suitable nose up attitude. The benefit of approaching at a constant height is that one less parameter has to be considered; in addition, any required go-around manoeuvre will be less dynamic. A missed approach should be carried out if any parameter (for example rate of descent or groundspeed) exceeds defined criteria after the stabilisation gate, see the discussion in **2.2.2 Energy State Monitoring** below.

2.2.2 Energy state monitoring

The energy state call out, previously not included in some operations manuals, is now considered to be critical in preventing CFIT or loss of control events in offshore helicopters. Again, it is not possible to define these points generically as each aircraft differs in its stability characteristics.

Similarly, the need for a standard '500 to go' call (for an onshore approach) or a '0.5nm' call for an offshore approach, defining the stabilised "gate", warrants examination. Many of the events related to energy state have occurred below this 500 feet level or inside 0.5nm, suggesting that a continuous monitoring of energy state is more valid than achieving a singular point in space where the aircraft is considered stable. The revised FSF guidance supports this view. Operators should ensure their procedures reflect this requirement.

For offshore approaches, in particular in DVE or at night, it is important to define criteria that would require a go-around to be flown should the approach become unstable between the 0.5nm gate and the committal point. These should normally include minimum power setting, minimum airspeed and maximum rate of descent.

2.2.3 Energy state call outs

Examples of approach minima for speed and power standards can however be encompassed in one of three ways, of which the first two are the preferred options:

1. The requirement to maintain a minimum of V_Y until the landing call is made for runways, subject to remaining on the correct vertical approach path.
2. The requirement to maintain a minimum of V_{TOSS} until the transition point for speed reduction is reached offshore, subject to remaining on the correct vertical approach path or at the required approach height.
3. Specify a minimum power below a minimum speed i.e. a prescribed call that initiates a go round, for example (note this type of call will be aircraft-specific). Guidance on power and airspeed combinations is available in CAP 1519.

2.3 Approach briefing

Approach Briefings can be considered in two parts; the details of the approach being flown be it visual or procedural, and the manner in which the aircraft is to be flown.

Common problems with briefings have been highlighted in accident investigations where errors of omission and inappropriate actions resulting from lack of information have been identified as causes. The traditional briefing list, as detailed in many operations manuals, has encouraged a non-interactive procedure followed by "Questions?", where the ability to share a common vision of the planned approach is often hindered. Equally the repetition of standard information, appropriate to all approaches, often prohibits the understanding of information specific to the approach being briefed.

The following is recommended for approach briefings:

a. An approach briefing shall be given for each landing. The briefing should be completed before the top of descent for an instrument approach and before carrying out the Before Landing checks for a visual approach. The coupler should be used during the approach briefing so that workload is reduced. The briefing will be conducted by the PF. Briefings should be fully interactive with each item briefed and confirmed as the briefing is given to ensure mutual understanding between pilots. If either pilot has any misunderstanding, both pilots should resolve the issue during the briefing.

b. It is recommended that PF initiates the preparation of the cockpit in advance of the briefing (setting up of required approach aids, frequencies and so on), then starts the briefing when the setup is complete. This minimises the chances of interruptions while further adjustments are made to settings, and reduces the possibility of essential steps being missed. During the briefing PF points out the aids setup to check that what he has set up (and asked the PM to set up on his side) actually matches what Is required in the procedure. This provides redundancy (dual confirmation) and also reduces the time required for the briefing.

c. Separate the section of the briefing that refers to aircraft management and ensure that both pilots understand the IAS, ROD and anticipated power settings for the approach. Emphasise the use of deviation calls and highlight the areas for the specific approach where particular focus may be required such as higher rates of descent when a downwind component is present. It is accepted that heading changes may be required during the final stages of an offshore approach, especially if the approach track is out of wind due to obstacles in the approach path, with the aircraft being aligned into wind at a late stage. However, flight path (track) changes should be minimised.

d. Brief a Go Around procedure including the aircraft management e.g. speed, ROC, power, heading and automation usage. All of this should normally be standard operating procedure and require minimum briefing, but any non-standard items must be briefed in detail. Consider the possibility that a go-around may be required late in the approach due to loss of visual references, for example due to heavy showers or patchy fog, as well as last-minute problems on the helideck. This section of the briefing should also be interactive, and each pilot should articulate what he is expected to do during the go-around.

NOTE:
In the context of approaches and automation, any variation to standard automation operating procedures must be briefed separately with particular attention drawn to the potential consequences and the required additional monitoring. See also the HeliOffshore videos on automation guidance.

2.4 Go Around management

Although itemised in 'd.' above, the 'Go Around' is not simply an item to be addressed in the briefing, but a flight procedure that is often neglected in both preparation and training. Statistics, kindly provided by the LOSA Collaborative, identify a strong tendency for fixed wing crews to continue approaches despite deviations outside of company published stabilised approach criteria.

Data gathered from 53 fixed wing LOSA programs conducted over the last 5 years indicate that 411 Unstable approaches, as defined by the specific companies and witnessed by observers, were continued to a landing. Of these approaches 55% were flown by the Captain of the aircraft. Only 12 unstable approaches resulted in missed approaches being flown.

Observations have also suggested that missed approaches are often poorly managed when they are conducted, prompting a revision to the observation criteria and the acquisition of additional data.

Clearly, the considerations during the go-around of a large jet are more complex than a helicopter because of flaps and speed restrictions but, the overriding indication is that crews are landing 'focused' and often ill prepared when a missed approach is required. Having said that, for a helicopter at low speed with a high nose pitch up attitude, at night, at 90 degrees offset to a drilling rig helideck, a go-around can be just as complex. The aircraft requires a substantial change in pitch attitude to accelerate back to V_{TOSS}, while minimising height loss; PF needs to transfer his scan rapidly from outside to inside, and PM needs to monitor the attitude, power and flight path very closely. Furthermore, helicopter training has often reflected the need to train the go-around from instrument approaches with one engine inoperative (OEI) and rarely reflects an all engines operative (AEO) go-around from an unstabilised approach. Operators should consider devoting some training time to AEO go-arounds from an unstabilised approach, possibly during a LOFT scenario.

As more LOSA observations are gathered by the offshore helicopter industry it will become more apparent as to whether similar areas of concern exist. It cannot be over emphasised however, that a revision of procedures and dedicated training scenarios should be considered as part of the overall approach management system within all companies.

Operations manuals should contain not only the instructions and appropriate calls to direct a go-around but also clear simple guidance on how to conduct the go around. This should include direction regarding the correct use of automation modes and any combination of modes to be avoided.

Operations manuals should also include a focus on the need to address go-around procedures in every approach briefing such that crews are prepared whatever the eventuality. Finally, attention should be drawn to the Human Factors that may affect the decision to go around such as fatigue and the powerful desire to land at the destination, often the home base.

2.5 Monitoring procedures

The ability to follow stabilised approach criteria and procedures requires both pilots to work in unison and share the same situational awareness. This requires the use of detailed briefings and also a prescribed set of standard callouts that ensure both pilots are sharing the same mental picture at all times during the approach.

Given that considerable variation exists between the aircraft types operated offshore and between operator philosophies, it is not possible to detail every specific call, although a large number are generic and could be applied. This guidance therefore provides the basic principles that should be applied to Operations Manual procedures and examples of some current practices.

Some examples are provided in the **Annexes** at the end of this document.

2.5.1 Standard calls

Standard calls fall under the criteria of calls that are required throughout the normal flight regime to ensure an equivalent situational understanding between the two pilots. These calls do not fall under deviation calls that are addressed later in this section.

All operators are encouraged to include standard calls as part of a continuous improvement process, using such tools as LOSA to ensure the continued validity of all cockpit procedures. Historically cockpit callouts have increased as the result of events and reports but are rarely reduced as a result of automation usage. To maintain the credibility of such calls and in turn ensure their correct and continued usage, it is considered essential to keep calls to a minimum and only use calls where a missed call or event would have a safety consequence.

2.5.2 Deviation calls

It should be noted that the examples provided in the annexes are not exhaustive and refer predominantly to the approach phase. It is essential to ensure brevity where aircrew can concentrate on the task in hand and not focus on the calls as a script to be followed. Calls must serve a safety purpose at all times.

Deviation calls should therefore be based upon the following criteria:

1. Pilots should make deviation calls as soon as a deviation is observed outside of defined limits to ensure the maximum time for correction before an unacceptable flight condition occurs.
2. The thresholds must be set at the point where a deviation to this level is rare but equally at the point where a recovery is still possible with minimum intervention. These settings should also ensure that PM is not required to make constant calls for minor deviations such that PF becomes immune to PM’s input and therefore fails to take action when it really becomes necessary.
3. Pilots must acknowledge ALL calls to ensure situational awareness and also to function as early detection of incapacitation.
4. Any call made for deviation from stabilised approach criteria must be acted upon immediately, not simply acknowledged.
5. PF determines if the aircraft can be recovered to the defined stabilised criteria and if it cannot, a go-around must be commenced.
6. If the criteria are not re-established before the required point on the approach PM shall command a go-around and PF shall comply immediately.
7. Operators should develop a non-punitive go-around policy that views all go-arounds as a safe choice, whatever the reason, including ATC requirements or bad weather but also for example misjudgment of an offshore visual approach.

2.6 Automation

2.6.1 General

Automation and its safe usage have been the subject of much debate, with focus areas of mode confusion, training and the development of procedures to ensure equivalent situational awareness between pilots.

HeliOffshore has, in particular, dedicated significant resources to both research and training videos to ensure the necessary understanding of both concept and operation of automation systems.

This section concentrates on the safe usage of automation during the approach and go-around phases of flight though the use of standardised operating principles.

2.6.2 Automation principles

HeliOffshore's Automation Guidance to support this information can be found in **Annex C**. These guiding principles are offered to ensure effective use of automation. Standard Operating Procedures based on these principles will help to mitigate the risks of interacting with cockpit automation and improve safety performance in usage and monitoring.

1. The coupler / flight director should only be engaged once the aircraft is in a trimmed stable configuration after takeoff, possibly defined by a minimum speed such as V_Y and a minimum height such as 200 feet AGL, and disengaged as late as possible in the approach with transition procedures clearly detailed in the Ops Manual.
2. All climbs should be performed in 4-axes (3 Cue Sikorsky) where applicable.
3. All descents should be performed in 4-axes (3 Cue Sikorsky) where applicable.
4. Cruise should be flown in 3-axes / 2-cue as a minimum standard utilising lateral modes for navigation and an altitude hold function.
5. For climbs and descents, including approaches, if required to operate with the collective channel inoperative, unless it conflicts with the design of the automation it is strongly recommended that airspeed should always be coupled to the cyclic and the rate of climb or descent should be controlled manually on the collective. This is particularly important if a go-around is required; both pilots need to confirm that the correct go-around power is set and the additional monitoring required by this non-standard configuration shall be covered in the approach briefing.

NOTE:
Specific consideration should be given to automation training requirements to ensure that all protection modes (EC225 or H175 as examples) are fully understood and the consequences of engine failure in degraded coupled modes are also understood.

2.6.3 Offshore approach at night or in DVE

Whenever possible, a straight-in landing is preferred. If a circling approach is unavoidable it shall be flown coupled in four-axes / 3-Cue, with PF adjusting ALT, HDG and IAS through beep trims while maintaining visual cues until the Committal Point.

The use of automation for offshore approaches should be integrated into the specified approach profiles as described under energy state earlier in this guidance document.

NOTE:
Certain aircraft types require the final stages of offshore approach profiles to be flown at speeds below the minimum coupled speed. This type of restriction requires manual flight on final approach and reinforces the need to concentrate on standardised approach profiles.

NOTE:
In some cases it may be easier to fly the lateral profile manually rather than coupled to HDG; this is acceptable provided the ALT (or RADALT) and IAS modes remain engaged.

CAUTION:
Operations manuals should clearly detail modes and combinations of modes that present additional dangers due to mode confusion. Examples of these inappropriate and potentially dangerous practices are using the collective to reduce airspeed when vertical speed mode is coupled on the cyclic rather than IAS, or equally the reduction of airspeed when in an altitude hold mode without IAS engaged.

2.6.4 Onshore approach

The variety of available onshore approaches and the range of automation available to conduct these various approach types makes the application of standardised criteria difficult across multiple types.

However, the application of the standard automation principles in **2.6.2 Automation principles** and the energy state monitoring criteria in **2.2.2 Energy state monitoring** will aid the safe conduct of all types of onshore approaches.

2.6.5 Manual flight

The transition from coupled to manual flight, a daily and normal occurrence for helicopter operations, requires defined criteria to ensure a safe and standardised procedure.

The ability of pilots of modern aircraft to maintain manual flying currency has also been a hot topic of debate and as such warrants inclusion in this guidance material. As a result the criteria under which manual currency practice can take place should be clearly defined in the appropriate section of each company's operations manuals. Example guidance is given below.

2.6.5.1 Criteria for manual flight

To address the potential loss of manual flying skills due to use of automation, crews are encouraged to fly manually in VMC and IMC. No limits are placed on the frequency of manual flying, but it may only be conducted in the following circumstances:

a. In VMC.
   i. By day onshore and offshore at any time, including takeoff, en route, approach and landing.
   ii. By night onshore at any time, including takeoff, en route, approach and landing.
b. In IMC.
   i. By day or night while en route at any time above MSA.
   ii. By day for onshore and offshore departures, en route below MSA, and for onshore instrument approaches, provided conditions are at or better than 4000 metres visibility and cloud base not below 600 feet or not below 200 feet above DH / MDH, whichever is the higher.
   iii. By night for onshore departures, en route below MSA, and for onshore instrument approaches, provided conditions are at or better than 5000 metres visibility and cloud base not below 1000 feet or not below 200 feet above DH / MDH, whichever is the higher.
c. Night offshore let-downs, approaches, and circuits shall not be flown manually.
d. Night offshore departures shall not be flown manually unless operating under the MEL.

In addition, cockpit workload must not be excessive, and the crew briefing shall be explicit in stating where the manual handling segment starts and ends.

2.6.6 Automation fly through

As a general principle, once the automation is engaged, it should be left to do its job. Any attempt to "help it along" may just confuse it and will often result in an unexpected aircraft state once the pilot lets go of the controls again. If the rate of change of parameter is too slow using the normal control beep switches, it may be possible to press the appropriate trim release, fly to and set the new required datum (for example airspeed) then release the trim button again. Be wary of disengaging a single axis to make a change in the datum; far better to anticipate changes in sufficient time for the automation to make them on your behalf.

2.6.7 Automation serviceability

Automation serviceability and how it should be restricted to avoid potential approach profile mismanagement is complex as the aircraft operated offshore are different in design and concept of operation.

It is therefore impossible to provide accurate guidance for each aircraft type but rather a set of guidance principles that should form the basis of changes to an Operators Minimum Equipment List (MEL) not necessarily provided as part of a master MEL (MMEL). In essence, additional restrictions should be considered over and above those recommended by the manufacturer's MMEL where enhanced safety is required during the approach phase of flight.

2.6.7.1 Automation serviceability recommendations

1. Any item that restricts the functionality of the autopilot should restrict operations to day VMC only.
2. Inoperative collective trim will require the aircraft to be flown in 3-axes / 2 Cue and will require enhanced monitoring; this should be limited to day VMC.
3. The MEL may make provision for system unserviceability to permit ferry flights or single flights back from offshore in other than day VMC conditions, to allow recovery of the aircraft to a maintenance base, provided such unserviceabilities are permitted by the MMEL.

Section 3
Summary of recommendations

Summary of recommendations

The aircraft should be configured by 1000 feet above the surface (first "gate" and first configuration crosscheck), but shall be configured at the latest by 500 feet above the surface (second "gate", configuration and stabilisation crosscheck). Continuing past the related gate should only occur if meeting the objective of the next gate is achievable; otherwise, go around. If the approach is not quite stable at 500 feet, the approach may be continued to 300 feet above the surface (final "gate" and stabilisation crosscheck). At this point, a go-around is mandatory if not stabilised (**1.2.1**).

Operators should establish flight profile guidance in their Operations and Training Manuals / Checklists for critical phases of flight operations (inclusive of taxi, take-off, cruise, and landing). As part of this flight profile guidance, operators will develop procedures for the use of stabilised approach procedures for all flights (**1.2.2.1**).

The provision of guidance encouraging operators to establish energy state criteria as part of an Approach Management policy, is considered an essential element of this guidance material and as such should be incorporated accordingly in Operations Manual guidance (**1.3**).

Continuous monitoring of energy state is more valid than achieving a singular point in space where the aircraft is considered stable. The revised FSF guidance supports this view. Operators should ensure their procedures reflect this requirement (**2.2.2**).

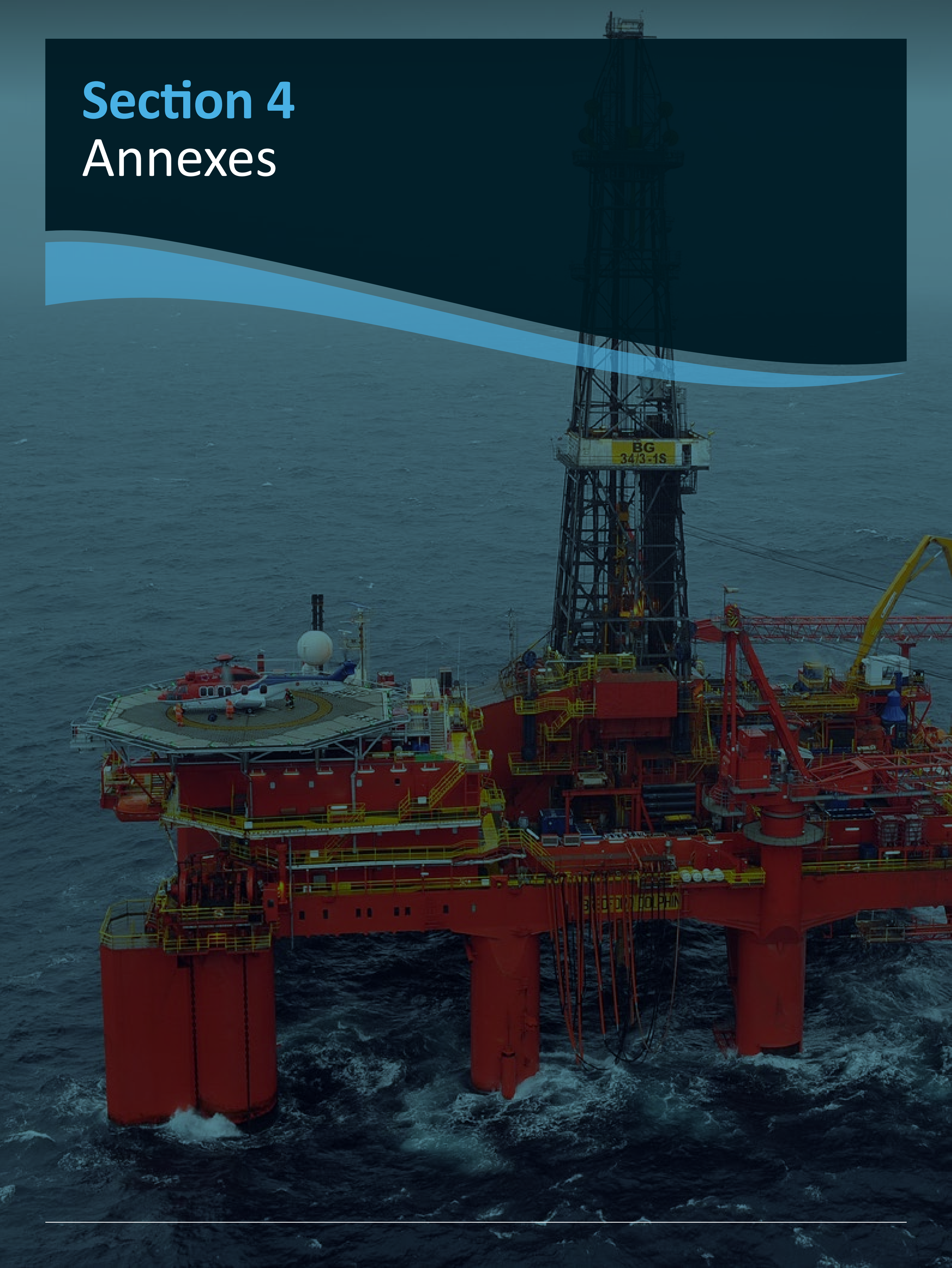
An approach briefing shall be given for each landing. The briefing should be completed before the top of descent for an instrument approach and before carrying out the Before Landing checks for a visual approach. The coupler should be used during the approach briefing so that workload is reduced. The briefing will be conducted by the PF but shall be interactive and shall include reference to go-around and to any non-standard configurations or approach requirements (**2.3**).

Operators should consider devoting some training time to AEO go-arounds from an unstabilised approach, possibly during a LOFT scenario. (**2.4**).

All operators are encouraged to include standard calls for normal operations and for deviations from normal flight profiles. Calls should be kept to a minimum, be logical and only be used where a missed call or event would have a safety consequence (**2.5**).

Operators should ensure that their operations manuals clearly detail procedures for the use of automation, and explain automation modes and combinations of modes that may present additional dangers due to mode confusion. Specific consideration should be given to automation training requirements to ensure that all protection modes are fully understood (**2.6**).

Section 4
Annexes



Annex A
Example briefings and callouts

Example full instrument approach briefing:

Contents:

a. Plate number, name, and date

b. Follow the briefing strip order, i-viii if applicable but in any case, the following items are to be included:
   i. Approach type
   ii. Radio navigation aids
   iii. If raw data or coupler / flight director will be used
   iv. Speeds
   v. Arrival: STAR arrival route
   vi. Procedural sector
   vii. FAT crossing altitudes and timing
   viii. Minima and weather
   ix. Runway elevation
   x. Actions at minima
   xi. Missed approach procedure including planned alternate and fuel requirements
   xii. Any airfield or heliport special briefings

Abbreviated IFR approach briefing:

a. ILS (or other approach) to runway XX at………

b. FAT is……º, DA / MDA is……feet, minimum RVR ... metres

c. Runway elevation is …..

d. Commencement and continuation of approach

e. I will fly 4-axis coupled / 3-axes coupled / raw data approach

f. My landing / your landing (subject to weather)

g. Go-around procedure will be…….

Example abbreviated offshore landing briefing:

a. Standard offshore landing, heading XX

b. Go-around to the right / direction XX

c. Review any turbulent arcs, obstructions or restricted landing arcs if applicable

Briefing

Pilot flying	Pilot monitoring
Plate 11-1, ILS Y dated 2 October 2015.	I have the same.
ILS to runway 03, ILS frequency 109.75, tuned and identified CVF my side.	109.75 tuned and identified I-ABC my side.
Final approach course 034 set my side.	034 set my side.
I will fly 4-axes coupled at 100 knots. No STAR, it will be radar vectors. Crossing altitude 1340 feet at 4DME.	1340 feet at 4DME.
Weather is above minima, there is no approach ban. Elevation is 210 feet, bug set at 410 feet.	Bug set 410 feet.
Assuming you are visual at minima I will continue to fly the approach fully coupled until I am happy with the visual references, then decouple and land.	Understood.
If we have to go-around, standard missed approach procedure is straight ahead to 2000 feet then start a left turn back to the NDB to hold at 3000 feet.	I will set ALTP TO 3000 feet once we start the descent. NDB is tuned and identified 397 DEF and set on the RMI.
We have enough fuel for two approaches before we need to divert to XXX.	I agree.

Example calls, onshore instrument approach

Flight event	Pilot monitoring		Pilot flying	
In all cases, PF shall maintain reference to the instruments while PM looks for visual references and also monitors the approach				
	Actions	**Call-out**	**Actions**	**Call-out**
At first inward movement of localiser bar		"Localiser alive"		"Checked"
At first downward movement of glideslope pointer / bar		"Glideslope alive"		"Checked"
If flown coupled, at localiser / glideslope capture		"Localiser / glideslope captured"		"Checked"
FAP inbound	(note a)	"FAP"		"Descending"
500 feet above DA, stabilised approach		"500 feet to go, stabilised"		"500 to go, stabilised"
or		**or**		**or**
500 feet above DA, not stabilised		"500 feet to go, not stabilised, go around"		"Going around"
100 feet above DA		"100 feet to go"		"100 to go"
At or just before DA				"Decide" (note b)
	If PM has required visual references	"Visual, look up"		"Visual, final checks"
		"Runway, 11 o'clock" or "Visual, lights straight ahead", as required		
		"Final checks completed"		"Checked" (note c)
	If not visual	"Go around"		"Going around"

Note:

a. Normal SOP calls and checks regarding FD selections, DAs, and bug settings are applicable during the approach
b. The "Decide" call shall be made in time to allow the go-around decision to be made at the minima
c. The final checks may be completed earlier if the destination is identified electronically

Example procedures for automation management and standard calls

Autopilot – Coupler / flight director modes

It is standard procedure to operate the aircraft coupled, encouraging better overall management of aircraft systems, navigation, and passenger comfort. It is important to involve both pilots in the process at all times to maintain a closed loop. All mode selections and de-selections shall be announced, and confirmed by the other pilot. PF may make mode selections himself or may request the PM to make selections, in particular at times of high workload. All mode selections below 500 feet at night or in IMC shall be made by the PM, on the PF's request, with the exception of selection of GA (and any other mode that may be selected directly by buttons on the flight controls) and full disengagement of the coupler / FD. While PM may adjust mode values at PF's request, PF may only adjust mode values once captured, provided it can be done directly by buttons on the flight controls; he shall call the adjustments he is making (for example, to IAS, HDG or ALT), so that PM is aware and can monitor.

Coupler / FD management

There are three steps. PF can start at step one or two depending on who is pressing the button on the coupler panel. PM will respond with the next step in line, and so forth. If the modes couple automatically, PF calls **"Captured"**.

When altitude change mode is used (ALTA / ALTP), both pilots shall confirm that the desired altitude is set with reference to the correct altimeter sub-scale setting. The pilot not selecting the altitude change mode shall then confirm that the correct vertical mode engages. Do not select the next desired altitude until clearance to climb or descend has been received, to avoid inadvertent altitude changes.

Deselection of a mode shall also be requested or announced. All decouple alerts shall be acknowledged, either with the procedure below, or if an unexpected alert is heard, with a clear statement of what has changed.

The three steps are command, action, and confirmation:

a. Command (request a mode, if required)

b. Action (mode selected or armed): Visually locate the mode select button in question, select the mode, and look for the expected mode annunciation and aircraft reaction

c. Confirmation (correct indication displayed on the FMA): Visually verify the correct mode annunciation and that the aircraft reacts accordingly

PF asks PM to couple a mode

PF	PM
"Select altitude"	
	"Altitude selected"
"Altitude captured"	

PF couples a mode himself

PF	PM
"Altitude selected"	
	"Altitude captured"

The helicopter is coupled in VS and reaches the acquired altitude

PF	PM
"Altitude captured"	
	"Checked"

PF asks PM to arm localiser

PF	PM
"Arm localiser"	
	"Localiser armed"
Pause	
"Localiser captured"	
	"Checked"

PF arms the localiser

PF	PM
"Localiser armed"	
	"Checked"
Pause	
"Localiser captured"	
	"Checked"

Note:
If there is a pause between a mode being armed and the mode capturing, the other pilot responds with **"Checked"**.

Annex B
Example guidance points on stabilised approaches

1. Stabilised approach:

The purpose of a stabilised approach is to ensure the helicopter is in the correct configuration and on the correct flight path for landing, with gear down, and groundspeed at the correct value for the conditions and the intended landing type (class 1 or 2, hover or running). The aim is to minimise pilot workload in the final approach segment down to the approach termination point.

An approach is stabilised when the following criteria are met:

a. The helicopter is in the correct landing configuration

b. The helicopter is on the correct (briefed and agreed) flight path within permitted tolerances and this can be maintained using angles of bank and rates of descent within stabilised limits. Normal limits should be defined by the Operator and may be, for example (these examples are not definitive):

   – Speed fixed for an instrument approach (within ±10 knots of briefed speed), or appropriate to the distance to go for visual approaches, for example offshore 50 knots groundspeed at half a mile to run, reducing to 30 knots groundspeed at one third of a mile to run.

   – Rate of descent no greater than 700 fpm.

   – Steady power setting (except that when coupled in 4 axis / 3 cue, variations of power demanded by the AFCS to maintain the approach parameters, and of instantaneous rates of descent, may be significant, especially in turbulence, but are acceptable within the context of a stabilised approach.

   – Bank angle variations less than ±20°.

   – Within half scale localiser or glideslope deviation or 5° of RMI bearing.

Approaches should be stabilised from defined gates (for example as illustrated below):

a. Onshore instrument approach, from 500 feet above runway elevation (but note the FSF guidance: approaches should ideally be stabilised by 1000 feet above elevation, make best endeavours to be on condition by 500 feet above elevation, or at least be correcting close to the requirements [for example correcting from one quarter scale deviation towards centreline], and must be stabilised at the absolute latest by 300 feet above elevation or, if not, must go around).

b. Onshore visual approach, from 500 feet above landing site elevation.

c. Offshore approaches, from 0.5 nm from the installation.

d. Onshore circling segment of any approach shall have wings level at 200 feet above airport elevation.

e. For low-level SAR and EMS operation, the helicopter shall be stabilised from the point of starting the final descent for landing and in any case before LDP +50 feet, as appropriate.

Just before reaching the gate, PM shall check that the required criteria are met; if they are, he shall call **"Stabilised"**. If any of the criteria are not met at the gate, PM will call **"Not stabilised, go around"**.

The stabilised approach is terminated for onshore instrument approaches at the MAP, when either a missed approach is initiated or the aircraft is manoeuvred to land, and terminated for visual approaches at LDP or the equivalent point for Class 2 landings. For ARAs, the visual segment after the MAP is flown as a stabilised visual approach up to the helideck descent point. All parameters should remain within the deviation call table limits.

2. Unstabilised approach:

An approach is unstabilised if any of the following criteria are met by the defined gate, or after passage of the final gate (these examples are not definitive):

– Rate of descent above 700 fpm and not correcting.

– Airspeed significantly above or below the requirement (for example deviation greater than ±10 knots on an instrument approach and not correcting).

– Deviation of half scale or greater on localiser or glideslope or 5° or greater on RMI bearing.

– Height below final approach height offshore before helideck descent point.

– TAWS/EGPWS call of "Sink Rate", "Undercarriage" or "Pull Up".

3. Key considerations and threats for the go-around:

– Why was the go-around required? Aircraft problem, airfield / helideck problem or weather problem (for example loss of visual references, windshear)

– Was the go-around due to an unstable approach?

– What parameter was unstable?

– How will this affect the go-around? For example was the airspeed low or the rate of descent high? Both of these will cause piloting difficulties in converting to the required go-around profile.

– Was the aircraft coupled, and in what configuration (3-cue / 4-axis, or 2-cue / 3-axis), or was it being flown manually?

– If the transition to the go-around involves a change of automation configuration, what needs to be managed closely? Does selection of "Go Around" mean that the roll mode drops out? Does the aircraft need to be re-trimmed to ensure that no unexpected attitude changes are introduced when the new mode(s) are selected?

Annex C
Automation guidance principles

HeliOffshore Automation Guidance

V1.0 December 2016

These guiding principles are offered to ensure effective use of automation. Standard Operating Procedures based on these principles will help to mitigate the risks of interacting with cockpit automation and improve safety performance in usage and monitoring.

Know how and when to use your automation

– Understand when and how your AP is designed to protect the flight envelope.

– Understand the functional capabilities and authority of your AP.

– Clarify use of automated modes during in-flight crew briefings.

Follow your SOPs for autopilot mode selection and deselection

– Ensure the aircraft is properly trimmed and power applied with an appropriate attitude.

– Consider and manage AP usage in 3 stages: (1) pilot intention (2) mode selection, (3) aircraft reaction.

– Use clear and consistent language to announce, confirm and acknowledge AP mode changes and FMS programming updates.

– Communicate misunderstandings or knowledge gaps around mode display symbology.

Use the appropriate level of automation for the situation and be prepared to change as necessary

– Use the AP as an aid to flight; step up and down between levels of automation, as required.

– Be prepared to fly manually if it reduces workload.

– Avoid manual control inputs when AP is engaged.

– Use 4-axis coupling where possible for all climbs, descents and approaches.

– Select a target altitude when making significant level changes.

Be aware of autopilot functional limitations during mixed-mode and degraded operations

– Be clear which channels are controlled through the AP or manually by the PF.

– Speed will always be a function of the helicopter's attitude in pitch; be aware of undesired speed changes when IAS mode is not coupled or is degraded.

Take appropriate and timely action when deviations from the desired aircraft state are observed

– Integrate the AP mode indications into your routine scan as PF and PM.

– Clearly announce observed deviations from the intended flightpath and intervene as required.

Annex D
Abbreviations and definitions

The following abbreviations and definitions are used in these guidelines:

AEO	All Engines Operative
ALT	Altitude hold mode (of an autopilot coupler)
ALTP / ALTA	Altitude Preset / Altitude Acquire mode (of an autopilot coupler)
AMG	IOGP Aircraft Management Guidelines
APV	Approach Procedure with Vertical guidance
CFIT(W)	Controlled Flight Into Terrain or Water
DA	Decision Altitude (on a precision approach or an approach procedure with vertical guidance)
DME	Distance Measuring Equipment (a ground-based navigation aid that permits an aircraft to determine range from it)
DVE	Degraded Visual Environment (conditions with visibility less than 4000 metres and / or when there is no distinct natural horizon). DVE includes offshore night (see further discussion in 2.2.1 Standardised Approach Profiles).
FAF / FAP	Final Approach Fix / Point (the final defined fix or point on an instrument approach)
FAT	Final Approach Track
FCOM	Flight Crew Operating Manual (published by aircraft manufacturers)
FD	Flight Director
FSF	Flight Safety Foundation
FOBN	Flight Operations Briefing Note (published by Airbus Helicopters)
G/S	Glideslope (of ILS)
HDG	Heading hold mode (of an autopilot coupler)
(H)TAWS	(Helicopter) Terrain Awareness System
IAS	Indicated Air Speed hold mode (of an autopilot coupler)
ILS	Instrument Landing System
IMC	Instrument Meteorological Conditions (flight in IMC must be performed by reference to instruments)
IOGP	International Oil and Gas Producers' Association
LDP	Landing Decision Point (the latest point on the final approach where the decision to land or to go around may be made)
LOC	Localiser (of ILS)
LOSA	Line Oriented Safety Audit
MDA	Minimum Descent Altitude (on a non-precision or APV approach)
MDH	Minimum Descent Height (on a non-precision or APV approach
MEL	Minimum Equipment List (produced by an operator and based on, but not less restrictive than, the MMEL, and approved by the operator's national regulatory authority.
MMEL	Master Minimum Equipment List (a list of equipment permitted to be inoperative, produced by the manufacturer and approved by the certifying regulatory authority (for example EASA or FAA).
MSA	Minimum Safe Altitude
NDB	Non Directional Beacon
OEI	One Engine Inoperative
PF	Pilot Flying
PM	Pilot Monitoring
ROC	Rate of Climb
ROD	Rate of Descent
RVR	Runway Visual Range
SOP	Standard Operating Procedures
STAR	Standard instrument arrival
V_{TOSS}	Takeoff Safety Speed (the lowest speed ensuring continued climb performance of at least 100 feet per minute (fpm)with one engine inoperative and landing gear down, at 200 feet above the takeoff surface; speed for best angle of climb).
V_Y	Best rate of climb speed (speed ensuring continued climb performance of at least 150 fpm with one engine inoperative and landing gear up, at 1000 feet above the takeoff surface).
VMC	Visual Meteorological Conditions (flight in VMC may be performed using visual references).

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Safety Through Collaboration