

# PC2 DLE

Use case with H145  
and  
perspectives



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Use case with H145  
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## Offshore operations context

To address the potential engine failure, performances should be limited by :

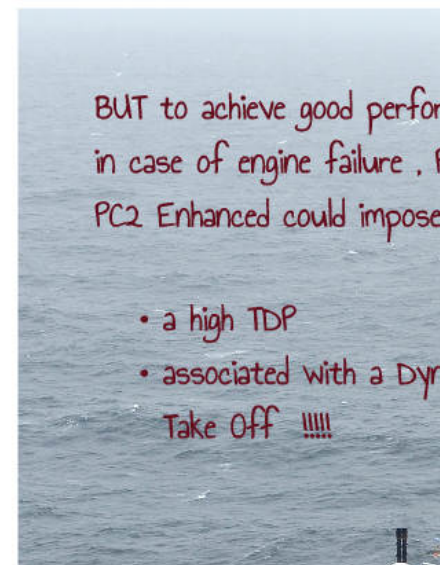
- Performance Class1 with theoretically NO Risk ,but with a payload reduction
- PC2 and PC2 with Limited Exposure which increase the Payload with an accepted risk of 1 catastrophic event each 20 million TL
- PC2 Enhanced which theoretically should improve safety ( compared to PC2 with limited exposure ) and increase weight

SINCE 2010

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BUT to achieve good performance in case of engine failure , PC2 Enhanced could impose

- a high TDP
- associated with a Dyn Take Off !!!!!





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- a high TDP
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Take Off !!!!!



Beginning of PC2 DLE  
concept is based on





Beginning of PC2 DLE  
concept is based on

HAZARD  
identification

Risks during all day  
operation (AEO)

Risk of  
engine failure

- ★ Pay load reduction effect  
( more sorties → more risk)
- ★ Loss of references

★ Deck Strike  
( T/O and Ldg )

★ Sea strike  
( T/O and Ldg )

★ Loss of references



Moving Deck

Low experience

Low Visibility or Turbulence





Moving Deck

Low experience

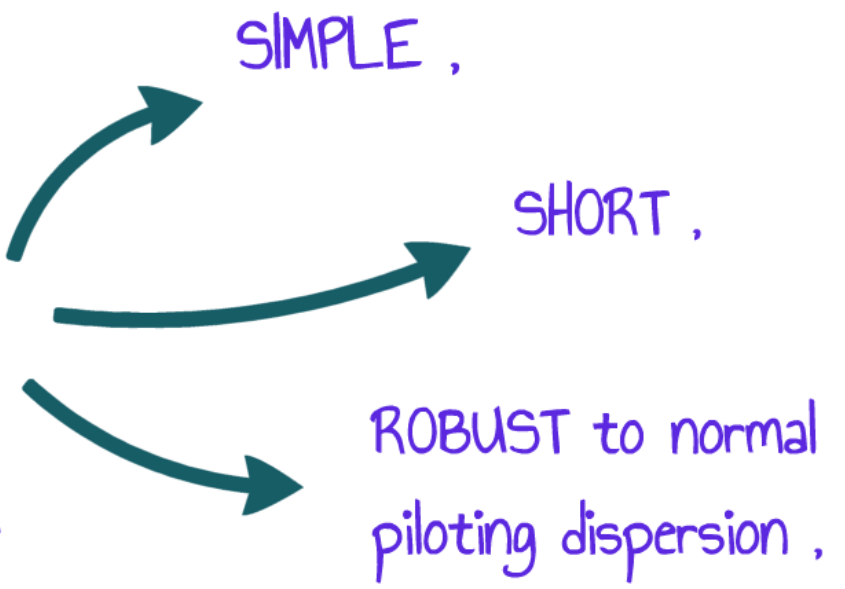
Low Visibility or Turbulence



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PC2 DLE objective : improve GLOBAL FLIGHT SAFETY  
( AEO and OEI )

## HAZARD MITIGATIONS

- Take Off and Landing Procedures
  - "SAME" procedure in AEO or OEI
  - Performance calculation taking into account Engine Failure
- 
- SIMPLE ,
- SHORT ,
- ROBUST to normal  
piloting dispersion ,



# PC2 DLE TAKE OFF PROCEDURE

## FLIGHT MANUAL

### A low Rotation Point

to avoid loss of reference (AEO) and guaranty the Rejected T/O (OEI)  
( specially for small helideck size and/or with poor cues )

### With TDP = RP

- Minimization of actions (too many sequences can lead to piloting dispersion with the risk of unsafe trajectory) (AEO and OEI)
- only one SIMPLE ACTION at TDP=RP: let's go ! (AEO OEI)
- limits CREW misunderstanding (AEO and OEI)

## as Cat A Sup

Helicopter rotor tip tangent to the helideck net

- 1/ To have the largest Deck edge margin (AEO and OEI)
- 2 / To reduce the procedure duration (minimization of trajectory drifts induced by dispersion during the sequence) (AEO and OEI)
- 3/ Gives the greatest margin regarding rear obstacles (AEO and OEI)



# PC2 DLE PERFORMANCES

FLIGHT TESTS



CERTIFIED SIMULATION  
TOOLS



Thank You  
Mr CORNU



CERTIFICATION  
CRITERIA

Calculations are done for the worst case :

- Total and sudden engine failure
- Factorised wind
- No EPC margin

To simplify calculation : Exposure time stops when aircraft is able to fly away

**VERY CONSERVATIVE  
methodology**



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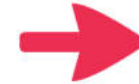
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PC2 DLE PERF  
available through







function

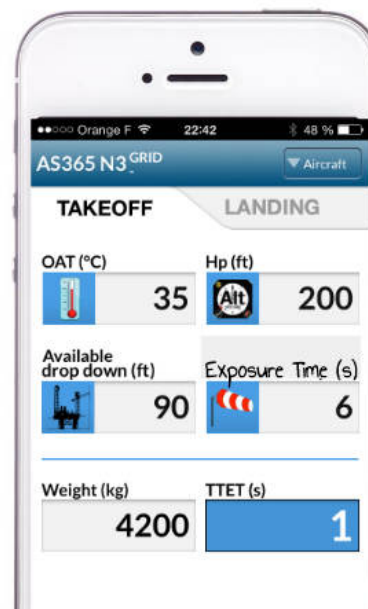


Available Drop  
down

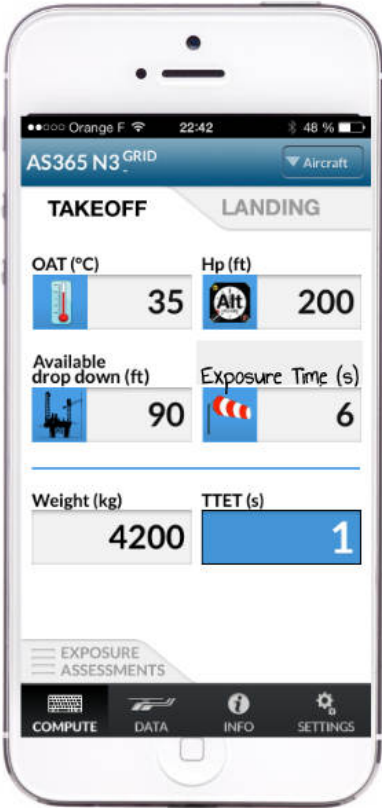


Exposure Time

PC2 DLE PERFORMANCE are  
available through :



PC2 DLE PERFORMANCE are available through :



# PC2 Defined Limited Exposure

normalized procedures  
justified performance

Normal  
Landing

Safe Forced  
Landing

Fly away

TDP

DPATO

TAKE OFF OEI event time scale

EASA Ops SFL Definition :

Unavoidable Landing or Ditching with a reasonable expectancy of no injuries to persons in the aircraft or on the surface

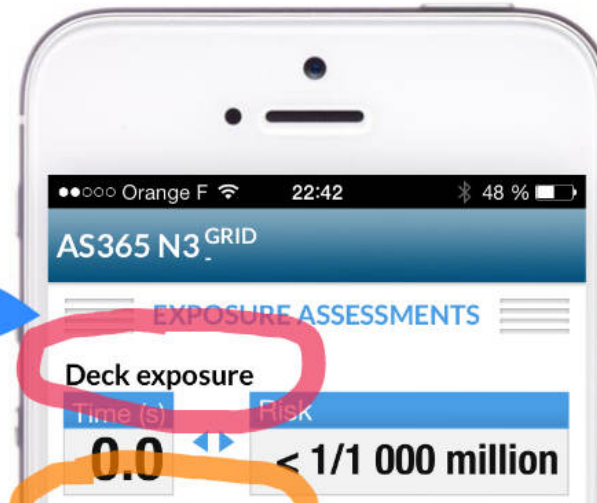
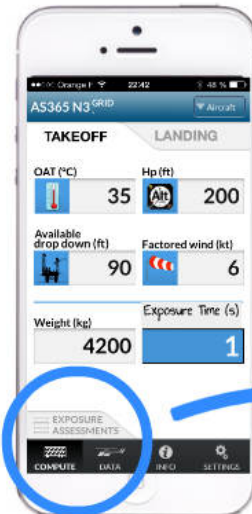


Deck risk

Ditching risk



Exposure Time



to keep lower  
than 1/ billion

to be set in  
accordance



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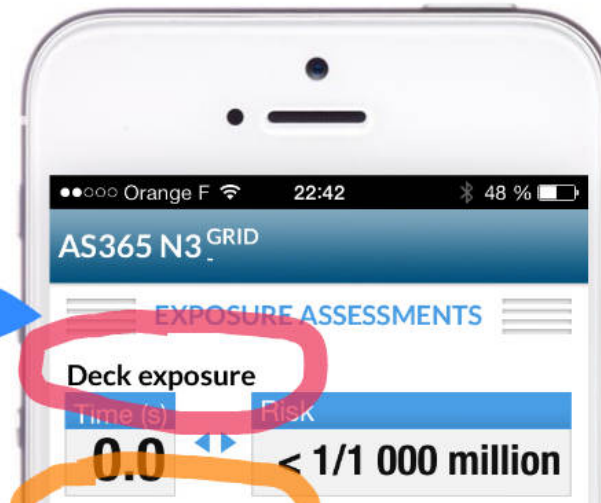
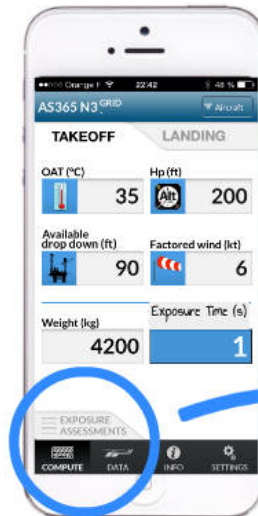


Deck risk

Ditching risk



Exposure Time



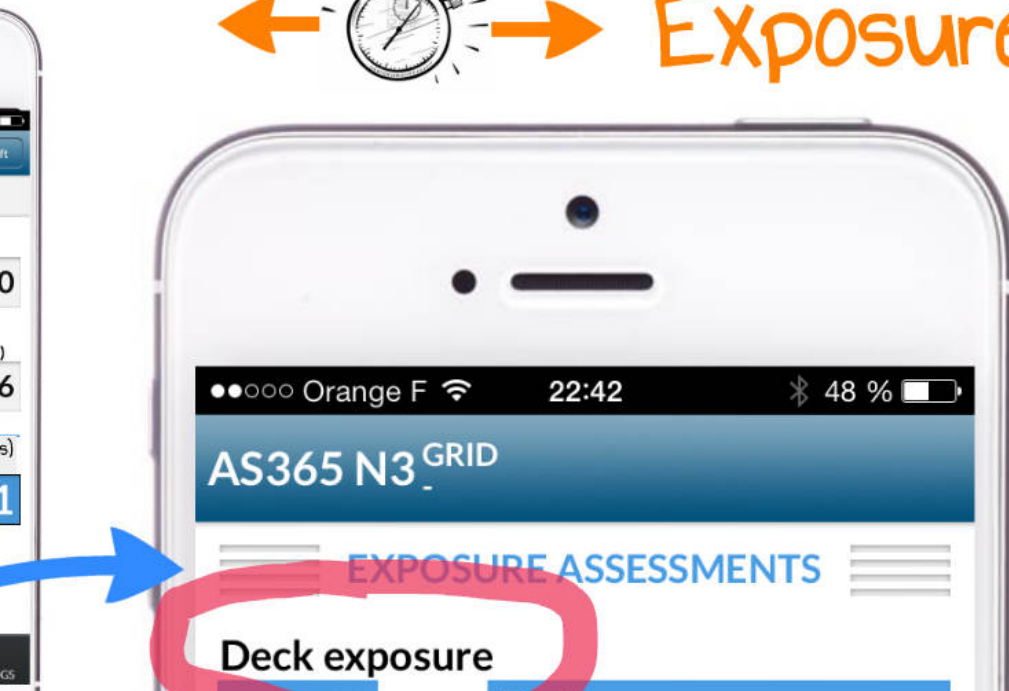
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accordance



Deck risk      Ditching risk

← → Exposure Time



to keep lower  
than 1/ billion



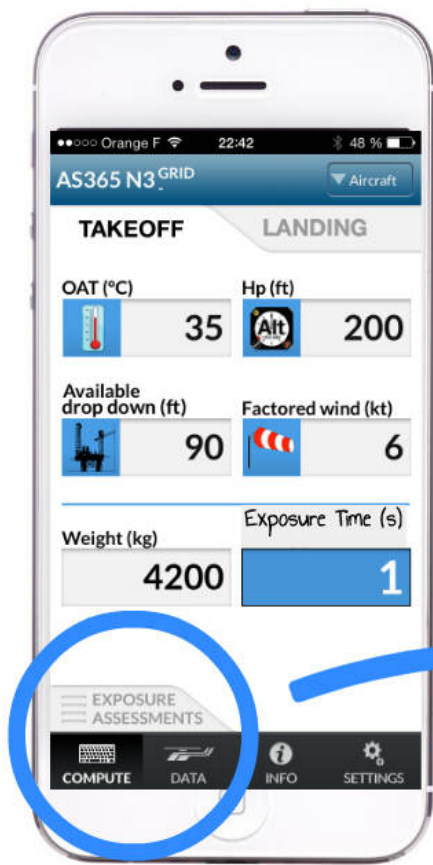
time scale

Deck risk

Ditching risk

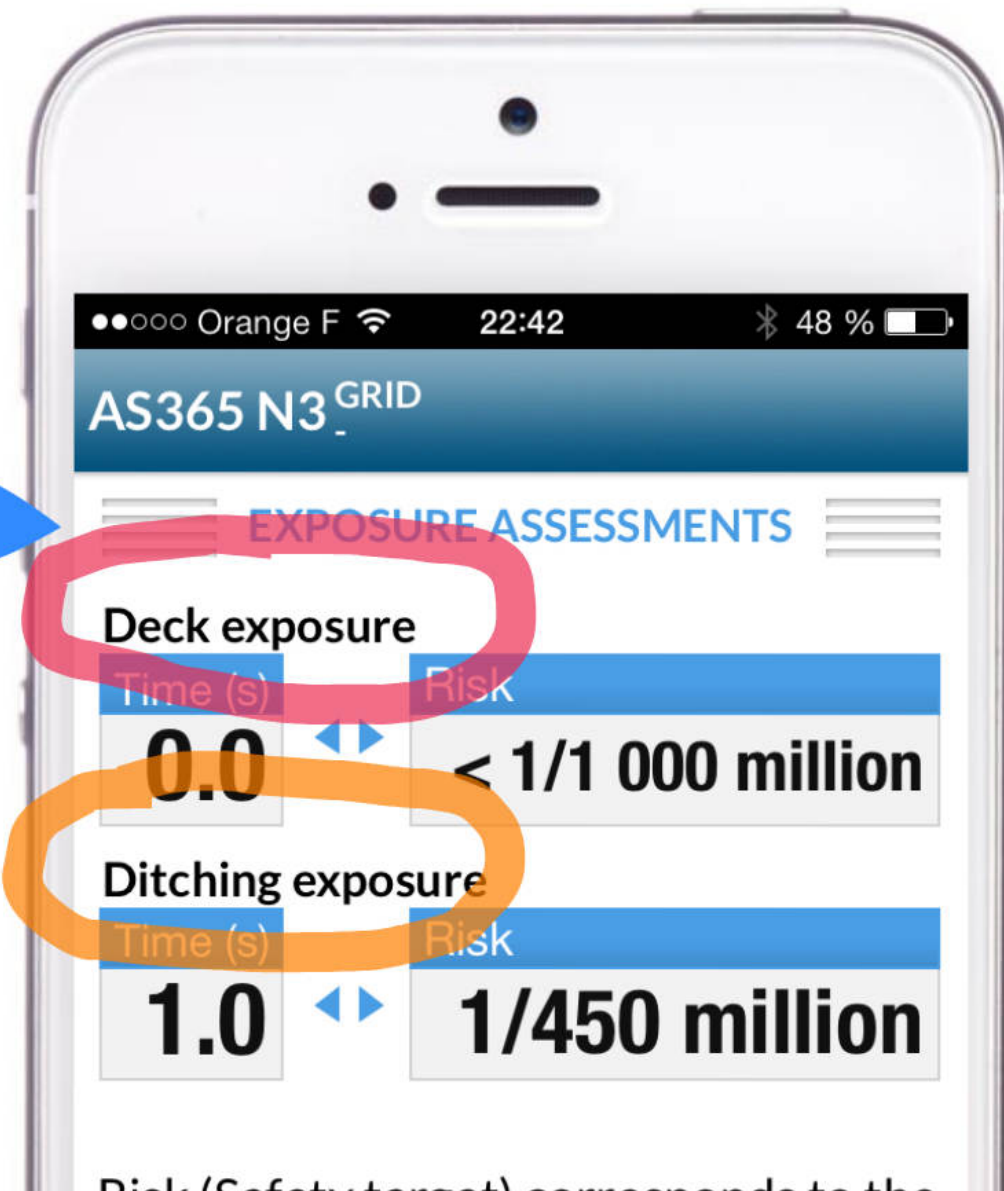


Exposure Time



Presently worldwide proposes a 3s Max

TOTAL



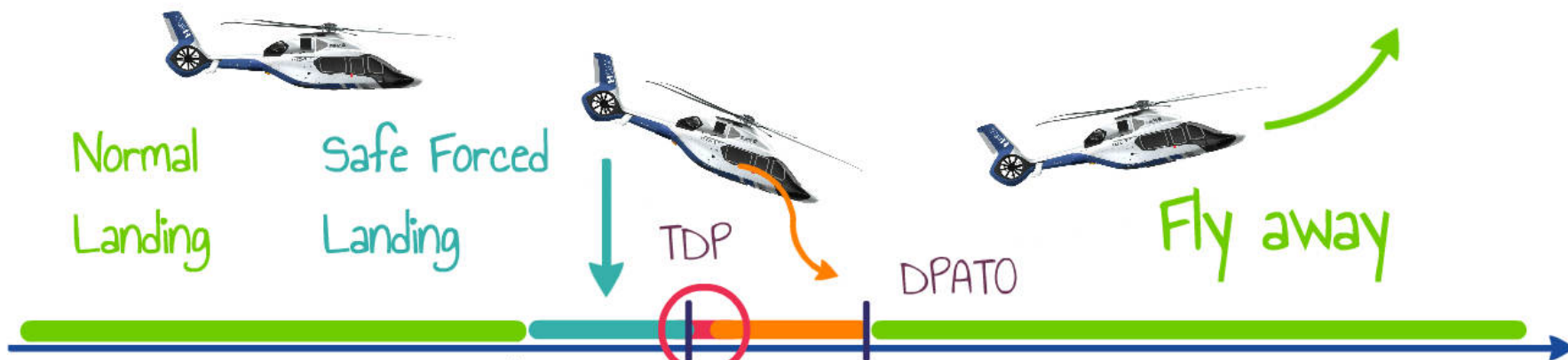
to keep lower than 1/ billion

to be set in accordance with SMS

EXPOSURE ASSESSMENTS	
Deck exposure	
Time (s)	Risk
0.0	< 1/1 000 million
Ditching exposure	
Time (s)	Risk
1.0	1/450 million

# PC2 Defined Limited Exposure

normalized procedures  
justified performance



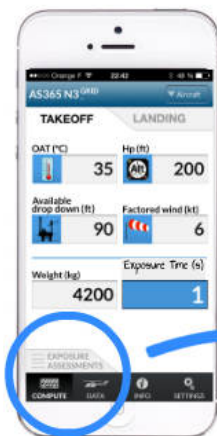
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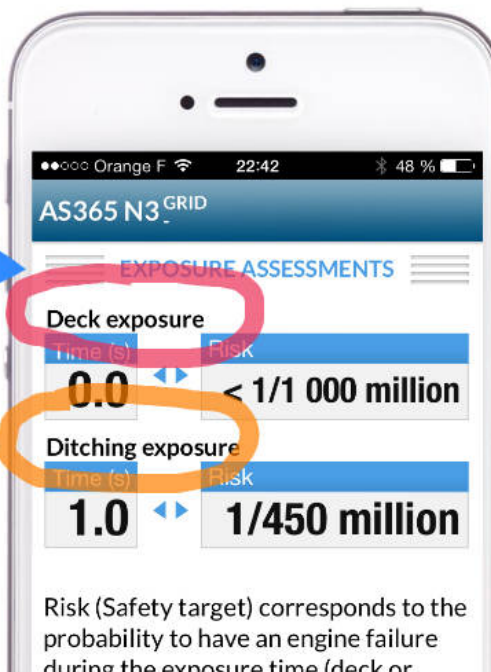
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Deck risk      Ditching risk  
← ⌚ → Exposure Time



Presently TOTAL  
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to keep lower  
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with SMS

Risk (Safety target) corresponds to the probability to have an engine failure during the exposure time (deck or

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PC2DLE on H145





# PC2DLE continued take-off after engine failure - free air testing



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# H145 Take OFF - Same PC1 and PC2 DLE procedure

## Normal procedure

1. Position helicopter tangent to deck edge
2. Climb vertically to 20 ft (TDP)
3. At 20 ft, rotate to  $-10^\circ$  and accelerate to VY



## Engine failure before TDP:

- Reject the take-off (back to the deck)
- For PC2 DLE weight Safe (forced) landing is ensured ( No exposure time )

## Engine failure after TDP:

- Continue take-off (rotate to  $-15^\circ$ )
- Deck edge clearance always ensured
- Depending on deck height: Ditch (exposure time ) or transition to climb

- 
- reject the take-off (back to the deck)
  - For PC2 DLE weight Safe (forced) landing is ensured ( No exposure time )

### Engine failure after TDP:

- Continue take-off (rotate to  $-15^\circ$ )
- Deck edge clearance always ensured
- Depending on deck height: Ditch (exposure time ) or transition to climb

### Take off Weight calculated through PC2 DLE Flight manual

- Whatever the Take Off weight : No deck edge Risk
- Only very low exposure with very low helideck, which could be reduced with small payload reduction ( depending on environment ... )



# H145 Landing - Same PC1 and PC2 DLE procedure

## Normal procedure

1. Arrive at 100 ft AHE at 30 kt; 1D offset from platform edge
2. Descend to 50 ft AHE at 30 kt (LDP)
3. Approach deck at 30 ft AHE at 10 kt
4. Land aircraft at center of helideck



## Engine failure before LDP:

- Balk the landing (i.e. go around) → No significant height loss
- Continue with the landing

## Engine failure after LDP:

- Same as normal procedure
- Safe landing is always ensured at MTOW

With PC2 DLE Flight manual : at Max weight → no exposure time

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# PC2DLE on H145 - Conclusions

H145 procedures standardized with PC1

- Simple and intuitive procedures
- Engine failures easy to handle (no complex maneuvers)
- Same procedure for H175, H160, etc.



A photograph of an offshore wind farm at dusk or dawn. In the foreground, a yellow service platform named 'alpha ventus' is visible, with a helicopter landing on its deck. The platform has 'AVO' and 'alpha ventus' written on it. Several wind turbines are visible in the background, their blades illuminated by the low light. The sea is dark and choppy.

One final remark...

Engine failures are not the only risk for offshore operations

(Engine failures are just given a lot of attention, because they are predictable and trainable)

Also ...

an intuitive cockpit,  
workload reducing systems,

simple procedures,

a good field of view,

situational awareness

... contribute a lot to flight safety

# PC2 Defined Limited Exposure synthesis



PC2 DLE is a toolbox to reduce the global risk ( and not only the consequences of engine failure ) with :

- defined , simple and robust procedures
- Smart applications with optimized performances and Risk Assessment for Deck ( lower than  $10^{-9}$  ) and for Ditching ( to be managed )

Consistent with  
Operators SMS



PC2 DLE concept brings STANDARDIZATION world wide with same Procedure for PC1 and PC2



PC2 DLE is compliant with EASA OPS regulation

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# PC2 Defined Limited Exposure evolution

## Performance Improvement :

Very low drop down available (small ships, ... ) could limit performances

Remember : Through Risk Mitigation, TDP is set to Max 20 ft (reference loss )

Thank to APM and electronic display which could help AEO and OEI trajectory keeping TDP could be higher than 20 ft and then allow the payload increase without Risk increasing

## Other type of operations

The PC2 DLE concept is a mean to objectivise and also reduce catastrophic risks !  
This benefit could also be transferred for others type of operations...