HeliOffshore
Safety Through Collaboration

Proposals for Offshore Helicopter Safety Enhancements

1. Introduction

This paper outlines a set of proposals that could further enhance safety in Offshore Helicopter Operations. It is intended to help support conversations for priorities, allocation of resource, investment, and to help avoid duplication of effort. Included in this document is the high-level data about accidents and occurrence types, the overall HeliOffshore Safety Strategy, plus the cost, benefit, timescales and implementation requirements for key safety proposals.

2. What the data tells us

The following data informs the HeliOffshore Safety Strategy, which is what we have used as the basis to agree which areas we should focus on to enhance safety performance. The following excerpt from the recent EASA accident report gives a good basis for discussion, for example, system failure, aircraft upset and obstacle conflict have the highest percentage of accidents, so we have selected these as justification for our priority areas to focus on to improve safety.

		Key Risk Areas (Outcomes)							
	Outcome Percentage of Fatal Accidents (Last 15 Years)	27.8%	16.7%	13.9%	8.3%	5.6%	0%	0%	0%
	Outcome Percentage of Non-Fatal Accidents (Last 15 Years)	34.4%	8.2%	9%	4.9%	4.9%	4.1%	1.6%	0.8%
Safety Area	Safety Issues	System Failure	Aircraft Upset	Obstacle Conflict	Terrain Conflict	Fire	Abnormal Runway (Landing Area) Contact and Excursions	Airborne Conflict	Incursions and Wrong Deck Landings
Operational	Detection, Recognition and Recovery of Deviation from Normal Operations		•	•	•	•	•	•	•
	Control of the Helicopter Flight Path and Optimal Operational Use of AFCS Capabilities		•	•	•		•	•	•
	Obstacle Clearance			•	•			•	
	Operation in Adverse Weather Conditions		•	•	•		•	•	•
	Fuel management	•	•						
	Flight Planning and Preparation		•	•	•	•	•	•	•
	Ground/ Helideck Operations	•	•	•		•	•		•
	Safe Landing Environment			•		•	•		•
	Helicopter Maintenance	•	•	•	•	•	•	•	•
Technical	Diagnosis of System Failures	•	•			•	•		
	Gearbox and Transmission System Reliability	•	•						
Consequences	Safe Forced Landings	•	•	•	•	•	•	•	•
	Safe Survival and Egress	•	•	•	•	•	•	•	•
Human Factors	Flight Crew Perception and Awareness		•	•	•		•	•	•
	CRM and Communication		•	•	•		•	•	•
	Knowledge and Competency of Individuals	•	•	•	•	•	•	•	•
	Personal Readiness	•	•	•	•	•	•	•	•
	Use of Rules and Procedures	•	•	•	•	•	•	•	•
Organisational	Crew Composition and Management		•	•	•		•	•	•
	SMS Implementation	•	•	•	•	•	•	•	•

Figure 1: Excerpts from EASA Report Offshore Helicopter Risk Portfolio from the last 15 years of global and offshore operations only

To enable an initial consideration of the Key Risk Areas (Outcomes) for the Offshore Helicopter Safety Risk Portfolio, the following chart provides details of the occurrence categories that were assigned to offshore helicopter occurrences.

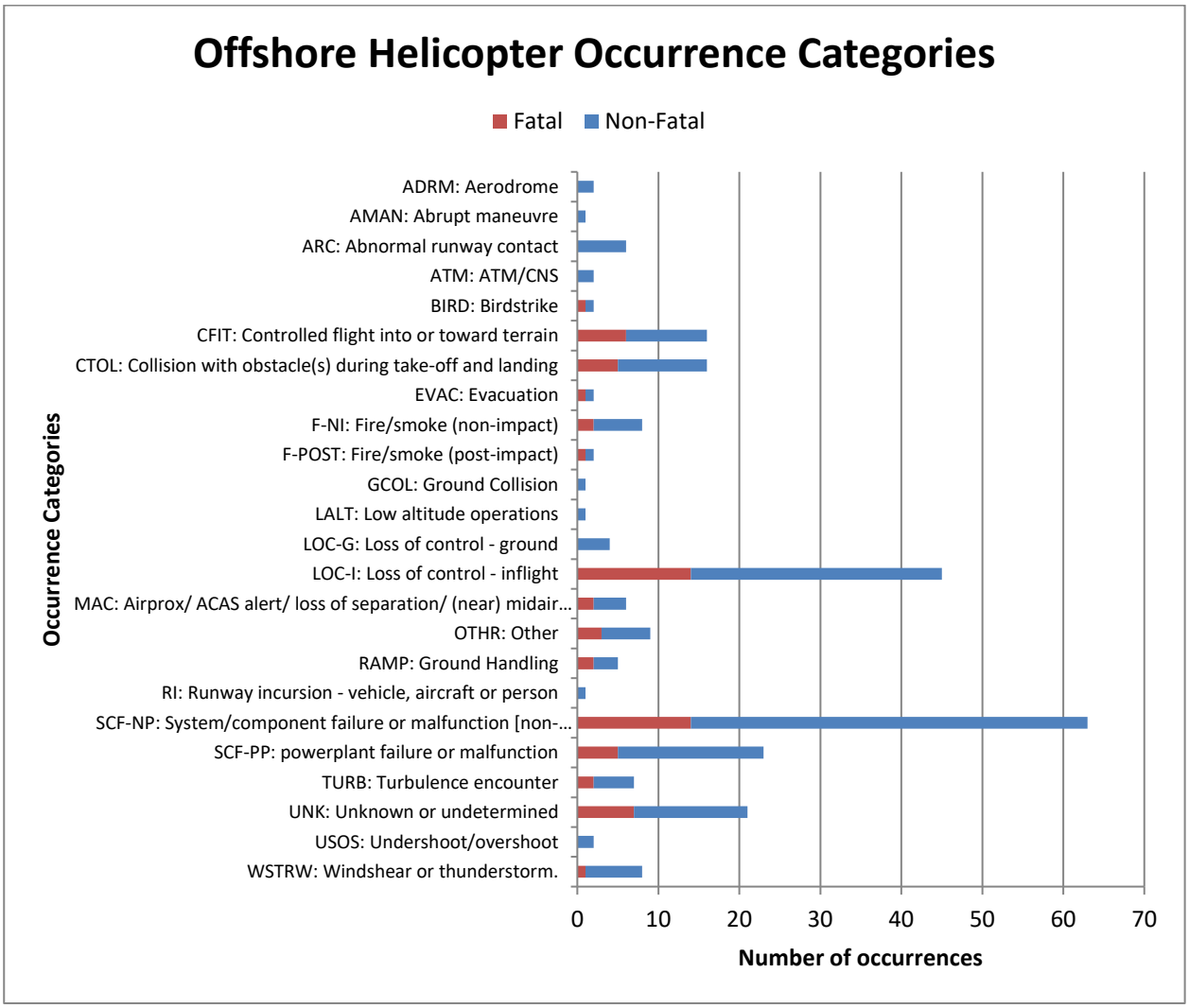


Figure 2: Offshore Helicopter Occurrence Categories from EASA Safety Risk Profile

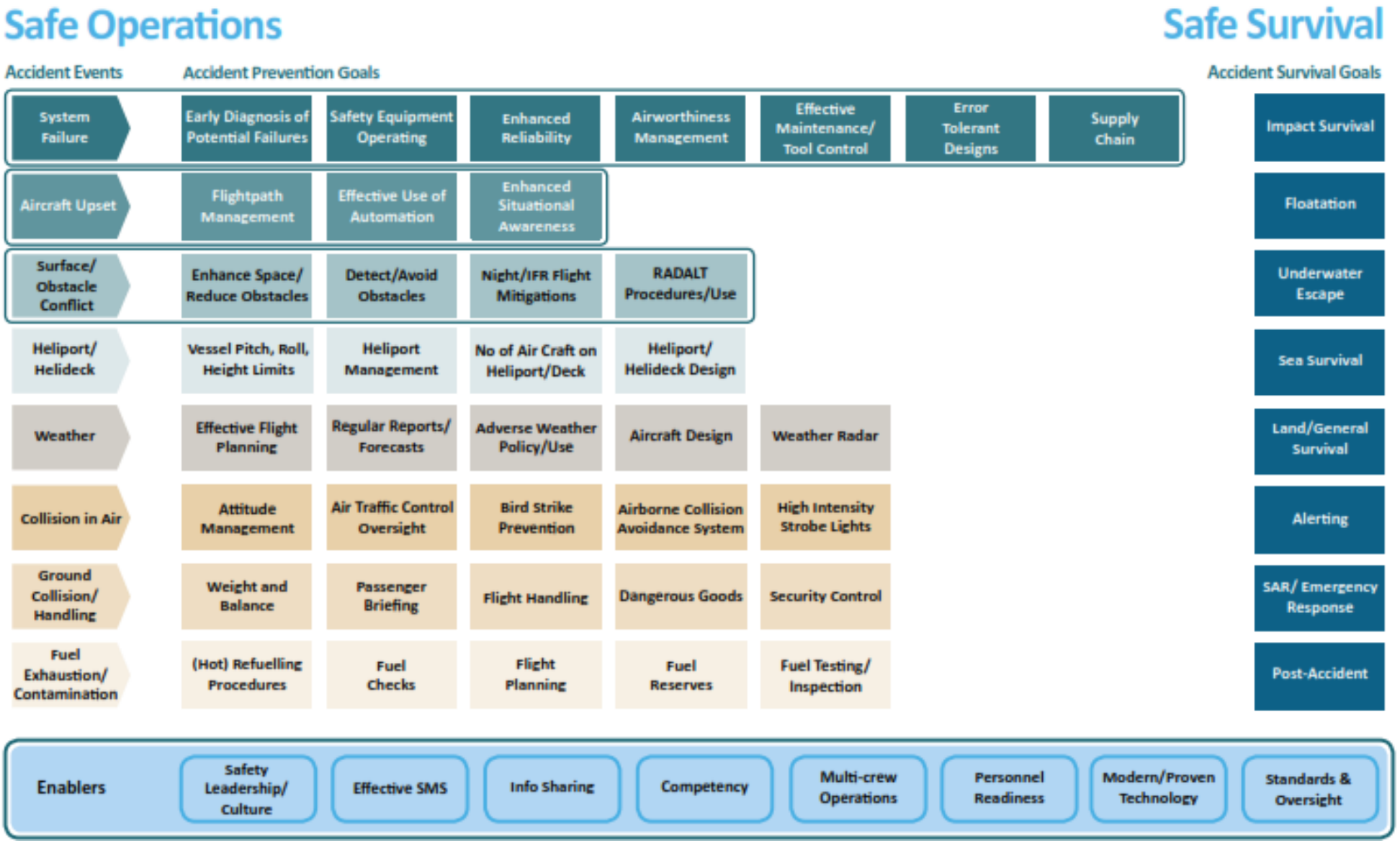
The four categories with the highest level of fatal accidents are:

1. System/component failures or malfunction
2. Loss of control in-flight
3. Controlled flight into or toward terrain
4. Collision with obstacle(s) during take-off and landing

The EASA Safety Risk Portfolio for Offshore Helicopter Operations, published in October 2015, has identified the top key safety issues that have been prioritised to focus on. You can find this in **Section 7.1.2 Safety Issues**, which details the following safety issues; technical safety, operational and enablers (organisational and human factors).

3. HeliOffshore Safety Performance Model:

The above data, together with expert judgement, were used to create the safety performance model below and the HeliOffshore Safety Strategy.



4. Summary of Safety Proposals and their Cost/Benefit

Key:

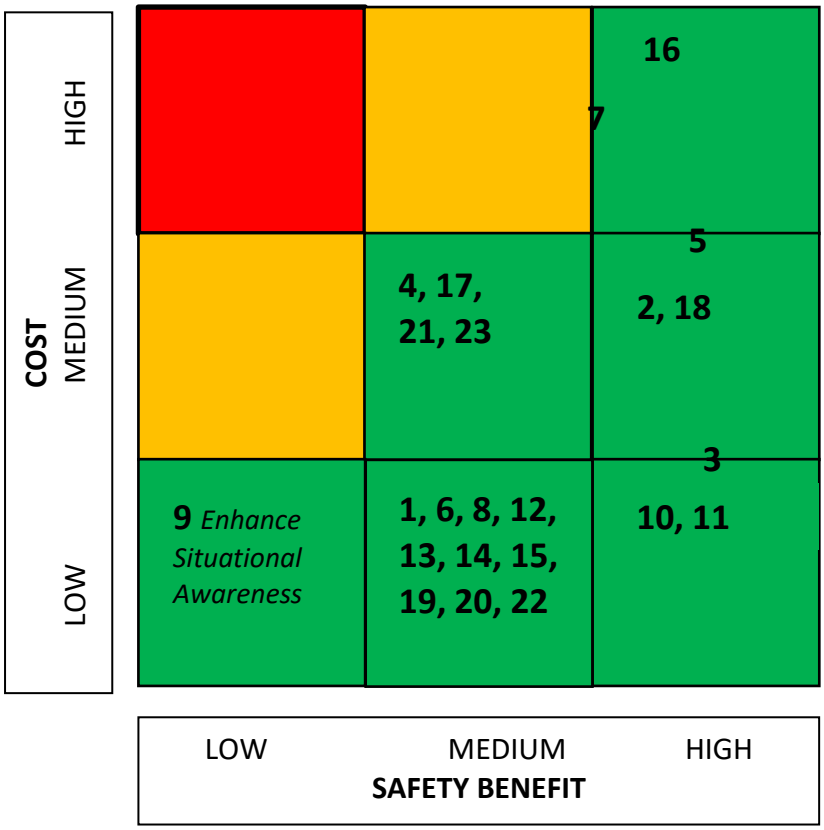
The following classifications have been defined:

Cost (approx.)*1	LOW	<£50k per aircraft/helideck
	MEDIUM	£50k to £250k per aircraft/helideck
	HIGH	>£250k per aircraft/helideck
Safety benefit*2	LOW	<10%
	MEDIUM	10-50%
	HIGH	>50%
Timescale*3	SHORT	<2 years to implementation
	MEDIUM	2 to 5 years to implementation
	LONG	>5 years to implementation

*1 Presented on a cost per aircraft/helideck as fleet size/total no. of assets unknown.
*2 European Aviation Safety Agency (EASA) Safety Risk Profile for Offshore Helicopter Operations
*3 Assumes full industry cooperation.

Legend for Summary Matrix

1. System Reliability & Resilience – HUMS
2. System Reliability & Resilience – Alternate Detection Methods
3. System Reliability & Resilience – Improved equipment reliability, near-term
4. System Reliability & Resilience – Improved equipment reliability, medium-term
5. System Reliability & Resilience – Improved equipment reliability, long-term
6. Operational Effectiveness – Approach Path Management Standards
7. Operational Effectiveness – GPS-Guided Offshore Approaches
8. Operational Effectiveness – Effective design and use of Automation
9. Operational Effectiveness – Enhance Situational Awareness
10. Operational Effectiveness – Enhance Obstacle Avoidance through HTAWS
11. Operational Effectiveness – Evidence Based Training
12. Safety Enablers – Continue to foster exchange of Safety Information
13. Safety Enablers – Implementing the Safety Management Database
14. Safety Enablers – Enhanced HFDM data
15. Safety Enablers – LOSA
16. Safety Enablers – Enhancement of the safety assessment processes for rotorcraft designs
17. Safety Enablers – Human Factors assessment of Helicopter Cockpits
18. Safety Enablers – Rotorcraft Fly by Wire requirements
19. Survivability – Ongoing Sea State Study
20. Survivability – Further enhancements to EBS
21. Survivability – Enhanced Emergency Flotation Systems
22. Survivability – Gather and share good survivability practice worldwide
23. Helideck Lighting

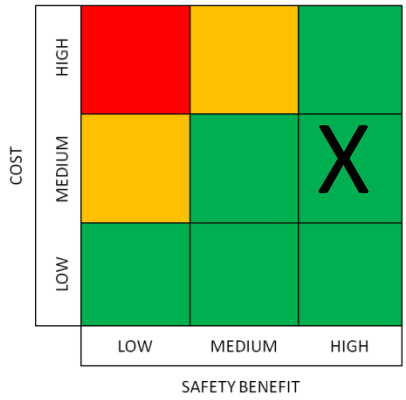

COST
HIGH
MEDIUM
LOW
16
7
5
4, 17,
21, 23
2, 18
3
9 Enhance
Situational
Awareness
1, 6, 8, 12,
13, 14, 15,
19, 20, 22
10, 11
LOW
MEDIUM
HIGH
SAFETY BENEFIT

5. Individual Safety Proposals and their Cost/Benefit

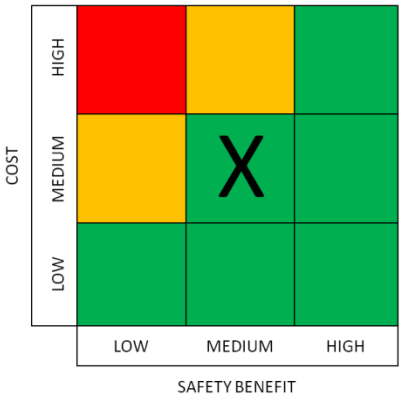
5.1 System Reliability & Resilience

Contributes to 28% of fatal accidents

1. Early diagnosis and resolution of potential failures through best practice implementation of Health & Usage Monitoring Systems (HUMS)		
Description	Optimised use of HUMS for detection and increase the effective use of HUMS best practice. Optimise system design and information sharing to further enhance the detection of potential failures.	
HeliOffshore Safety Plan Ref.	System Reliability and Resilience	
Resources required for implementation	Contractual requirements for optimisation of design use and information exchange.	
Timescale	Short	
Safety benefit	Medium	
Cost	Low	

2. Early diagnosis and resolution of potential failures through development of Enhanced Condition Monitoring (previously Alternate Detection Methods)		
Description	Develop and implement alternate detection methods to compliment HUMS, e.g. reliability and trend data, acoustic emissions, oil analysis etc. For further information see **Appendix 1 on System Reliability and Resilience on page 18**.	
HeliOffshore Safety Plan Ref.	System Reliability and Resilience	
Resources required for implementation	Contractual requirements for optimisation of design use and information exchange.	
Timescale	Short-Medium	
Safety benefit	High	
Cost	Medium	

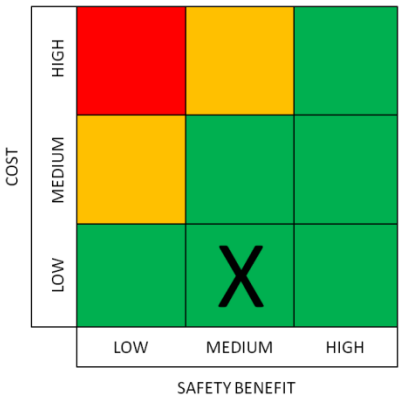
3. Improved equipment reliability, including fewer single point failures, and system(s) redundancy		
Description	**NEAR TERM:** Address safety critical reliability issues through enhanced maintenance and effective implementation of existing upgrades. Enhanced feedback loop between operations and OEMs. For further information see **Appendix 1 on System Reliability and Resilience on page 18**.	
HeliOffshore Safety Plan Ref.	System Reliability and Resilience	
Resources required for implementation	Compliance with the InfoShare codes of conduct, protections including confidentiality and the safety database. Willingness and contractual requirements to share information. May require resources from operators and OEMs to analyse data and act upon results and feedback on progress.	
Timescale	Short	
Safety benefit	High	
Cost	Low-Medium	

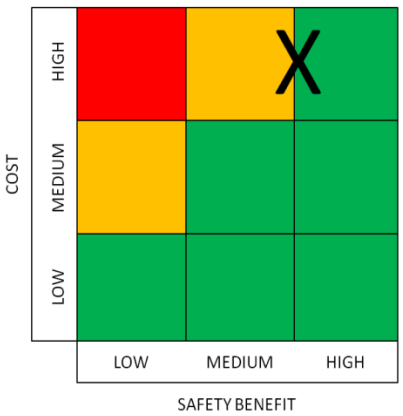
4. Improved equipment reliability, including fewer single point failures, and system(s) redundancy		
Description	**MEDIUM TERM:** System upgrades and reduced operational impact of system failures. This includes items such as reducing 'land immediately' events and limiting 'return to base' through reduced false alerts and more reliable systems. For further information see **Appendix 1 on System Reliability and Resilience on page 18**.	
HeliOffshore Safety Plan Ref.	System Reliability and Resilience	
Resources required for implementation	Contractual requirements for system upgrades, and information sharing alignment on the safety benefit for the business case for system upgrades.	
Timescale	Medium	
Safety benefit	Medium	
Cost	Medium	

5. Improved equipment reliability, including fewer single point failures, and system(s) redundancy		
Description	**LONG TERM:** Enhanced resilience in design. For further information see **Appendix 1 on System Reliability and Resilience on page 18**.	
HeliOffshore Safety Plan Ref.	System Reliability and Resilience	
Resources required for implementation	Contractual requirements for enhanced designs, investment in research and development for future system designs, maintenance training and simulators.	
Timescale	Medium-Long	
Safety benefit	High	
Cost	Medium-High	

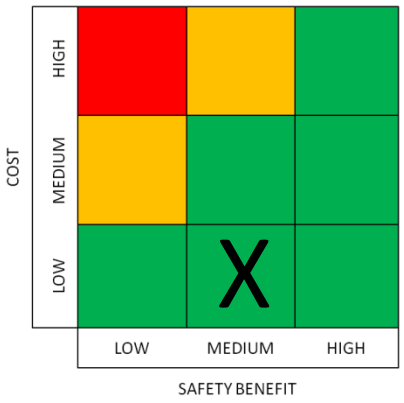
5.2 Operational Effectiveness

Contributes to 17% of fatal accidents

6. Approach Path Management Standards and early identification of flight path deviation		
Description	Approach Path Management Standards and early identification of flight path deviation	
HeliOffshore Safety Plan Ref.	Aircraft Upset	
Resources required for implementation	Participation in the Operational Effectiveness workstream, and promotional and publication costs, such as implementation guides and videos. The biggest requirement will be people's time to participate, along with other priorities. There may possibly be a need to create a contractor position to help with the development of this work to help speed it up, with the potential cost of under £100K.	
Timescale	Short	
Safety benefit	Medium	
Cost	Low	

7. GPS-Guided Offshore Approaches		
Description	All four helicopter OEMs have systems available, but not all are certified. Work to support implementation of this technology.	
HeliOffshore Safety Plan Ref.	Aircraft Upset	
Resources required for implementation	Alignment with regulators of the steps to progress certification, where appropriate, and contractual requirements for implementation, training and procedures to optimise use.	
Timescale	Medium	
Safety benefit	Medium-High	
Cost	High	

8. Effective Design and Use of Automation, including FCOMs and automation training videos		
Description	Effective Design and Use of Automation, including FCOMs and automation training videos	
HeliOffshore Safety Plan Ref.	Aircraft Upset	
Resources required for implementation	Resources for development and implementation.	
Timescale	Short	
Safety benefit	Medium	
Cost	Low	

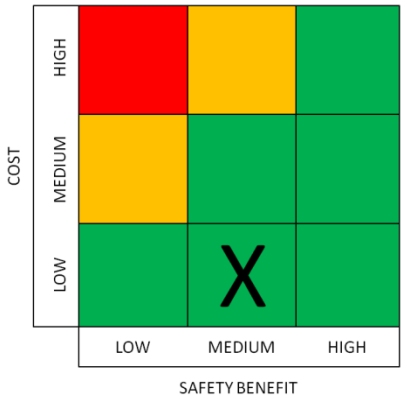
9. Enhance Situational Awareness through better understanding of eye movement		
Description	Enhance Situational Awareness through better understanding of eye movement	
HeliOffshore Safety Plan Ref.	Aircraft Upset	
Resources required for implementation	Contractor position costing less than 100K, pilots and a simulator, which have already been budgeted by HeliOffshore.	
Timescale	Short	
Safety benefit	Medium	
Cost	Low	

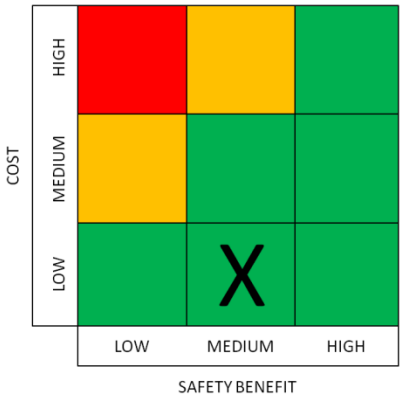
10. Enhance Obstacle Avoidance through advanced Helicopter Terrain Awareness & Warning Systems (HTAWS)		
Description	Retrofit of Phase 1 HTAWS improvement 'package' comprising revised and new warning envelopes.	
HeliOffshore Safety Plan Ref.	Obstacle Avoidance	
Resources required for implementation	Support from OEMS to finalise the specification and to implement, commitment from oil companies for funding, contractual reqt to use the new system.	
Timescale	Short	
Safety benefit	High	
Cost	Low	

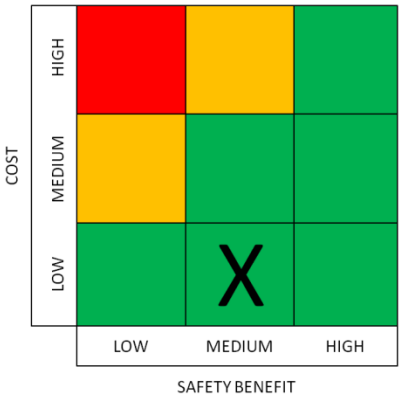
11. Evidence Based Training to Support Effective Operational Performance		
Description	Create regulatory pathway for helicopter operators (initially under EASA) to employ initial and recurrent competency-based pilot training that is designed to address identified operational risk.	
HeliOffshore Safety Plan Ref.	Aircraft Upset: All goals Surface/Obstacle Conflict: All goals	
Resources required for implementation	SME input to support established EASA Rule-making Task (0599) team members.	
Timescale	Medium	
Safety benefit	High	
Cost	Low	

5.3 Safety Enablers

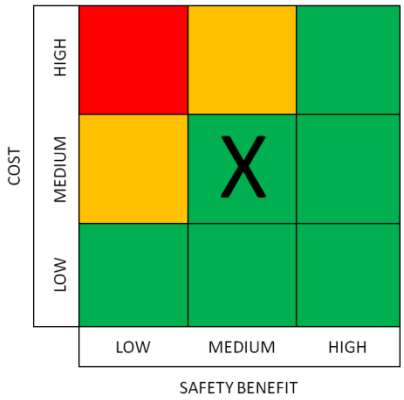
12. Continue to foster exchange of Safety Information		
Description	Continue to foster exchange of Safety Information	
HeliOffshore Safety Plan Ref.	Safety Enablers	
Resources required for implementation	Requires adherence to InfoShare protocols, with confidentiality protection built in, with a willingness to share information on safety events. This has already been implemented. Phase 2 will include enhanced data sharing systems.	
Timescale	Already in place	
Safety benefit	Medium	
Cost	Low	

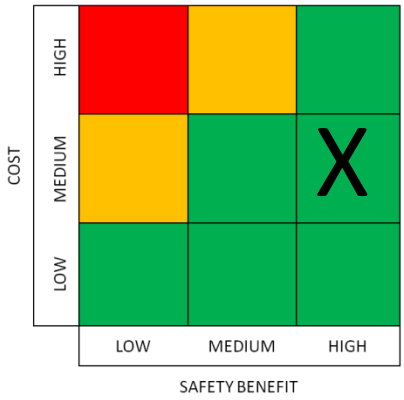
13. Implementing the Safety Management Database		
Description	Implementing the Safety Management Database	
HeliOffshore Safety Plan Ref.	Safety Enablers	
Resources required for implementation	The biggest cost is resources required from OEMs and operators to help format, analyse and respond to the data. Enablers could be a network of safety analysts, development of information sharing taxonomies and standards, confidentiality protection and agreed protocols.	
Timescale	Short	
Safety benefit	Medium	
Cost	Low	

14. Enhanced Helicopter Flight Data Monitoring (HFDM) data		
Description	Upgrading of existing HFDM to include monitoring of compliance with SOPs, monitoring of offshore helideck environments and usage monitoring.	
HeliOffshore Safety Plan Ref.	Safety Enablers	
Resources required for implementation	Modifications to HFDM analysis software will likely be required. Extent of improvements that are possible may be limited on some helicopter types due to unavailability of flight parameters. Learning culture to support this work in place.	
Timescale	Short	
Safety benefit	Medium	
Cost	Low	

15. Line Orientated Safety Audits (LOSA)		
Description	Use of observational techniques such as LOSA	
HeliOffshore Safety Plan Ref.	Safety Enablers	
Resources required for implementation	Data analysis capabilities, and the ability to act upon the results. Trained observers with cockpit access, or the funds to support this work, and an appropriate learning culture in place.	
Timescale	Short	
Safety benefit	Medium	
Cost	Low	

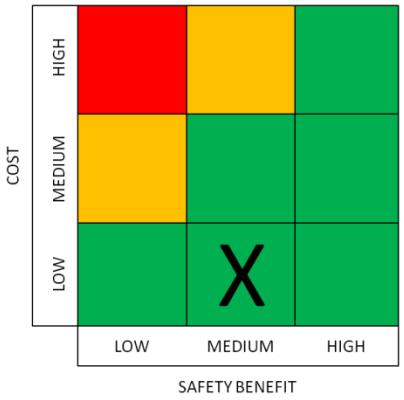
16. Enhancement of the safety assessment processes for rotorcraft designs		
Description	Enhancement of the safety assessment processes for rotorcraft designs through robust and up-to-date methodologies.	
HeliOffshore Safety Plan Ref.	Enhanced Certification	
Resources required for implementation		
Timescale	Short	
Safety benefit	High	
Cost	High	

17. Human Factors assessment of Helicopter Cockpits		
Description	Reduction in the likelihood of rotorcraft accidents attributed to human factors that are caused or exacerbated by the rotorcraft design.	
HeliOffshore Safety Plan Ref.	Enhanced Certification	
Resources required for implementation		
Timescale	Short	
Safety benefit	Medium	
Cost	Medium	

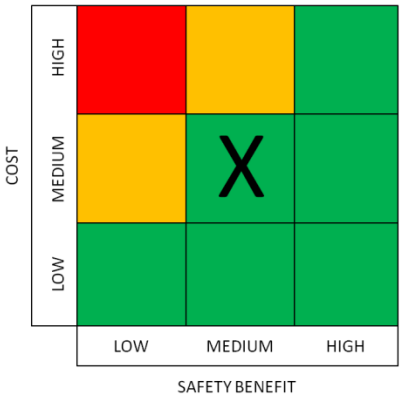
18. Rotorcraft Fly by Wire requirements		
Description	Facilitation of the introduction of Fly by Wire technology to rotorcraft in a safe and efficient manner.	
HeliOffshore Safety Plan Ref.	Enhanced Certification	
Resources required for implementation		
Timescale	Medium	
Safety benefit	High	
Cost	Medium	

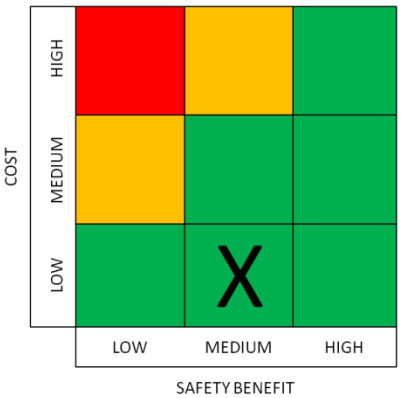
5.4 Survivability

19. Ongoing Sea State study		
Description	Development of initial sea state study to: (1) establish consistent reporting and forecasting of sea state in majority of HO operating regions develop and define operating limitation related to wave steepness in place of fixed SWH limit	
HeliOffshore Safety Plan Ref.	Safe Survival: Impact Survival Flotation	
Resources required for implementation	Working group with SMEs from various backgrounds: (1) marine climatology (2) sea-keeping (naval architecture (3) helicopter operations (4) EASA RMT.0120 group members Marine meteorological reporting / forecasting	
Timescale	Medium	
Safety benefit	Medium	
Cost	Low	

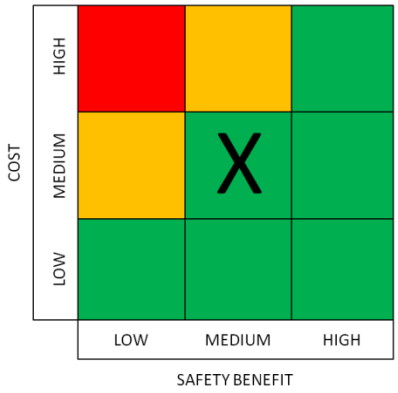
20. Further enhancements to Emergency Breathing Systems (EBS)		
Description	Implementation of CAP 1034 Category A EBS for passengers and flight crew Emergency Flotation Systems (EFS) to increase underwater survival time and reduce fatalities due to drowning in survivable water impacts/post-ditching capsizes.	
HeliOffshore Safety Plan Ref.	Safe Survival/System Failure	
Resources required for implementation	Several systems approved to CAP 1034 available off the shelf. Already implemented on the UKCS.	

	Mandatory under EASA operating rules effective from 1 July 2018.	
Timescale	Short	
Safety benefit	Medium	
Cost	Low	

21. Enhanced Emergency Flotation Systems (EFS)		
Description	Development and retrofit of additional flotation units to prevent total inversion in the event of capsize, and increase the post-crash operability of the EFS to significantly reduce fatalities due to drowning in survivable water impacts/post-ditching capsizes.	
HeliOffshore Safety Plan Ref.	Safe Survival/System Failure	
Resources required for implementation	Civil system for the S92 being developed in Australia by One Atmosphere (has applied to EASA for certification). No new technology required but there will be some design 'challenges'.	
Timescale	Short	
Safety benefit	Medium	
Cost	Medium	

22. Gather and share good survivability practice worldwide		
Description	Ensure best practice is shared globally.	
HeliOffshore Safety Plan Ref.	Safe Survival	
Resources required for implementation	Willingness of members to share best practice, including benefits achieved with implementation.	
Timescale	Short	
Safety benefit	Medium	
Cost	Low	

5.5 Other

23. Helideck Lighting		
Description	Retrofit of circle & H lighting specified in Appendix C of CAP 437 to offshore helidecks for night operations.	
HeliOffshore Safety Plan Ref.	Obstacle Avoidance/Aircraft Upset	
Resources required for implementation	At least four systems approved by HCA available to purchase off the shelf.	
Timescale	Short	
Safety benefit	Medium	
Cost	Medium	