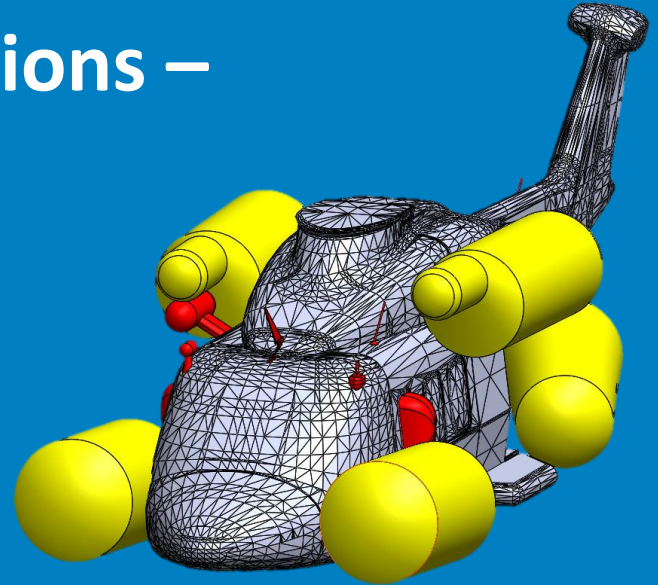


Helicopter Off-Shore Operations – New Flotation Systems (FS)

A feasibility study of implementing a High-Mounted Emergency Flotation System for CS27 and CS29 helicopters performing off-shore operations.



Disclaimer



This project is funded by the European Union under the Horizon 2020 Programme.

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Welcome to the webinar!

This webinar is the final dissemination event of the research project Helicopter Off-Shore Operations – New Flotation Systems (FS)

This project has received funding from the European Union's Horizon 2020 research and innovation Programme.



The EU delegated the contractual and technical management of this research action to EASA.

EASA contracted DART Aerospace for the implementation of the research action following a public tender procedure.



EASA managed projects are addressing research needs of aviation authorities and are an important pillar of the EASA R&I portfolio.

The agenda

Welcome

Willy Sigl, EASA

The research scope and objectives

Emily Lewis and Lionel Tauszig, EASA

Research activities and results

Mike Lee, DART Aerospace

- HEFS design and improved air pocket
- Deployment safety aspects
- Heat resistance
- Aerodynamic aspects
- Overall Integration aspects
- Recap of conclusions

Benefits from this project

Emily Lewis, EASA

Questions and answers

The participants and the project team

Concluding remarks

Willy Sigl, EASA

Note: this webinar will be recorded and made available at the EASA website after the event.

1. The Research Scope and Objectives

Research Overview and Objective


Research Project **EASA.2019.HVP.18**: New Flotation Systems



- Received funding from the European Union's Horizon 2020 research and innovation programme
- The research action is based on the Horizon 2020 Work Programme Societal Challenge 4 'Smart, green and integrated transport'

Awarded to: **DART**
AEROSPACE

 June 2020 to June 2023
(extended to December 2023)

 € 1,475,000



<https://www.easa.europa.eu/en/research-projects/helicopter-shore-operations-new-flotation-systems>

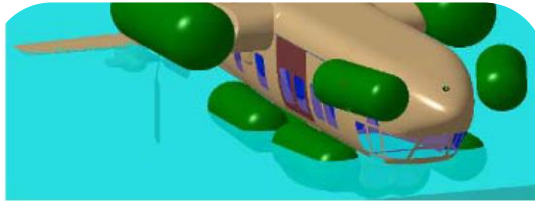
OBJECTIVE:

provide answers to technical issues regarding the feasibility of providing a step change in occupant survivability following capsizing of a helicopter through the introduction of an air pocket scheme utilising flotation units mounted high up on the helicopter fuselage.

Background

- Capsize resistance extremely challenging to achieve in all emergency situations
- Following capsizes, drowning is the most likely cause of fatalities
- Incompatibility between breath-hold capability and required time to escape

EXTENSIVE RESEARCH PREVIOUSLY PERFORMED → “AIR-POCKET”



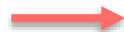
- ✓ Air pocket can be achieved with addition of high mounted EFS
- ✓ Capsized floating attitude with sufficient portion of the cabin above the water line
- ✓ Sizing and location assessed
- ✓ Feasibility of solution validated by wave tank testing to confirm the hydrodynamic performance
- ✓ Human subject trials to establish feasibility of egress

EASA.2007.C16

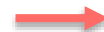


RMT.0120, NPA 2016-01

Proposed enhanced post-capsize survivability features (air pocket) for CS-27 and CS-29 update



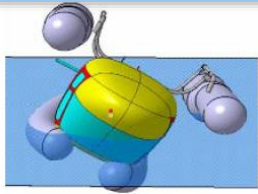
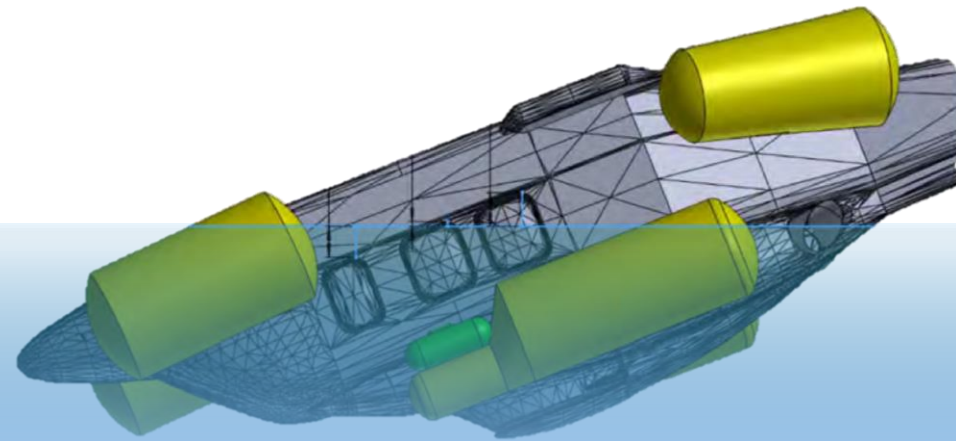
Technical issues highlighted which require further investigation



RESEARCH
EASA.2019.HVP.18

Scope

- Research Technical Questions:



System Design

Can a HEFS be designed for a reference CS-27 Category A and CS-29 helicopter such that the target air pocket is achieved ?



Deployment

Does the risk of inadvertent deployment in flight present a significant flight safety issue due to the potential for interference with the main rotor?



Heat Resistance

Are there materials available for the different components of the HEFS, which are sufficiently heat and puncture resistant ?



Aerodynamics

Does the reference design (size, location and shape) of the stowed HEFS result in unsurmountable negative aerodynamic effects ?



Integration

Does the implementation of the HEFS produce any significant challenges regarding overall usability / integration aspects ?

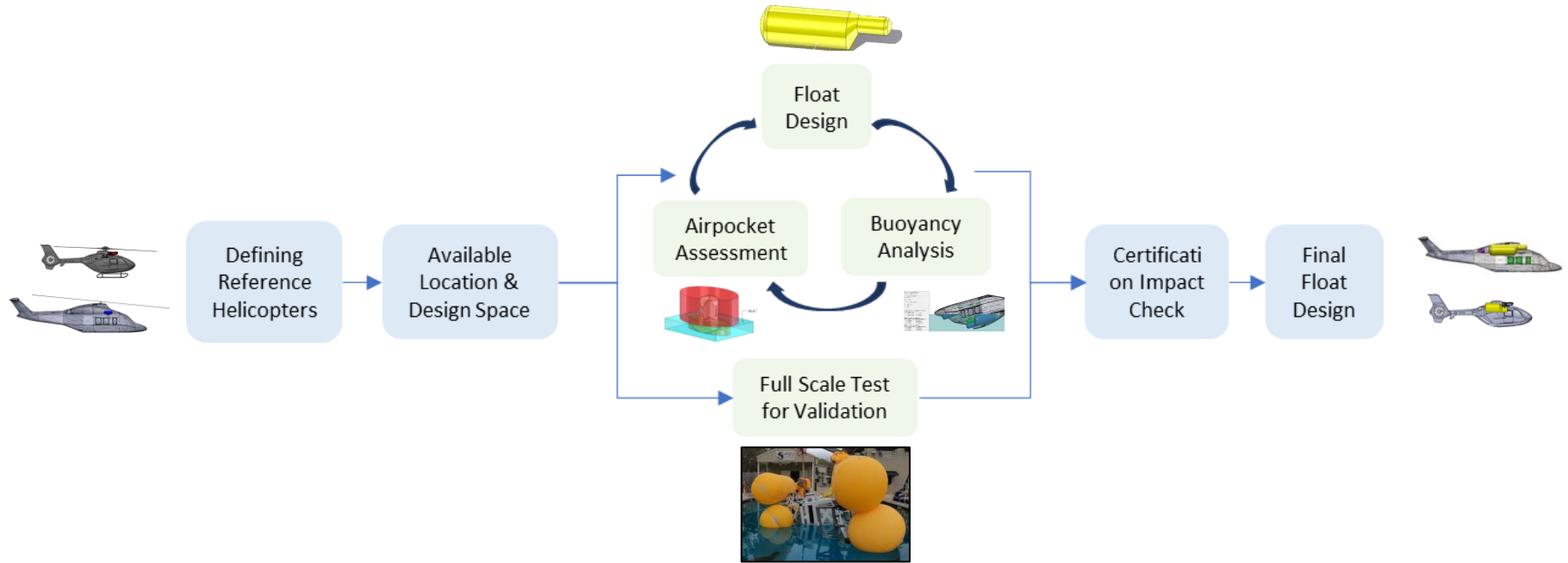
2. Research Activities and Results

2. Research Activities and Results

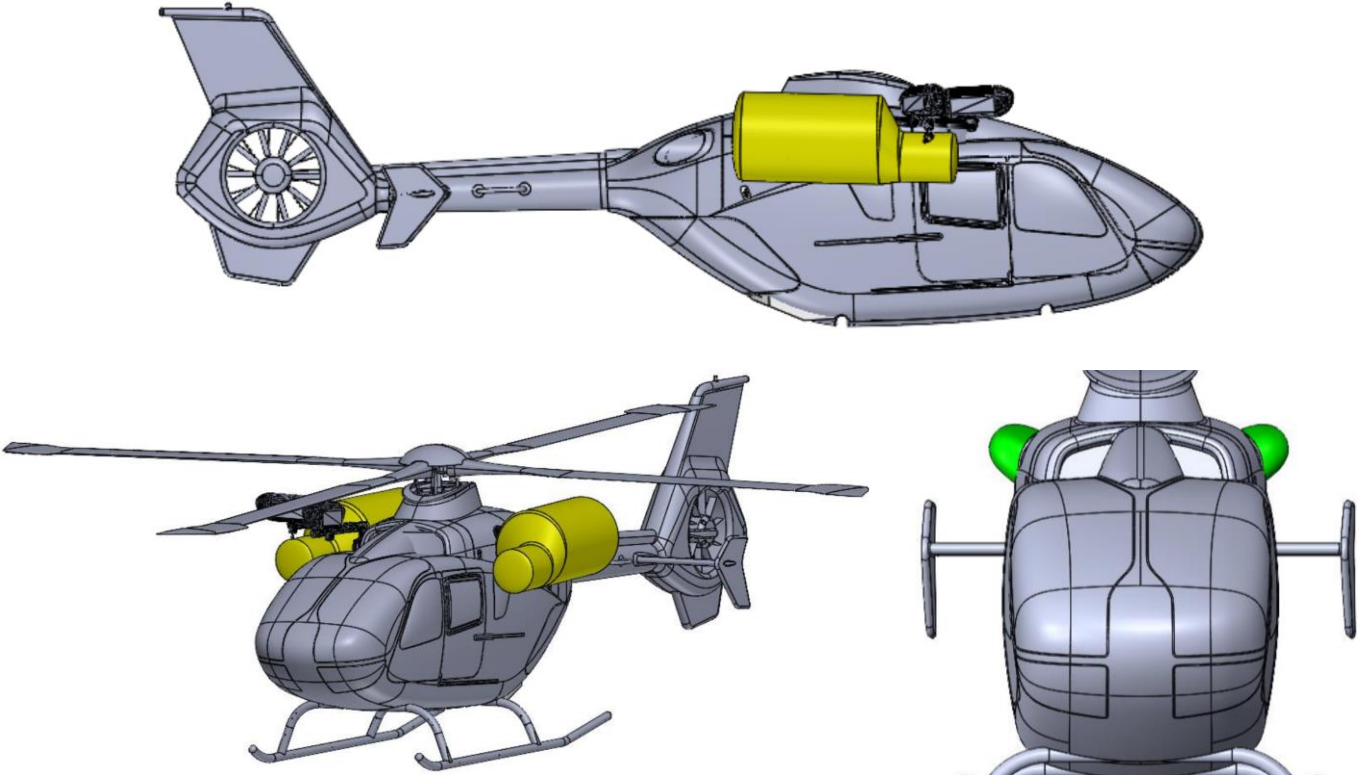
I. HEFS Design and Improved Air Pocket

Can a High-mounted Emergency Flotation System (HEFS) be introduced on CS27 and CS29 helicopters to provide an internal air pocket, essential for ensuring breathable air for passengers following a ditching and capsizing event ?

Feasibility Analysis Approach

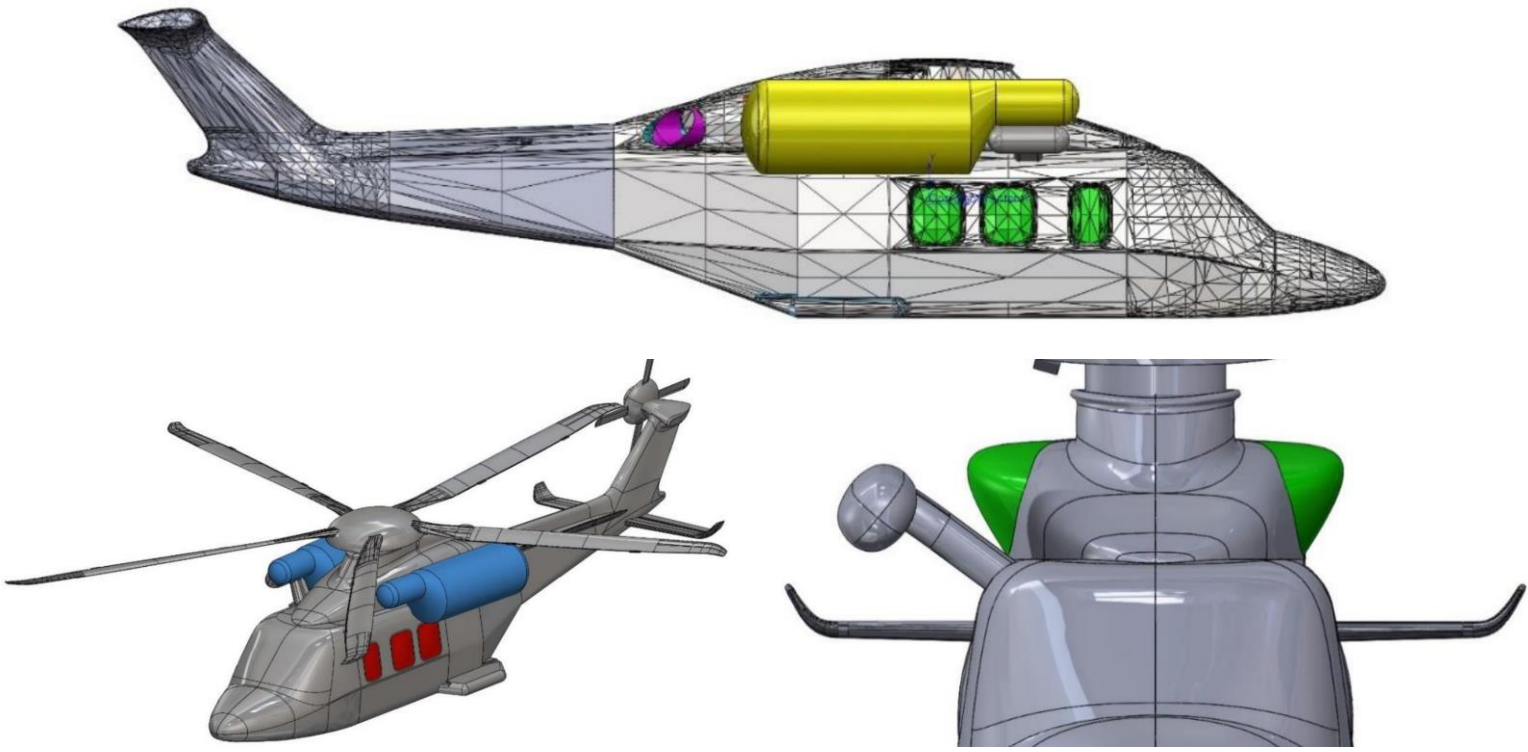


CS27 Cat A HEFS Design



CS27 Cat A Reference Helicopter HEFS design

CS29 HEFS Design



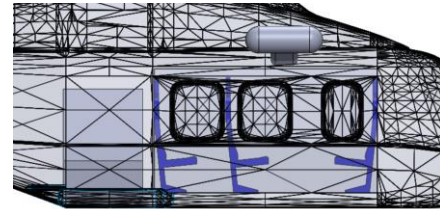
CS29 Reference Helicopter HEFS design

Reference Helicopters and Design Space

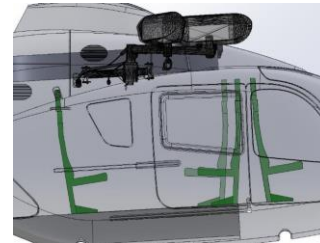
- Reference configuration includes an assessment of:
 - Rescue hoist
 - Passenger seats
 - Engine inlets
 - Exhaust location
 - Access panels
 - Emergency exit locations



CS29 Reference Helicopter



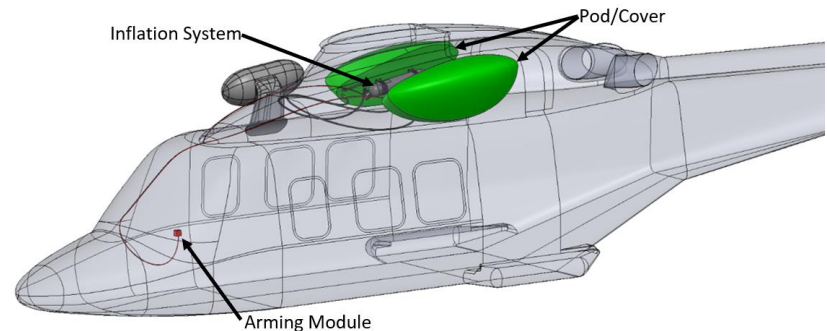
CS27 Cat A Reference Helicopter



HEFS Design

High-Mounted Emergency Flotation System (HEFS) design and location:

- **Float**
 - Float shape is designed to avoid interference with the optional rescue hoist and rotor blades
 - Overall volume and location based on air pocket analysis and worst-case heat condition
- **Pod**
 - Sized based on established float-to-pod volume ratios.
 - Exterior cover face shape optimized to minimize drag and maximize downstream pressure recovery
 - Avoid interference with any critical sensors, components or inlets/outlets
 - The location of the pods satisfies aimed buoyancy
- **Inflation System**
 - Utilizes high-pressure gas charges from electrically actuated reservoirs



Buoyancy Analysis and Results

- **Purpose:**

- To establish the stable resting position of aircraft

- **Configurations:**

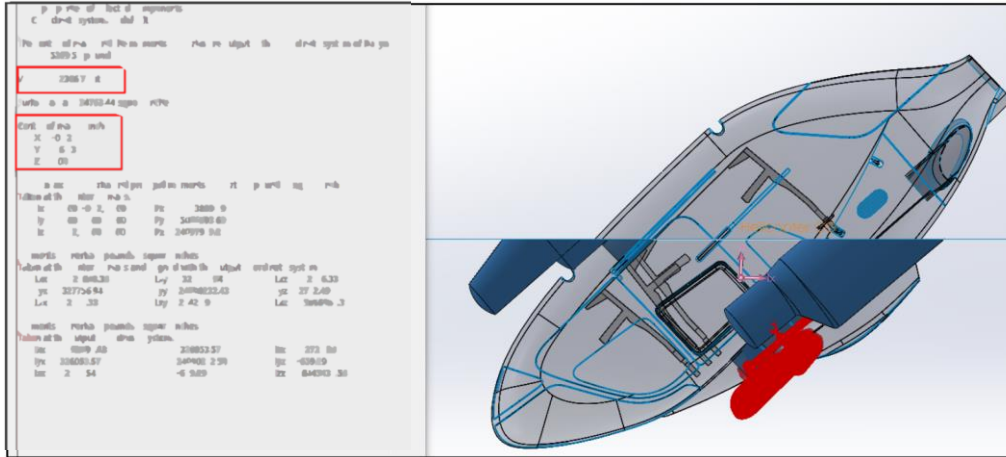
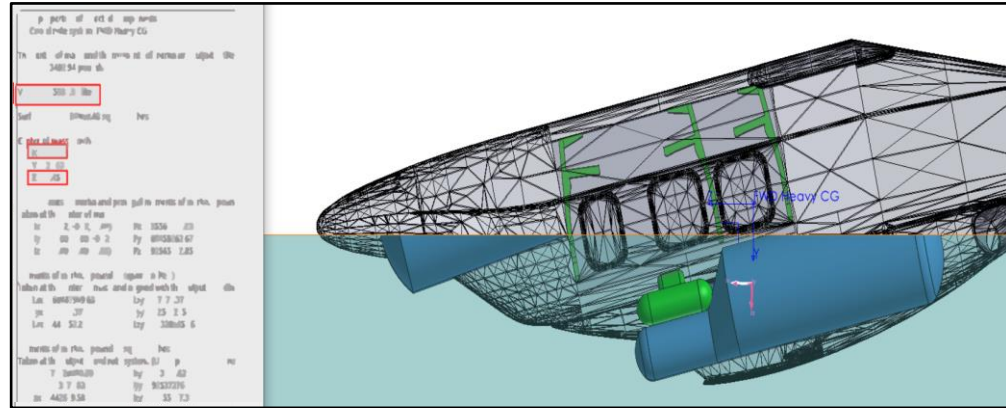
- All floats intact (EFS and HEFS)
- Primary EFS critical compartment damaged
- HEFS critical compartment damaged

- **CS29 results:**

- Stable side floating position
- Stable fully capsized

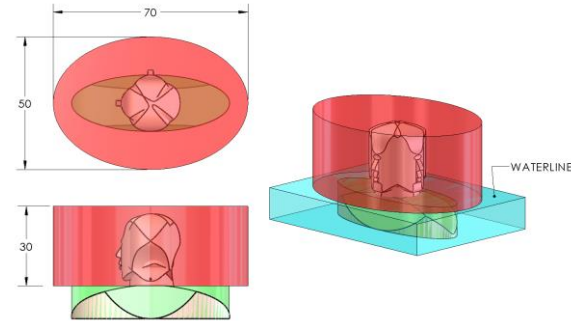
- **CS27 Cat A results:**

- No stable side floating position
- Stable fully capsized

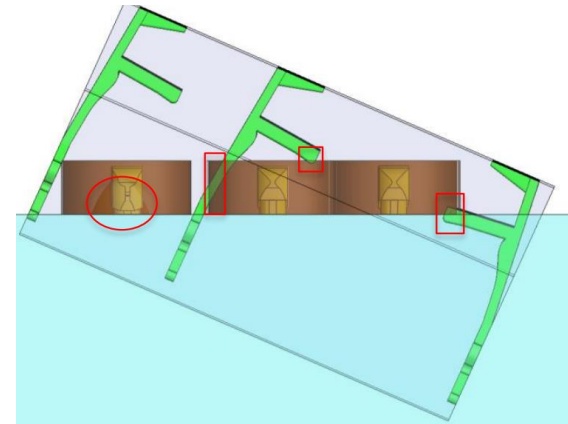


Air Pocket Assessment

- **Preliminary Air Pocket Shape**
 - EASA's Notice of Proposed Amendment minimum air pocket volume per passenger (NPA 2016-01 air pocket)
- **Preliminary Air Pocket Results**
 - Analysis demonstrated air pockets interference with one another and with the aircraft in numerous scenarios
 - The analysis conservatively assumed that occupants could not cross rows of seats.



Proposed NPA 2016 air pocket

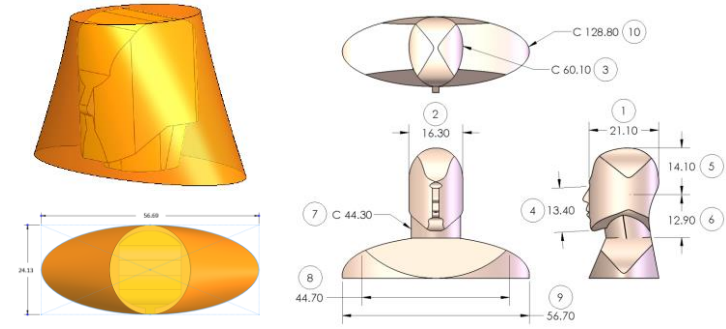


Air pocket clashes with chairs and with other air pockets

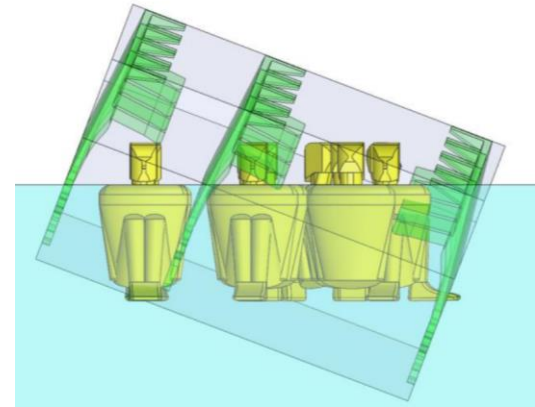
Air Pocket Assessment

- **Recommended Air Pocket Shape**
 - Air pocket shape and volume has been defined, based on 95th percentile of male head dimensions
 - The occupant body volume has also been taken into consideration

- **Recommended Air Pocket Results**
 - Analysis demonstrated no air pocket interference
 - The recommended tapered air pocket design ensures increased occupant survivability and is feasible for reference helicopters with HEFS
 - The analysis conservatively assumed that occupants could not cross rows of seats



Recommended “Tapered” air pocket



Air pocket clearance with chairs and with other air pockets

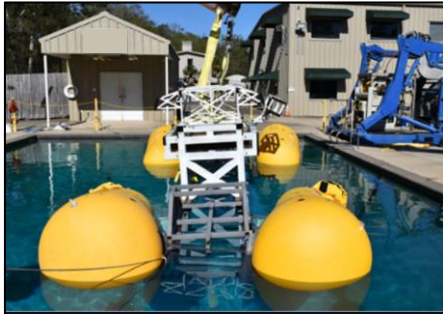
Full Scale Buoyancy Test

- **Full-scale Testing:**

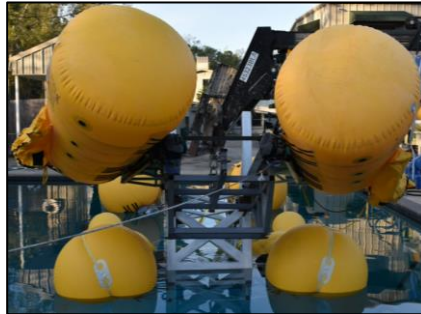
- Testing was performed with a CS29 reference helicopter fixture to validate buoyancy analysis
 - Upright position
 - Fully capsized position (inverted)
 - Side float position
 - Dynamic tests (dropping from 11 to 63 degrees from side floating position)

- **Key Findings:**

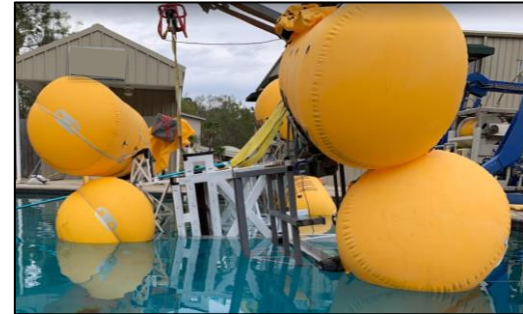
- Helicopter maintained stability in a side float position, even when dynamically perturbed
- Float bags and restraints demonstrate the ability to withstand impact loads



CS29 Upright position (no HEFS)

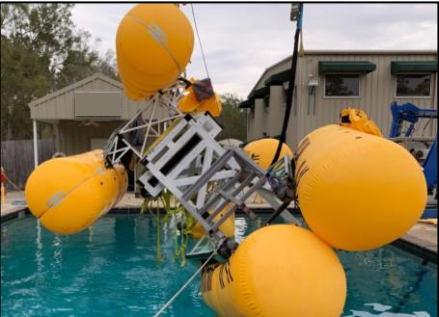
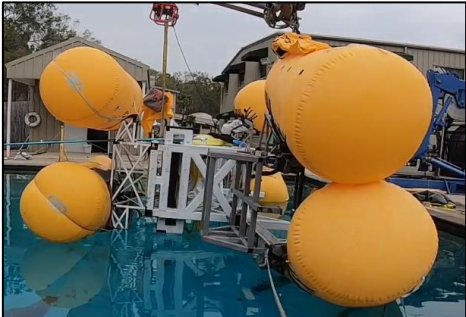
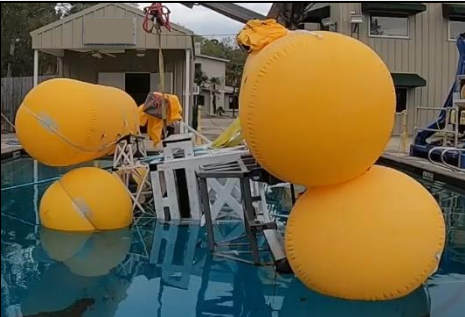
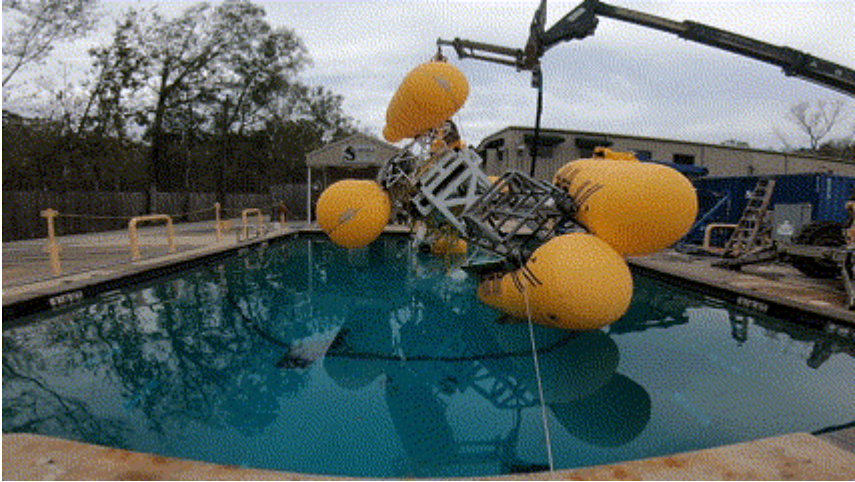


CS29 Fully capsized



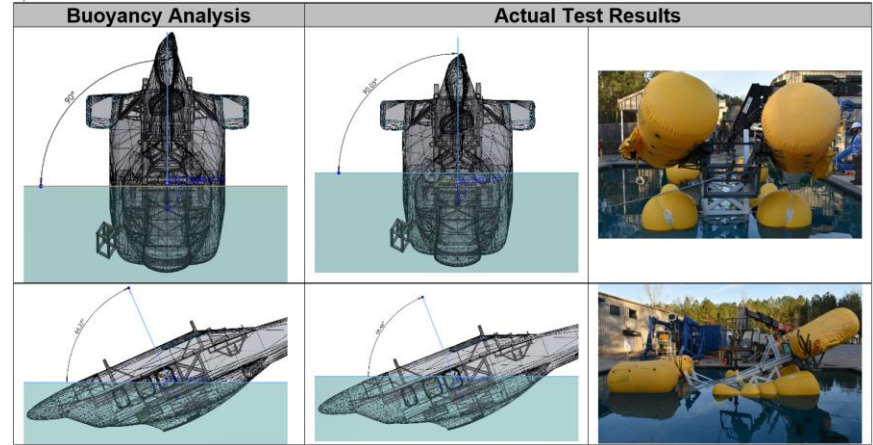
CS29 Side float

Full Scale Buoyancy Test

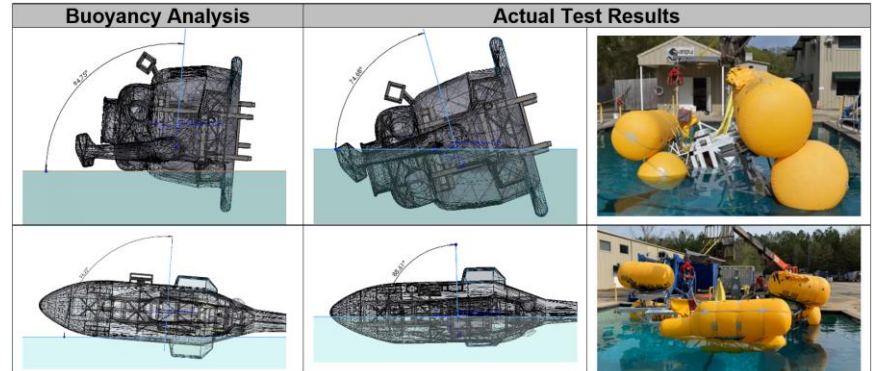


Buoyancy Analysis Validation

- **Key Findings:**
 - Full capsized position correlated closely with simulations
 - Side float position exhibited deeper fuselage immersion due to insufficient float bag retention on test fixture
 - Even under the conservative full-scale test conditions, the air pocket analysis verified the presence of a sufficient air pocket



Fully capsized position^[1]



Side floating position^[1]

HEFS Design and Air Pocket Conclusion

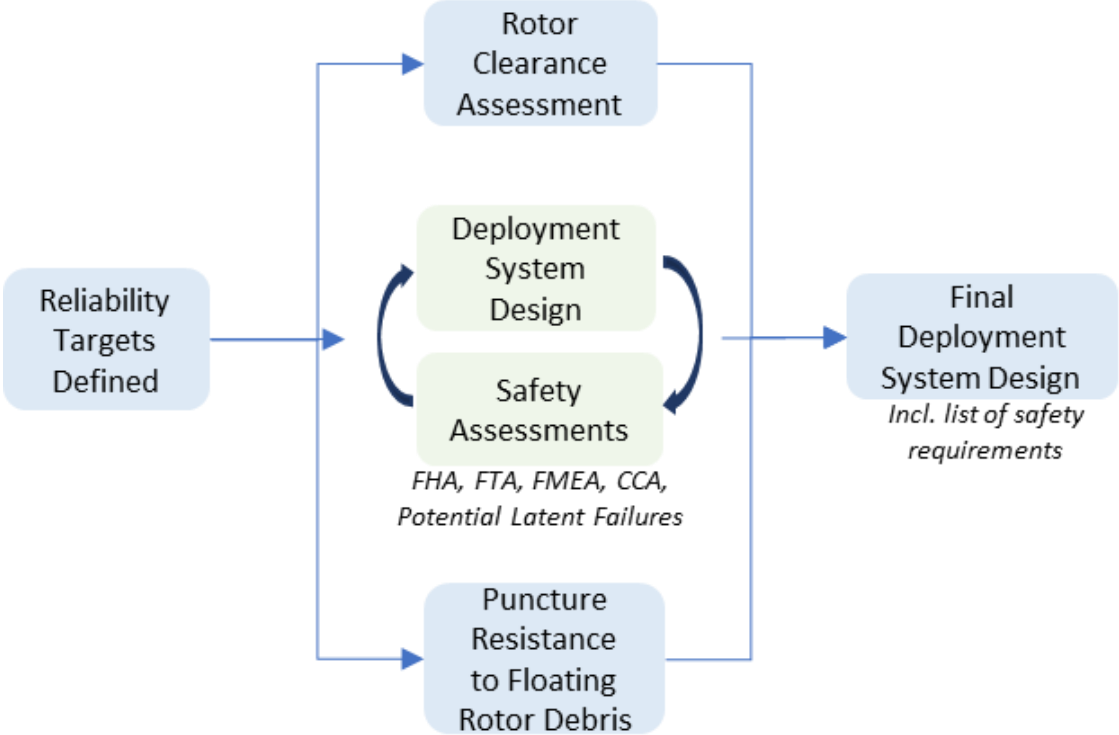
- Computer simulated results closely correlated to the real world test results
- The revised tapered air pocket definition enables the feasible design of a HEFS that ensures an adequate air pocket for enhanced occupant survivability in both CS27 Cat A and CS29 reference helicopters
- CS29 reference helicopter demonstrates stability in both the side float and fully capsized position.
- CS27 Cat A reference helicopter shows stability only in a fully capsized position, with no stable side floating position observed

2. Research Activities and Results

II. Deployment Safety Aspects

Does the risk of inadvertent deployment in flight present a significant flight safety issue due to the potential for interference with the main rotor?

Reliability Approach



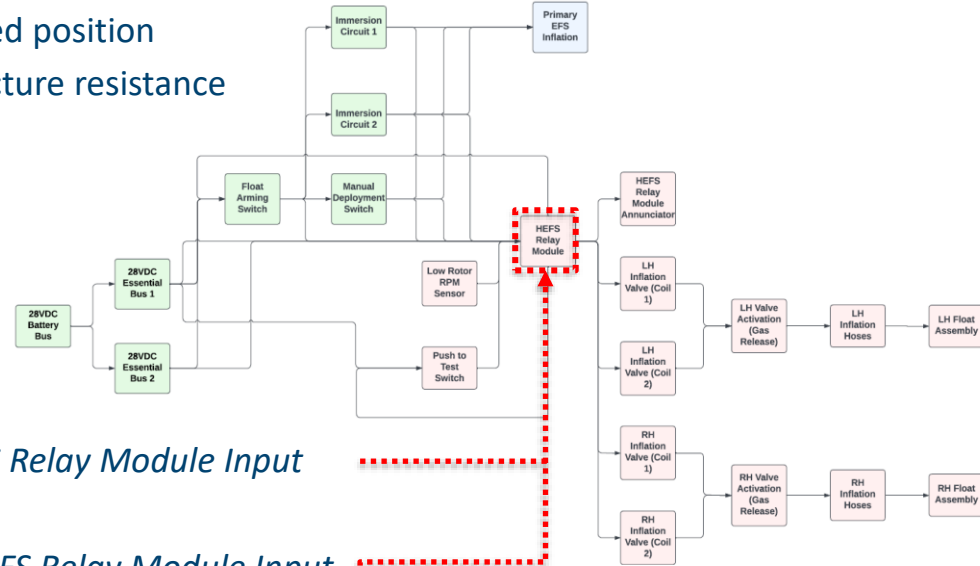
Deployment System Design

- **Design Objective:**
 - Utilize existing float sensors for water immersion and rotorcraft sensors for main rotor RPM switch
 - Common float arming switch or logic will be utilized with the primary EFS
 - Achieve reliability requirements without invoking DAL requirements (no complex hardware)
 - Balance reliability versus availability and tie into existing rotorcraft EFS sensors
 - Ensure annunciation of any active input path
- **Inadvertent Deployment:**
 - The HEFS shall not activate in flight or prior to the trigger criteria being fulfilled.
 - The functional failure shall not result from a single failure point and shall be extremely improbable (1E-09/Flight Hour)
- **Failure to Deploy:**
 - The HEFS shall function according to design when the trigger criteria are fulfilled.
 - The functional failure shall be demonstrated to be extremely remote (1E-07/Flight Hour)

Deployment System Design

- **Design Considerations:**

- No pilot action needed during ditching / survivable water impact event
- Ensure no deployment until rotor stopped
- Ensure positive rotor clearance in most deflected position
- Ensure inflatable materials have adequate puncture resistance



Float Immersion Circuit 1 / 2 AND Low Rotor RPM => HEFS Relay Module Input

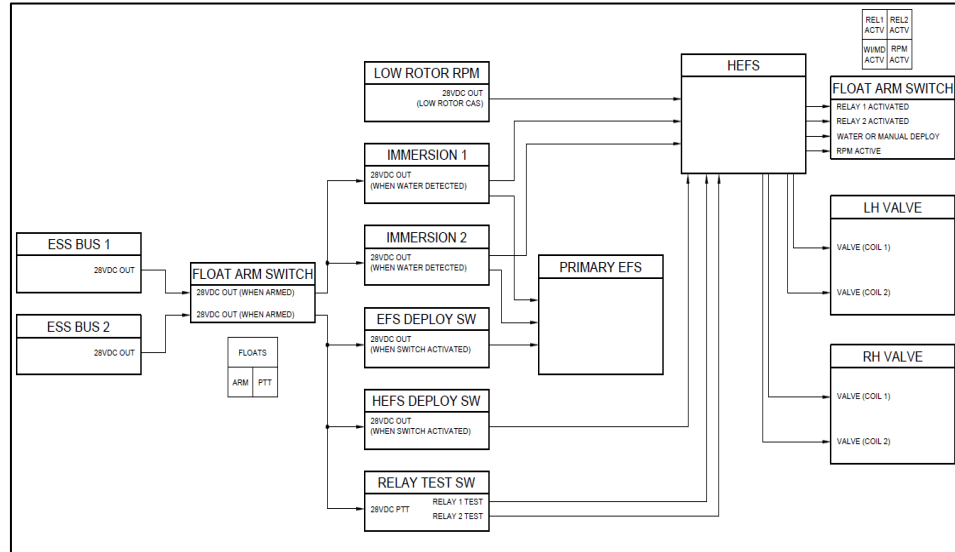
OR

HEFS Float Deployment Switch AND Low Rotor RPM => HEFS Relay Module Input

Deployment System Design Conclusion

- **Key Takeaway:**

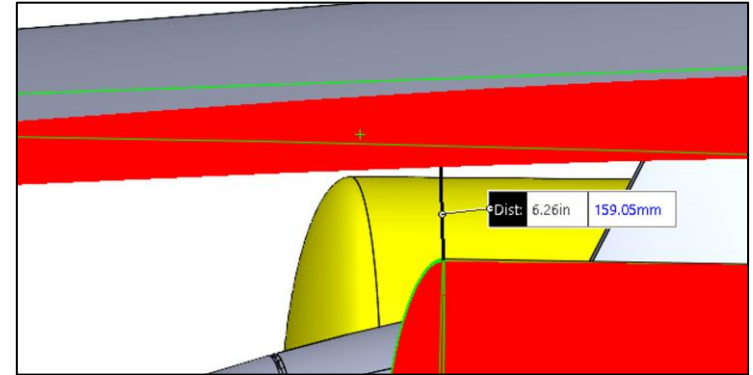
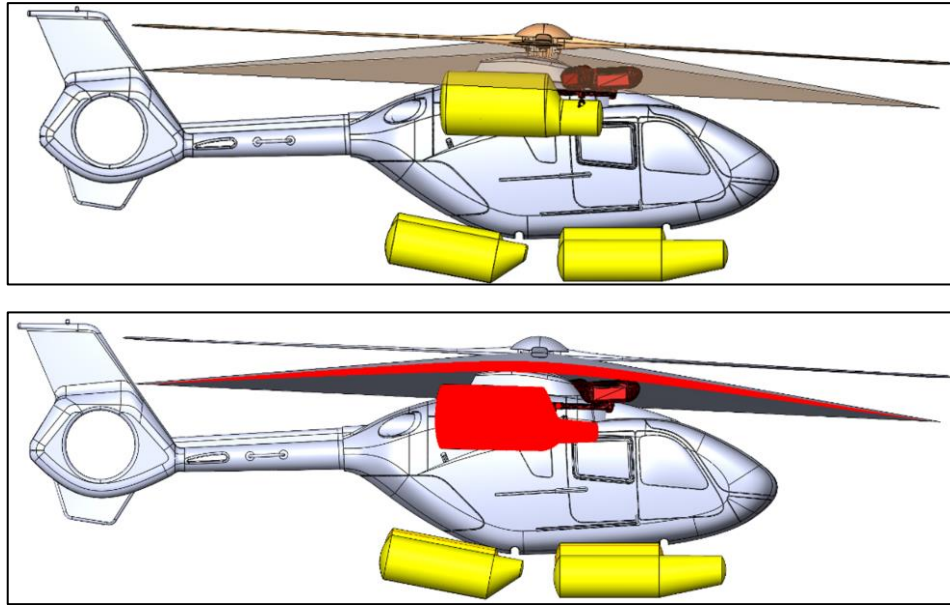
- Inadvertent deployment: $1E-09$ / flight hour is feasible
- Failure to deploy: $1E-07$ / flight hour is feasible accounting for a probability of capsize of 30% over 5 minutes
- System reliability: $4.1E-06$ / flight hour is feasible
- Activation system design and reliability targets can be achieved without requiring software



Deployment System Block Diagram

CS27 Cat A Rotor Clearance for HEFS

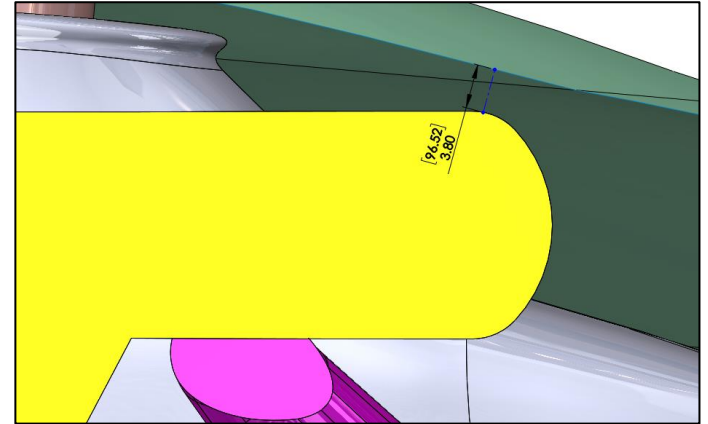
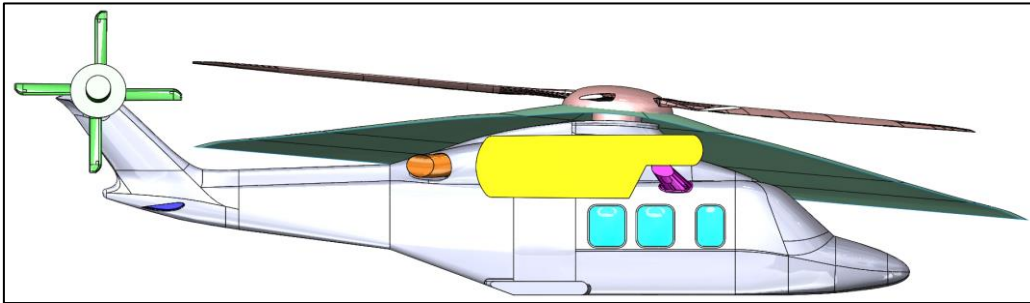
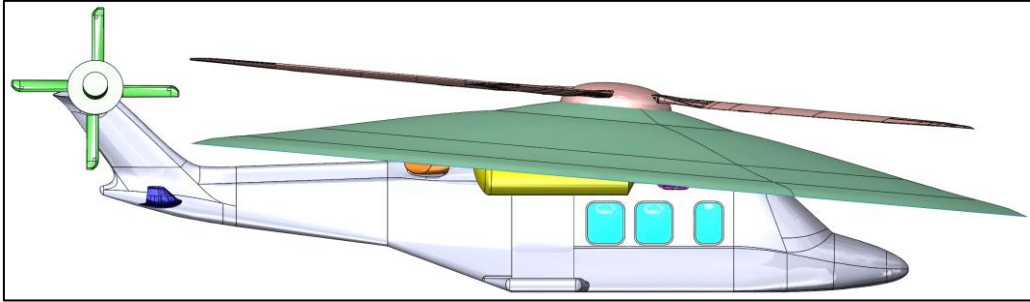
- Rotor clearance of the inflated HEFS is ensured at all times
- Even though rotor clearance is ensured, inadvertent deployment is still considered a catastrophic event



6.26 in [159.05 mm] clearance for the lowest rotor blade position CS27 Cat A reference helicopter

CS29 Rotor Clearance for HEFS

- Rotor clearance of the inflated HEFS is ensured at all times
- Even though rotor clearance is ensured, inadvertent deployment is still considered a catastrophic event



3.80 in [96.52mm] clearance for the lowest rotor blade position CS29 reference helicopter

Puncture Resistance

- The fabric material has been tested in accordance ETSO-2C505 standard and has demonstrated results that exceed the test requirements by a factor of >6x.
- Following the completion of testing new puncture resistance standard ASD-STAN prEN-4886 has been released. Any newly developed systems will need to comply with this standard.



2. Research Activities and Results

III. Heat Resistance

Are there materials available for the different components of the HEFS, which are sufficiently heat resistant ?

Heat Resistance Analysis

Heat Conditions and Materials

- Define temperature requirements
- Materials are required to maintain properties at 200°C
- 5x composite and 9x fabric materials were selected
- Critical float bag hardware (pressure relief and check valves) selected

Material Down Selection

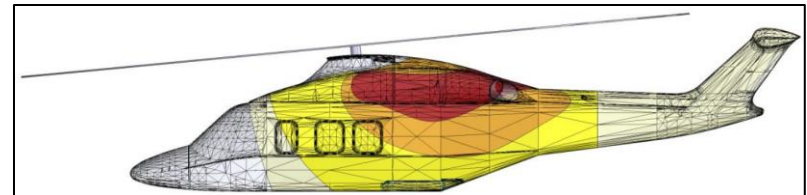
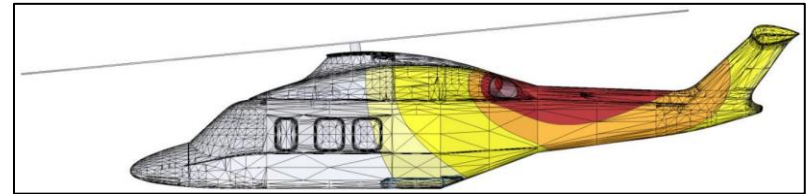
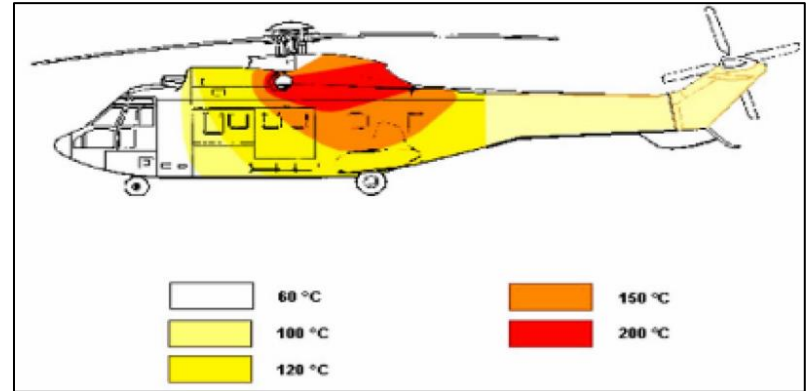
- Testing performed to down select the most optimal materials
- 2x combinations of float and fabric coupons were selected for further testing

Cycle Testing

- The combination of down selected materials were subject to simulated flight temperatures followed by simulated inflation

Heat Resistance Approach

- We utilized heat map data from an EC225^[1] (top image) to establish **conservative** baseline fuselage surface temperatures.
- This baseline was transposed onto the reference CS29 helicopter which displays a peak temperature of 200°C
 - Middle image is transposed based on exhaust duct location
 - Bottom image is transposed based on worst case heat condition for HEFS mounting location



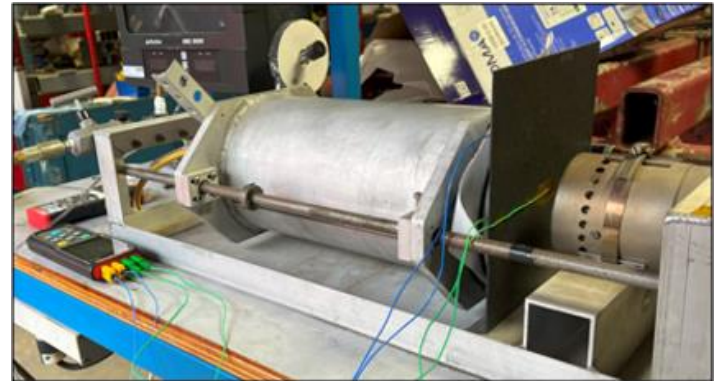
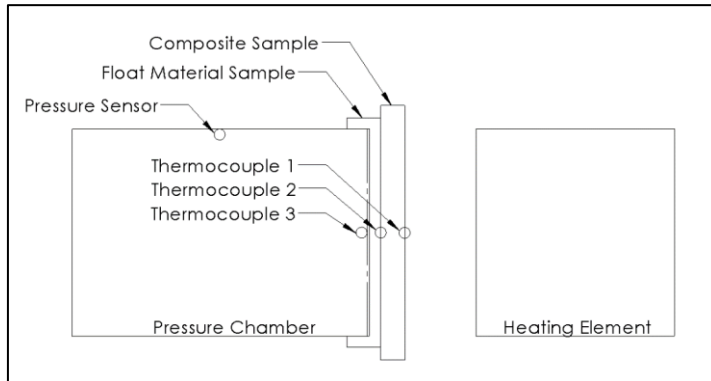
Heat Resistance Test

- Heat transfer and physical deterioration data were collected by exposing both composite materials and float fabrics to a temperature of 200°C for a duration of 30 minutes
- The ability of the float fabrics to retain air was assessed at a pressure of >2.0 PSI.
- A qualitative visual assessment was conducted on composite material samples to evaluate the extent of deterioration after being subjected to the testing conditions
- Composite material [E] demonstrated the greatest ability to reduce heat transfer
- Fabric material [C] demonstrated no visual deterioration or loss of air retention properties

Coupon Type	Coupon Identification	Coupon Material	Air Retention	Thickness (in)	Avg Delta T	Avg Delta T per Thickness
Composite	Material A	Epoxy Carbon Prepreg	N/A	0.084	32.07	381.78
	Material B	Epoxy Carbon Prepreg	N/A	0.084	36.26	431.70
	Material C	Epoxy Carbon Prepreg	N/A	0.140	43.60	311.44
	Material D	Epoxy Fiberglass Prepreg	N/A	0.145	41.06	283.16
	Material E	Epoxy Fiberglass Prepreg	N/A	0.065	32.70	503.09
Fabric	Material A	Silicone Coated Woven Nylon	No	0.027	N/A	N/A
	Material B	Woven Nylon	Yes	0.024	N/A	N/A
	Material C	Urethane Nylon	Yes	0.009	N/A	N/A
	Material D	Silicone Coated Fiberglass	Yes	0.047	N/A	N/A
	Material E	Silicone Coated Fiberglass	Yes	0.048	N/A	N/A
	Material F	Silicon Coated PTFE	No	0.011	N/A	N/A
	Material G	Silicone Coated Fiberglass	No	0.014	N/A	N/A
	Material H	Silicone Coated Fiberglass	No	0.013	N/A	N/A
	Material I	Woven Fiberglass	Yes	0.021	N/A	N/A

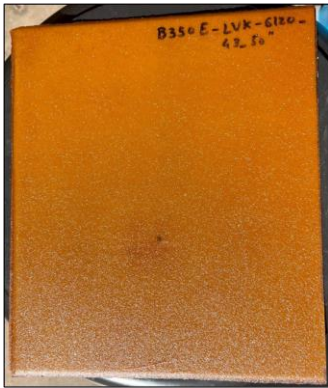
Heat Resistance Thermal Cycle

- **Phase A (Simulated ascent):**
 - Temperature of the heating element increased until composite sample surface achieved 200°C
- **Phase B (Simulated flight):**
 - Temperature maintained at 200°C for 2.5 hours
- **Phase C (Simulated ditching and float activation):**
 - Heating element turned off
 - Composite sample removed from thermal test fixture
 - Immediately pressurized test chamber to >2.00 PSI



Heat Resistance Results and Conclusions

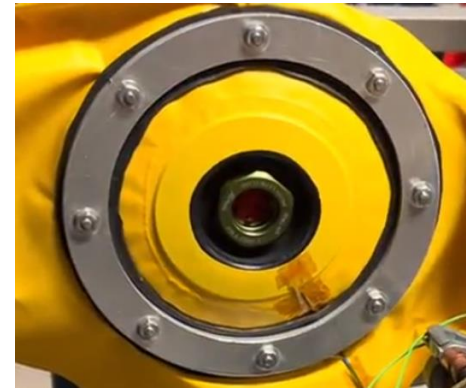
- Industry standard fabric and composite materials have demonstrated the ability to retain performance at elevated temperatures and preliminary endurance testing has demonstrated favorable results
- Industry standard hardware (and manufacturing techniques) used in conjunction with these materials remain operational when subjected to high-heat conditions
- As part of this research program, thermal cycling will be performed, and it is recommended to conduct comprehensive advanced age testing of any future material being considered for this purpose in order to rigorously assess thermal resilience and optimal weight to heat resistance



Post Test Composite



Post Test Fabric



Post Test Pressure Relief Valve

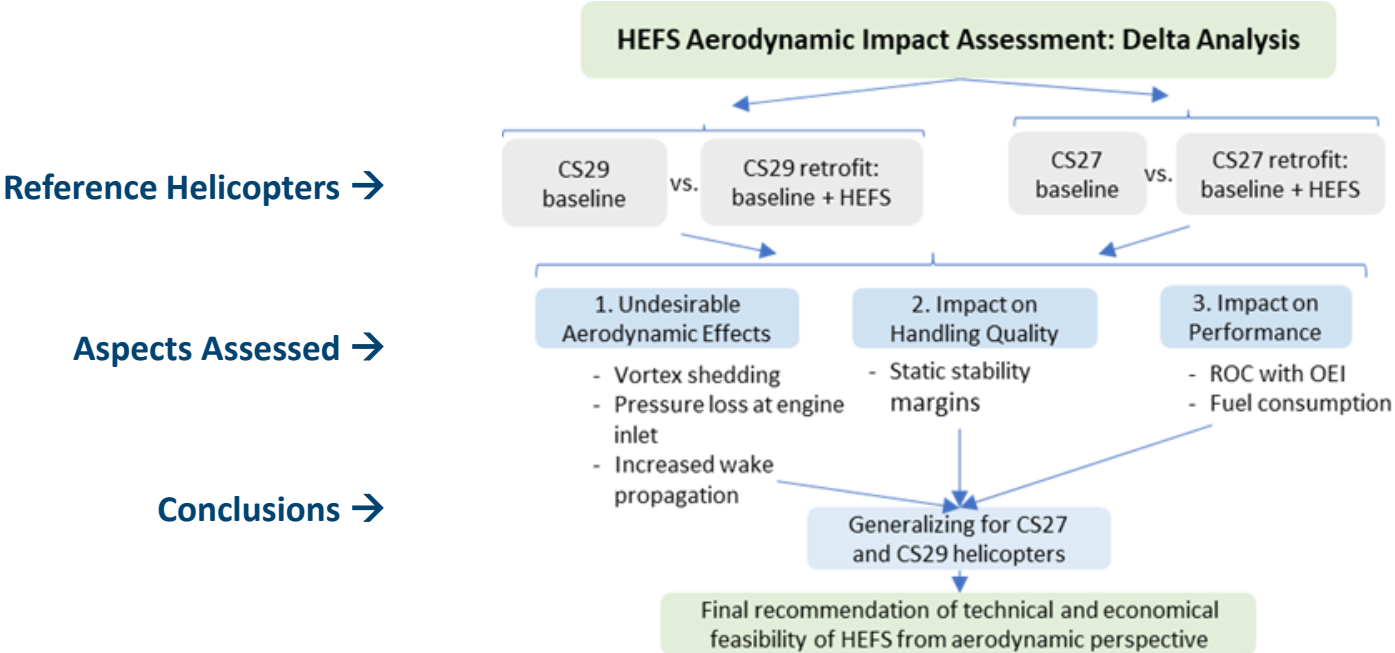
2. Research Activities and Results

IV. Aerodynamic Aspects

Does the reference design (size, location and shape) of the stowed HEFS result in unsurmountable negative aerodynamic effects ?

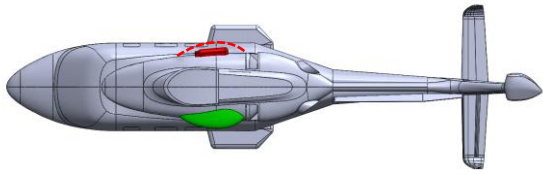
Aerodynamic Approach

- A delta analysis, employing methodologies such as qualitative analysis, quantitative analysis (Computational Fluid Dynamics (CFD)), and handbook methods, were conducted to evaluate the aerodynamic effects of HEFS

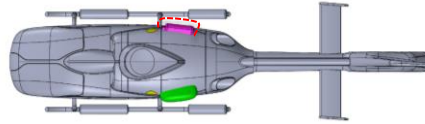


Aerodynamic Qualitative Analysis

- Pod size and location were qualitatively assessed in comparison to existing helicopter modifications and equipment. The HEFS's aerodynamic impact was expected to be similar to or less than that of rescue hoists utilized on both CS29 and CS27 Cat A off-shore fleets



CS29: pod (green), inflation reservoir (red)



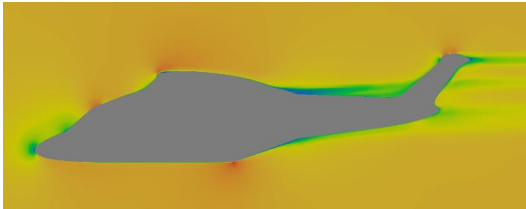
CS27 Cat A: pod (green), inflation reservoir (pink)



Offshore helicopter modifications and ancillary equipment ^[1]

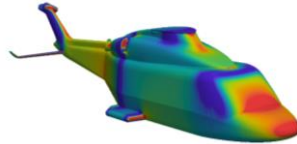
Aerodynamic Quantitative Analysis

Steady-State CFD

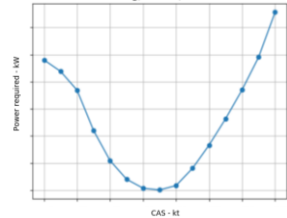


Steady-state CFD model to determine forces and moments

Model Validation



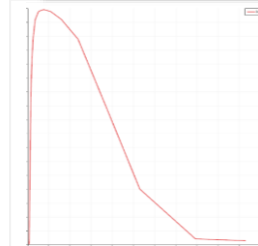
Static pressure distribution



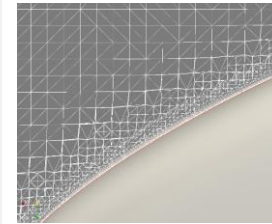
Power and drag curves

Model validation with data from OEMs

Model Verification



Turbulence settings



Grid settings

Model verification with open-source data

Aerodynamic CFD Scenarios

- 80 kts, 110 kts, 140 kts speeds were selected for the analysis (within the validated speed range)
- The worst case aerodynamic centre of gravity location and take-off weight have been assessed
 - Aft-centre of gravity
 - Medium take-off weight for stability analysis
 - Maximum take-off weight for performance analysis
- Varying altitudes have been assessed from sea level up to 5000ft

Aerodynamic Qualitative Results

- **Wake propagation:**
 - The wake propagation has been compared for a model with and without HEFS pods. A negligible difference was found regarding wake propagation downstream of the HEFS (image right) and flow is also similar at the horizontal stabilizer.
- **Engine inlet flow quality:**
 - Pressure recovery was assessed at engine inlet for CS29 reference helicopter (inlet is located directly downstream of HEFS pod)
 - Conclusion: HEFS pods have a minimal impact on quality of the engine inlet flow for the reference case



Wake propagation CS29 baseline



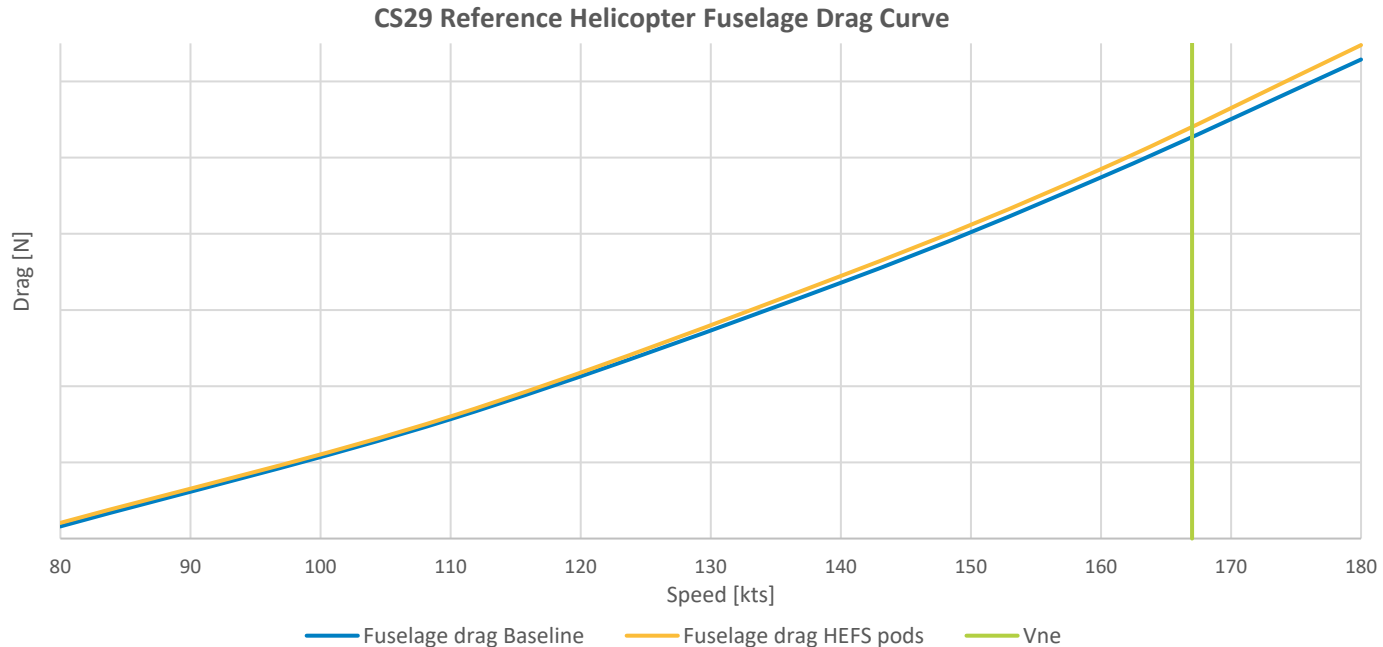
Wake propagation CS29 with HEFS pods

Aerodynamic Performance Analysis

- Forces and moments resulting from CFD simulations have been post-processed with a flight mechanics tool
- Outcomes have been presented as % delta between the baseline CS29 reference helicopter and the helicopter with a HEFS
- To assess impact on handling quality, the delta in longitudinal static margins were calculated
- To assess impact on performance, the following was calculated:
 - Delta in drag
 - Delta in fuel consumption caused by delta in drag
 - Delta in rate of climb with one engine inoperative (ROC OEI) caused by delta in drag

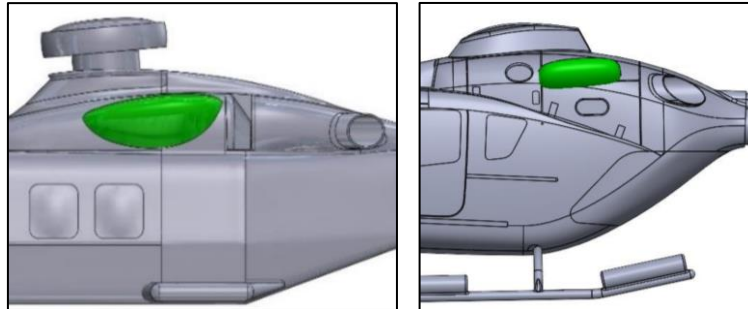
Aerodynamic Performance Results

- **Key results for Handling Quality & Performance:**
 - Minimal delta in longitudinal static margins (< 1% for all reference cases)
 - Minimal delta in fuel consumption caused by additional drag (< 1% for all reference cases)
 - Negligible degradation in ROC with OEI (@80 kts SSL, for CS29 3 ft/min, for CS27 Cat A 5.5 ft/min)



Aerodynamic Conclusions

- Analyses suggest HEFS installation can comply with relevant CS27 Cat A and CS29 requirements, with minimal effects on static stability, rate of climb, and fuel consumption
- Aerodynamic effects of HEFS is not likely to be more intrusive than existing equipment
- For CS27 Cat A helicopters, limited space may result in a less aerodynamically optimized pod design compared to CS29 helicopters
- Retrofitting HEFS may have a more noticeable aerodynamic impact compared to integrating it into new-built helicopters
- It is advisable to validate the aerodynamics of the final pod design through flight tests as part of a future HEFS design and certification programs



2. Research Activities and Results

V. Overall Integration Aspects

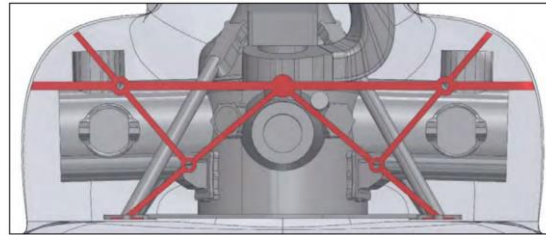
Does the implementation of the HEFS produce any significant challenges regarding overall usability / integration aspects ?

Integration Considerations

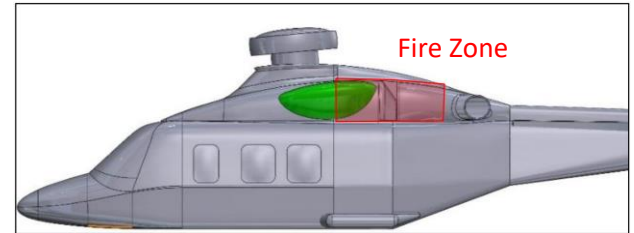
- Main physical integration considerations for retrofitting the HEFS:
 - Installing HEFS in most ideal location for buoyancy (mounted as high as possible, as forward as possible)
 - Existing inlets, outlets and ancillary equipment cannot be covered or obstructed
 - The outer shape of the pod should be aerodynamically optimized
 - Structural integration
 - Egress routes should not be obstructed by floats
 - Vibration and shock spectrum must be evaluated
 - Cost effectiveness
 - Maintenance
 - Interference with the fire zones



Pod Internal bracket



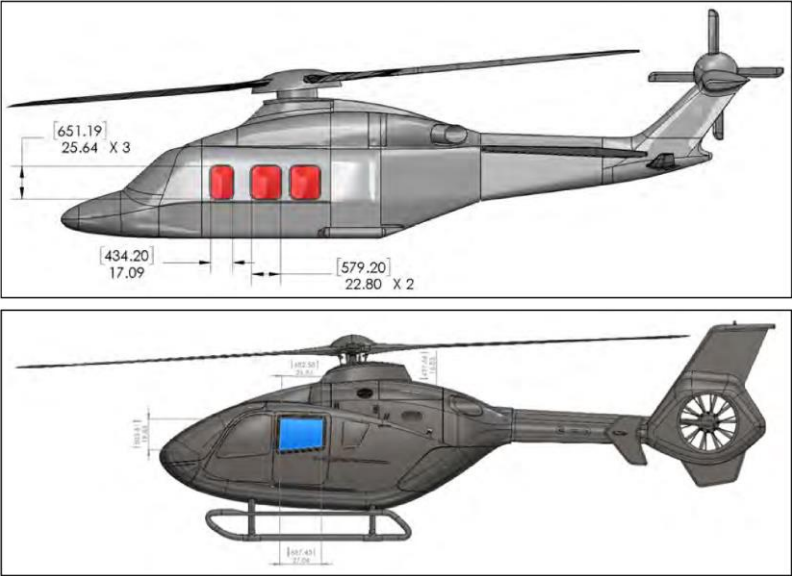
Concept CS29 Attachment support structure



Fire Zone

Continued Functionality of Emergency Exits

- The HEFS must not obstruct the emergency egress process/route

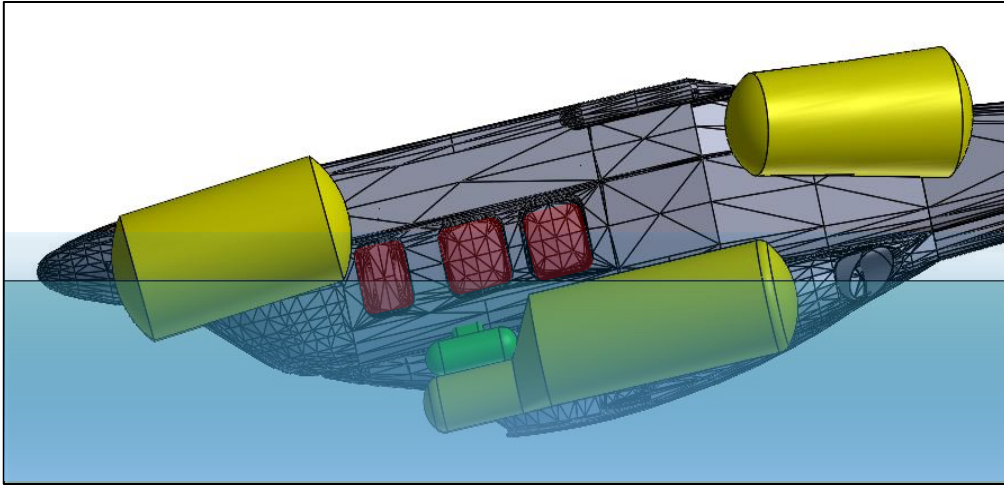


CS29 Emergency egress process

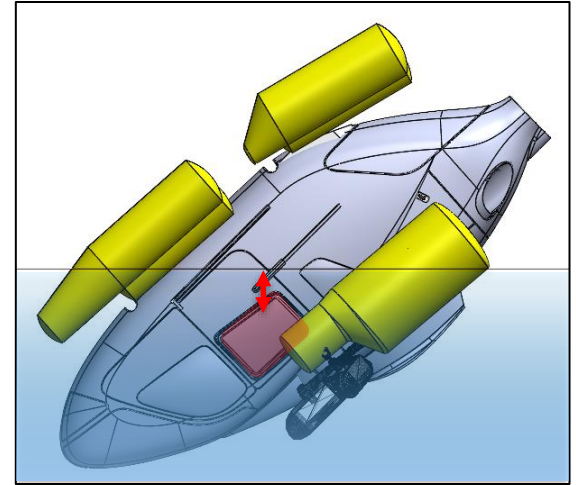
Emergency exit CS29 ref. helicopter (red) and CS27 Cat A reference helicopter (blue)

Continued Functionality of Emergency Exits

- When capsized, float retention straps prevent them from deflecting towards the exits
- Images below demonstrate that the HEFS designed for the CS29 and CS27 Cat A reference helicopters do not obstruct emergency egress routes



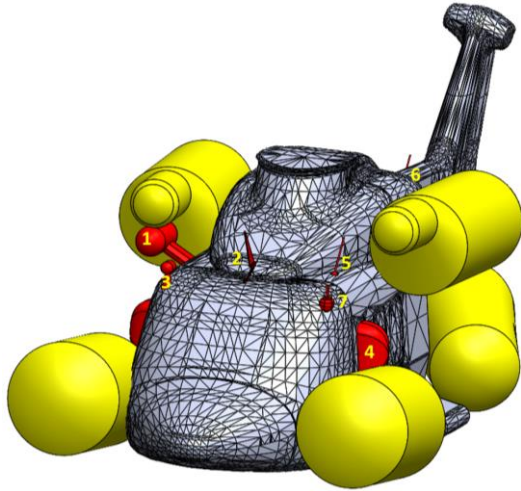
CS29



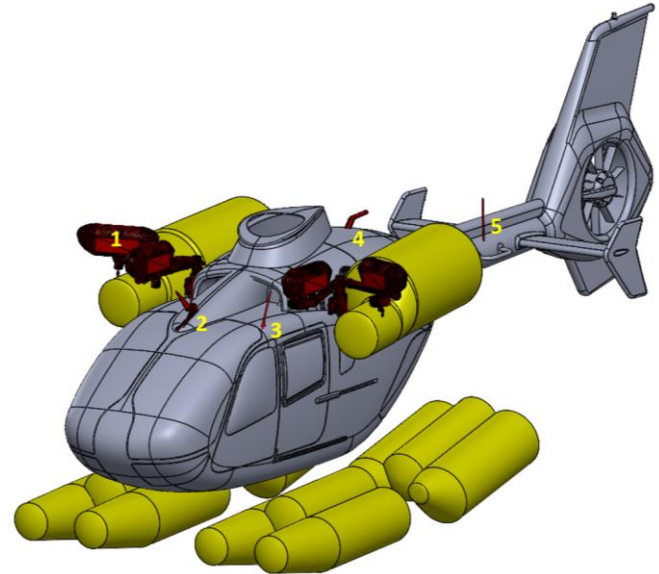
CS27 Cat A, distance emergency egress handle to waterline = 29 cm

Interference with Ancillary Equipment

- For the reference helicopters, the HEFS were designed around the most predominant equipment used in combination with for off-shore operations
- Reinforcement patches may be used to further protect the float bag from sharp fuselage protrusions



CS29 reference helicopter including most prevalent off-shore ancillary equipment



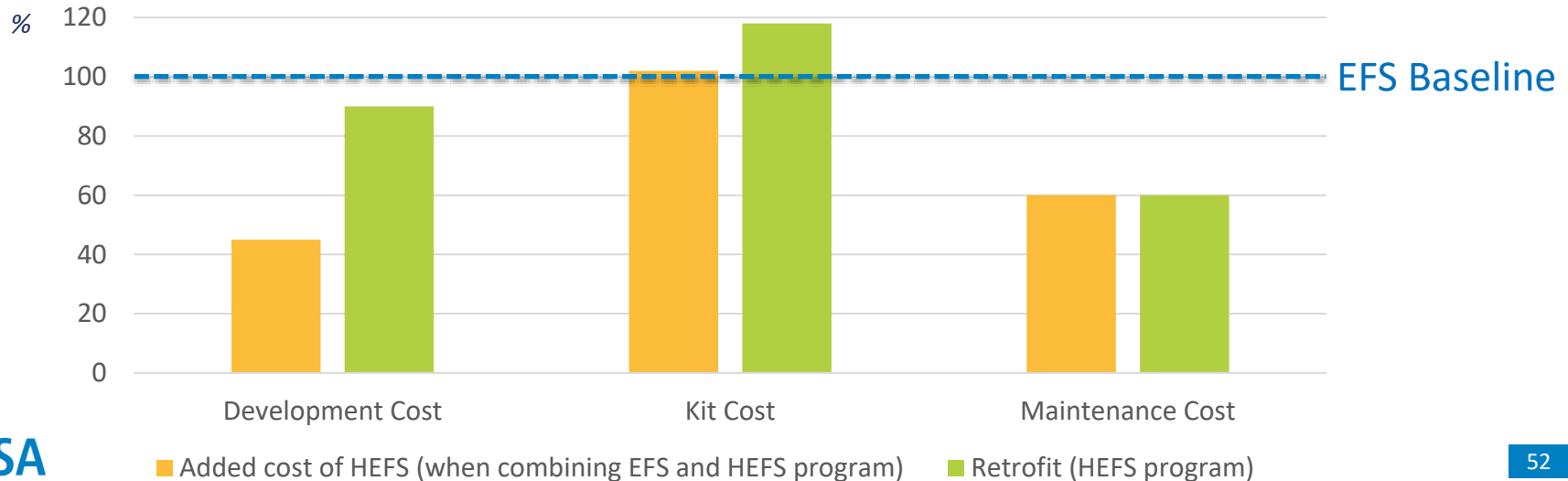
CS27 Cat A reference helicopter including most prevalent off-shore ancillary equipment

Maintenance and Continuing Airworthiness

- **Main considerations:**
 - Maintenance of the HEFS
 - Impact of HEFS on routine maintenance of other systems
- **Maintenance of the HEFS:**
 - Most maintenance tasks of the HEFS are comparable to the tasks for the primary EFS
 - All maintenance tasks of the HEFS can be performed during scheduled maintenance intervals
 - Design and retention methods utilized on each platform may vary drastically, however the intent of the HEFS, is to limit the impact on routine maintenance actions and to have a removal / installation time that is comparable to or less than a standard EFS pod.
 - It is anticipated that a HEFS can be designed for existing rotorcraft to avoid removal in order to perform routine daily maintenance on a CS29 rotorcraft however this design objective and may be considerably more challenging on a CS27 platform due to space restrictions. This requirement will be more feasible on newly developed rotorcraft.

Cost-Effectiveness

- Cost-effectiveness has been assessed by comparing HEFS to the standard EFS
- Distinction is made between cost categories (development cost, kit cost, maintenance cost)
- Maintenance cost differ proportionally with the number of floats (primary EFS = 4 floats, HEFS = 2 floats)
- Impact of HEFS on fuel consumption costs due to added drag is minimal (for both ref. cases < 1%)



HEFS Weight

- Below estimate is a preliminary indication of the weight of the system, which is subject to change depending on final float and pod dimensions

CS27 Cat A & CS29 HEFS Estimated Weight		
Description	CS27 Cat A Weight [kg]	CS29 Weight [kg]
Float and Pod Assembly (2x)	22	26
Gas Reservoir Assembly (2x)	19	21
Installation Kit (no structural provisions at aircraft level)	8	8
TOTAL HEFS System Weight	49 kg	55 kg

Integration – Conclusions

- The HEFS can be designed such that obstruction of emergency egress routes is avoided, however it is important to design suitable retention methods to avoid deflection of the inflated floats once in contact with water
- A survey of the current CS27 Cat A offshore fleets has shown that installation of a **retrofit** HEFS will be challenging on CS27 Cat A helicopters however, retrofitting CS29 helicopters is also considered challenging but is more feasible. Implementing HEFS directly into a **new design** is considered to be feasible for both CS27 Cat A helicopters and CS29.
- HEFS maintenance effort and intervals is expected similar to normal EFS maintenance.

2. Research Activities and Results

VI. Recap Conclusions

Recap

- **Key Take Away:**
 - The revised tapered air pocket definition enables the feasible design of a HEFS that ensures an adequate air pocket for enhanced occupant survivability in both CS27 Cat A and CS29 reference helicopters. The CS27 will not achieve a stable side floating, only a full capsized attitude. The CS29 will achieve a stable side and fully capsized floating attitude.
 - Industry standard fabric and composite materials have demonstrated the ability to retain performance at elevated temperatures and preliminary endurance testing has demonstrated favorable results
 - CFD analyses suggest HEFS installation can comply with relevant CS27 Cat A and CS29 requirements, with minimal effects on static stability, rate of climb, and fuel consumption
 - A failure to deploy rate of $1E-07$ per flight hour is also feasible when factoring in a 30% chance of capsizing within five minutes OR $4.1E-06$ per flight hour when not factoring in a 30% chance of capsizing within five minutes.
 - A survey of the current CS27 Cat A offshore fleets has shown that installation of a **retrofit** HEFS will be challenging on CS27 Cat A helicopters however, retrofitting CS29 helicopters is also considered challenging but is more feasible. Implementing HEFS directly into a **new design** is considered to be feasible for both CS27 Cat A helicopters and CS29.

Research Project Conclusions Overview

OVERALL PROJECT OBJECTIVES– FINAL CONCLUSIONS HEFS OFFSHORE FLEETS

Description	Retrofit CS29	Retrofit CS27 Cat A	New Design CS29	New Design CS27 Cat A	Remarks
HEFS Design and Improved Air Pocket	Feasible	Feasible	Feasible	Feasible	<ul style="list-style-type: none"> Tapered air pocket recommended No stable side float position for CS27 Cat A ref. helicopter
Deployment Safety Aspect	Feasible	Feasible	Feasible	Feasible	<ul style="list-style-type: none"> Simple design with annunciation of active and failed states Reliability and availability targets are achievable
Heat Resistance	Feasible	Feasible	Feasible	Feasible	<ul style="list-style-type: none"> Suitable combination of composite and float bag material found that can withstand the worst-case heat scenarios Optimization needed to improve thickness/weight ratio etc.
Aerodynamic Aspects	Feasible	Challenging	Feasible	Feasible	<ul style="list-style-type: none"> Need for sufficient physical design space on upper cowling for aerodynamic optimization of HEFS pod
Overall Integration Aspects	Feasible with challenges	Challenging	Feasible	Feasible with challenges	<ul style="list-style-type: none"> Limited physical space for integration will pose challenges for retrofitting on specific CS27 Cat A helicopters

3. Benefits from the Project

Benefits and Future Activities



RMT.0120, NPA 2016-01

- Initial regulatory text proposal
- Technical issues highlighted which require further investigation**



RESEARCH

EASA.2019.HVP.18

- Feasibility confirmed
- Cost and Complexity assessed
- Rulemaking proposal



AS332 Super Puma G-WNSB Sumburgh, UK 23 August 2013

Safety Recommendation 2016-019:

“It is recommended that the European Aviation Safety Agency amends the Certification Specifications for Large Rotorcraft (CS 29), certified for offshore operation, to require the provision of a side-floating capability for a helicopter in the event of impact with water or capsizing after ditching. This should also be applied retrospectively to helicopters currently used in offshore operations.”

AIRCRAFT ACCIDENT REPORT 1/2016



Report on the accident to
AS332 L2 Super Puma helicopter, G-WNSB
on approach to Sumburgh Airport
on 23 August 2013

Rulemaking: Potential Way Forward

◆ *If benefit is not justified, the rulemaking process will not continue*



Preliminary Benefit Analysis

RMT.0120 Phase 3

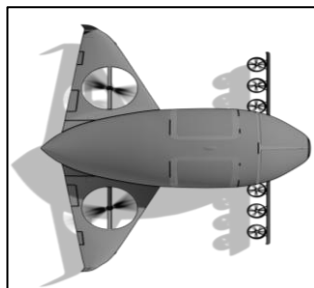
EPAS Update

Benefit Analysis for Initial Airworthiness

NPA published for initial airworthiness

Benefit Analysis for Retrofit

NPA published for continuing airworthiness



SC VTOL MOC

SC VTOL MOC update
Q1 2024



Q1/2 2025



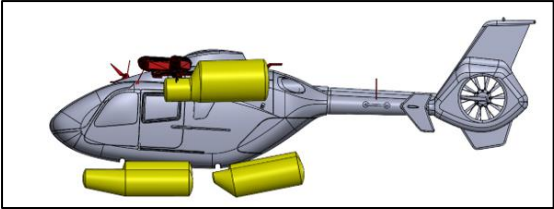
Opinion



Qualitative Benefit Analysis



CS-27



CS-27 Category A



CS-29

Increasing Benefit (number of PAX)



Increasing Technical Challenges

Initial Airworthiness



CS-27

CS-29



Increasing Cost



Increasing Technical Challenges



Part-26

Retrofit



Benefits and Future Activities Conclusion

- Research Project **EASA.2019.HVP.18** has concluded that solutions are feasible to answer the technical issues raised
- RMT.0120 may be reopened:
 - Initial airworthiness would be assessed in the first step (target Q1/Q2 2025 NPA)
 - Retroactive implementation would be assessed in a second step (target Q3 2025 NPA)
 - If the benefit is not justified, the rule making task will not continue
- Implementation for CS-29 has increased benefit and less technical challenges compared to CS-27
- Initial airworthiness implementation has less cost and less technical challenges compared to retroactive implementation
- NPA 2016-01 text will need to be revised based on the recommendations of the research

- SC VTOL MOC will be updated according to the research recommendations, as appropriate

4. Q&A

Question and Answers

→ For sending questions, please use the *slido* app:

- www.slido.com
- Event code: 3189153
- Passcode: tst949

5. Concluding Remarks



Thank you for joining this webinar!

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