SAR Helicopter Hoists & Stretchers

Technical Note

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Abbreviations	Definitions
AD	Airworthiness Directive
AS	Aerospace Specification
CAA	Civil Aviation Authority
CS	Certification Standard
EASA	EU Aviation Safety Agency
ETSO	European Technical Standards Order
HMCG	His Majesty's Coastguard
MV	Motor Vessel
PCDS	Personnel Carrying Device System
SAE	Society of Automotive Engineers
SAR	Search and Rescue
STC	Supplemental Type Certificate

1 Introduction

This briefing paper has been commissioned by OEUK to provide further context on the design and certification of Search and Rescue (SAR) helicopter hoists[1] and stretchers.

This is a topic that has gained attention in relation to OEUK's recently issued Safe Weight Limit Policy for Offshore Workers[2]. This policy addresses increasing worker weights and the associated challenges for evacuation, rescue and medical response offshore.

This paper is not intended to re-examine the policy or independently critique the calculations that defined the weight limit.

The author of the paper, Andy Evans of OEUK-member Aerossurance Limited, is a Chartered Engineer and Fellow of the Royal Aeronautical Society. He is a former UK Civil Aviation Authority (CAA) Surveyor, who has been a UK CAA approved nominated postholder in an offshore & SAR helicopter operator and in two aviation design organisations designing role equipment and special mission modifications. With Aerossurance he has advised two European Coast Guards, several energy sector SAR services, one Marine Pilotage Association and several offshore renewable energy companies contracting helicopter hoist operations.

[1] We will use the term 'hoist' for this equipment as strictly hoists operate vertically and winches operate horizontally. This terminology is consistent with the aviation standards and regulations for the design such equipment. This does not invalidate the common use of 'winch' as a prefix for SAR helicopter crew members (e.g. the modern 'winch-paramedic' and the more traditional, non-gender neutral 'winchman').

[2] https://oeuk.org.uk/industry-support/hse/safe-weight-limit-policy/

2 Hoists

In November 1945 the first helicopter hoist rescue was conducted in the US[3]. The use of helicopters for SAR, first by the military and later by civil operators, has expanded ever since. Hoists then started to be increasingly used as part of regular transport flights to deploy and recover marine pilots. The offshore wind industry now use helicopter hoisting to wind turbine nacelles. Consequently, the use of helicopter hoists has risen in recent years.

Modern helicopter hoists are complex devices with electric motors and clutches. They must operate in a corrosive, high-vibration, weight-sensitive environment, close to electromagnetic emitters (like radars and satellite communication transmitters). They must deliver precise control to enable personnel to be safely inserted or extracted from a constrained area on moving vessel, pitching, rolling and heaving, in high wind.

Figure 1: Dual Hoist Installation on an OHS AW139

Source: Aerossurance

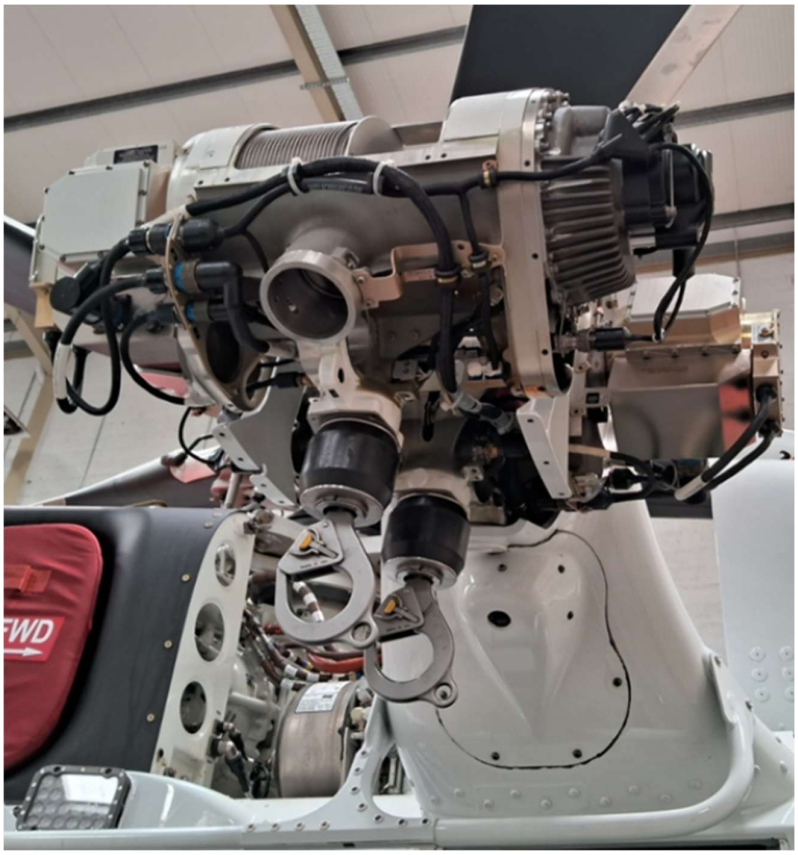
The hoist cables consist of stainless-steel wires, twisted into strands. Multiple strands form an inner core, with an outer wrap of a cable. They are just 3/16 in (4.76 mm) in diameter. Not only must the cable withstand the load of personnel and their equipment, but they must withstand wear and fatigue of repeated hoists, corrosion, abrasion and shock loads. The typically 90 m cable must be consistently wound and unwound on a drum, that translates during winding, several layers deep without jamming or slipping. The cable terminates in a

[3] https://sikorskyarchives.com/first-helicopter-civilian-rescue/

single swaged end fitting that connects to the hoist hook. Overloads, deterioration or defects can lead to a catastrophic cable failure and multiple fatalities.

Despite the fact that falls can be fatal for personnel attached to the hook, hoists must also be fitted with an explosive cable cutting system to save the aircraft and its occupants if a cable snags, but with a very low probability of unintended activation. The hook also has to be simple to use but resistant to harness and strop carabiner 'ring reversal' or 'dynamic rollout' events that can also lead to fatal falls.

Figure 2: Dual Hoist on a Bristow AW189 (Cowlings Removed)



Source: Aerossurance

Consequently, the design, continuing airworthiness and operation of helicopter hoists are specialist, safety critical activities. There are two US hoist manufactures (Onboard Systems[4] and Breeze-Eastern) and two far smaller European manufacturers. Within the North Sea, the Onboard Systems designed products dominate.

The EU Aviation Safety Agency (EASA) responded to an occurrence in February 2013 when a test load struck the ground during a post-hoist maintenance test. This was due to a failure of the hoist overload clutch resulting in the uncommanded paying out of the cable. EASA issued

[4] Onboard Systems acquired what was the Goodrich hoist and winch business from Collins Aerospace in late 2024.

an Airworthiness Directive (AD)[5] that introduced a new periodic overload, a reduced Time Between Overhaul, hoist removal if any slippage occurred and more restrictive operating envelope. In addition, hoists rated at 272 kg (600 lb) were reduced to 249 kg (550 lb) capacity above 0°C, or 227 kg (500 lb) at 0°C or below.

New hoists in the UK or EU must be certified under Part-21 regulations[6]. In the UK and EU Part-21 necessitates Design Organisation and Production Organisation approvals[7]. Part-21 in turn specifies detailed technical regulatory Certification Standards (CSs). For new hoists the current CS is European Technical Standards Order ETSO-2C208[8], issued in 2022[9]. This is a 17 page document, developed by the EASA and adopted by UK CAA, that primarily consists of an appendix that modifies and enhances the existing 31-page, SAE Aerospace Standard (AS) 6342 - Minimum Operation Performance Standard for Helicopter Hoist Systems[10], issued in 2020 after 6 years of development[11]. Among the improvements are consideration of cable rebound, better overload protection, minimisation of single load paths, enhanced fatigue and damage tolerance requirements, and a route to introduce alternative cable materials. AS6342 and ETSO-2C208 are a once in a generation re-datum of hoist design requirements.

Onboard Systems for example are developing a new hoist to meet the ETSO[12], eliminate the restrictions imposed on earlier hoists by AD and introduce new capabilities (including a 303 kg [668 lb] capacity & enhanced supportability). Initial research and development on what is called the Pegasus hoist, started in 2015 and preliminary design commenced in 2017 while AS6342 and the ETSO were evolving. Two prototype hoists entered testing in 2017 and 2021. In 2024 the production design was completed. Certification and qualification testing is currently underway and expected to be completed in late 2026. Fatigue testing alone requires 1 million hoist cycles. A range of shock, vibration and environmental tests are also needed. While the evolving certification requirements, COVID and corporate restructuring will likely have extended the Pegasus development programme, this does illustrate the commitment necessary to introduce a new helicopter hoist. Onboard Systems must complete demonstration of compliance with the ETSO to the satisfaction of the aviation regulators in order to obtain certification of the Pegasus hoist.

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[5] https://ad.easa.europa.eu/ad/2015-0226

[6] https://regulatorylibrary.caa.co.uk/748-2012/Content/Initial_Air_Home_1.htm

[7] Alternative Procedures to Design Organisation Approval (ADOA) are available for organisations who only design equipment to an ETSO, but these route does not grant the privileges of a Design Organisation.

[8] https://regulatorylibrary.caa.co.uk/cs/Content/PDF%20Files/Initial%20Airworthiness%20Adopted%20CS-UKTSO%20Amdt%2017.pdf

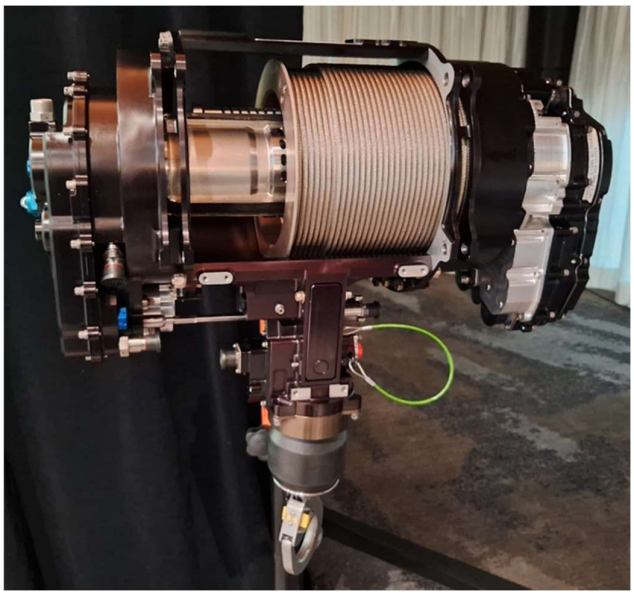
[9] The benefit of the ETSO is that more of the certification of the hoist is done up-front with the ETSO, leaving just installation issues when installing on a helicopter. Previously the hoist design had to be reconsidered for each new helicopter types.

[10] https://www.sae.org/standards/as6342-minimum-operational-performance-standard-mops-helicopter-hoist-systems

[11] Which started after the 2013 occurrence.

[12] The development history quoted was presented at the Onboard Systems EU Hoist Operators Conference in Cologne, November 2025.

Figure 3: Pegasus Hoist On Show, March 2025



Source: Aerossurance

Once a hoist is certified under the ETSO, then a major modification[13] is still required for each helicopter type it is to be fitted to. We consider entry into service of the Pegasus hoist is likely not until some point in 2027, with a relatively slow introduction as user experience and confidence ramps up. To introduce a new hoist to all SAR helicopters in the UKCS would require modifications for the S-92A, AW189 and AW139[14], and fitment to c 20 helicopters with two operators.

The tragic loss of an HM Coastguard winchman on MV Green Lily in 70 knot winds and Sea State 8 in 1997[15] resulted in the development of the dual hoist installation[16]. This provided redundancy and enhanced safety in the event of a cable cut[17], cable jam or other hoist fault. Thus, any hoist upgrade programme needs to consider upgrade two hoists per SAR helicopter[18].

[13] This may be a major modification to the type design or a Supplemental Type Certificate (STC).

[14] HMCG operate from 10 SAR helicopter bases (to be supplemented by 2 seasonal bases in future). Current data shows 7 bases are likely support areas of oil and gas operations, and one seasonal base is likely to do so in future. https://www.gov.uk/government/statistics/search-and-rescue-helicopter-statistics-year-ending-march-2025/search-and-rescue-helicopter-annual-statistics-year-ending-march-2025 As the HMCG contracted fleet moves between bases (e.g. to cover scheduled maintenance), for interoperability any change in hoist would need to be rolled out across all bases and spare aircraft. There is also the Industry SAR service in Aberdeen for the Central North Sea.

[15] https://www.bbc.co.uk/news/uk-scotland-42010480

[16] Only one of these electrically powered hoists can be used at a time due to the limitations of helicopter electrical power capacity and so are not designed to be used in a synchronised manner together.

[17] In the case of MV Green Lily the Hoist Operator had to cut the cable due to snagging on the vessel's superstructure while lowering the cable to the winchman who was the last person aboard the vessel. https://assets.publishing.service.gov.uk/media/5422f4f9ed915d137100054f/dft_avsafety_pdf_500140.pdf

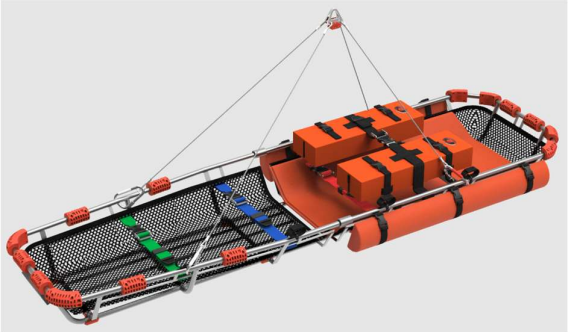
[18] It would be suboptimal, costly and problematic from continued airworthiness, training and competency perspectives to have different two hoists installed on the same aircraft.

3 Stretchers

Traditionally the term 'stretcher' conjures up the image of a collapsible fabric device with two wooden poles and some cross bracing. Obviously, stretchers have evolved massively to incorporate new materials, more ergonomic design and to better restrain patients.

Even modern stretchers that might be available on an offshore installation have a patient weight limit (136 kg in the case of one popular unit[19]) and would still present problems for a team of six manually manoeuvring a heavy patient up several flights of stairs on an installation.

Figure 4: Exemplar SAR Stretcher



Source: Lifesaving Systems

SAR helicopter stretchers have additional requirements, which include:

- Flotation: provide self-righting and head-up flotation due to hoisting in a maritime environment and the need to give a restrained stretcher patient a chance of survival in the event of a helicopter ditching.
- Corrosion resistance: due to the maritime environment.
- Flammability: materials used must pass cabin component flame resistance requirements.
- Impact resistance: to ensure structural integrity in the event of a high energy contact with an obstacle during hoisting.
- Orientation when hoisting: a head up incline helps with aerodynamic stability during hoisting.
- Meeting airworthiness requirements as a Helicopter External Loads Personnel Carrying Device System (PCDS) and, once on board and secured, meeting the requirements of litters within the CS for rotorcraft, including meeting crashworthiness requirements[20].

Not surprisingly this results in a stretcher heavier than those in ground only use. The mass is managed in the newest stretchers by using materials such as titanium rather than stainless steel.

[19] https://ferno.com/uk/product/paraguard™-excel-rescue-stretcher

[20] CS-29.561(b): (i) Upward – 4 g, (ii) Forward – 16 g, (iii) Sideward – 8 g, (iv) Downward – 20 g, (v) Rearward – 1.5 g.

4 Other Considerations

While there may be some limited mass gains from reconsidering stretchers and other SAR equipment in use, we would observe that the biggest likely variable in the calculation is that of SAR personnel. The default assumption used, based on current average equipped Industry SAR winch-paramedics, is 90.3 kg. While typical for the default masses used in performance calculation scenarios in various SAR helicopter tenders [21], that is approximately the 50-percentile mass of all male offshore workers [22]. Marginal gains through equipment enhancement could be offset by greater variation in SAR winch-paramedic mass and their essential equipment.

The OEUK policy also assumes hoisting at >0°C and above. Below that temperature the EASA AD imposes a further 22 kg reduction in capacity. This would reduce the number of offshore workers, as measured in 2022, who could be carried by approximately one third.

[21] Though a Norwegian Ministry of Justice SAR tender did assume 104 kg.

[22] https://oeuk.org.uk/wp-content/uploads/2025/10/OEUK-Safe-Weight-Limit-Policy-Explanatory-Note-Issue-1.pdf

5 Conclusions

Hoists are complex devices, and the design of a higher-capacity hoist that would enable an increase to the OEUK Safe Weight Limit is likely to be many years away.

The forthcoming Pegasus hoist is expected to expand hoist capacity but there is no firm timescale for operational introduction. Introduction would require successful completion of pioneering certification against new standards and for UKCS coverage, be certified for installation on three helicopter types and c 40 be procured (excluding spares)[23]. It can be expected that timescale likely to be measured in years and it would be prudent to allow a new hoist to build service experience before initiating any retrofit programme. The added capacity however would not easily be turned into a major increase in OEUK Safe Weight Limit due to the other risks that the safe weight limit mitigates including manual handling issues on installations and the mass limits of existing installation stretchers.

SAR stretchers also have demanding requirements to meet. Any savings in the assumes equipment are likely outweighed by variability on winch-paramedic mass.

[23] Dual hoists for 18 HMCG helicopters and 2 Industry SAR helicopters. If the Aberdeen Industry SAR concept was expanded across the UKCS then fewer helicopters would need equipping.

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