



EASA Briefing Paper

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Pegasus – Additional buoyancy for offshore helicopters

**IP & Design Rights
One Atmosphere Pty Ltd**

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1.0 Executive Summary

One Atmosphere (OA) have engaged Aviation Engineers and ATL to support the application and compliance verification for a Supplemental Type Certificate to install Pegasus onto CS.29 certified helicopters. One Atmosphere have invented, developed and prototyped Pegasus to a point where the system has been proven to deploy and float full size helicopters in open sea conditions. Furthermore, One Atmosphere are currently working on the installation and certification of Pegasus on the Tiger Military aircraft to support over water operations.

2.0 Simple interface approach:

- 100% autonomous – No wires or software.
- Mechanical interface only – Fitment of 2 mounting points per unit.
 - Back plate of Pegasus has been designed to cater for virtually any mounting point configuration to provide high a degree of flexibility for airframe integration.
 - Scalable design based on modular components

3.0 Tiger Helicopter Example:

OA has been developing an ultra-light weight post-crash buoyancy system for the Australian Defence Force's Tiger Armed Reconnaissance Helicopters.



Figure 1. Pegasus installed on the Tiger Armed Reconnaissance Helicopter

This Pegasus variant has only two mechanical mounting points per unit to interface with the airframe. The hard point location and design has been positioned to align with structural frames beneath the lateral skin to provide the required strength.

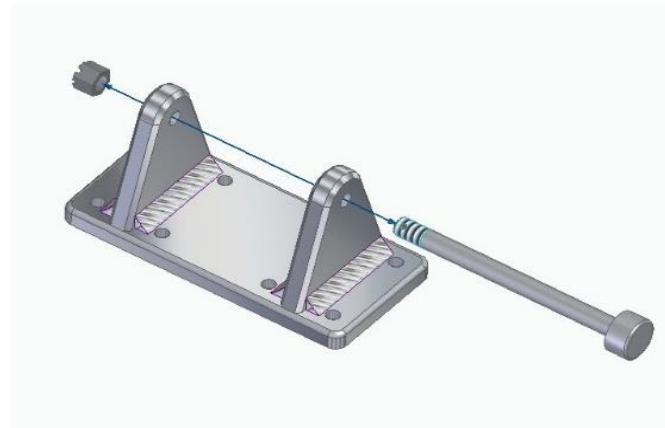


Figure 2. Pegasus mounting bracket.

With the mounting points placed on the airframe where structural frames/strength allows, the corresponding mounting points on the Pegasus units are aligned to suite the mounting point configuration.

Large offshore helicopters including the S-92 can be easily modified to allow a retro fit solution.

4.0 Pegasus System Overview

4.1 Inflation Subsystem:

One Atmosphere (OA) has produced a new and light weight method of inflating large volume buoyancy bags very fast, even against increasing sea pressure as it sinks. The inflation system consists of at least two pyrotechnic devices that work in concert to enable the buoyancy bag to be deploy rapidly and without damaging the buoyancy bag itself.

4.2 Buoyancy bag Subsystem:

Some of the pyrotechnic gas produced by the inflation system can be extremely hot, so the buoyancy bags are manufacture from a heat resistant super fibre. The fibres themselves also yield high tensile strength to withstand dynamic loadings as it inflates underwater to raise heavy objects. It also has significant puncture resistant properties to assist in preserving the integrity of the buoyancy bag in very challenging environments.

4.3 Electronic Crash Detection Subsystem:

The electronic crash detection subsystem is design to never automatically function or deploy the Pegasus system unless it is under water. It contains several sensors that are programed to sense a water impact event and will activate the Pegasus system one the activation criteria have been met. The Subsystem also conducts an internal diagnostic test every time it is turned on, and provides a solid green light to indicate it is on and working correctly.



4.4 Cover subsystem:

The Pegasus cover is a light weight composite. Initially developed for military applications to provide ballistic tolerance, resistance to heat and rocket/missile detritus and EMI/RFI emissions. While civil variants will not require the same level of protection the cover will protect the Pegasus from the marine environment elements and possible engine exhaust wash.

4.0 Sikorsky S-92 Study

4.1 OA is designing a similar approach for large offshore helicopters like the S 92, where:

- Mounting point locations are determined with the OEM.
- OEM can design the mounting points if preferred.
- OA tailor Pegasus to interface with mounting points.
- Option to fit multiple units, e.g. 2, 3 or 4.
- Concept has been tested by OA on a smaller helicopter (A109)



Figure 3. Post ditch prior to capsizing (2 systems fitted)

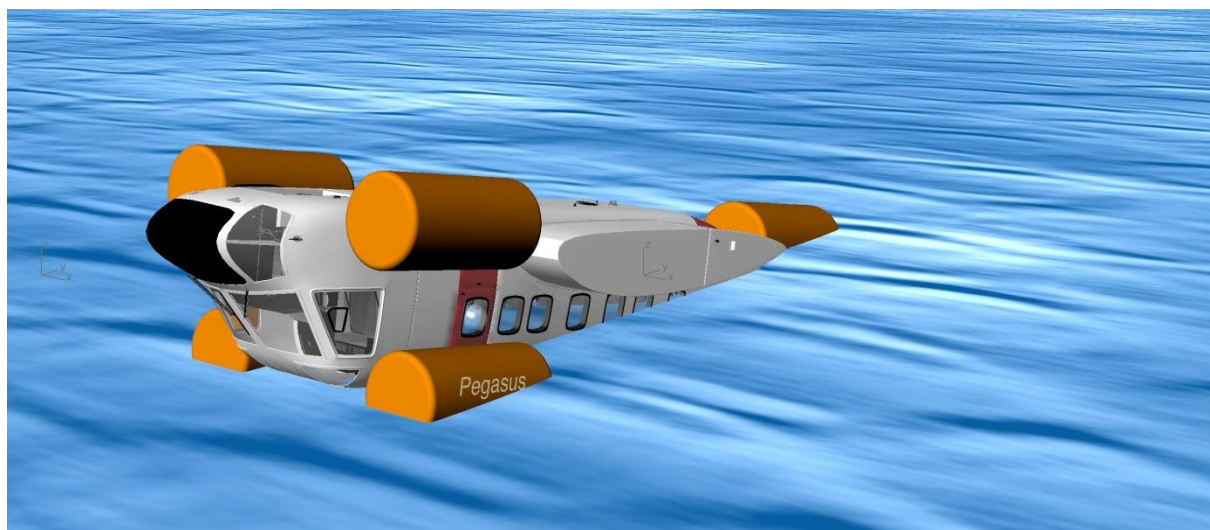


Figure 4 - Post capsizing and automatic Deployment (2 systems fitted), (Possible configuration)

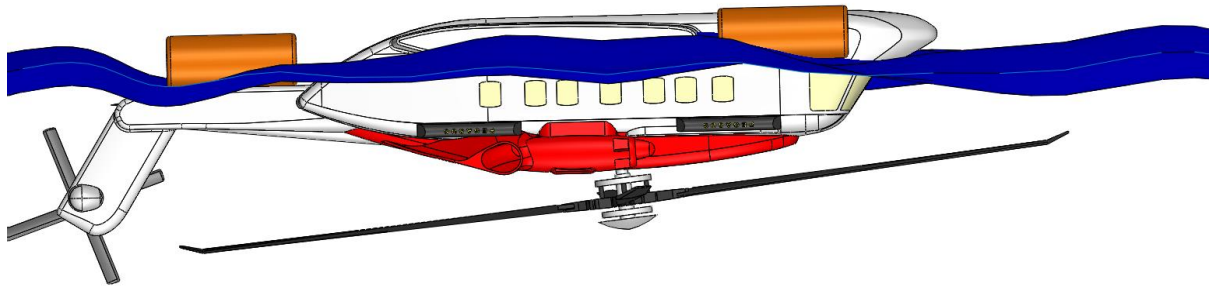


Figure 5 - Post capsize, No Deployment (4 systems fitted), (Possible configuration)

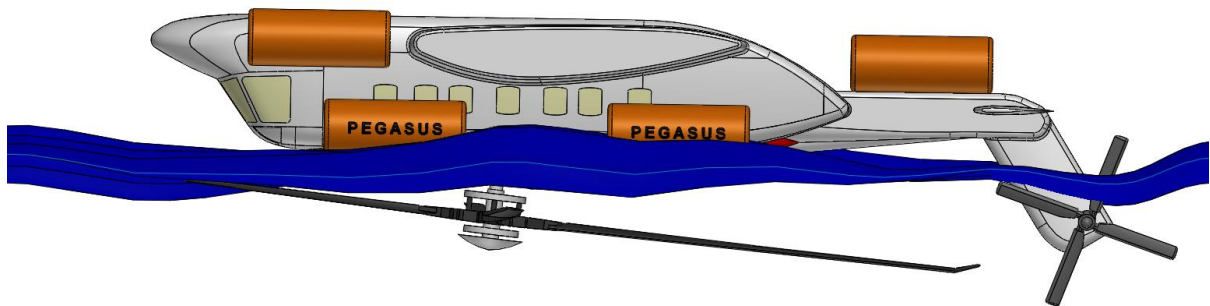


Figure 6 - Post capsize, Full Deployment (4 systems fitted), (Possible configuration)

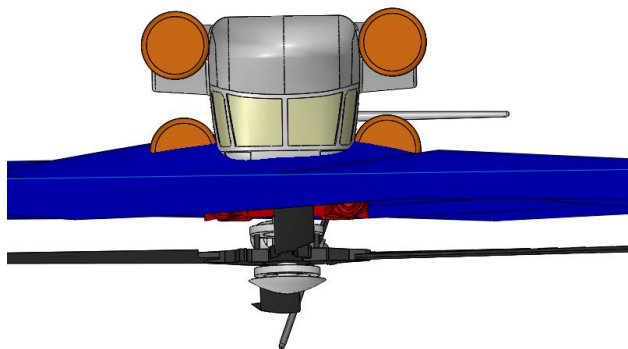


Figure 7 - Post capsize, Full Deployment (4 systems fitted), (Possible configuration)

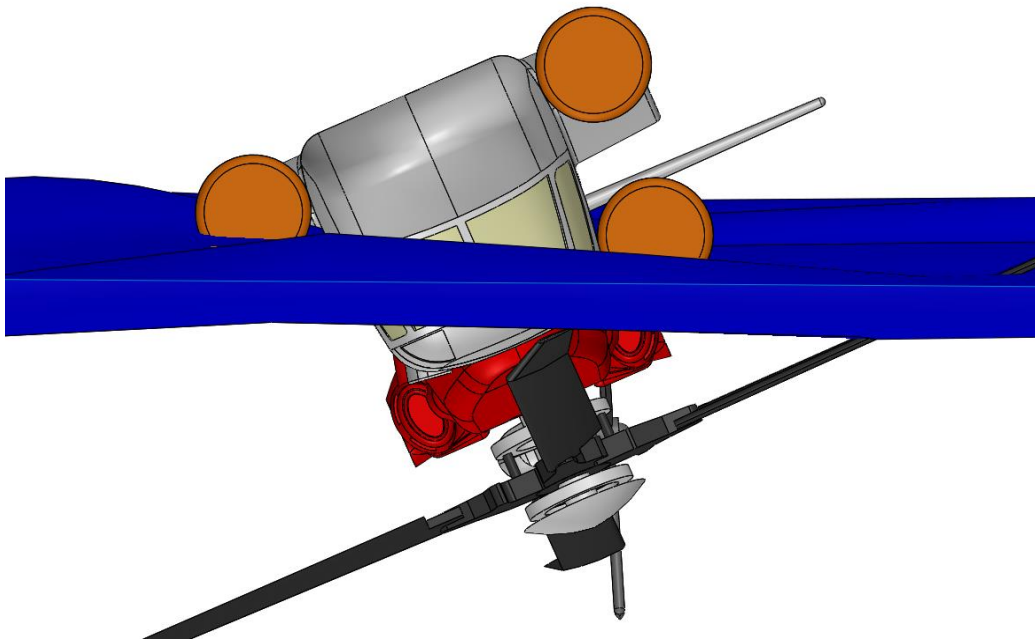


Figure 8 - Post capsize, Full Deployment (4 systems fitted, with puncture/failure on one side), (Possible configuration)

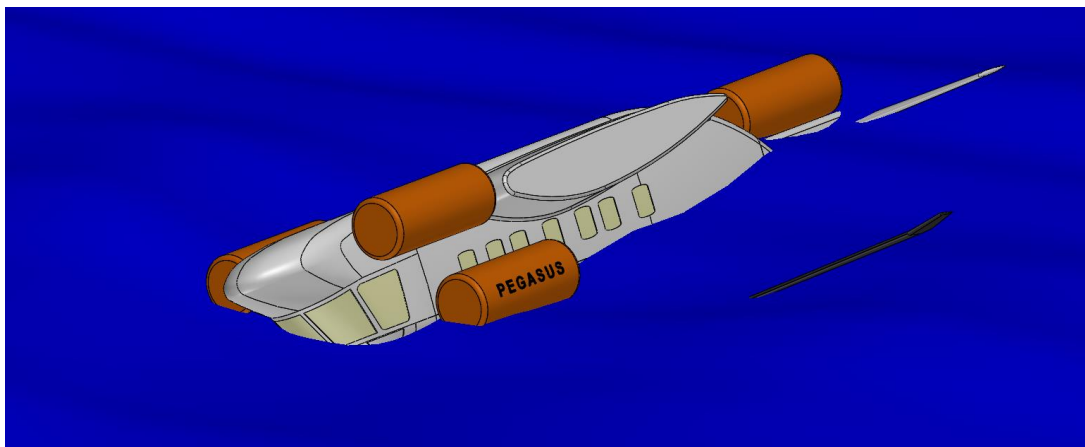


Figure 9 - Post capsize, Full Deployment (4 systems fitted, one system deployed), (Possible configuration)



5.0 EASA NPA.

Aviation Engineers & ATL have submitted a Form 33 to start the formal application process for the STC. It is recognised that the current rules per CS 29 Amendment 3 do not fully cater for a post-crash Emergency Floatation System (EFS). The basis for the design and certification being used is CS29 Amendment 3 supported by EASA NPA 2016-1.

EASA NPA 2016-1AMC 29.810 – Ditching in paragraph (c)(8) states:

One method of meeting the post-capsize survivability provisions of CS 29.801(i) is to create a post-capsize rotorcraft floating attitude which will create an air pocket in the passenger cabin. This can be achieved by means of additional buoyancy. An air pocket will remove the time pressure for escape. Passengers will not need to immediately escape through a ditching emergency exit. They can utilise the air in the pocket for continued survival during the time needed for all to make their escape.

- i. The required additional buoyancy should not be placed in a location vulnerable to damage or likely to detach (e.g. the tail boom), but located away from the normal flotation units such as high up on the side of the fuselage in the form of buoyant cowlings or redundant flotation units (or both). Any use of additional flotation units should be considered as part of the emergency flotation system and meet the same standards of float design. Consideration will need to be given to the automatic activation of additional floats and the inflation sequence to avoid possible damage from turning rotor blades or impact debris.
- ii. An alternative means of compliance may be to relocate the existing flotation units higher up on the sides of the fuselage to form the 'wet floor' concept. An air pocket would then form if the rotorcraft were to fully invert.
- iii. The size and shape of the air pocket should be sufficient to accommodate all passengers. A minimum volume per passenger, in the form of an elliptical column of 70 cm x 50 cm (27 in. x 19 in.) and height of 30 cm (11 in.) relative to the static waterline should be established and demonstrated as fitting into the air pocket, including with the critical float compartment failed. This will accommodate all passengers up to and including those classified as extra-broad (shoulder width = 68.6 cm). As the rotorcraft will have capsized, seats will consume a significant amount of otherwise useable volume and this will need to be taken into consideration in the non-stroked position.
- iv. The air pocket should be accessible and immediately available without passengers needing to cross seat backs. Where the cabin is divided by the presence of seat backs, a sufficient volume of air to accommodate all passengers seated within that row should be provided. E.g., if there are three seats facing a further three seats, the minimum between-row air pocket should accommodate six passengers (six of the elliptical columns should fit). If all seats are forward-facing, and there are four seats in each row, the minimum air pocket should accommodate four passengers (four of the elliptical columns should fit).
- v. Egress from the air pocket will ideally be via exits with a significant portion remaining above the water line. It should be substantiated that egress is feasible, for instance, that opening of the exit will remain reasonably easy (e.g. not involve the need to find the opening handle under an appreciable water depth) and that seats or other cabin items provide sufficient stepping points, if needed.....

5.1 The following illustrations utilise the interior cabin of the S92 and overlay the air pocket per paragraph (iii) of the NAP above each passenger place.

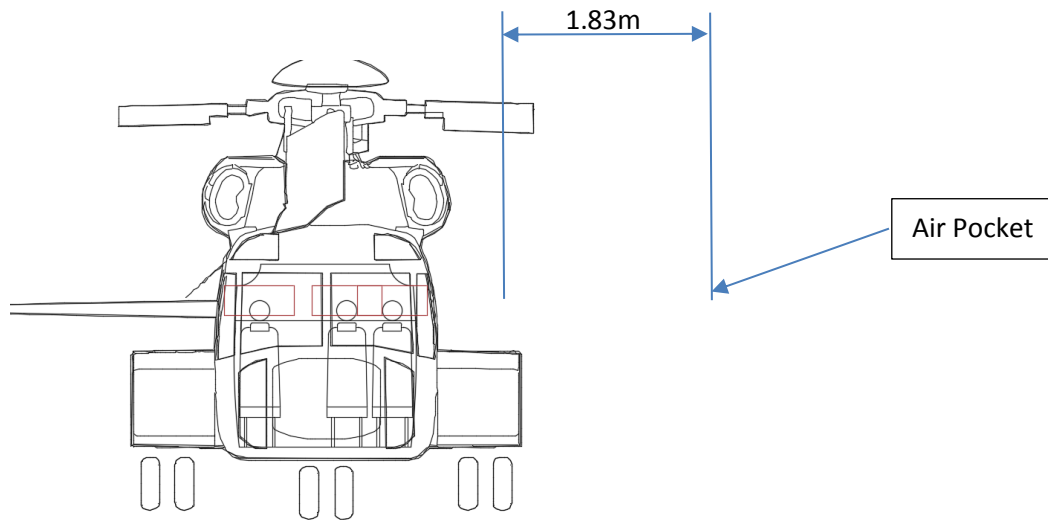


Figure 10 – S 92 Standard Cabin with Air Pocket shown above each pax Place.

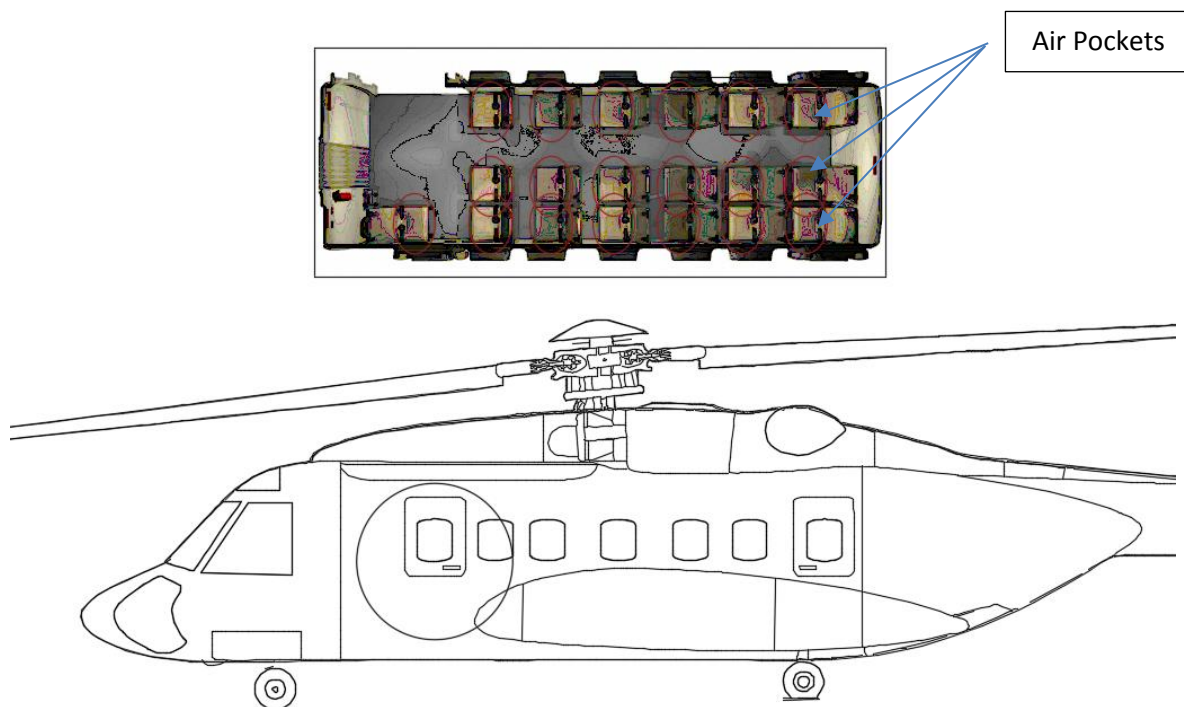


Figure 11 – S 92 Standard Cabin LOPA with Air Pocket shown above each pax Place.

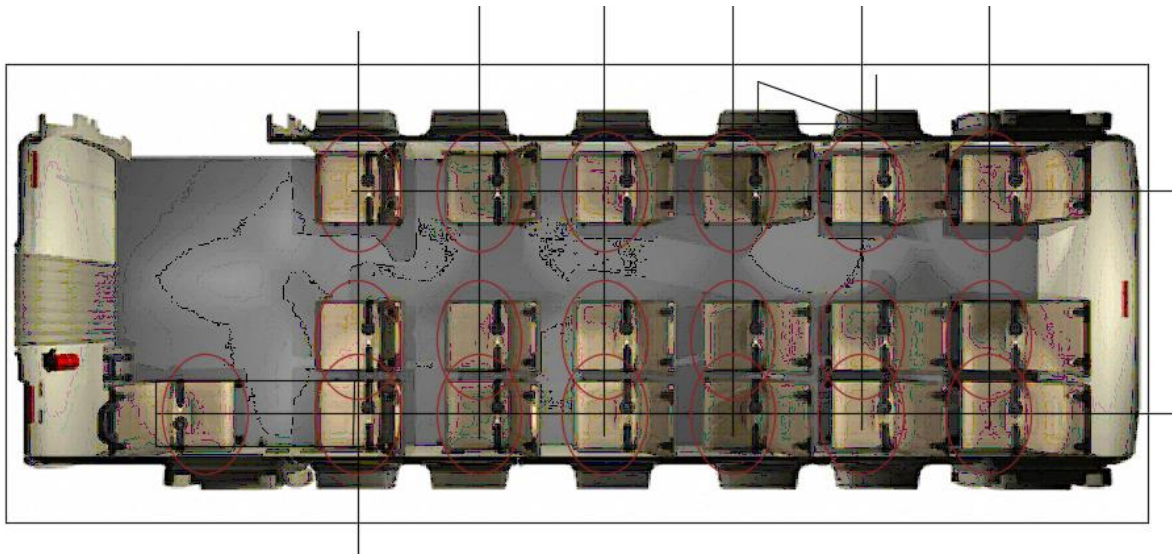


Figure 12 – S 92 Standard Cabin LOPA Large View (Air Pocket shown above each pax Place)