



Certification of the AW139 for ditching in sea state 6





Summary



- Reference to the applicable regulations
- Drivers of the task
- Description: the helicopter model, ditching and seaworthiness tests
- The outcome of the activity
- Conclusions and inputs for discussion



Applicable Regulations Vs Sea Conditions



29.563 Structural Ditching Provisions	Defines the design water impact conditions (forward and vertical velocity, rotor lift) and the criteria to calculate the loads acting on the floats. The above conditions and criteria are generic, i.e. do not refer to a specific sea state. AC 29.563 section b) - Procedures, states: <i>The most severe wave heights for which approval is desired are to be considered. A minimum of Sea State 4 condition wave heights should be considered.</i>
29.801 Ditching	Refers to '<i>reasonably probable water conditions</i>'. AC 29.801 clarifies that '<i>sea state 4 is representative of reasonably probable water conditions to be encountered. Therefore, demonstration of compliance with the ditching requirements for at least sea state 4 water conditions is considered to satisfy the reasonably probable requirement</i>'.



Background: why AW decided to perform this activity?



- The AW139 RFM did not provide reference to the sea state to which the ditching procedure were related
- Operators were insistently requesting confirmation on whether ditching was possible in conditions more severe than sea state 4 or not
- The available data (Advisory Circular and test reports) were referred to sea state 4



Sea state 6 certification



The following activities have been performed to substantiate the aircraft capability to safely perform a ditching up to sea state 6 conditions:

- Floats loads: the loads developing on the floats have been calculated taking into account the characteristics of sea state 6 waves.
- Scale model ditching and seaworthiness tests; investigation of:
 - Helicopter behaviour at ditching
 - Impact loads (pressures)
 - Aircraft stability into the waves
- Structural substantiation of the helicopter for the sea state 6 water impact and float loads.



Ditching and seaworthiness tests



Ditching and seaworthiness tests have been performed, in a naval tank, using a scale model (1:12) of the helicopter.

- Ditching: the model, without floats (note: AW139 floats are inflated following water entry) is launched onto the incoming waves. Tests are aimed to evaluate the behaviour of the helicopter at water entry. Impact pressures are recorded.
- Seaworthiness tests: the model, with floats, is placed into the waves. The test is aimed to verify the capability of the rotorcraft with floats inflated to sustain the sea (i.e. no instability / capsizing)

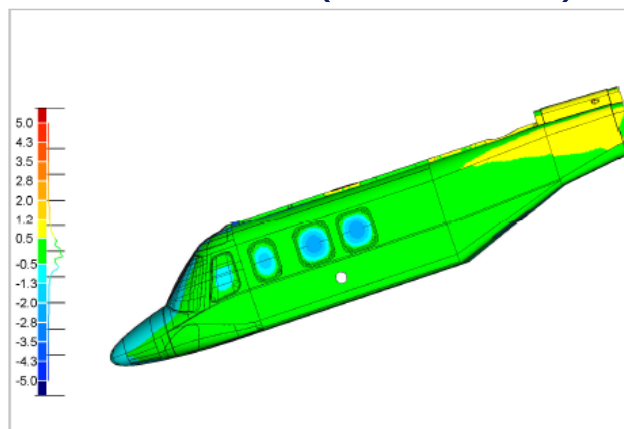


HELICOPTER SCALE MODEL

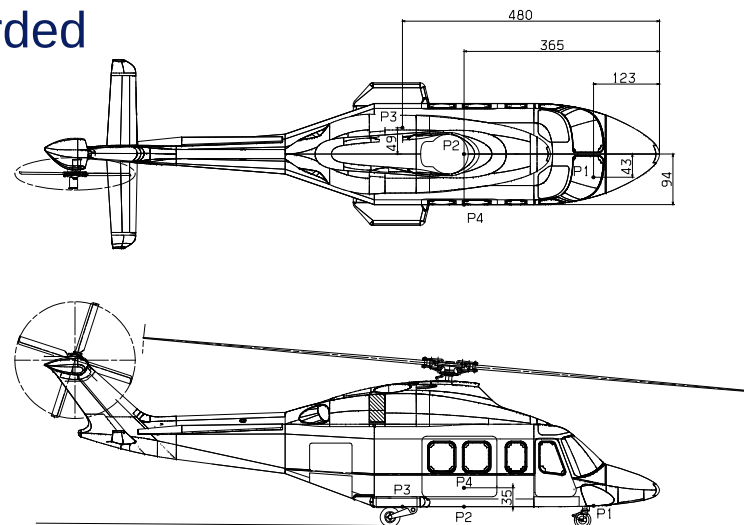


The scale model was...

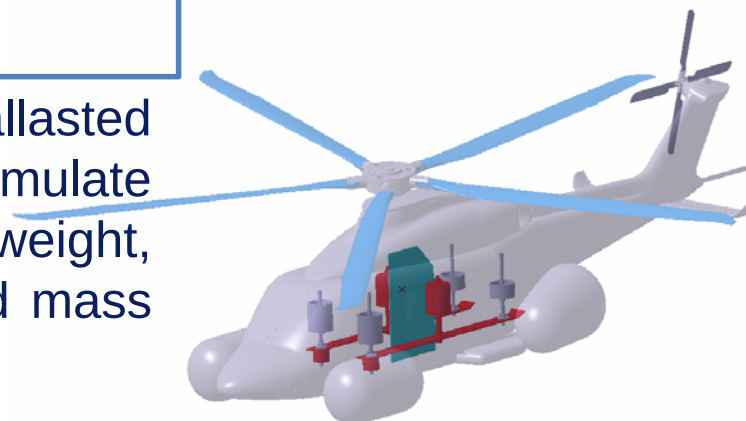
geometrically representative of the real aircraft (scale 1:12)



equipped with a data acquisition system allowing the impact pressures to be recorded



predisposed to be ballasted to appropriately simulate the helicopter weight, centre of gravity and mass distribution





Ditching tests



Test conditions representative of sea state 6, i.e.:

Sea state 6 (Very Rough):

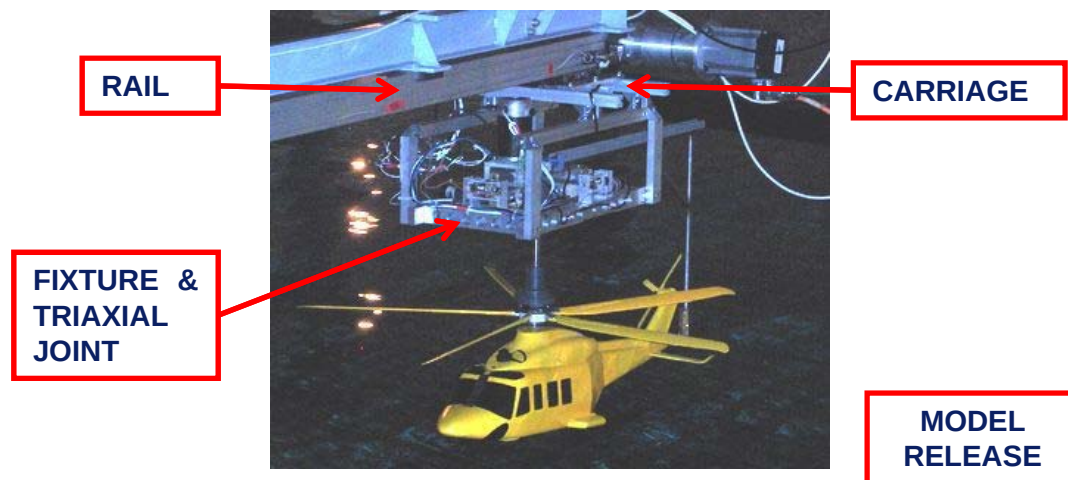
- Significant wave height 4 to 6 m (13 to 20 feet)
- Wind speed 28-47 knots
- Height/length wave ratio 1:12.5

Scale factor used: 12

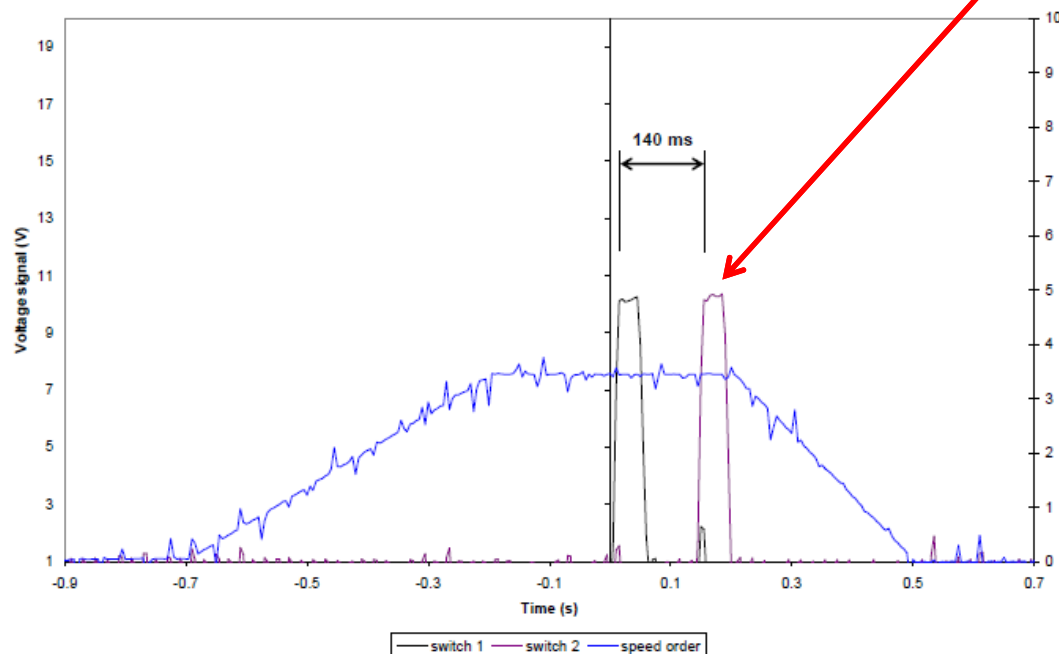
Water entry conditions in accordance with 29.563



Ditching tests: launching system



The fixture to which the model was attached allows orientation on the 3 axis to simulate the desired roll, pitch and yaw angles.



The carriage was driven in such a manner to obtain a constant speed area. The model was released before the end of this area by means of a switch activated by the carriage.



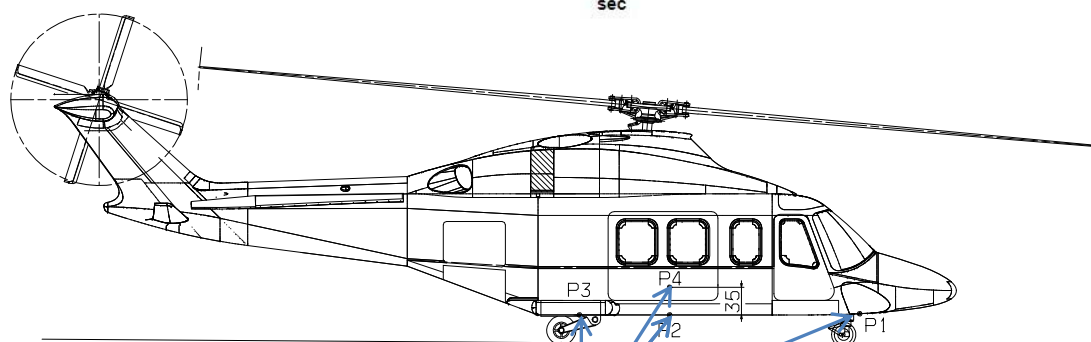
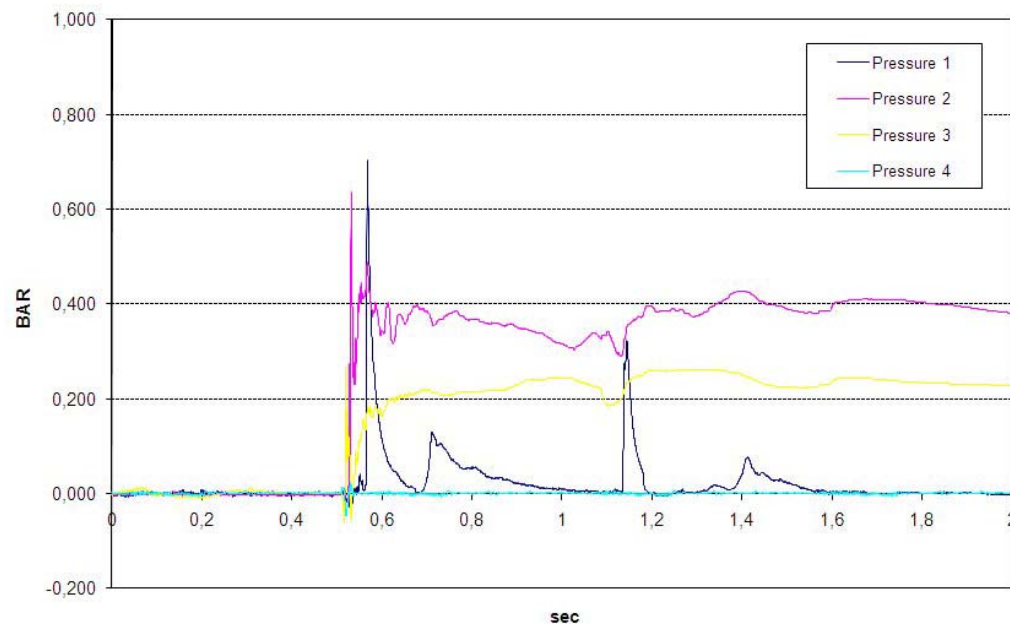
Ditching tests

SIREHNA 2009-17
AW139 DITCHING TESTS

REGULAR WAVES : 6
MASS/CG : Q
ROLL: 0 PITCH: 05
YAW: 0
1/12.5 NOV 2009
RUN: 25



Impact pressures



The pressures acquired have been analysed (taking into account the scale factor) to determine equivalent static pressure values to be used for the aircraft fuselage substantiation.



SEAWORTHINESS TESTS



DGA Technique
hydrodynamique

Sirehna 2009-17 DEC09
AW139 MODEL TESTS
FLOATS:P/N 3G9560 F00113
3G9560 F00111
REGULAR WAVES:6 1/12,5
WAVES ANGLE:90
MASS/CG:G RUN:02



Result: RFM modification



WAS

IS

GENERAL INFORMATION

Emergency Flotation and Life Raft System Part N° 3G9560F00111

This system comprises of 4 flotation bags, 2 mounted on the lower nose section (left and right hand sides) and two mounted on the lower

SECTION 1 - LIMITATIONS

BASIS OF CERTIFICATION

The Emergency Flotation and Life Raft System P/N 3G9560F00111 is approved for ditching in accordance with JAR/FAR 29.

The Emergency Flotation System P/N 3G9560F00113 is approved for ditching in accordance with JAR/FAR 29 provided the following approved equipments, in accordance with the National Operation rules, are fitted:

- Life raft(s)
- Survival type Emergency Locator Transmitter
- Life preservers

GENERAL INFORMATION

Ditching Regulations

Demonstration of emergency over water landing capability and buoyancy up to Sea State 4 is required by ditching regulations. However, for this installation Sea State 6 has been demonstrated and approved.

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Conclusions & inputs for discussion



- AW139 RFM now explicitly refers to ditching in sea state 6 conditions
- Flight manuals for other helicopters (e.g. AW139 competitors) do not provide specific indications on the limit sea state for which the aircraft is certified for ditching
- Questions:
 - Does the absence of specific indications on the flight manual allow operations on the sea whatever the environmental conditions are?
 - Should the regulation provide more detailed instructions?
 - Does the reference to the sea state in a RFM 'limit' capabilities of a helicopter, whereas when no specific substantiation / indication is provided the possibility to perform a ditching can be considered not related to the sea conditions?