

Research Update for 7 December 2009 HSRMC Meeting:

Note: Item numbers correspond to the joint industry HSRMC research programme.

1 HUMS

All work on the advanced HUMS VHM data analysis using anomaly detection techniques has been completed. All interim reports have been completed and accepted, and the overall final project report is being drafted. The final report will include a summary of the HSRMC-funded S61 and S.Puma MRGB seeded defect testing in an appendix which will be written by the CAA. The next progress meeting with GE Aviation is scheduled for 27 January 2010.

Overall the project has been very successful. GE Aviation are progressing implementation via OEMs for aircraft with OEM supplied HUMS, and will be dealing with HUMS suppliers and helicopter operators direct for 'legacy' HUMS. Oil & Gas UK are fully supporting the implementation of this technology and have written to all OEMs requesting their support. Negotiations with AgustaWestlands, Eurocopter Sikorsky and Meggitt are all progressing well.

2 Side-Floating Helicopters

Helicopter type-specific design study: The helicopter type-specific design study for side-floating helicopters was let by EASA to Eurocopter and Aer Azur. The work has been completed and the final report has been placed on EASA's website. There are a number of weaknesses in the final report, but the study did find the side-floating concept to be practical and effective. The main problem is that the report recommends a symmetric system (without any convincing justification), which leads to unduly pessimistic outcomes in terms of weight, cost and drag. Disappointingly, systems aspects such as deployment have only been superficially addressed and, in a number of areas, the study has not moved the concept forwards very far. EASA had intended to hold a workshop on the subject of ditching and water impact early in 2009 at which Eurocopter were to present their work. This has not taken place and no action has been taken to set it up.

The CAA has received some enquiries from the Canadian S92 accident investigators; a copy of the summary report on the HSRMC work (CAA Paper 2005/06) has been forwarded to them.

EBS Specification: EBS is considered to have the potential to mitigate the safety risk associated with water impact/post ditching capsize in the short to medium term pending availability of side-floating emergency flotation systems, and in the long term in the event that retrofit of the side-floating scheme is judged to be impractical. The example draft technical standard for EBS contained in CAA Paper 2003/13 is being developed into a full specification to ensure that any EBS voluntarily deployed truly represents a net safety benefit. Dr Susan Coleshaw (the author of the study reported in CAA Paper 2003/13) has been contracted to perform this work.

The cold water trials at Portsmouth University were completed in July, and the 'warm' water trials at Falck-Nutec and being planned for late October through November.

Consultation and reporting will take place early in 2010 with the project being completed by end March 2010. A presentation on this project was given at the 11/12 June 2008 RAeS Maritime Operations of Rotorcraft conference.

3 Operations to Moving Decks

A specification for the vessel motion sensing equipment has been developed jointly with the industry. The specification has been used to define the prototype equipment necessary for the sea trials and, once validated by the sea trials, will be added to the joint UK/Norway guidance material (Norsok Standard).

The next phase of the project is to conduct sea trials to evaluate the use of the equipment by pilots and deck crew and to collect data to enable the present, conservative, MSI/WSI limits to be refined. The trials are to be hosted by Maersk on their Global Producer III FPSO, equipped with a Miros motion sensing system and served primarily by Bond Offshore Helicopters S.Pumas. Two meetings of all parties involved have been held in Aberdeen. The trials procedure, the trials proformas and the trials safety assessment have all been completed and are ready to be circulated for final approval. A three-phase approach is being adopted:

- 1) Phase 1 - Install new motion sensing system software and check instrumentation for correct implementation of calculations etc.
- 2) Phase 2 - Make new motion sensing system live and install and test the helideck-mounted motion status repeater light system. This phase will not involve using any new or modified limits or operating procedures. Helideck motion status is to be driven by current P/R/H (and HR?) limits only.
- 3) Phase 3 - New motion sensing system is live, and helideck motion status driven by current P/R/H (and HR?) and MSI/WSI limits. MSI/WSI out of limits will give amber status only (i.e. not red) for the trial, prompting the pilot and deck crew to adopt modified procedures or abandon the landing as appropriate. Pilot and deck crew proformas completed during this phase.

The new motion sensing system software has been installed on the vessel and Phase 1 is underway. The repeater light system for Phase 2 has been designed and costed; contractual proceedings are being progressed but it is unlikely that it can be installed before February 2010 due to delivery times and scheduling the installation on the vessel.

Further work on the MSI/WSI operating limits will be needed on completion of the sea trials to address the modelling of helicopter control movement while on deck, and also the phasing of the maximum values of the MSI and WSI, both of which are based on arguably over-conservative assumptions in the present limits. Some work on the analysis of helicopter control movements has already been completed with the valuable assistance of CHC Scotia Helicopters.

This project remains a joint UK/Norwegian initiative; the last joint industry meeting was held on 7 December 2007. A presentation on this project was given at the 11/12 June 2008 RAeS Maritime Operations of Rotorcraft conference. It is hoped that a presentation on this work can be included on the agenda for the Oil & Gas UK ASTG Seminar in June 2010.

4 Helideck Lighting

The AGI Stage 2 lighting system (green perimeter lights as per Stage 1 plus replacement of floodlighting with lit aiming circle and 'H' marking) is installed and operating on the Hydrocarbon Resources Ltd CPC-1 platform in Morecambe Bay.

A limited trial of the system on the CPC-1 was conducted during the second half of February 2009. A total of 10 flight crew questionnaires covering 14 landings were received of which seven were very positive, two positive and one neutral. The trial had to be suspended due to some of the lighting panels coming loose. The system was re-installed in early May and the trial recommenced on 14 May. Demonstration flights for UK industry representatives were conducted on 2 November 2009. All participants commented favourably on the system which was especially encouraging as, purely by chance, the flights were conducted in conditions of degraded visibility. A further six profomas have now been received, two of which covered 11 approaches between them; five were very positive and one positive. The in-service trial will continue throughout the winter 2009/10 night flying season, and discussions are underway with a view to producing and installing a production version of the system for evaluation.

The draft specification for the Stage 2 lighting scheme was included in the 6th Edition of CAP 437 as an appendix by way of advance information. This has been refined following discussions with the manufacturers, AGI and Orga, and an interim (pending completion of the winter 2009/10 in-service trials) report has been produced which includes the updated specification. This document has been circulated to the industry for comment.

It is hoped to extend the proposed demonstration flights for the GPS guided offshore approaches (see item 6 below) to include flights to a platform equipped with the new helideck lighting to show how the two schemes combine to form an integrated solution.

A presentation on this project was given by the CAA at the 10 June 2008 Oil & Gas UK ASTG Symposium and at the 11/12 June 2008 RAeS Maritime Operations of Rotorcraft conference.

5 HOMP

The remaining HOMP research is the provision of a measure of low airspeed for use in the ground-based analysis system. The original programme of work had reached a point where, in order to make progress, flight trials were needed to generate a new, more accurate database to train the neural network being used. This exercise was to be performed by Bristows but had not progressed due to logistical difficulties. At the November 2006 HMLC Bond kindly offered the use of one of their aircraft for these trials, and an initial meeting between Bond and the CAA was held on 5 June 2007 to discuss how best to take advantage of the offer and move the project forward.

At this point the project was transferred to GE Aviation as Westlands were no longer able to support it. Following a review of the work completed by Westlands, GE conducted a small feasibility study which included a second attempt using the existing flight data. Although the overall conclusion of this work is that further flight trials to obtain a better data set are required, the reason for disappointing performance is now understood. Furthermore, the GE results demonstrate potential both in terms of the comparable performance (to Westlands) achieved without using IAS as an input parameter, the significantly better generalisation obtained, and also the good results obtained in synthesising IAS from other aircraft parameters. The final report on the GE work has been completed and accepted. A costed proposal for further flight trials is now awaited from GE.

The next progress meeting with GE Aviation scheduled for 27 January 2010.

6 Offshore Approaches

All work on the three-phase hazard analysis covering en-route navigation, WXR approaches and GPS enhanced WXR approaches has been completed and a final summary report has been produced for publication in the public domain as a CAA paper later in 2009. A presentation on the new GPS assisted weather radar approach was given at the 12 November 2008 HMLC meeting, and CAA Flight Operations has written to the helicopter operators with details of the new approach procedure which is to be implemented.

The EU 6th Framework GIANT project work was launched in November 2006 and comprised:

- data collection and analysis to establish the suitability of EGNOS for the offshore helicopter application;
- joint UK/Norway design of a 'full' GPS approach;
- hazard analysis of the 'full' GPS approach; and
- simulator trials of the 'full' GPS approach at Eurocopter.

All of this work has been completed and the project report is presently being finalised. This report will be published in the public domain as a CAA paper early in 2010.

A joint industry meeting on this research was held on 6 March 2009. Presentations on the work performed under the EU 6th Framework GIANT project were given and a draft of the final report circulated for comment by end March 2009. The next stage of the project called HEDGE, which forms part of an EU 7th Framework project, was reviewed and discussed. The work will essentially comprise the production and trials of a demonstrator system and a number of additions to the project were identified for costing. The additions presently being considered include:

- demonstration of the integration of the SOAP procedure with the enhanced helideck lighting;
- safety assessment of the visual segment;
- integration of AIS into the navigation display; and
- addition of RNAV guidance to assist shuttling.

Due to the pressing need to integrate the corresponding design, development, testing and certification of the associated hardware and software with the rest of the project, the AIS work package (third bullet above) has been given top priority and the available funding used to task the contractor with this work. Note also that the recently completed safety assessment of the new DGPS approach procedure shows AIS to be necessary to adequately address all conflict scenarios.

Contracting of the other additional work packages will be largely dependent on availability of funding. Mainly as a result of the recommendation in the AAIB report on the G-BLUN accident in Morecambe Bay, EASA are taking an interest in this research and the possibility of EASA contributing funding to the project is being explored.

Presentations on this project have been given by Helios at the 10 June 2008 Oil & Gas UK ASTG Symposium and at the 11/12 June 2008 RAeS Maritime Operations of Rotorcraft conference, and by the CAA at the 2-3 December 2009 EASA Rotorcraft Symposium.

7 Helideck Friction

The contract for a programme of work comprising a review of the current helideck friction criterion in CAP 437 and a review of a range of friction measuring devices was let to NLR in The Netherlands in October 2007. An HCA representative is participating in the monitoring and direction of the project. The experimental work was started in April 2008, some of which was witnessed by CAA and HCA representatives, and has now been completed. The project report is presently being finalised with the contractor.

In essence, the work confirms the Finlay Irvine GripTester to be the most appropriate device for measuring helideck friction. The main problem with this device is its portability but, while the research was being conducted, a smaller more portable friction tester employing the same measurement principle as the GripTester was identified (T2GO, manufactured by ASFT in Sweden). A costed proposal has been received from NLR to add a review of this device to the study for inclusion in the final report, but cannot be progressed until sufficient funding is available. Finlay Irvine has also produced a 'Micro GripTester' which was demonstrated to the CAA on 24 September 2009. It is understood that this will replace the current GripTester.

The contract with NLR has been extended to add the work on establishing a new criterion for aluminium helideck surfaces. The need for a small extension to include helicopter tyre footprint pressure as a variable in this work has been identified, but awaits availability of funding. The programme for this work was reviewed and agreed at a meeting with NLR on 25 November and the project launched. Testing is expected to start in January 2010.

8 Turbulence Criterion

All work on the development of the turbulence criterion and the review of the present CAP 437 0.9 m/s vertical wind component criterion has been completed and reported. Following consultation with the industry, the turbulence criterion was added to CAP 437 in the 6th Edition, and the 0.9 m/s vertical wind component criterion has been removed. The final reports on the HOMP validation of the turbulence criterion and the review of the 0.9 m/s criterion have been published in a single CAA paper (CAA Paper 2008/02). The helideck design guidance material published in CAA Paper 2004/02 has been updated to take account of the results of this work, and has been republished in CAA Paper 2008/03. These documents are referenced in the 6th edition of CAP 437. A presentation on this project was given at the 11/12 June 2008 RAeS Maritime Operations of Rotorcraft conference. No further research on helideck environmental issues is currently anticipated.

The final report on the validation of the turbulence criterion recommends that helicopter operational monitoring (HOMP) data be routinely collected and analysed to monitor the turbulence environments around offshore platforms, providing quantitative feedback for improvement and refinement of the HLL and, possibly, further tuning of the criterion. A presentation to HCA and the helicopter operators to promote this use of HOMP data was given in Aberdeen on 7 November 2006 and was well received. All information necessary to implement the algorithm in HOMP has been provided to the helicopter operators and their HOMP system suppliers. A further presentation was given at the 16 April 2008 HMLC meeting, and this was repeated at an ad-hoc CAA/CHC meeting held on 7 November 2008.

9 Extension of HUMS to Rotors

The initial study on extending HUMS to rotors comprised a review of all relevant work (including the earlier HSRMC-funded studies) in order to form a consolidated view of

the state of the art of the application of VHM techniques to the detection of rotor system Potentially Catastrophic Failures (PCFs). The study has been completed and the overall results are:

- the review of accidents and incidents shows a steady decline in the occurrence rates from the early 1990s; the majority of occurrences are related to the main rotor and the majority of these are related to hub (rather than blade) defects;
- there is no evidence that Vibration Health Monitoring (VHM) would be effective in providing adequate advance warning of main rotor faults; there is some evidence that VHM could help with tail rotor faults; other health monitoring technologies (e.g. strain gauges) might offer benefits; and
- the direction of the earlier research is not considered optimal in the context of current knowledge and experience.

The final report has been reviewed and accepted, and has been published in the public domain as CAA Paper 2008/05.

Further work entailing the application of the anomaly modelling techniques developed on the transmission HUMS research (see item 1 above) to in-service tail rotor HUMS data has been contracted to GE Aviation and is nearing completion. The somewhat mixed results of this work were presented at the 21 October 2009 progress meeting. A small extension to the work programme is consequently being explored to attempt to produce a more definitive result.

As regards main rotor health monitoring, a meeting was held between the CAA and AgustaWestland on 20 May to discuss this subject with a view to identifying opportunities for collaborative work. A major joint industry initiative is being worked up by Westlands and it is hoped that the CAA will be able to participate, albeit in a relatively minor role. Further meetings are planned.

10 Tail Rotor Failures

A feasibility study on the provision of a tail rotor strike warning system is included in the joint industry HSRMC work programme, but insufficient funding is available to proceed at present. It is understood that some work is being performed in this area by Sikorsky in the USA.

11 TCAS

A programme of work has been proposed comprising in-service trials of TCAS II equipment on a North Sea helicopter to establish the feasibility and likely benefits of fleet-wide implementation. A separate trial has already been performed by Bristow Helicopters.

Bristow Helicopters have completed dedicated flight trials utilising a BAE 146 'intruder' aircraft, and provided the CAA with a copy of the associated data and documentation. A presentation of the work at Bristows was given to the 54th HSRMC meeting on 30 January 2008, at the 16-19 September 2008 European Rotorcraft Forum in Liverpool, and at the 2-3 December 2009 EASA Rotorcraft Symposium. The in-service trials commenced in April 2008. It is understood that Bristow Helicopters have committed to fleet wide implementation of TCAS II; four S.Pumas have been fitted.

12 EGPWS Warning Envelopes

A programme of work aimed at using Flight Data Monitoring/HOMP data to refine the thresholds currently used by Class A Helicopter Terrain Awareness Warning System (H-TAWS) has been proposed by Bristow Helicopters. Currently the only helicopter Class A TAWS is the Honeywell Enhanced Ground Proximity Warning System (EGPWS) Mk XXII.

Modes 1–6 of the GPWS element of EGPWS utilise warning thresholds which are not optimised for offshore operations, or indeed helicopter operations in general. The GPWS thresholds have apparently been largely read-across from the fixed wing EGPWS where the Enhanced (look-ahead) mode is now the primary means of alerting the crew to approaching terrain. The GPWS thresholds have consequently been set sufficiently low to reduce the false alarm rate. Unfortunately, this results in helicopter thresholds which will alert the crew too late to be of real safety value, except for the fixed threshold. In order to optimise the GPWS element of EGPWS, and future helicopter Class A TAWS, it is proposed to use HOMP/FDM data to refine the GPWS warning thresholds.

A project specification has been drafted and agreed. GE Aviation were asked to produce ROM costs for the work but have declined the work as they are no longer involved with HOMP. A potential alternative contractor has been identified and contacted.

13 Triggered Lightning Strike Forecasting

A programme of work has been proposed to investigate and demonstrate the feasibility of forecasting/predicting triggered lightning strikes to helicopters.

Lightning strikes present a significant safety risk to helicopters, particularly those operating in the North Sea region. Although the aircraft are protected against lightning strikes, the lightning environment in the North Sea region has been demonstrated to present a risk five times higher than that assumed during the design and certification process. Although there were issues relating to the lightning protection on the aircraft concerned, the lightning strike to G-TIGK in 1995 served to demonstrate the potentially severe consequences of lightning strikes to helicopters. Furthermore, lightning strikes can cause damage that is difficult to detect and which may later present a safety risk; the fatal accident to G-BJVX in 2002 illustrates how, in extremis, this can result in catastrophe. In addition to the safety risk (which forms the primary motivation for this project), any lightning strike to a helicopter will normally entail significant maintenance action costing up to £2 million per event.

A project specification has been drafted and agreed. Tendering presently awaits confirmation of funding.

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4 December 2009

**Proposed HSRMC Research Programme – Funding Status
as at 4 December 2009 HSRMC Meeting**

Item	CAA Project Code	Title	Funding Status
1. ONGOING WORK			
1	5.1	HUMS - advanced analysis of HUMS data.	Sufficient funding available to complete all work currently identified.
2	5.3	Ditching/Water Impact - side floating helicopter design study.	Study completed by Eurocopter/Aer Azur under contract to EASA. Final report published on EASA's website.
		Ditching/Water Impact - EBS specification.	Sufficient funding available to complete all work currently identified.
3	5.10	Operations to Moving Helidecks – generation of MSI / WSI operating limits and in-service trials.	Sufficient funding available to complete all work currently identified.
4	8.2	Helideck Lighting - in-service trials of new scheme (circle & 'H' lighting).	Sufficient funding available to complete all work currently identified.
5	14.3	HOMP - extension to low airspeed regime.	Sufficient funding available to complete all work currently identified.
2. EXTENSIONS TO EXISTING PROGRAMMES			
6	5.7	Offshore Approaches (GIANT) – development and simulator evaluation of 'full' GPS approach + EGNOS reception study.	Study completed. Final report to be published in the public domain.
		Offshore Approaches (HEDGE) – demonstration of the integration of the SOAP procedure with the enhanced helideck lighting, safety assessment of the visual segment, integration of AIS into the navigation display, addition of RNAV guidance to assist shuttling.	Sufficient funding available for AIS receiver integration only.

Item	CAA Project Code	Title	Funding Status
7	8.1	Helideck Friction - review of CAP 437 criterion and test/monitoring techniques.	Additional funding required if industry wishes to pursue the provision of a more portable friction tester.
		Helideck Friction - development of new criterion for aluminium decks.	Additional funding required to investigate the effect of helicopter tyre footprint pressure.
8	8.5	Helideck Environment - review of CAP 437 vertical wind component criterion.	Study completed. Final reports published in CAA Papers 2008/02 and 2008/03.
3. NEW PROJECTS			
9	-	HUMS – preliminary study on extension to rotor systems.	Study completed. Final report published in CAA Paper 2008/05.
		HUMS - application of advanced data analysis techniques to HUMS tail rotor data.	Sufficient funding available to complete all work currently identified.
10	5.16	Tail Rotor Strike Warning.	Insufficient funding to proceed at present.
11	-	TCAS - in-service trials.	Trials presently progressing outwith HSRMC at Bristow Helicopters.
12	-	EGPWS Warning Envelopes	Funding to be confirmed.
13	-	Triggered Lightning Strike Forecasting	Insufficient funding to proceed at present.