

Research Update for 13 July 2010 OIAC HLG 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 second draft of the overall final project report has been produced. The CAA version of 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 CAA. The last progress meeting with GE Aviation took place on 31 March 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 are actively progressing this with the OEMs.

(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. 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 but is now proposed for 2011.

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. Some communications have also taken place with Robert Wells, the Commissioner running the Offshore Helicopter Safety Inquiry in Newfoundland. He also has a copy of CAA Paper 2005/06 and has shown great interest and met with the Oil & Gas UK Helicopter Task Group and with Dr Sue Coleshaw, CAA's contractor for the EBS research (see below). At the Commissioners request, Dr Coleshaw has submitted a report to the enquiry. The report includes input from the CAA promoting the side-floating scheme.

EBS Specification: EBS is considered to have the potential to mitigate the safety risk associated with water impact/post ditching capsizes 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 were completed in February 2010. Reporting is in progress and industry consultation will take place in the near future with the project being completed around end June 2010. A presentation on the work was given at the 11 May HSRMC meeting.

(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 being 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 contracted, and was to be installed during May 2010 but has been delayed by the ash cloud. Further delays at Miros, the motion sensing system manufacturer, mean that Phase 2 is unlikely to start before end September 2010. The second draft of the interim project report has been received and is under review.

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.

A Joint Industry Project (JIP) on operations to moving decks is presently being worked up by MARIN in The Netherlands and it is hoped that the future MSI/WSI work can be integrated with that programme and benefit from significant 'gearing'. A presentation from MARIN was given at the 11 May HSRMC meeting.

A presentation on this work has been scheduled for the Oil & Gas UK ASTG Seminar in September 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 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 7 were very positive, 2 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 02 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 6 profomas have now been received covering 15 landings; 5 were very positive and one positive.

The system is presently unserviceable and, with the passing of the night flying season, no resources are to be committed to repair it. The next step is the installation and demonstration of a production version of the system which is presently expected to be available in September 2010.

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 evaluation of the production version) report has been produced which includes the updated specification. This document has been circulated to the industry for comment.

A response to the industry feedback on the interim report has been issued, and an industry workshop will be arranged to present the production version of the system and discuss any remaining concerns with the manufacturer once the relevant information on the new production system is available. OGP have agreed to allocate agenda time for the workshop at their 21/22 September 2010 Aviation SubCommittee meeting. The interim report will be completed and published once the production version of the system has been installed and evaluated by CAA.

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. Sufficient funding is expected to be available to purchase the additional lighting system likely to be required.

A presentation on this project was given by CAA at the 10 June 2008 Oil & Gas UK ASTG Symposium, the 11/12 June 2008 RAeS Maritime Operations of Rotorcraft conference, and the 22 -24 March CHC Safety & Quality Summit.

(5). HOMP

The remaining HOMP research is the provision of a measure of low airspeed for use in the ground-based analysis system. This work has been using a database of Bristow S.Puma data including a low airspeed as measured by a HADS. As a result of the work completed to date, it has now been established that this data is unreliable due to the HADS sticking. Although it is now clear that flight trials will need to be performed to generate a new database, the more recent analysis performed by GE Aviation has demonstrated significant potential of the concept. The final report on the GE work has been completed and accepted. Bond Helicopters have agreed to support the trials and progress in the form of a meeting between GE, Bond and CAA.

(6). Offshore approaches

The final summary report on the three-phase hazard analysis covering en-route navigation, WXR approaches and GPS enhanced WXR approaches has been produced and published as CAA Paper 2009/06.

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,
- simulator trials of the 'full' GPS approach at Eurocopter.

All of this work has been completed and the final project report was published in the public domain as CAA Paper 2010/01 in May 2010.

A joint industry meeting on this research was held on 06 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 SOAP 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.

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 (3rd 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. Work on the safety assessment of the visual segment (2nd bullet above) is being addressed by a PhD student at Imperial College; a presentation on Felipe Nascimento's work was given at the 11 May HSRMC meeting. Contracting of the remaining two work packages will be largely dependent on availability of funding. Next in line will be the demonstration of the integration of SOAP with the enhanced helideck lighting (1st bullet above).

Work on the currently contracted programme is progressing well. The flight trials are presently expected to be performed in the autumn of 2010.

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 CAA at the 02-03 December 2009 EASA Rotorcraft Symposium and the 22 -24 March CHC Safety & Quality Summit.

(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. A 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). Finlay Irvine has also produced a 'Micro GripTester' which was demonstrated to 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 programme for this work was reviewed and agreed at a meeting with NLR on 25 November and the project launched. Testing was expected to have been completed by end April 2010, but has been delayed due to staff illness at NLR. An extension to the work programme to include a third helideck type and a second helicopter wheel type (contact pressure) is presently being considered.

(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 07 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 07 November 2008.

Disappointingly, this has still not been implemented by the helicopter operators (NB: CHC in The Netherlands are attempting to implement the scheme 'off-line' using Excel), and its value and importance has been emphasised by the findings of a recent audit of HCA by CAA. It appears that few flow studies are being commissioned by the industry and no flow study results are being received by HCA, and this situation is being exacerbated by poor reporting by flight crews; very few turbulence report forms are ever received.

(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 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 has been completed. The slightly mixed results of this work were presented at the 07 December 2009 HSRMC meeting. Whereas it seems possible to detect faults prior to start of the last flight (provided that both axial and radial vibration data are available), on-board analysis would be required to provide timely warnings. The main problems are the 'noisy' nature of the data and, in the case of the S.Puma study, the lack of axial vibration data. An extension of this work to the AW139 is presently being considered to address these issues and to investigate the effectiveness of the analysis for more modern tail rotor designs.

As regards main rotor health monitoring, meetings have been held between CAA and AgustaWestland on 20 May 2009 and 28 Jan 2010 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 CAA will be able to participate, albeit in a relatively minor role. If funding is approved, the initiative is expected to start second half of 2010.

(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 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 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 02-03 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.Puma's 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. This project is being jointly funded by Bristow Helicopters and OGP.

Modes 1 – 6 of the GPWS element of EGPWS utilises 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.

The contract for the work has been let to Flightdatapeople, and work is underway. An initial set of HOMP/FDM data has been analysed and was reviewed at a project progress meeting on 22 June 2010. A full year's worth of data (approx 800 flights) will be analysed once the preliminary analysis has been completed and checked.

(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. Funding has been offered by Oil & Gas UK and by CAA Norway. The invitation to tender was issued on 02 July with responses due by 30 July.

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**PROPOSED HSRMC RESEARCH PROGRAMME – FUNDING STATUS AS AT
13 JULY 2010 OIAC HLG 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.	Some CAA funding available but costs presently unknown.
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 published in CAA Paper 2010/01.
		Offshore Approaches (HEDGE) – <ul style="list-style-type: none"> 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.
7	8.1	Helideck Friction - review of CAP 437 criterion and test/monitoring techniques.	Sufficient funding available to complete all work currently identified.
		Helideck Friction - development of new criterion for aluminium decks.	Sufficient funding available to complete all work currently identified.
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.	Sufficient funding available to complete all work currently identified.
13	-	Triggered Lightning Strike Forecasting.	Sufficient funding available to proceed with invitation to tender.