

## **Research Update for 02 February 2011 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, and the overall final project report delivered and accepted. The CAA version of the final report currently being produced 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.

Overall the project has been very successful and Oil & GAS UK are progressing implementation. AgustaWestlands are backing the system and a 'try & buy' trial has been running with CHC on their AW139 fleet which is now drawing to a close. An industry workshop was held at GE Aviation on 11 November to review the status of the implementation programme and it is hoped that it will now move quickly to the next stage of a Controlled Service Introduction (CSI) on CHC's AW139 fleet.

### **(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. EASA presently propose to review the regulations and advisory material on ditching and water impact starting in January 2012. A workshop is expected to be held around mid-2011 in preparation for this exercise. This area has also been identified as a priority item for attention by the European Helicopter Safety Team (EHST) initiative.

Copies of the summary report on the HSRMC work (CAA Paper 2005/06) have been forwarded to CAA the Canadian S92 accident investigators and to Robert Wells, the Commissioner running the Offshore Helicopter Safety Inquiry in Newfoundland. Dr Sue Coleshaw, CAA's contractor for the EBS research (see below), has met with Robert Wells and subsequently written and presented a report to the OHSI. The report includes input from the CAA promoting the side-floating scheme. The OHSI has completed its review and published its findings which will be followed up in due course.

EBS Specification: EBS is considered to have the potential to mitigate the safety risk associated with water impact/post ditching capsizing 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.

All trials work has been completed and interim and trials reports have been submitted together with the first draft of the specification. These documents have been reviewed and commented on and the final overall project report is now being produced. Industry consultation will take place prior to publication of the final consolidated report. 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 CAP 437 and the joint UK/Norway guidance material (formerly the 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. A three-phase approach is being adopted:

- 1) Phase 1 - Data collection and analysis
- 2) Phase 2a - Installation and commissioning of new motion sensing system and deck motion lights.
- 3) Phase 2b - Evaluation of deck motion lights, driven by current P/R/Inc and HR limits only. This phase will not involve using any new or modified limits or operating procedures.
- 4) Phase 3: New motion sensing system is live, and helideck motion lights driven by current P/R/Inc/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.

Phase 1 is well advanced and over a year's worth of data collected; the analysis of the data is to be specified and contracted. Regarding Phase 2a, the deck motion lights and the new motion sensing system have been installed but the new software necessary to implement the MSI/WSI and drive the motion lights is awaited. Commissioning and Phase 2b will follow when the software has been installed, hopefully during 1<sup>st</sup> quarter 2011, with Phase 3 expected to start in March 2011 when an improved limit curve for the S.Puma has been produced. The second draft of the interim project report has been received and reviewed. Further work on the MSI/WSI operating limits will be needed on completion of the sea trials.

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 meeting between the key participants of MARIN, NLR, CAA and Atkins was held on 19 January. The Phase 1 of the project is funded and is scheduled to start on 01 February with the launch meeting being held at the FPSO Forum in Monaco on 22 March.

A presentation on this work has been given by Atkins at the Oil & Gas UK ASTG Seminar in September 2010, and by CAA at the EASA Rotorcraft Forum in December 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) presently installed on the Centrica CPC-1 platform in Morecambe Bay is to be replaced with a production version of the system. The equipment has now been delivered and should be installed by end February. Hopefully this will allow sufficient time for the system to be evaluated by line flight crews during the winter 2010/11 night flying programme.

The draft specification for the Stage 2 lighting scheme was included in the 6<sup>th</sup> 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 industry for comment and a response to the industry feedback issued. Presentations from CAA and AGI/Orga were given at the 21/22 September 2010 OGP Aviation Sub Committee meeting and an updated version of the report circulated to industry for comment. The interim report will be finalised and published once the production version of the system has been installed and evaluated by CAA.

It is planned 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. The contract for the offshore approach trials has been extended and BP have been approached with a view to hosting the new lighting system on one of their installations.

Presentations on this project have also been 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 2010 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 the next step will be to arrange a meeting between GE, Bond and CAA. This is presently on hold due to the workload at GE related to the implementation of AAD (see item 1 above).

## **(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.

The next stage of the project called HEDGE, which forms part of an EU 7<sup>th</sup> Framework project. The work essentially comprises the production and trials of a demonstrator system and the following additions to the project have been identified:

- integration of AIS into the navigation display,
- demonstration of the integration of SOAP with the enhanced helideck lighting,
- safety assessment of the visual segment,
- 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 (1st bullet above) was given top priority and added to the contract first. 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. The demonstration of the integration of SOAP with the enhanced helideck lighting (2nd bullet above) has recently been added, and work on the safety assessment of the visual segment (3rd bullet above) is being addressed by a PhD student at Imperial College; a presentation on Felipe Nacimiento's work was given at the 11 May HSRMC meeting.

Work on the currently contracted programme is progressing well. The first batch of flight trials are scheduled to be performed over the weekend of 29/30 January 2011.

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 2010 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 'final' version of the project report has been received and accepted, and now needs to be circulated for industry comment/consultation.

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 2009 and the project launched. An extension to the work programme to add a second helicopter wheel type (contact pressure), and assessment of the effect of helideck 'hole' size/shape has been contracted and work is finally underway.

## **(8). Helideck Environmental Research**

All research has been completed and reported and, where applicable, incorporated in CAP 437. Attention is presently being focussed on the use of helicopter FDM to map and monitor the environments around offshore platforms.

### Turbulence:

The final report on the validation of the turbulence criterion (CAA Paper 2008/02) recommends that helicopter FDM 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 is only now just starting to be implemented by the helicopter operators, 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.

## Turbine Exhaust Plumes:

The final report on the visualisation of offshore gas turbine exhaust plumes (CAA Paper 2007/02) recommends that helicopter FDM data be routinely collected and analysed to identify 'problem' platforms for consideration for installation of a plume visualisation system. The importance of this hazard was highlighted by the issue of Sikorsky Safety Advisory SSA-S92-10-002 in April 2010 concerning flight through high temperature exhaust plumes.

### **(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 the 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. Progress on this is presently delayed due to the workload at GE related to the implementation of AAD (see item 1 above).

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 AgustaWestland and it is hoped that CAA will be able to participate, albeit in a relatively minor role.

### **(10). Tail Rotor Strike Warning**

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.

### **(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 54<sup>th</sup> 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. Bristow Helicopters have committed to fleet wide implementation of TCAS II. Bond and CHC are also fitting TCAS to their North Sea fleets.

## **(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. Following acceptance of the interim report produced on this work, the programme of work to extend the analysis to a full year's worth of data (approx 800 flights) has been agreed, costed and the contract extended. This work is well advanced and a progress meeting has been scheduled for 01 February 2011.

## **(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 and expensive maintenance action.

Following confirmation of funding from Oil & Gas UK and by CAA Norway and a competitive tendering process, the contract for this project was let to the UK Met Office. Work started on 01 December 2010 and the first progress meeting took place on 11 January 2011. The next progress meeting has been scheduled for 10 February 2011.

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**PROPOSED HSRMC RESEARCH PROGRAMME –  
FUNDING STATUS AS AT 02 FEBRUARY 2011 - OIAC HLG MEETING.**

Item	CAA Project Code	Title	Funding Status
<b>1. ONGOING WORK</b>			
1	5.1	HUMS - advanced analysis of HUMS data.	Study completed. Final report being published as a CAA paper.
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.
<b>2. EXTENSIONS TO EXISTING PROGRAMMES</b>			
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"> <li>demonstration of the integration of the SOAP procedure with the enhanced helideck lighting,</li> <li>safety assessment of the visual segment,</li> <li>integration of AIS into the navigation display,</li> <li>addition of RNAV guidance to assist shuttling.</li> </ul>	Sufficient funding available for AIS receiver integration and flight demonstration of integration with helideck lighting only.
7	8.1	Helideck Friction - review of CAP 437 criterion and test/monitoring techniques.	Study completed. Final report to be published as a CAA paper.
		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.

Item	CAA Project Code	Title	Funding Status
<b>3. NEW PROJECTS</b>			
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 complete all work currently identified.