

Research Update for 20 June 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 has now closed. An industry workshop was held at GE Aviation on 11 November 2010 to review the status of the implementation programme. Oil & Gas UK met with the helicopter operators' senior management on 03 March 2011 to press for early implementation. Due to ongoing technical reservations, CAA met with the helicopter operators' technical staff on 14 March 2011. Commercial proposals for AAD implementation on AW139 fleets have now been produced by the helicopter operators but, at close to \$30 per flight hour, the costs are higher than expected. Oil companies are now considering the proposals.

(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 will be held on 05/06 December 2011 in preparation for this exercise. This area has also been identified as a priority item for attention by the European Helicopter Safety Team (HEST) initiative.

Representatives from C-NLOPB and Transport Canada attended the 25 May 2011 HSRMC meeting to discuss the lessons learned from the March 2009 Cougar S92 fatal water impact accident. C-NLOPB repeated their presentation at the 08 June 2011 OGUK Aviation Symposium on 08 June 2011. C-NLOPB expressed significant interest in progressing the side-floating concept; discussions with Sikorsky, UK CAA and research establishments in Canada are under way. C-NLOPB also propose to attend the December 2011 EASA workshop.

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. Note that TSB in Canada has recommended that EBS be mandated for overwater flights in its Aviation Investigation Report (A09A0016) on the March 2009 S92 fatal accident.

All trials work has been completed and the first draft of the overall project report has been received and is under review. Industry consultation will take place prior to publication of the final consolidated report. Presentations on the work have been given at the 11 May HSRMC meeting and the 08 June 2011 Oil & Gas Aviation Symposium.

(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) once it has been finalised.

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 being specified. 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, with Phase 3 expected to start shortly afterwards using an improved limit curve for the S.Puma which is presently being 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, but it is presently anticipated that an interim advisory only system will be rolled out by late 2011/early 2012.

By way of a 'spin-off' to the development of the MSI/WSI, advice is being provided to HCA on the measurement of heave rate in support of the recent move to standardise on heave rate across UK and Norway. A technical note has been produced which is presently being checked.

A Joint Industry Project (JIP) on operations to moving decks has been established by MARIN in The Netherlands and was launched at the FPSO Research Forum on 22 March 2011. CAA has joined the JIP and future MSI/WSI work will be integrated with that programme to benefit from the significant 'gearing' on resources. Atkins has been contracted by CAA to provide technical support to the JIP. An initial technical meeting between the key participants of MARIN, NLR, CAA and Atkins took place on 05/06 April 2011 to bring MARIN and NLR up to speed on the existing work and agree the technical work programmes for Phase 1. A second meeting has been scheduled for 06/07 July. The main sponsors are MARIN, NLR and the Dutch Government. Further sponsors are being sought and it is hoped that AgustaWestlands will join the JIP.

A presentation on the HELIOS JIP was given by MARIN at the 11 May 2010 HSRMC meeting. Presentations on this work have been given by Atkins at the Oil & Gas Aviation 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 being replaced with a production version of the system. The mounting plates have been manufactured and are being delivered to Centrica. A date for installation of the initial Zone 2 certificated system will be set once all the equipment is in place on the platform. CAA will evaluate the system on the CPC-1 as soon as it has been installed by means of a dedicated flight, and the durability of the equipment will be monitored. This will hopefully enable CAP 437 to be updated later in 2011 as planned, and should also mean that the system will be installed and ready for the start of the 2011/12 night flying season enabling capture of further feedback from line flight crews in time to include in the CAA report.

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 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 has been approached with a view to hosting the new lighting system on one of their installations. Discussion are ongoing with a view to installing a second system on the BP Miller platform.

Presentations on this project have been given by CAA at the 10 June 2008 Oil & Gas UK Aviation 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 7th 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.

The AIS work package (1st bullet above) and the demonstration of the integration of SOAP with the enhanced helideck lighting (2nd bullet above) have both been contracted. 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 Nascimento's work was given at the 11 May 2010 HSRMC meeting.

Work on the currently contracted programme is progressing well. The first batch of flight trials were performed over the weekend of 29/30 January 2011; CAA were briefed on the results on 07 March. Some refinements to the system have been identified and will be implemented prior to the next set of daylight trials, which are to be scheduled for September 2011. In addition, some new guidance displays are to be prototyped and reviewed for possible inclusion. Night trials will be considered when a helideck fitted with the new lighting system (see item 4 above) is available in the North Sea.

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 has been circulated with a CAA foreword for industry comment/consultation. The closing date for comments was 25 May 2011. Some replies have been received which will be reviewed in due course and a response circulated.

In essence, the work confirms that devices like the Finlay Irvine GripTester are the most appropriate type of device for measuring helideck friction. The main problem with these devices is their 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 test criterion for aluminium helideck surfaces. This involves full scale testing of five different types of aluminium deck surface using actual S61 and S76 wheels mounted on a test rig. All variables expected to be relevant are being exercised. Results to date indicate that none of the aluminium decks tested meet the minimum μ value of 0.65 stipulated in CAP 437. Additional tests to evaluate the effects of helideck nets are being worked up.

(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 it's 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 detection techniques developed on the transmission HUMS research (see item 1 above) to in-service tail rotor HUMS data was contracted to GE Aviation and 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. Production of the final report on this work is presently delayed by the ongoing investigation into one of the accident examples used in the study.

As regards main rotor health monitoring, a series of meetings have been held between CAA and AgustaWestland (most recent on 09 March 2011 which included EASA) to discuss this subject with a view to identifying opportunities for collaborative work. A major joint industry initiative, the Rotorcraft Technology Validation Programme (RTVP) has been launched by AgustaWestland and it is hoped that CAA and EASA will be able to participate.

(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 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. 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 well advanced. Following completion of a 'pilot' study, analysis of a full year's worth of Bristows EC225 HOMP/FDM data (approx 800 flights) has been undertaken and completed. Plotting of available data from relevant accident cases has established that, by themselves, the traditional EGPWS warning envelopes are not effective in all cases. Further analysis aimed at investigating the benefits of employing additional/alternative parameters to define warning envelopes is in progress. If sufficient promise can be demonstrated using the EC225 data, the work programme will need to be extended to evaluate the warning envelopes on a second helicopter type. The next progress meeting has been scheduled for 29 June 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 is now nearing completion. Reports on the literature review and the development of a forecasting algorithm have been received and reviewed.

The last progress meeting was held on 20 May 2011, at which the helicopter operators were represented by Simon Cotterell of CHC. The results have been very promising - the detection rate for the 11 reported (MOR) helicopter lightning strikes for which sufficient data was available was just under 80%. It also correctly detected (time and location) 8 of the 9 'natural' lightning strikes that occurred during winter 2010/11. Although further improvements/refinements are possible, the view of the team is that the next sensible step would be to move to an in-service trial, with further work being considered on conclusion of the trial.

Following agreement to fund from Conoco Phillips, Perenco, Apache, Centrica Energy, CAA Norway and BP, the contract is presently being extended to have a trials system in place on OHWeb in time for the start of the 2011/12 lightning season (i.e. by 01 November). If the trials system performs satisfactorily, it will be left running on OHWeb going forwards, i.e. a permanent fix (or something reasonably close to it) for this problem could be up and running by autumn 2011 and at relatively modest cost.

A presentation on this work was given at the 08 June 2011 Oil & Gas UK Aviation Symposium.

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Nomenclature

AAD	Advanced Anomaly Detection
CAA	Civil Aviation Authority (UK)
C-NLOPB	Canadian Newfoundland and Labrador Offshore Petroleum Board
EASA	European Aviation Safety Agency
EBS	Emergency Breathing System
EGPWS	Enhanced Ground Proximity Warning System
EHEST	European Helicopter Safety Team
FDM	Flight Data Monitoring
FPSO	Floating Production Storage & Offloading
GE	General Electric
GPS	Global Positioning System
GPWS	Ground Proximity Warning System
HADS	Helicopter Air Data System
HCA	Helideck Certification Agency
HLL	Helideck Limitations List
HOMP	Helicopter Operations Monitoring Programme
HSRMC	Helicopter Safety Research Management Committee
H-TAWS	Helicopter Terrain Awareness Warning System
HUMS	Health & Usage Monitoring System
JIP	Joint Industry Project
MOR	Mandatory Occurrence Report
MRGB	Main Rotor Gear Box
MSI	Motion Severity Index
OGP	Oil & Gas Producers Association
OGUK	Oil & Gas UK
PCF	Potentially Catastrophic Failure
RTVP	Rotorcraft Technology Validation Programme
SBAS	Space-Based Augmentation System
SOAP	SBAS Offshore Approach Procedure
TAWS	Terrain Awareness Warning System
TCAS	Traffic Alert & Collision Avoidance System
VHM	Vibration Health Monitoring
WSI	Wind Severity Index
WXR	Weather Radar

PROPOSED HSRMC RESEARCH PROGRAMME – FUNDING STATUS AS AT 17 JUNE 2011.

Item	CAA Project Code	Title	Funding Status
1. ONGOING WORK			
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.
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 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
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.	Further funding required for extension to include a second helicopter type.
13	-	Triggered Lightning Strike Forecasting.	Sufficient funding available to complete all work currently identified.