

## RAeS Rotorcraft Group Conference 2016

# THE AUTOMATED ROTORCRAFT

SHORT, MID AND LONG TERM SOLUTIONS

*By our Staff Reporter*

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The global helicopter industry faces a number of challenges in the years to come; one of which is to exploit the potential increases to operational output and safety through the increased use of automation. This technology is mandated for most commercial air carriers and has been used routinely in fixed wing operations for many years. By comparison, automated operations are still relatively new in rotorcraft operations. The Conference Co-Chair and outgoing Chairman of the Society's Rotorcraft Group, [Mike O'Donoghue](#) explained that this year's conference was designed take a deeper look at automated operations across the spectrum and the work that was going on or that would be necessary in the short, mid and long-term to ensure that automated operations were robust and took account of the lessons learned from fixed wing operations and other applications. The conference was designed to do this starting with a look at the current and future operational needs of the three industry sectors: Offshore; Military and Onshore. This would be followed by an in-depth look at those human factors particularly pertinent to automated operations for the remainder of the morning. The second part of the day would be devoted to the provision of resilient training to support automated operations. On the second day the design issues surrounding automation would be examined and rounded off in the afternoon by a look at the cockpit technologies necessary to support automated operations finishing off with a glimpse into the future with an update on trials of an optionally piloted rotorcraft.

Moving swiftly on, Mike introduced his Co-Chair and **Keynote Speaker**, [Mrs Gretchen Haskins](#). Gretchen needed little introduction to the delegates as most were familiar with her work and achievements as the current CEO of HeliOffshore and as the former Group Head of the CAA's Safety Regulation Group. Gretchen then gave a [strategic view of rotorcraft automation](#) concentrating on the outcomes of advanced safety, performance and operational integrity which would, in turn, increase confidence in helicopter operations in the civilian air transport role. She was particularly keen to encourage audience participation over the two days of the conference and wanted to know what people thought. [Click here for a summary of Gretchen's talk](#). Having set the scene Gretchen introduced [Jim Lyons](#) who would guide the three presenters through the first session on **Operational Needs (1)**. It was easy to see why Jim had been selected for this task given his extensive experience and

detailed knowledge of helicopter operations and performance. Jim masterminded the 2014 conference entitled 'Automation Friend or Foe' and he took a few minutes to make the link between the outcomes of this conference and the need to take a look at developments in the intervening two years using with the present conference providing a timely opportunity for the industry to take stock and see what work was still outstanding in the short and mid-term and whether longer term solutions in development were consistent with this. Jim also mentioned that the Society would be following up the onshore aspects discussed over the next two days with a dedicated conference on 5<sup>th</sup> and 6<sup>th</sup> July next year. The first speaker in this session was **Tim Rolfe**, himself no stranger to the Society having spoken at conferences in the past and particularly for delivering the keynote speech in the 2014 *Friend or Foe* conference. A copy of Tim's article in *Aerospace* written after this conference had been helpfully included in the delegate pack and was a most useful review of the state of play in automated operations in 2014. Tim spoke about the current and future needs with respect to offshore operations highlighting the introduction of new fleets with greater automated capabilities and the training that was necessary to ensure that these capabilities were exploited routinely, assuredly and safely. Tim said that identifying the needs of the helicopter operating crew must be at the heart of the process of managing the design, certification and development of automated flight control systems on offshore helicopters which are used in a variety of operating conditions many of which were not built with aviation on mind and wondered whether Industry needs were articulated well enough to OEMs before and after aircraft development. He posed two questions:

- *Does the existing regulation reflect and support a need for a constant focus on operational and training performance improvement?*
- *How do operators successfully outline operational objectives for the use of automation offshore and measure our own levels of operational performance with a view to improve?*

Both of these points came up later in the day when Rick Newson offered his thoughts on training for resilience. [Click here for a summary of Tim's talk](#). It was then the turn of **Lt Steve Baldie** to describe military applications and the extent and level of current automated operations. To a degree, this is platform limited and Steve's own experience as the training officer of a front-line squadron in the Commando Helicopter Force was particularly relevant given that Merlin is arguably the Armed Forces most capable helicopter in respect of its level of automation. Steve outlined the required capability for tactical automated operations now and in the longer term in various military roles commenting on training and other factors. [Click here for a summary of Steve's talk](#). The onshore sector was ably covered by **Captain Jim Lynch**, the Head of Training of Specialist Aviation Services, Jim told us that onshore automation is in various stages of development and was dependent on three factors: the crews, the equipment available and suitable training resources. Jim described the wide scope of activities and types in the onshore sector and how this challenged the

straightforward adoption of industry procedures and processes to increase efficient and safe automation. He raised three pertinent questions: How has the onshore side of the industry developed its automation practice? What can it do better and more importantly how can it improve? The first question was harder to answer. Your reporter suspected that it might have been acquired through transfer from other rotorcraft sectors, e.g., the military and offshore and from various other sources. [Click here for a summary of Jim's talk](#). In the second session on the Human Dimension, Captain Ian Scott gave some chilling examples of the latter and the third session on Training for Resilience addressed Jim's question of how improvements could be made.

Next, Gretchen returned to facilitate the second and crucially important session on **The Human Dimension (2)** introducing **Dr Hazel Courtney** who started by examining [how humans assimilate and process information](#). Hazel explained how when designing any system but in particular an automated one, knowledge of how our brains worked was fundamental. For example, it might be tempting to think that because auditory information reaches the brain and is processed by the relevant lobe faster than other the other information pathways that this makes audio/audible warnings the logical way to alert a pilot to a flight critical event. However, further knowledge tells us that in conditions of high workload, the auditory channel is the first to be dumped and so additional or alternative methods must be incorporated. Using biological and psychological examples such as this one, Hazel described how optimum human performance could be supported through appropriate knowledge, focussed training and equipment design. [Click here for a summary of Hazel's talk](#). **Captain Ian Scott** then took the stage and described [typical autopilots](#) giving examples of the associated cockpit displays. His unassailable point was that it was vital that pilots understood the autopilot modes. It was clear from examples that this was not always the case and in doing so he reinforced many of Hazel's points. [Click here for a summary of Ian's talk](#). After a useful networking lunch, during which I was able to talk to presenters and facilitators as well as doing some useful networking of my own we took our places at the tables provided. The numbers attending meant that the Society could lay out the room in 'cabaret' style. It was clear that this was popular with the delegates and it made for a more relaxed and participative style of conference. The facilitators were able to use the table layout to advantage during the discussions directing questions and generally using the room layout to obtain maximum audience participation. The last presentation in this section was given by **Andy Fawkes** of Thinke. His [presentation on creating an effective human-machine partnership](#) was based on his extensive experience across various industries notably in the field of simulation. Andy produced a number of fascinating examples of ways in which the humans and autonomous systems could work together effectively and this was the perfect way to stimulate a discussion among the Panel and the delegates. [Click here for a summary of Andy's talk and the Panel Discussion](#).

The last session of Day 1 focussed on **Resilience in Training (3)** facilitated by **Gordon Woolley**. Gordon was clearly an ideal person to do this because of his extensive rotorcraft training experience and his work with the Society's Flight Simulation Group which included developing standards for mission training by applying a rigorous training task methodology for use in simulators. In terms of getting the best out of automated operations in the short and mid-term, training clearly holds the key and it was therefore wholly appropriate that the first presentation in the session was delivered by **Rick Newson** of the CAA. Rick's expertly delivered presentation on training for resilience was comprehensive and packed with facts and figures about the regulatory requirements, how training was currently being delivered and the shortcomings apparent not only in the training methods themselves but also in testing ending with a plea to embrace Operational Suitability Data which apart from being a legal requirement would assist in targeting training needs accurately. Rick also introduced the topic of Evidence Based Training. Picking up the challenge of designing appropriate training for automation, ex CAA test pilot **Chris Taylor** described how Starspeed Aviation had identified a training gap for recently qualified pilots or pilots recently leaving the armed forces with minimal experience of modern glass cockpits or automation. As a result, they had approached Chris to design a two day course to "Bridge the Gap". Chris then went on to describe the training needs of pilots trained on R22, R44, Gazelle or Squirrel in order to prepare them for a type rating course on modern multi-crew transport helicopters such as flown offshore. This was fascinating stuff and connected well with what Rick Newson had just told us and to the human factors earlier in the day. [Click here for a summary of Chris' talk](#). Gordon then invited **Captain Frank Hopps** of Virgin Atlantic to tell us how the fixed wing operators had gone about this using the ATQP programme. Frank was not only a very experienced long haul training captain but he also had considerable military rotary wing experience too so he was an ideal person to bring out some of the early lessons in flying automated operations but was able to assess how those or ones like them could be applied to contemporary automated operations in helicopters and he offered a few words of advice on avoiding some of the pitfalls that fixed wing operators had encountered and dealt with many years ago.

The [last presentation in this session](#) was given by **Geoff Newman** who asked whether Evidence Based Training (EBT) would deliver a more competent helicopter pilot. He highlighted a problem with the current 'syllabus based' training system in that it confined the training regime to a limited 'menu' of manoeuvres and exercises. Whilst this menu can represent a challenge for the candidate it provides little opportunity to analyse the fundamental piloting skills that make a vital contribution to 'competence'. This chimed very much with Rick Newson's earlier comments and his example of a TS 10 report which failed to bring out the critical competencies of leadership and communication. Geoff said that EBT could deliver that extra dimension of training providing opportunities for the instructor to see inside the mind of the candidate and deliver a meaningful influence upon his thought processes. Geoff felt that EBT was a powerful solution which would address many of the

points that Rick Newson had made earlier in his presentation on Training Resilience. Geoff finished by discussing his work developing of an EBT programme for the rotary wing. Gordon then drew the session to a close with a Panel discussion and questions from the audience. As expected many views were expressed on training for automation. [Click here for a summary of Geoff's talk.](#)

Mike O'Donoghue then drew Day 1 to a close with a short summary of the presentations and discussions that had taken place during the day and drew the delegates attention to the recent EHEST Leaflet (HE-9 Automation and Flight Path Management). A copy of the booklet was in the Delegate Pack and Mike suggested that people reads through it tonight as it covered most of the ground discussed on Day 1 as well as preparing for the next day's sessions.

Gretchen Haskins opened Day 2 of the Conference reminding people of some of the points covered and asking the delegates to ask themselves the following questions at the end of the conference: *Out of what you have heard, where do you think we are and what do you think we are doing about it?* Gretchen then introduced [Simon Stacey](#) to chair the longest session of the conference on **Design - Reducing Complexity at the Operational Level (4)**. Simon introduced the session observing that designers had to take account of the human factors mentioned the day before while taking account of the operational need and also being cognizant of the need to ensure that new systems were supported by first-class training. [François Lassale](#) gave the [first presentation of the day](#) 'looping back' to human factors by setting the scene with the unintended consequences of automation. Designers need to remember that how cleverly and carefully they design a system, the human is very likely to come up with a different way of using or exploiting it. The results of this may be unforeseen and may also be unhelpful or bring about an unsatisfactory outcome. This should be anticipated during the design and development stage using appropriate resources. [Click here for a summary of Francois' talk.](#) [Dario Iannucci](#) followed this with a presentation on information and system management information. Dario's presentation touched the very heart of the matter which is how designers address the issues raised by previous speakers such as Hazel Courtney and Andy Fawkes. Designing displays and controls that interface with the crew in a manner that provide the right information at the right time while ensuring that the information presented is easy to assimilate, intuitive and, crucially, does not create additional workload or swamp the pilot with information in an emergency situation where the risk of distraction and narrowing of focus is high and where failure to do this adequately could have serious consequences. [Click here for a summary of Dario's talk.](#) Dario's presentation led nicely into [Simon Sparkes's explanation of how models of truth can be created to describe very complex automated systems](#). While the importance and relevance of this topic is not purely limited to automated systems, they are an excellent example. Modern automated systems call for extremely complex engineering and they require advanced technical qualifications and know how to understand. What is needed is a

model that crews can readily understand assuming that they have received the appropriate training - a point made earlier by Geoff Newman and Ian Scott. However, such models must not sacrifice accuracy for simplicity so that in the event of a malfunction, or even a normal condition but one which is different from the norm, the crew can use the simplified model to diagnose and understand what has happened even though the system may actually be operating in a subtly different way but one which would be hard to grasp without detailed specialist knowledge. [Click here for a summary of Simon's talk](#). Right on cue, **Rupert Hibbert**, from Airbus Helicopters took the stage to [describe how Airbus was taking forward the recommendations of the Joint Operators' Review](#) and bring everyone up-to-date with Airbus Helicopters' Flight Crew Operations Manual (FCOM). Rupert is a very experienced trainer himself and he explained the rationale for the FCOM and how the operators' recommendations - which had also been identified during the 2014 conference - were being taken forward to include explanations of the complex systems or models of truth as Simon described them, in a readily assimilable way so that training providers and operators could standardise training and operating manuals which in turn would provide authoritative guidance and advice to aircrew. The last presentation in this session was ably delivered by **Phil Stehr** himself a past chairman of the Rotorcraft Group and Council member. Phil has many years of experience and knowledge concerning the certification of rotorcraft which he deployed to good effect pointing out that certification and regulation was a primary enabler to the successful adoption of new and novel automated technologies. If there were problems in this area they might well surpass all the technical and programme effort that had gone into the project. It was therefore vital that all concerned (End Users, Regulators, Operators, OEMs and all the associated providers) needed to develop a culture and methods that promotes focussed on the intended use of automated systems to achieve safe operation from the outset. Phil believed that a breakthrough in the way we tackle certification was needed and suggested several avenues by which this might be achieved. These included focussing on operational performance outcomes rather than prescriptive rules; proving the robustness of human-machine interfaces throughout the project life cycle and promoting the concept of Safety Benefit. [Click here for a summary of Phil's talk](#). Simon Stacey then led a wide-ranging and thought provoking discussion which reinforced the need to reduce complexity at the operational level.

**Captain David Rolfe** of London's Air Ambulance took the chair for the final session of the conference which looked at **Cockpit Technologies to Support Automation (5)**. The session started with two papers on Helicopter Terrain Avoidance Warning Systems (HTAWS). The [first presentation](#) was given jointly by **Mark Prior**, Bristow Helicopters Company Test Pilot and **Dave Howson**, Research Project Manager with the UK CAA. Mark covered the background to the project, the operational requirements HTAWS and how these systems would form an integral part of future automated systems and procedures. Dave then covered the underpinning research and development that was used to define and support the project before handing over to **Prof Polly Dalton** from The Royal Holloway College who

[described the project from a human factors point of view](#) in particular the work on deriving the optimum method of warning crews. Again this was an excellent reinforcement of the HF topics raised earlier in the conference. [Click here for a summary of Mark, Dave and Polly's talks](#). After a short break we came together for the two final presentations of the conference. **Adam Poole** of Leonardo Helicopters Division described the importance of easy and accurate data inputting to automated systems in his presentation on Electronic Flight Bags. These have often been 'add-ons' to developed systems and there is a feeling that sometimes the enthusiasm for such data entry devices was not matched by the thought that went into their development. This is to a degree slightly unfair because in many cases work started on the development of the automated system itself long before the data entry device envisaged was available. One only has to look to the Apple iPad and automated fixed wing operations as an example of the adoption of new technology. Adam also drew attention to the flexibility and operational capability that could be added by applications such as Helipad. [Click here for a summary of Adam's talk](#). It fell to **Dr Ed Goddard** also from Leonardo Division to give the last presentation of the conference and what could have been more fitting than a glimpse of the future with the use of a fully automated rotorcraft in an optionally piloted mode. Ed took us through the recent trials of PZL SW-4 Puszczuk helicopter which was a demonstrator for a full size rotary wing UAV. This was a first for the UK aerospace sector and fascinating stuff. While it may be a while before we see transport operations being carried out without an on-board human crew, it seems increasingly likely that for selected missions this could be an option. There is also the possibility of automation effectively replacing the co-pilot and operating as a *pilot's associate* as envisaged by the DARPA programme of the same name in the early 1990s. Ed's presentation provided much food for thought and offered a tantalising glimpse of the future which could be explored in a future conference. [Click here for a summary of Ed's talk](#).

Mike O'Donoghue then drew the conference to a close drawing together the main points that had emerged over the two days. He thanked all the presenters, the session chairman, the conference and events staff at the Society and his co chairman, Gretchen Haskins for all the work that had gone into arranging a useful and thought provoking couple of days. In particular, he thanked all the delegates for attending the conference and for their contributions throughout the conference. The conference proceedings would be published and all were invited to give their feedback.

In summary, this was a most enjoyable and worthwhile conference. The presentations were all of a very high quality and beautifully delivered the presenters and facilitators ensured that all timings were spot on throughout the two days. This was no mean feat and I congratulate all the presenters and session chairmen for the fastidious way in which this was done at the same time ensuring that sufficient time was allowed for lively and informed debate. Too many conferences are spoilt by over-running presentations and poor timekeeping so it was a joy to see a well-oiled machine in place and one where considerable

trouble had been taken to ensure that there was no unnecessary repetition or duplication. Similarly the way in which speakers reinforced points by previous presenters or even ones still to speak was impressive.

I am very much looking forward to reading about the presentation and to receiving the conference proceedings. I think that the content was worthy of gathering together in the form of an action programme in much the same way as was done for the *Automation Friend or Foe?* Conference in 2014.

As a result of attending the conference, I am keen to learn more about this important topic and will certainly plan to attend the Automation Conference on 5 and 6<sup>th</sup> July 2017 which will focus on automated operations in the onshore sector.