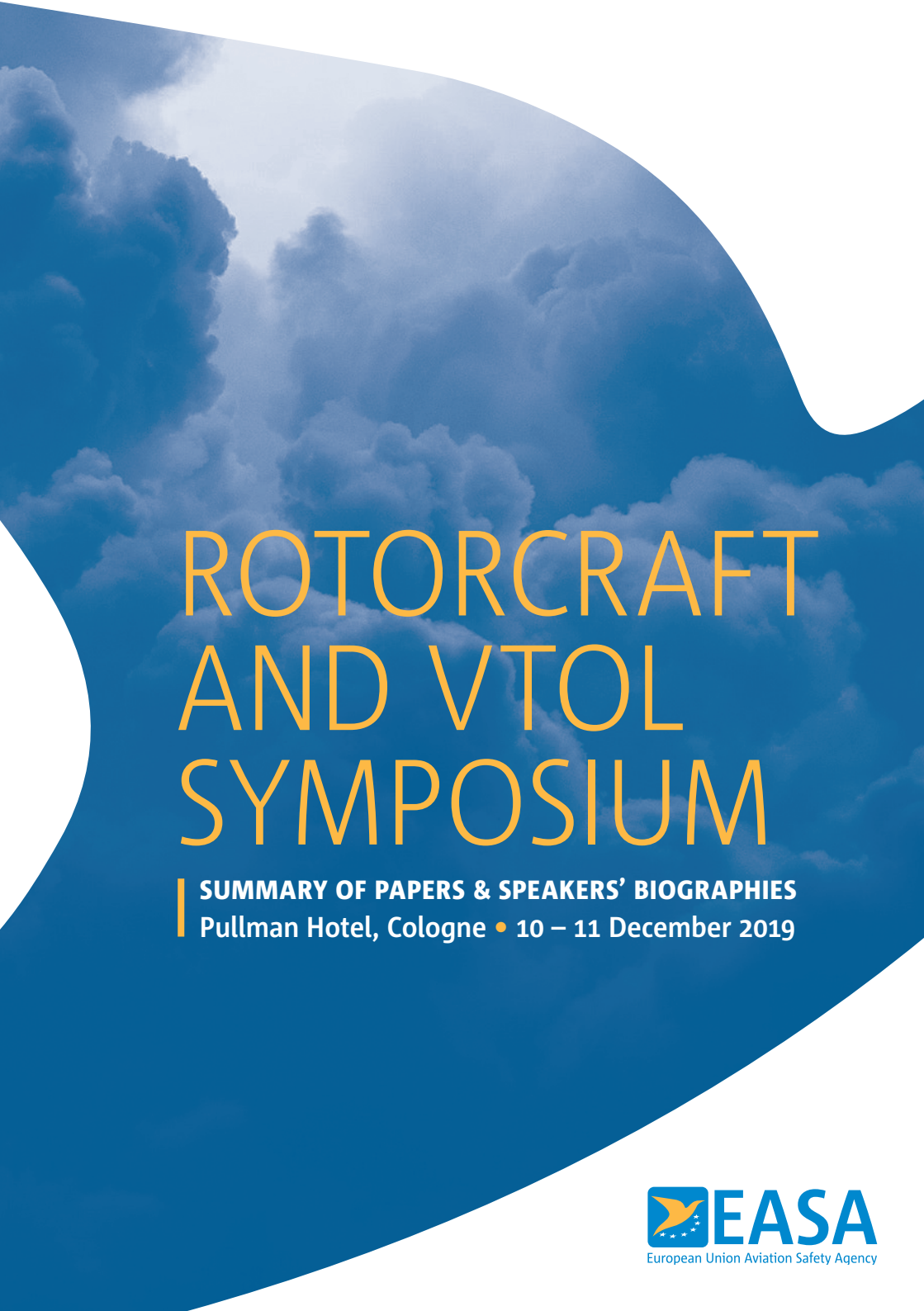


ROTORCRAFT AND VTOL SYMPOSIUM

SUMMARY OF PAPERS & SPEAKERS' BIOGRAPHIES

Pullman Hotel, Cologne • 10 – 11 December 2019

EASA

European Union Aviation Safety Agency

Speakers' Glossary

Foreword

Dear Aviation authorities, Manufacturers, Operators, Pilots, Safety Investigators, Researchers and all those vesting an interest in rotorcraft safety worldwide,

Welcome to the 13th edition of the EASA Rotorcraft and VTOL Symposium.

With more than 7 700 helicopters flying, Europe has the 2nd-largest fleet in the world behind the US. It also has a strong manufacturing industry. Helicopters are an important part of our daily lives and our society's functioning – they are used for emergency operations to save lives and for other essential activities such as aerial work in mountains, agriculture, offshore, and also for commercial transport.

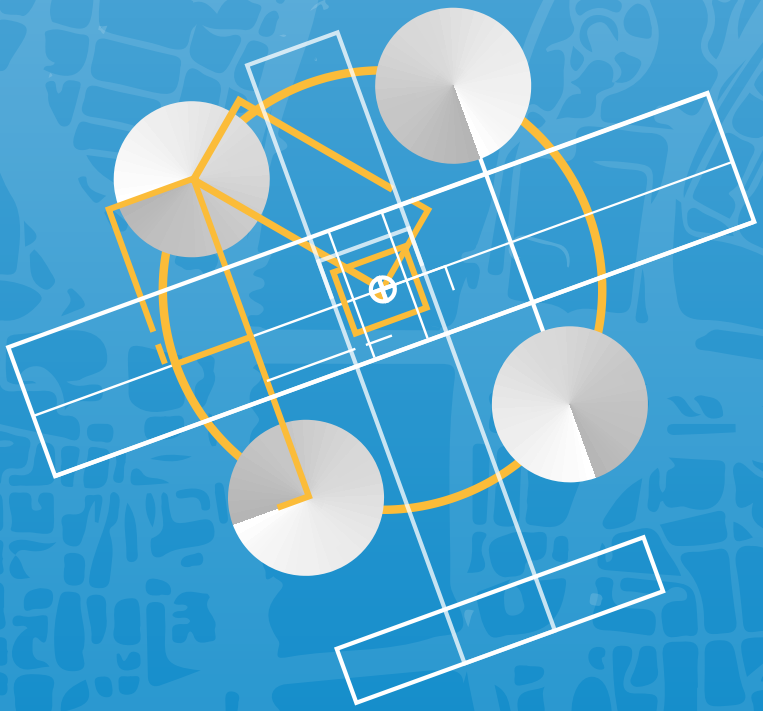
Emphasis will be put this year on the Rotorcraft Safety Roadmap, its short-, mid- and long-term goals, what are the next steps, and what has been achieved so far. We will have a special safety promotion session on technology and safety benefits. We will also keep you informed of the latest developments regarding special conditions on eVTOL together with the latest requirements and standards for eVTOL certification.

Various workshops and sessions are planned over two days, with keynote speakers, industry presentations, demo sessions and many networking opportunities.

We hope that all participants will enjoy this year's Symposium's program.

Rachel Daeschler

ACTING EASA CERTIFICATION DIRECTOR



ROTORCRAFT AND VTOL SYMPOSIUM

DAY 1

Agenda Day 1

08:00 – 08:55	**Check-In and Welcome Coffee**

PLENARY SESSION

09:00 – 09:15	Opening **Rachel Daeschler, acting EASA Certification Director**
09:15 – 09:35	Keynote Speech **Peter Möller, Chairman European Helicopter Association (EHA)**
09:35 – 10:10	EASA Rotorcraft Safety Roadmap and enabling VTOL **David Solar, EASA Head of the VTOL Department**
10:10 – 10:25	FAA Innovation Certification Process **Jorge R. Castillo, Manager, FAA Rotorcraft Regulations Branch**
10:25 – 10:35	Q&A Plenary session
10:35 – 11:05	**Networking Coffee Break**
11:05 – 11:25	PBN and GLS GAST-C approach capability on AW1x9 helicopters **Simone Gobbi, Leonardo Helicopters**
11:30 – 11:50	Cooperative Visual Segments **Adrian Ilinca, Airbus Helicopters**
11:55 – 12:15	Safety improvements for existing and new commercial products **Tony Randall, Bell**
12:20 – 12:40	General presentation on the EASA Special Condition on small VTOL **Volker Arnsmeier, EASA**
12:40 – 13:00	Q&A Plenary session
13:00 – 14:30	**Networking Lunch Break**

SESSION ON TRAINING AND SIMULATION • BALLROOM A-C

14:30 – 14:50	Embracing Flight Simulation Training Devices (FSTD) Innovations **Daan Dousi, EASA**
14:50 – 15:10	Virtual Reality Motion Training Solutions **Fabi Riesen, VR Motion**
15:10 – 15:30	Recent helicopter accidents and the pilot's decision to fly in the prevailing conditions **Clements Robert, AAIB UK**
15:20 – 15:50	Q&A • ADAC 1 Mio HEMS missions
15:50 – 16:20	**Networking Coffee Break**
16:20 – 16:45	Update on the CARI on Main Gearbox (MGB) **Marco Dioli, EASA**
16:45 – 17:10	Ready for EBT **David Abad, ECA**
17:10 – 17:20	Q&A session Ballroom A-C
17:20 – 17:30	Closing Remarks for Day 1 and ESPN-R videos 2019.
18:00 – 20:30	**Networking Reception**

SESSION ON VTOL CERTIFICATION • AMC / MOC • BALLROOM D

14:30 – 14:50	Eurocae WG-112 VTOL and the lean approach **Anna Von Groote, Eurocae**
14:50 – 15:10	Handling Qualities Rating Method for VTOL **Hamdy Sallam, EASA**
15:10 – 15:30	Development assurance and safety assessment processes (AMC.2510) **Guillaume Soudain, EASA and Arne Malcharowitz, EASA**
15:20 – 15:50	Q&A
15:50 – 16:20	**Networking Coffee Break**
16:20 – 16:45	Flight control systems for VTOL **Duncan Jones, EASA**
16:45 – 17:10	EVTOL Propulsion System Safety **Kyle Heironimus, Bell**
17:10 – 17:20	Q&A session Ballroom D
17:20 – 17:30	Closing Remarks for Day 1
18:00 – 20:30	**Networking Reception**

Rachel Daeschler

ACTING EASA CERTIFICATION DIRECTOR

Rachel Daeschler has worked as the acting Certification Director at EASA since January 2019.

She joined the Agency in 2004 and has occupied several successive positions, starting as a large aeroplane project certification manager. In 2010 she took over the position of large aeroplane section manager, and in 2014 she was appointed head of the Safety Intelligence department and deputy to the Strategy and Safety management Director. In 2018 she was seconded to ICAO Montréal as coordinator for Regional Safety Oversight Organisations.

From 1996 to 2004 she served within the French National Aviation Authority (DGAC), first as part of the aircraft certification office (until 2002), then as deputy head of the Reims Area Control Centre.

She graduated in engineering from École Polytechnique and École Nationale de l'Aviation Civile (France) and has a specialized master's in aircraft airworthiness.

Peter Möller

CHAIRMAN EUROPEAN HELICOPTER ASSOCIATION (EHA)

Peter started his career in 1975 in the German Army Aviation Corps. Since 1982 he has gained experience in the fields of aerial work operations, commercial air transport, ambulance and HEMS operations in Europe and West Africa. He has held positions as Flight Operations Manager, Crew Training Manager and Managing Director in Air Lloyd Deutsche Helicopter Flugservice and as Crew Training Manager and Flight Operations Manager in Luxembourg Air Ambulance. He is now Chairman of the European Helicopter Association (EHA).

Keynote Speech

He will look back on the development of the Rotorcraft Symposium over the past 12 years, underlining the importance of this event for the European Helicopter Industry. The cooperation between the regulator and the European helicopter industry, including the establishment and activation of the Advisory Body system has reached a new quality level, which challenges the industry to actively support the development of a new or updated regulatory framework with the focus of improving safety and ensuring the economic growth of the industry.

A look into the future will describe the new challenges for the helicopter operators with regard to new players joining the airspace and the market. EHA and EASA will enter a new era of cooperation, which will be beneficial for the whole rotorcraft sector.

David Solar

EASA HEAD OF THE VTOL DEPARTMENT

On April 1st 2019, David was appointed as Head of VTOL Department in the Certification Directorate which includes rotorcraft and eVTOL products.

He started his career in 2001 in Dassault Aviation as a development and certification engineer on the F7X program.

In 2005, he was appointed as the Falcon Customer Support Technical Manager providing round the clock customer support of the Dassault Civil fleet from the Falcon 10 to the Falcon 900EX Easy and preparing the entry into service of the F7X.

He joined EASA in 2006 as a Large Transport Aircraft Project Certification Manager. In 2014, He was appointed as the Large Transport Aircraft Section Manager and also became the Deputy Head of Large Transport Department in 2016.

In September 2017, he was nominated as the Acting Head of Rotorcraft Department. In total, David Solar has almost 20 years of work experience in Civil Aviation. A graduate from Les Arts et Métiers (ENSAM) and from the University Pierre et Marie Curie in France, he also holds an Executive Master's of Business Administration from the Hautes Etudes Commerciales (HEC Paris).

EASA Rotorcraft Safety Roadmap

2019 has been a very busy year for EASA staff in the Rotary Wing areas. The presentation of the EASA Rotorcraft Safety Roadmap will focus on the implementation status of the different streams of the Safety Roadmap which was revealed during the previous Rotorcraft Symposium. It will also provide an outlook on what has to be done in 2020 and beyond to reach the ambitious objectives to improve the rotorcraft Safety in Europe by 50% in the next 10 years and have visible changes within the next 5 years. It will also highlight some of the potential challenges that can be anticipated and where industry will have a key role to play to truly move forward.

Federal Aviation Administration

Jorge R. Castillo

MANAGER, FAA ROTORCRAFT REGULATIONS BRANCH

Jorge is the manager of the FAA Rotorcraft Standards Branch, in the Policy & Innovation Division, Aircraft Certification Services. His office is responsible for all airworthiness standards and policy pertaining to Part 27 and Part 29 normal and transport category rotorcraft. His office also supports airworthiness standards and policy pertaining to eVTOL and powered-lift aircraft. Prior to 1995, he worked for the United States Department of Defense as a systems and software engineer on various major advanced military aircraft and weapon systems. He joined the FAA in 1995 where he was employed as an aircraft certification engineer for systems and software before transitioning into management within the FAA in 2005.

FAA Innovation Certification Process

Recognising the changing landscape of the aviation industry and the pace of innovation, the FAA Aircraft Certification Services (AIR) has been assessing its organisation structure and its certification approaches and processes. The

prior Aircraft Directorate concept within FAA AIR has been replaced with a functional division organisation. This change is intended to allow the FAA to be more effective, agile and responsive to the needs of the flying public, and the ever changing aviation industry.

Further refinement of AIR's organisation is under way. Recognising the potential for safety enhancements that come with innovations and emerging technologies, the FAA is placing priority and emphasis on streamlining its certification approach and processes.

One such innovation is the advent of eVTOL/Urban Mobility aircraft, which has the potential to revolutionise urban air transportation. The FAA has embraced this challenge and is actively working with many companies of innovation products, aviation associations, and its bilateral partners to make this vision a reality.

Simone Gobbi

LEONARDO HELICOPTERS

Simone obtained a Master's of Science degree in Telecommunication Engineering from Politecnico di Milano in 2002, and has been employed for 17 years at Leonardo Helicopters within the Avionic Systems Design and Development field of the Engineering department. He started as an avionic system engineer on AW139 helicopter line. In 2007 he was appointed as the Project Coordinator for electroavionics aspects, developing competencies for radio-navigation systems, communication systems, surveillance, displays, mission systems, sensors and electromagnetic effects. In 2011, he became the Compliance Verification Engineer for electroavionics systems, electric systems and autopilots on the AW169 helicopter line. Furthermore, since July 2017, he has worked as the Head of System Engineering Technology Civil Aircrafts within the Electrical and Avionic Systems area, for all the civil helicopter lines

of the Leonardo Helicopters Division: AW109, AW119, AW169, AW139, AW149, AW189 and tiltrotor AW609.

PBN and GLS GAST-C approach capability on AW1x9 helicopters

Thanks to the narrower en-route and terminal width allowed by the use of RNP0.3 and RNP AR 0.3 navigation specifications, the helicopter routes will be able to be fit in dense airspace typical in major North-America and European areas or obstacle-rich environment. In order to provide a safety enhancement in high density airspace or obstacle-rich areas, Leonardo Helicopters has applied for EASA certification of PBN capabilities for its civil fleet, namely helicopters AW109, AW169, AW189, AW139, and got EASA approval for them, to date just AW139 remaining at the final stage of approval process. Thus Leonardo Helicopters are able to guarantee the high lateral/vertical performance required by the navigation specifications through an advanced RNP Monitoring & Alerting function embedded in the core of FMS software RNPx capable. In addition to PBN capabilities down to RNP0.3, in 2019, Leonardo Helicopters also certified the GLS approach capability with EASA on AW189 Helicopter. This capability will be also soon extended to AW169. The AW 189 is the world's first GBAS equipped and certified helicopter.

The GBAS has a significant role to play in helicopter operations worldwide because enables helicopter precision approach operations where existing ILS or LPV-200 PinS approach capabilities are limited; GBAS can provide also the vertical guidance in areas not covered by SBAS. GBAS on Leonardo helicopters improves overall crew safety below VFR limits and enables precision approaches to runways or helipads helidecks in adverse weather conditions. The use of GBAS could be crucial for saving lives in case of SAR/HEMS operations on helicopters landing locations located within the range of a GBAS ground station.

Adrian Ilinca
AIRBUS HELICOPTERS

Adrian is a technical certification engineer within the Airbus Helicopters airworthiness

technical department. He trains and coaches airworthiness office staff on avionics compliance demonstration matters, evaluates compliance verification engineers authorizations and provides methodological know-how for avionics installations airworthiness investigations.

Adrian has performed development, airworthiness and operational projects, working previously with Industria Aeronautica Romana, Dac Air, Henri Coanda Airport, Fairchild-Dornier and Aerodata. Various large and small rotorcraft, large and normal-category aeroplane projects have offered opportunities to gain knowledge and experience of applicable standards, recommended practices and design investigation techniques.

Cooperative Visual Segments

Cooperative Visual Segments (CVS) aims to improve flight safety during visual phases of flight. Discussion will examine the Point-in-Space (PinS) approaches visual segments.

Visual Segments sustain the flight path from the Missed Approach Point (MAPt) to a heliport or landing locations and are supported by visual aids to pinpoint obstacles and Final Approach and Take-off Area (FATO) physical characteristics. Such characteristics are currently collected within standardised aeronautical mapping data and are made available to rotorcraft operators as Aeronautical Information Service (AIS) products.

Adhering to the AIS product concept, helicopter landing locations out of Aeronautical Information Publication (AIP) coverage, may be mapped and made available to rotorcraft operators.

This discussion will assess how mapping data is used as well as obstacle / visual aids operational state information, by means of aeronautical or commercial network data exchange. By these means flight planning quality is improved and deficiencies in landing locations / visual aids lighting systems may be observed continuously.

The network ground stations may be implemented by devices co-located with the obstacle / lighting facilities. These devices monitor the object functional status / availability and distribute the information on authorised mobile stations requests.

The network airborne mobile station may include equipment or hosted applications installed in the rotorcraft to provide the visual aid functional status information.

Data captured as functional / operational status vector represents the added value within the Cooperative Visual Segment information.

Applying it to AIP not published (out of AIP coverage) locations may provide an operational benefit to all operators with helicopter PinS approach authorisation.

Tony Randall

BELL

Tony joined Bell in 2011 following a 21-year career in the United States Marine Corps and was promoted to his current role in 2014. His responsibilities include oversight of Bell Safety Management Systems, flight safety from engineering concept to aircraft delivery, worldwide product safety, safety risk management and accident investigation.

His military experience includes working as an Aviation Safety Officer, Director of Standardization and Safety, night systems instructor, instrument and Operational Risk Management examiner, and experimental test pilot. He holds FAA ATP and Flight Instructor, Rotorcraft-Helicopter ratings and Commercial Airplane Single and Multiengine Land with an instrument rating.

Tony graduated from USN Test Pilot School in 1998, spent 4 years as a developmental test pilot and flew first flight of the UH-1Y. He is a member of the GAMA Safety and Accident Investigation Committee, the Society of Experimental Test Pilots, Steering Committee for the USHST and Chair of the VFS Safety Technical Committee.

Safety improvements for existing and new commercial products

Worldwide helicopter operations continue to become safer by the year, but the number of accidents, incidents and fatalities associated with the helicopter industry continue to outpace the levels seen in the airline industry. Many operators, government agencies and OEMs have been participating in worldwide, industry driven safety initiatives in an attempt to cut down the number of accidents.

Both OEMs and regulators have been working to incorporate higher safety into "new design" aircraft and have also worked safety improvements into older designs. Older aircraft may have been certified under older standards and with technologies that may not provide the level of safety that can be achieved with today's technologies and matching standards.

This presentation will provide information about how Bell is innovating to drive safety into new aircraft designs and will discuss our efforts to drive safety into our fielded fleet of both out of production and still in

production aircraft. Technology enhancements in materials for building air vehicles, fly-by-wire control systems, and improved crew information and man machine interface devices, combined with techniques such as Crew Error Management are allowing the possibility to provide aircraft with a significantly enhanced level of safety.

Volker Arnsmeier

EASA

Volker is in charge of the newly created Section within the EASA VTOL Department since its establishment earlier this year. He started his professional career as an Officer and helicopter pilot in the German Armed Forces, followed by industry experience in managing helicopter mission equipment installations.

When he joined the aviation authorities in 2003, he worked as the Rotorcraft Project Certification Manager for LBA as well as EASA. Since 2014 he has managed the Light Rotorcraft Section and holds a commercial pilot license for helicopters. Together with his team he manages the eVTOL certification activities for various projects, and develops any necessary technical requirements as well as related means of compliance.

General presentation on the EASA Special Condition on small VTOL

A new class of aircraft using the principles of distributed lift/thrust is developing. Unlike previous aircraft designs they offer a multitude of propulsion units distributed across the aircraft, combined with a huge variety of aircraft configurations. This technology provides opportunities for high degrees of redundancy and automatic flight control systems through fly-by-wire features, in combination with various challenges like new energy sources and aircraft sizes.

In this context EASA drafted in 2018 the Special Condition VTOL to address the aforementioned features of this new class and to create a common ground for the variety of designs. Public comments were taken into account and the final version of the SC VTOL was published in summer 2019, now to be complemented by respective Means of Compliance.

Daan Dousi

EASA

Daan a Dutch national, and is the manager of the European Union Aviation Safety Agency (EASA) Aircrew and Medical Standards and Implementation section. He has been with EASA for the past 8 years with a total of 20 years of aviation experience. His section is responsible for overseeing the standardised implementation by the 32 EASA member states of the European flight crew licencing and training requirements.

In addition, his section maintains the said requirements through rulemaking activities. Prior to joining EASA, Daan worked for commercial airlines and training organisations where he gained competences in airline operations, flight crew training, training organisation management and airport ground operations.

He holds a business and management degree, as well as a type rating certificate. He also completed an integrated ATP course, and obtained an instructor qualification on the Boeing 737.

Embracing Flight Simulation Training Devices (FSTD) Innovations

This presentation aims to provide an insight into the FSTD capability signature concept (FCS) currently being developed under rulemaking activity.

The existing paradigm for use of training devices has been in operation since the 1990s, with a strong focus on Full Flight Simulators (FFS). These devices provide a high fidelity but are costly at the same time. Also the regulatory framework is restrictive and inflexible regarding the use of other training devices.

EASA is working to change this paradigm and allow for more flexibility and access to other innovative training devices with the introduction of this FCS concept.

EASA will show how the concept will:

- Strengthen the link between training task and training tool
- Cater for new innovative training tools
- Enable better standardisation of training tools used

And we will show how we intend to amend the European regulatory framework to enable the concept.

Fabi Riesen

VR MOTION

Fabi is the CEO of VRMotion Ltd, with a Degree in Electrical Engineering.
Since 1998, he has been developing various simulators. In 2014, he started to experiment in VR combined with Motion Platforms. After his eMBA exam in 2016, he co-founded VRMotion. He has owned PPL(A) SEP since 1999.

Virtual Reality Motion Training Solutions

New technologies enable a new type of helicopter flight training: Practice basic manoeuvres, advanced techniques and emergency training on a simulator and apply them thereafter in a real helicopter at advanced level.
Modern Virtual Reality training solutions make it possible to learn basic manoeuvres (e.g. hovering). The most realistic simulations enable you to train in advanced techniques such as Helicopter External Sling Load Operation (HESLO).
A high-resolution photorealistic visual system is required to set up an immersive training scenario and avoid motion sickness. Force feedback on the controls allows normal and non-normal exercises to be practiced realistically. Tracking the pilot's movements makes the cockpit operable. All these features allow you to fly realistic manoeuvres and enable scenario-based trainings.
Fabi Riesen, CEO VRMotion, presents a powerful solution to improve flight safety in helicopter operations.

Robert Clements

AAIB UK

Rob is a Senior Inspector of Air Accidents (Operations) with the Air Accidents Investigation Branch. He joined the AAIB in 2017 after flying for British Airways for 13 years. He flew Boeing 777 and 737 and he continues to fly regularly with BA on the B777 as part of his role with the AAIB. He was a training co-pilot for British Airways and holds a B777/787 Type Rating Instructor and Examiner qualification. He has over 8,500 flying hours.

He has a Master's Degree in Aeronautical Engineering from Imperial College and Post Graduate Certificates in 'Accident Investigation' and in 'Safety & Human Factors in Aviation' from Cranfield University.

Furthermore, he regularly flies light aircraft, both fixed and rotary wing and is currently qualified on the Robinson R66.

Recent helicopter accidents and the pilot's decision to fly in the prevailing conditions

On the 30th May 2018 a Bell Jet Ranger helicopter crashed into a field in North Yorkshire killing the sole occupant. On 29th March 2017 an Airbus AS355 helicopter crashed into the Rhinog Fawr Mountain in Wales killing the five occupants. These two accidents share many similarities. The respective investigations into these accidents found no technical defects with the helicopters. In both accidents the actual and forecast weather was for low cloud on the planned route, although the visibility was above the legal minimum for a VFR flight.

In each case, witnesses saw the helicopter enter cloud prior to the accident. Although both flights were operated by pilots holding private pilot's licence, they were not qualified to fly in instrument meteorological conditions. Both pilots decided to fly in challenging weather conditions and to continue the flight in deteriorating weather. It is likely that both pilots felt self-inflicted pressure to operate the flights. Neither investigation report made any safety recommendations.

The EASA Rotorcraft Safety Roadmap targets enhancing pilot training to improve safety. More pilot training on decision making, pressure to operate,

plan continuation bias and the hazard of flying in poor weather could help reduce this type of accident. This presentation reviews these accidents and explores why that decision may have made sense to them and the challenge of preventing similar accidents.

Marco Dioli

EASA

Marco graduated in Aerospace Engineering at Politecnico di Milano, with a focus on Space Structures and Systems. After graduation, he joined AgustaWestland and then spent fourteen years assessing design, certification and continuous airworthiness aspects of different CS 27 and CS 29 civil and military helicopter models, both in Italy and in the USA.

Furthermore, he joined EASA in 2017 and he is currently working as the Project Certification Manager in the VTOL Department, following certification and continuous airworthiness of Airbus Helicopters.

He likes to spend his free time with his wife and three beautiful daughters, other passions include football, motorcycles and rock'n'roll.

Update on the Continuing Airworthiness Review Item (CARI) on Main Gearbox (MGB)

On July 2nd 2018, EASA issued CARI 29-01 "Fatigue cracking in MGB Critical Parts with Integral Bearing Races".

Based on the service evidence related to the LN-OJF helicopter accident, the CARI had the scope to collect and review design and service experience data on CS 29 helicopters in order to assess the potential for critical cracks and the capability of the existing monitoring systems to anticipate the failure.

The proposed update starts from the collected data and goes through the main contributing factors on which the CARI was based on, to present the EASA approach on the lesson learnt.

David Abad

ECA

David represents the professional pilots' associations as Chairman of the European Cockpit Association (ECA) Helicopter Working Group. He has been involved in this Group since its foundation in 2010. He is a Vice Chairman of the IFALPA Helicopter Committee and Technical and Flight Safety Officer in SEPLA (Spanish Pilot Association). He is also a helicopter pilot, holds an EASA ATPL(H)/IR licence and works as an SAR pilot at Babcock International for the Galician Coastguard service in Spain.

Furthermore, he was a former Head of Training and Flight Safety Manager. He did an IFALPA Accredited Accident investigator course in the Madrid Polytechnic University of Aeronautical Engineers and has a Master's in Business Administration from IE (Madrid).

He has experience in SAR, CAT, Aerial Works and Training flying A139, S-76, H-135, A109 and Robinsons (R66, R44 and R22). He holds FI/TRI/IRI/CRMI and MCCI ratings as well as examiner certificates.

Moreover, he was awarded with the IFALPA Polaris Award and Crew of the Year by Babcock International and received two honourable mentions from the International Maritime Organization (IMO), and several local recognitions for his service to the community.

Finally, he was a member of the EASA Rulemaking Task RMT.0599 Helicopter subgroup for the EBT development in helicopter operations.

Ready for EBT

After three years of Rulemaking work, we are about to see the publication of the Data Report which validates the Evidence Based Training (EBT) concept for Helicopter operations.

It has been a long and hard period, and we are starting to get familiar with this concept. In fact, a few changes have been made in many organisations to accommodate this new way of training and checking of its crews. We are getting ready for it, and after the publication of the Data Report will be able to implement it.

Some changes have also been made to the FCL, Regulation Air Ops 965/2012,

to fully integrate this training in how we train crews in order to develop their "competences".

During the presentation, we will show a comprehensive review of the Data Report sources, especially the results of the Accident Analysis, which supports the EBT implementation and shows that competency factors played a key role in the vast majority of events and accidents.

Now the time for change has arrived, so we will soon see the commitment and involvement of all stakeholders in order to move towards Competency Based Training (CBT).

He would like to thank all RMT.0599 (Helicopters) group members for their amazing job and commitment to achieve a common goal of making operations safer through better trained and safer crews!!

Anna Von Groote

EUROCAE

Anna von Groote joined EUROCAE in 2011. From 2006, before joining EUROCAE, she worked at the European Committee for Standardization (CEN), beginning in where she assumed responsibilities for the organisation's work programme in different sectors. In her role as Programme Manager at CEN, she was responsible amongst others for the aerospace and air traffic management sector.

She holds a Master's degree in European Studies from the Centre for European Integration Studies, University of Bonn (Germany) and a Master of Laws (LL.M.) degree with a focus on Intellectual Property and Technology law from the University of Liverpool (UK).

Industry shaping means of compliance to support VTOL certification

The joint EUROCAE-EASA workshop on standards for VTOL aircraft, held on 6th June 2019, concluded that there was an urgent need for standards to support the European and global industry to comply with the EASA Special Condition on VTOL. Therefore, EUROCAE Working Group 112 was created with the objective of delivering the first tangible results before the end of the year.

EUROCAE enables this ambitious timeframe with the introduction of a lean process as a pilot project. This gains valuable time and minimises administrative efforts, while maintaining the high quality and the main principles of EUROCAE: openness, transparency and consensus.

WG-112 brings together a broad variety of expertise from the major VTOL OEMs, system and equipment suppliers, airports, operators, R&D organisations, academia and authorities from Europe and beyond. The activity is organised around five main domains of interest: Electrical Systems, Lift/Thrust, Safety, Flight and Ground. For each, a dedicated Sub-Group works along an approved workplan to produce the necessary standards. A Steering Committee, composed of WG leadership, EUROCAE and EASA, meets regularly to guide the work, monitor and coordinates the various SGs

and maintains an overarching view of the activity, progress and link with EASA. The SC also ensures awareness and coordination with relevant international partners to promote global harmonisation.
In relation to the most urgent items of the SC-VTOL, a first set of standards was identified with publication dates set for December 2019. EUROCAE will present an overview of achievements to date and an outlook of future activities.

Hamdy Sallam

EASA

Hamdy is a Rotorcraft Flight Test Pilot, working for EASA since March 2017. His previous professional experience was gained mainly in the military, working for the Italian Air Force. During his time there he was the Flight Lead in the 18th Squadron in Trapani, flying operationally F-16 ADF, and then Chief of Rotary Wing flight Test Section in the Italian Military Flight Test Centre of Pratica di Mare. His flight experience was gathered on different aircrafts, from light propeller (type SF-260), GA commuters as P-180, heavy aircrafts (C-130J and C-27J) and fighters (F-16, Tornado, AMX, Typhoon).
He has also been involved in several military certification programs, such as the ICH-47F program, VH-139 (VVIP version of AW139), HH-139 (military version of AW139), HH-101 CSAR (military version of EH-101), NH-90 and AW149.

Handling Qualities Rating Method for VTOL

The aircraft needs to be controllable and manoeuvrable to cope with any adverse weather conditions encountered inadvertently, and to avoid obstacles or traffic which are detected late. The control and manoeuvring of the aircraft requires a certain amount of physical and or mental workload from the crew.
Degraded HQ leads to increased pilot attentional demand for aircraft control, hence reduced excess workload capacity for other tasks and for situational awareness. Satisfactory HQ gives the crew the opportunity to have excess workload capacity, and allows them to operate

safely for longer periods and to be able to deal with contingencies.
The following is a method of determining and evaluating the Handling Qualities (HQ) for VTOLs in the enhanced category. The overall process is derived from the FAA Advisory Circular 25-7D Appendix E. The method will need to be followed by a "tool" to evaluate and show compliance with the minimum HQs.

Guillaume Soudain

EASA

Guillaume has been working for 13 years as a Software and Airborne Electronic Hardware Expert in the Certification Directorate of the EASA.
In 2014, he was appointed as the Software Senior Expert and since then he has been in charge of the coordination of the software aspects of certification within the Agency.
He was a member of the EUROCAE WG-71/ RTCA SC-205 joint committee in charge of producing the software standard ED-12C/ DO-178C and its associated documents. He is now the EASA representative in the EUROCAE/ RTCA Forum for Aeronautical Software (FAS).
Prior to joining EASA, he worked for 5 years as a Software Engineer in the development of Automatic Flight Control Systems in the European rotorcraft industry.

Arne Malcharowitz

EASA

Arne studied Aeronautical Engineering at the Technical University Berlin.
After working in research, he joined EASA in 2016 as part of the Junior Qualification Programme, which aims at hiring and training

young aviation professionals for the specific needs of a regulatory authority.

After finishing the programme, Arne started working in the VTOL department in the Heavy Rotorcraft Section as a Junior Expert for Development Assurance and Safety Assessment. He is involved in the development of the Acceptable Means of Compliance for the new Special Condition for VTOL in the domain of Safety Assessment processes.

Development assurance and safety assessment processes (AMC.2510)

This presentation aims at introducing the main concepts that are developed in the AMC to EASA Special Condition on VTOL, focusing on paragraph VTOL.2510. After looking at the scope of the AMC material, they will outline EASA's expectations in terms of development assurance and safety assessment processes for small category VTOL aircrafts, with a close assessment of the safety objectives applicable to such a category of product. The presentation will also focus on particular challenges raised by the Special Condition for systems development, like the single failure concept and especially Common Mode Analysis (CMA) aspects.

Duncan Jones

EASA

Duncan has spent the last 13 years as a hydromechanical systems expert at EASA dealing with Flight Control Systems, Hydraulics, Landing Gear and Doors for commercial and GA aircraft, large and small rotorcraft along with smaller VTOL types. Current projects include assessing rotorcraft for continued airworthiness.

He is responsible for the ETSO approval of tyres, wheels and brakes and hydraulic hoses. Prior to this, he spent 7 years as the designated certification specialist at Airbus UK where he was responsible for the certification of the long range and A380 landing gear systems. This followed on from 15 years as a spacecraft assembly, integration and test engineer.

Flight control systems for VTOL

The Special Condition for VTOL was published by EASA on 02 July 2019. The certification requirements were developed to be commensurate with the type of operation, in order to provide flexibility and proportionality and also to give the industry a clear vision of the objectives for their designs. It was foreseen that the advisory material (AMC) to this special condition would contain additional guidance and clarification where necessary.

The Flight Control System is usually considered to be the most critical system on current aircraft types and even more so on the VTOL designs currently proposed. This presentation is an introduction to the Flight Control System aspects of the proposed AMC and is intended to provide an overview of the topics covered. This should allow clear and focused review of the AMC during the public comment period.

Kyle Heironimus

BELL

Kyle is a member of the Bell Innovation team, currently leading the electric propulsion system development for Bell's NEXUS urban air taxi demonstrator. Prior to joining the Innovation team, he was responsible for the engineering design, development, and certification of the controls and hydraulics systems on the Bell 505.

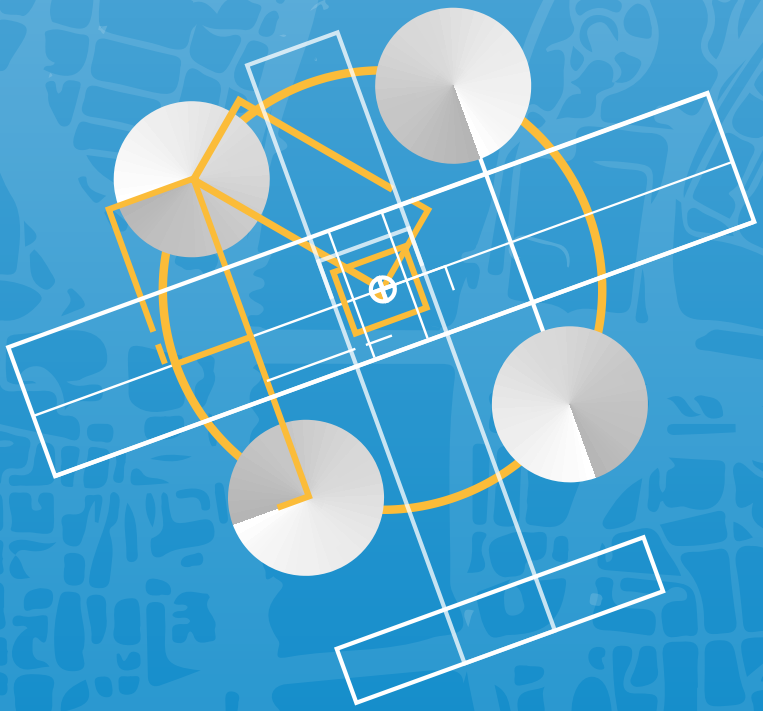
During his tenure at Bell, he has contributed to a wide range of commercial and military programs including H-1, V-22, 412, 505, 525, and experimental aircraft. His experience includes aircraft systems design, flight test, systems engineering, safety analysis, and Part 27 certification. Kyle holds degrees in mechanical engineering from the University of Miami and systems engineering from Southern Methodist University.

EVTOL Propulsion System Safety

In terms of design, analysis and qualification of safety critical aircraft systems, EVTOL aircraft are approached with the same methods, tools, and techniques typical of the aerospace industry. Consistent with EASA's recent release of Special Condition SC-VTOL-01, "Category Enhanced" aircraft electric propulsion systems are required to meet 10-9 failures per flight hour safety objectives for any failure that would prevent continued safe flight and landing of the aircraft. While electric propulsion can offer designs that are highly distributed and redundant, redundancy alone does not ensure that safety targets will be met.

Common mode and cascading failures must also be considered, driving the need for dissimilarity and segregation of systems and components. Furthermore, power and energy sizing of electric propulsion systems must consider any likely failures to ensure that safe flight can be maintained. Careful attention must be paid to the architecture of the electric propulsion system since design decisions made to meet safety targets can easily drive complexity, weight, and cost that will exceed the thresholds of viability for the vehicle's intended mission. As such, an optimised EVTOL aircraft must trade the propulsion system's levels of redundancy, dissimilarity, and criticality to minimise complexity, weight, and cost while meeting the safety targets.

An example of such a trade is made against a generic hexacopter architecture that demonstrates high levels of redundancy in the propulsion system alone may be inadequate to meet the safety targets as they do not fully address common mode and cascading failures - particularly failures that result in system transients or oscillations instead of "failing passive". The example also shows that introducing criticality to certain parts may be necessary to achieve the safety requirements and can also significantly reduce the power and energy sizing of the system.



ROTORCRAFT AND VTOL SYMPOSIUM

DAY 2

Agenda Day 2

SAFETY WORKSHOP FOR THE EUROPEAN SAFETY PROMOTION NETWORK ROTORCRAFT (ESPN-R) • BALLROOM A-C

09:00 – 09:10	Introduction to Safety Workshop **Michel Masson, EASA,** **Bernd Osswald, Airbus Helicopters,** **and Christian Mueller, EHA / NGFT**
09:10 – 09:45	Keynote Speech: Technological Developments in the Human Machine Interface **Bruce Webb, Airbus Helicopters Inc.**
09:45 – 10:00	IHSF Actions Involving Technology **Tony Molinaro, FAA, International Helicopter Safety Foundation (IHSF)**
10:00 – 10:50	What the Future Holds - Emerging Safety Technologies and How This Affects Training **Jorge R. Castillo, Manager, FAA Rotorcraft Regulations Branch**
10:50 – 11:20	**Networking Coffee Break**
11:20 – 12:20	Interactive Workshop on Handling Automation and Flight Path Management **Bettina Schleidt, SRH Hochschule Heidelberg** Wrap up of the Safety Workshop **John Franklin, EASA**
12:20 – 13:45	**Networking Lunch Break**

SESSION ON VTOL CERTIFICATION • AMC / MOC • BALLROOM D

09:00 – 09:20	Load factors in emergency landing and Crashworthiness (VTOL.2325, VTOL.2270) **Aiko Duehne, EASA**
09:20 – 09:50	Interpretation of the single failure criteria for structure (2250(c)) **Emily Lewis, EASA**
09:50 – 10:10	Bird strike combining the airframe and engine approach **Herdrice Hereson and Régis Rossotto, EASA**
10:10 – 10:30	HIRF and lightning for small VTOL **Jean-Christophe Lamy, EASA**
10:30 – 10:50	Q&A
10:50 – 11:20	**Networking Coffee Break**
11:20 – 11:40	Electric and Hybrid Propulsion System certification requirements **Régis Rossotto, EASA**
11:40 – 12:00	System Engineering Requirements as part of the Aircraft System Development Process **Nick Kefalas, Sikorsky Aircraft / Lockheed Martin**
12:00 – 12:20	Q&A
12:20 – 13:45	**Networking Lunch Break**

PLENARY SESSION

13:45 – 14:10	The Myth of losing tail rotor effectiveness **André-Michel Dequin, Airbus Helicopters**
14:10 – 14:40	Proposal of Service Provision scheme for Rotorcraft Operators in Class G Airspace **Manuel Santos, essp-sas.eu**
14:40 – 15:00	Rotorcraft Certification by Simulation (RoCS) **Giuseppe Quaranta, Politecnico di Milano**
15:00 – 15:15	Q&A Final plenary session
15:15 – 15:30	**Wrap up and Closing Remarks** **Rachel DAESCHLER, acting EASA Certification Director and David SOLAR, EASA Head of the VTOL Department**

Introduction to Safety Workshop

The Safety Workshop is organised by the European Safety Promotion Network Rotorcraft (ESPN-R) in cooperation with the International Helicopter Safety Foundation (IHSF).

ESPN-R is a mixed Industry-Authorities team established in January 2017 that contributes to defining and implementing Safety Promotion actions from the European Plan for Aviation Safety (EPAS), and the EASA Rotorcraft Safety Roadmap.

The topic of the year is "Technologies With Safety Benefits." ESPN-R Coordinators Michel Masson, EASA, Bernd Osswald, Airbus Helicopters, and Christian Mueller, EHA / NGFT will welcome participants.

Bruce Webb, Director of Aviation Education and Community Outreach, former Airbus Helicopters Incorporated Chief Pilot, will deliver a keynote address on "Technological Developments in the Rotorcraft Human Machine Interface."

Tony Molinaro, FAA, IHSF Communications, will then summarise the IHSF Actions Regarding Emerging Technology.

The next presentations by Thomas Gogel, Airbus Helicopters and Francesco Parisi, Leonardo Helicopters Training Academy, will address "What the Future Holds - Emerging Safety Technologies and How These Affect Training."

Leonardo will introduce the new safety promotion video on "Automation and Flight Path Management," developed as part of the ESPN-R 2019 work program.

In relation to the above video, Professor Bettina Schleidt, SRH Hochschule Heidelberg and rotorcraft pilot will then facilitate an interactive workshop on "Handling Automation and Flight Path Management."

John Franklin, EASA, will wrap up the event and thank contributors and participants. A warm welcome to the participants of the Safety Workshop 2019!

Michel Masson
EASA

Michel Masson

EASA

Michel is the Senior Safety Promotion Officer, EASA. He is also the Coordinator of the European Rotorcraft Safety Promotion Network (ESPN-R) and the Safety Promotion Network (SPN) of the Member States. Furthermore, he is the former Secretary of the European Helicopter Safety Team (EHEST), which closed in 2016.

He has a PhD in Work and Organisational Psychology from the University of Liege, Belgium, and is an approved ISO:9000 auditor. Before joining EASA in 2006, he worked as a Human Factors and Safety Expert with Boeing Research & Technology Europe (BRTE) in Madrid, Spain, with the Joint Research Centre (JRC) of the European Commission (EC) in Ispra, Italy and with Dedale in Paris, France, where he contributed to several projects notably for Airbus, Air France, Eurocontrol and the French Nuclear Industry.

Bernd Osswald

AIRBUS HELICOPTERS

Bernd has worked for the company for 23 years, mainly as the Chief Engineer and Senior Program Manager. He currently works as the Head Lead of Worldwide Network of Aviation Safety Officers.

The actual position entails:

- Leading and managing the accident investigation team for all Airbus Helicopters
- Coordinator of ESPN-R.

Christian Müller

EHA / NGFT

Christian is 47 years old and is the owner of the Next Generation Flight Training (CH ATO.0299). He is a Swiss native and has a Master's of Arts from the University of Berne.

He was the Senior Consultant in International Financial Institutions before becoming the Head of Training of a Swiss Helicopter Pilot School. He holds a FI (A/H) EASA/FAA certification and is serving as a Member on the Board of Swiss Helicopter Association and Board of Governors EHA.

He is also the Chairman of the EHA Working Group in Aerial Work, a Member of the RAeS and a Member the ESPN-R. He still serves as a Lt Col in the Swiss Air Force, General Staff, in the G-7 (Training) area.

Bruce Webb

AIRBUS HELICOPTERS

Bruce is the Director of Aviation Education and Community Outreach for Airbus Helicopters. He believes that the key to improving aviation safety is through a better understanding of human behaviour.

His interest in aviation began in High School where he attended an aerospace course as a sophomore and then attended a vocational A&P School as a junior and senior. He went on to complete his Bachelor's degree from the University of Illinois while concurrently pursuing his FAA Rotorcraft Helicopter Pilot Certificates.

He co-owned and operated an FAA approved part 135, 137, and 145 helicopter operation in the Chicago area for more than six years. He flew medical helicopters (VFR and IFR BK-117's) for more than four years in Nebraska, Ohio, and North Carolina. He

came to Airbus (Eurocopter) in 1999 as a pilot and was quickly promoted to Chief Pilot, a position he held for sixteen years. He stepped down in 2016 to begin this new challenge of promoting safety from a lectern...not a cockpit.

With more than thirty-six years of helicopter experience behind him, he is a passionate speaker whose unique perspectives resonates with audiences.

Tony Molinaro

FAA, INTERNATIONAL HELICOPTER SAFETY FOUNDATION (IHSF)

Tony has served as the news media spokesman and communications consultant in the Federal Aviation Administration's Public Affairs office in Chicago since January 1999. Major projects include participation in the Chicago O'Hare Airport modernisation effort since 2001 as well as involvement in noise issues associated with Chicago O'Hare and Chicago Midway Airports.

He is also the communications team leader for the International Helicopter Safety Foundation (www.IHSF.aero) and the U.S. Helicopter Safety Team (www.USHST.org). This includes managing the USHST and IHSF web sites and each group's social media initiatives via Facebook, Twitter and YouTube.

Prior to joining the FAA, Molinaro spent 14 years in Corporate Communications for United Airlines at its World Headquarters. As the Media Relations Manager, he oversaw the company's public relations for its West Coast Shuttle by United, technology launches such as E-Ticketing, and the inauguration of the Star Alliance partnership. In addition, Molinaro managed three PR firm consultant teams in Denver, Los Angeles and New York, and served as United's manager of its 20-person Creative Services department.

Thomas Gogel

AIRBUS HELICOPTERS

Thomas has worked for more than 31 years in the aerospace industry and 25 years in the Aviation industry.

Work experience spans from Lufthansa Technik, Fairchild Dornier and Babcock to Airbus Helicopters. Positions at Airbus range from the Head of the military Prototype Shop, to a Technical Support Management function and Aviation Safety management. He has also built up the world wide safety network at Airbus Helicopters. In this function, he headed the EHEST and developed it into the new EAPN-R structure.

Francesco Parisi

LEONARDO HELICOPTERS TRAINING ACADEMY

Francesco is a Leonardo Helicopters instructor pilot. He started his work in aviation more than 30 years ago as a helicopters pilot of the Italian Navy. Later he worked as the Captain in an airline and for the last 6 years he has worked as an instructor of the Leonardo Helicopters Training Academy.

He mainly works as a type rating instructor pilot on simulators. In addition, he carries out theoretical training in the classroom especially in the “Glass Cockpit and Automation Management”. He is also part of the team that is preparing the training programs of the tilt rotor.

Bettina Schleidt

SRH HOCHSCHULE HEIDELBERG

Bettina is a Professor for Applied and Business Psychology and Human Factors at SRH University of Applied Sciences, D-Heidelberg, as well as a Coach and Consultant at Human Factors Consult, D-Sasbachwalden.

Furthermore, she is a Commercial Helicopter Pilot and member of the European Association for Aviation Psychology (EAAP), Quality Manager for Part-145 and Helicopter Operation Companies.

Her main research areas are human factors at the work place, peer support, psychology of emergencies or aircraft investigation.

She has professional experience in banking and business and has worked on several projects in the automotive area before she changed to the aviation area.

John Franklin

EASA

John started his aviation career in the RAF, serving as an Engineering Officer on the Tornado aircraft and then within the Military Aviation Authority. He joined EASA in 2011 and is currently EASA's Head of Safety Actions where he now leads the Agency's Safety Promotion activity and supports the strategic coordination of Safety Intelligence activities.

Aiko Duehne
EASA

Aiko started his aviation career as an aircraft mechanic working mainly on small and medium aircraft. After some years he started his engineering education at the University of Stuttgart studying “Aeronautical and Aerospace Engineering” with majors in “Lightweight Construction” and “Systems Engineering”. During this time he gained more practical experience with Britten Norman and Airbus.

In 2007 he moved to the German National Aviation Authority “LBA” as a structures expert in the field of certification. Finally, he has been working with EASA since 2012 as the structures expert in the VTOL department, responsible for various rotorcraft, eVTOL and rulemaking projects.

Load factors in emergency landing and Crashworthiness (VTOL.2325, VTOL.2270)

The safety of the occupant during an emergency landing has to be ensured in modern conventional rotorcraft and fixed wing aircraft. The different take-off and landing capabilities (vertical take-off and landing / conventional take-off and landing) have to be considered when looking at the emergency landing conditions for this kind of vehicle.

There are two kinds of emergency landing scenarios to be taken into account. In the emergency landing conditions described in VTOL.2270, the occupants are deemed able to egress the VTOL by themselves, whereas in VTOL.2325, for fire protection, it should also be possible to rescue the occupants after a survivable crash landing.

VTOL.2270 takes into account the static inertia loads the occupant experiences during an emergency landing and ensures that any item of mass that could injure an occupant, doesn’t become loose. In addition, the dynamic effects during an emergency landing have to be accounted for and it has to be ensured that the occupant can escape serious injuries in order to evacuate themselves from the VTOL.

The aim of VTOL.2325 is to ensure that the occupants are protected in a survivable emergency landing from any hazard due to fire or harmful fluids, gases or fumes originating from the energy storage system. Therefore it has to be shown that an occupant, although seriously injured, will be able to be rescued from the crashed vehicle.

Emily Lewis
EASA

Emily is a Structures and Cabin Safety Expert in the Rotorcraft VTOL Department at EASA. Since joining EASA in May 2014, she has been involved in several major Rotorcraft and General Aviation Certification / Continued Airworthiness activities. Before joining EASA, Emily worked for a European helicopter design and manufacturing company. She has a MEng degree in Aerospace Engineering, specialising in Aerospace Structures, from the University of Southampton and is registered as a Chartered Engineer with the Royal Aeronautical Society.

Interpretation of the single failure criteria for structure (2250(c)

The Special Condition VTOL.2250 (c) has introduced a very demanding design and construction objective for any VTOL certification: "For Category Enhanced, a single failure must not have a catastrophic effect upon the aircraft." This very high safety standard applicable to the Enhanced VTOL design will request the applicants to develop a new and more systematic approach for the selection of the aircraft configuration and its design.

In this context, the existing guidance material already applicable to CS 27/29 structure or system can be adapted to eVTOL, considering that the alternative or compensating factors or provision currently accepted for catastrophic classification in CS certification are not specifically proposed for the VTOL requirement. The available methodology and processes, the existing tools and the acceptable assumptions to comply with SC VTOL 2250 (c) are included in this presentation.

Herdrice Hereson

EASA

Herdrice has represented EASA at the ARAC Rotorcraft Bird Strike Working Group initiated by FAA and has also drafted the AMC SC-VTOL on VTOL 2250 (f). She has been a Structures Certification Expert for EASA for 13 years. She has also worked as a PCM for the last few years. Furthermore, she has been involved in several Rotorcraft and Large Aircraft Certification and works as a project certification manager on a light helicopter drone certification project.

Régis Rossotto

EASA

Régis joined EASA (European Aviation Safety Agency) as the project certification manager for hybrid and electric propulsions. He comes from the rotorcraft industry, having joined the engine integration department of Airbus Helicopters in 2005 after his studies.

He mainly specialised in the analysis of engine-related incidents and accidents, engine air intake environmental tests and engine control system integration for which he became the team leader. During that period, he worked on different technical research programmes focusing on the future of aviation through 'non-conventional' power plants. After 10 years of working in the engine integration field, he joined the certification department of Airbus Helicopters.

Finally, he moved to EASA in 2016 to actively contribute to this new adventure of hybrid and electric propulsion in aviation. He now holds in key position in the certification of electric and hybrid propulsion in EASA.

Bird strike combining the airframe and engine approach

The SC VTOL 2250 (f) requires an acceptable level of protection from bird strike for Aircraft in Category Basic of 7 to 9 passengers and in the Enhanced Category. This presentation will discuss the AMC Special Condition VTOL.2250 (f) and VTOL.2400 EASA SC VTOL defined to provide means of compliance and guidance material related to bird strike protection. After having explained the AMCs background, the presentation will highlight how the consistency between the airframe and the engine requirement is ensured.

Jean-Christophe Lamy

EASA

Jean-Christophe is a Electrical System, HIRF and Lightning Protection expert (Panel 5). He was recruited by EASA in December 2006. His previous experience was at DGAC France as a Electrical System and Avionics expert on various aircraft. Within EASA, he is currently the Panel 5 expert in the VTOL Department, working mainly on Rotorcraft and VTOL Projects. He has also some other activities such as Panel 5 for Large Aircraft, Panel 5/6 in General Aviation and PCM for Rotorcraft.

HIRF and lightning for small VTOL

The electrical and electronic systems of VTOL must be protected against the catastrophic and hazardous effect of the HIRF (high-intensity radiated field) and lightning threats.

The guidance proposes to define the likelihood of exposure to lightning and is a simplified alternative of the current multi product AMCs HIRF/IEL (20-158/20-136). Several principles are applied:

- clarification of the rules (interpretation of the requirements, perimeter of the system),
- simplification (less aircraft testing with the use of generic transfer functions, more testing at the equipment level than system level),
- proportionality (the higher VTOL categories use a more rigorous approach with a more severe environment and/or determination of real transfer function. Essential systems are not considered for the lower VTOL categories and/or VTOL operating in VFR).

The methods proposed in the guidance ensure the consistency in the HIRF and IEL approaches. For each electrical and electronic systems, the same methods are proposed for the HIRF and Lightning protection i.e. same perimeter of the system, use of real transfer function or equipment testing according to the environmental standards and the same Certification Level per Channel).

These AMCs have been developed thanks to various documents like AMCs multi product, FAA Policy and ASTM HIRF/IEL for CS/Part 23.

Nick Kefalas

SIKORSKY AIRCRAFT / LOCKHEED MARTIN

Nick is the Avionic, Electrical and Flight Control Systems Technical Officer and Certification lead for Lockheed Martin Sikorsky Aircraft. He is also the Senior Systems and Equipment Design manager with over 30 years of expertise in Complex System Design and Aircraft Certification/Airworthiness.

Furthermore, he is the FAA Designated Engineering Representative for Systems and Equipment (Avionics, Electrical, Flight Controls, including Airborne Electronic Hardware). He is the author of multiple technical Publications, and Position Papers on Advanced Aerospace topics including Standards for Flight Control systems, Complex Electronic Hardware, Design and Certification, System Requirements and Decomposition, Autonomy, and Adv. Flight Controls. He has also published works in

FAA journals, American Helicopter Society (AHS), IEEE, and SPIE.
He was the recipient of the American Helicopter Society Pinckney Award for the Sikorsky S-92A Helicopter. He has also been the Adj. professor for the University of New Haven, School of Engineering since 1995 with the curriculum emphasis on Digital Circuit Design, Communication and Control Systems. Finally, he is a member of several FAA / EASA Boards and Committees, including RTCA and SAE. He was responsible for aerospace inverter patent applications for both the US & International markets. Invertor with both and US & International patents for aerospace applications.

System Engineering Requirements as part of the Aircraft System Development Process

This topic will introduce the audience to an overview of the System Requirement engineering process as pertaining to the aircraft development life cycle for both simple and complex systems. It will examine the principle of viewing the rotorcraft or aircraft as a System of Systems and helps facilitate understanding of the interaction and interrelationships of requirements within that framework and its mission.
The presentation will then examine how Mission requirements affect and interact within the core structure and why they must be taken into account within the System Development Life Cycle Process. The topic will also briefly explore how to apply, concepts for: – performance analysis – reliability and safety – function, architecture and key performance issues of major subsystems – risk analysis and management – design closure to deliver lifecycle value as well as the ability to understand complex systems and design choices through the retrospective analysis of existing aircraft systems and previously developed systems and components.

André-Michel Dequin
AIRBUS HELICOPTERS

André-Michel Dequin joined Aerospatiale Aerodynamic Department (later encompassed in Eurocopter, now Airbus Helicopters) almost 40 years ago, at the time the Unanticipated Yaw problem was first investigated in the US Army. After 25 years spent in Aerodynamics, Flight Mechanics, Flight Loads and Performance, he moved to the Project Team of the H175 helicopter. He returned as an Aeromechanics expert after this aircraft was certified. After he realised there was still a problem with Unanticipated Yaw, heinvested himself in that domain. He came to a better understanding of this phenomenon and now tries to share his views.

The Myth of Losing Tail Rotor Effectiveness

The helicopter community has been plagued by accidents during the last forty years due to unanticipated yaw, also called Loss of Tail rotor Effectiveness (LTE). How the problem was identified and what answers were given were first reconstructed from period documents and Airbus experience. A part of the mystery still remained and in particular no clear explanation of the phenomenon was given. An analysis of accident databases existing in different countries was then presented. The figures are quite shocking and a yearly average exceeding 18 accidents was identified. Surprisingly, three out of four accidents take place in close vicinity to the ground where the recovery actions recommended in the FAA AC 90-95 "Unanticipated Right Yaw in Helicopters" are not applicable. An explanation of the phenomenon was proposed, using the pedal curve as a tool. It allows for understanding of how and in what conditions unanticipated yaw occurs in the simplest case, hovering with wind. It also shows that recovery is affected by the modification of the pedal position at trim, induced by the change in heading coming from the yaw rate, which makes the pilot feel the tail rotor to be ineffective. Accidents most probably occur because pilots do not use pedal corrections of sufficient amplitude during recovery. A more complex case is also analysed, low speed turns to the right in ground reference with wind, as used during photographing or filming flights where unanticipated yaw often takes place. Such events

are shown to occur when entering tailwind conditions, where the airspeed is reduced while a side wind component exists. A few myths based on our poor understanding of the issue are then corrected, highlighting the unsafe way of flying helicopters with left wind direction, when performance is limited. The pedal curve provides a clear understanding of unanticipated yaw and gives an opportunity to solve that problem. There is a need to build a unique, clear and consistent message toward pilots, appropriate to the low height conditions where the problem occurs, that shall be propagated by Authorities, Industry and Flight Schools.

Manuel Santos
ESSP-SAS.EU

Manuel is an air Navigation Engineer, holds a Master's degree in Air Traffic Management and has more than nine years of experience in ATM.

He started his professional career in 2010 at INECO as Flight procedures designer. Afterwards, Manuel joined ISDEFE, in order to support Flight Procedures Design activities related to the implementation of PBN approaches at different airports in Spain.

Later he joined SENASA, as the ATM Civil Inspector, supporting AESA (Spanish CAA) in the following aspects: NAA organisational analysis, structural design and adaptation to comply with international requirement, certification and outgoing of ANSP in Spain.

Finally, he joined ESSP as the Aviation Consultancy Expert to support Service Development activities that enable the implementation of GNSS-based procedures.

He has participated in projects related to PBN implementation activities such as: EGNOS Service Provision schemes in environments without ATS services, Helicopter procedures, LPV implementation for General Aviation and non-instrumental runways.

Proposal of Service Provision scheme for Rotorcraft Operators in Class G Airspace

Service Provision scheme for Rotorcraft Operators in non-ATS environments, located in Class G Airspace, is key for those services improving safety of Rotorcraft operations, such as EGNOS use

for HEMS operations at hospital-helipads (PinS approaches and Low level routes). As an important step for the implementation of EGNOS-based procedures in HEMS operations, ESSP, as the EGNOS Service Provider, has been working over the last years to define a free of charge EGNOS Service Provision scheme for Rotorcraft Operators. In particular, it was first applied for Norsk Luftambulanse AS, which currently operates HEMS in Norway and in Denmark in the near future.

In order to establish the operational and legal framework to use the EGNOS Safety-of-Life Service as a navigation aid, an EGNOS Working Agreement (EWA) has been signed with the Rotorcraft Operator in full cooperation with both the operator and the Norwegian Civil Aviation Authority. In doing so, some issues needed to be properly tackled.

The signature of the EWA agreement concludes an important step in international cooperation to employ EGNOS precision signals and services for a cost efficient navigation solution for the benefit of patients in need of helicopter transport by Norsk Luftambulanse AS using satellite based navigation in Norway.

It is also intended that the proposed Service Provision scheme described in the EWA, including a proposal of EGNOS NOTAM distribution, will also be implemented in other States, Rotorcraft and Aircraft Operators around Europe. For this reason, ESSP' proposal should not be considered as a particular assessment or solution of the scenario for Norsk Luftambulanse AS. It proposes to show a feasible and homogenous solution in terms of Service Provision scheme for Rotorcraft Operators around Europe mainly in non-ATS environments.

Giuseppe Quaranta
POLITECNICO DI MILANO

Giuseppe Quaranta has worked as a Full Professor of Aerospace Structures at Politecnico di Milano, Department of Aerospace Science and Technology since 2019. He got his PhD in Aerospace Engineering in 2004 working on tiltrotor aeromechanics and

whirl flutter, thanks to an AgustaWestland (now Leonardo) scholarship. He has been involved as an investigator in several EU funded researches on rotorcraft and tiltrotor dynamics. Currently he is the coordinator of the first European network of Universities NITROS that offers a Double Doctorate focused on the improvement of rotorcraft safety.

He is also the coordinator of the project ROCS Rotorcraft Certification by Simulation, a CleanSky 2 project dedicated to the development of the Next Generation tiltrotor. His research focuses on multidisciplinary modelling for aircraft design and verification. Among the research topics recently addressed, include rotorcraft aeromechanics and vibration reduction, Rotorcraft Pilot Couplings, virtual simulation for rotorcraft, robust aeroelasticity, innovative Fluid Structure Interaction approach, Icing assessment and simulation, SHOL analysis in wind tunnels.

Rotorcraft Certification by Simulation

RoCS (Rotorcraft Certification by Simulation) project aims at defining a virtual engineering flight simulation process for the generation of evidence for certification of rotorcraft.

The objective is to establish, in collaboration with industry and regulators, the characteristics that a virtual flight simulation environment must have to be adequate to demonstrate compliance with airworthiness standards, in a safer, more economical and more effective way than the current flight test procedures.

The challenge is to develop, in agreement with the regulatory authority, guidelines that define the part of the certification basis that could be fully substituted, or in some cases complemented by flight simulation as well as the metrics and methodology to assess the quality and reliability of simulation models and flight simulator cueing fidelity for those specific tasks. The project started in the second half of 2019, so the presentation aims to introduce the project and its main goals to the rotorcraft community.

RoCS is coordinated by Politecnico di Milano and involves five additional partners: University of Liverpool and Liverpool John Moores University, DLR, NLR, and GIEI, and the topic leader, Leonardo Helicopter Division, who will support the activity proving data and its certification expertise.

Furthermore, the project foresees a strong collaboration with EASA, with a supervising role of the activities performed. RoCS is a project funded by the Clean Sky Joint Undertaking under H2020 programme.

ORGANISER

European Union Aviation Safety Agency
Clément Audard, Safety Coordinator,
VTOL Department