EASA
European Aviation Safety Agency

ROTORCRAFT SAFETY ROADMAP

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Updated version

Rotorcraft Safety Roadmap

Achieving significant safety improvement for Rotorcraft

with evolving aviation industry

Table of Contents

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I Introduction

I.1 The need for an European Rotorcraft Roadmap

Safety is fundamental to any transport system and is always the top priority. Progress in reducing EU-wide fatalities caused by rotorcraft accidents has stagnated in recent years. The EASA Executive Committee reviewed European and worldwide rotorcraft safety data and decided to launch a strategic approach and set an ambitious target to reduce the number of accidents and incidents in Europe.

A group of external experts from the NAAs and the industry was tasked to jointly develop with EASA an action plan that can feed in an EASA strategic roadmap. The strategic safety roadmap should focus on rotorcraft transversal issues and include training, operations, initial and continuing airworthiness, the environment and innovation. The focus is on traditional/conventional rotorcraft. Drones, electrical or hybrid Vertical Take-off and Landing aircraft (eVTOLs) and Urban Air mobility vehicles are outside the scope of this roadmap and are covered by other ongoing activities. **Pilot training has to be addressed as a priority.** The Roadmap contains proposed actions that complement the measures already adopted or implemented by EASA and/or other European stakeholders. Once the Roadmap has been defined and agreed, it should be implemented via dedicated implementation plans. This roadmap should be considered in the wider context of the aviation system to enable cross domain synergies to be integrated where appropriate.

I.2 A strong European industry

Currently more than 7 700 civil rotorcraft are operated in Europe, and they provide a wide range of services to the community. The European industry is particularly strongly represented in the medium and large civil turbine rotorcraft with about 57 % of the worldwide fleet (excluding Russian Federation rotorcraft), and this represents about 70 % of the current market share.

Region of the world (by state of registration)	Number of civil rotorcraft
USA	9 073
EASA Member States	7 762
Asia	5 363
Latin America	4 383
Russia	3 249
Oceania	2 885
Africa	2 446
Canada	2 409
Middle East	1 056
Europe (non-EASA)	954
Central America	511
Total	**40 091**

Table 1 – Number of civil rotorcraft by world regions.[1]

[1] Data source FlightGlobal (aka Ascend). Statistics on 30/6/2015. UK fleet included in EASA MS.

I.3 Essential missions of Rotorcraft

Rotorcraft provide essential services to European society, which are not limited by transportation needs. In particular, rotorcraft are extensively used in the following services, such as HEMS, surveillance, police, aerial work and agriculture. In addition, they also support a significant part of the economies of some EASA countries with offshore operations. These operations also support the development of offshore wind farms, which are becoming an essential element of renewable energy development.

I.4 Outlook and new challenges

The rotorcraft market is segmented. The oil and gas business typically involves larger rotorcraft serving offshore platforms. Industry outlooks show that growth will come from the medium sized rotorcraft segment, with the offshore segment developing to support offshore wind platforms. New markets have the potential to grow quickly, and the Chinese market, which currently represents 3% of the worldwide market, is foreseen to grow to 30 % in the next 10 years. European industry is already investing in these new market opportunities. The military rotorcraft market is becoming increasingly important for EASA. The Rotorcraft sector may be impacted, as most of the platforms are dual-use, and some NAAs may be interested in opting to use EASA to support their regulatory activities for military/state registered aircraft. Some operators who perform cross-border operations may also wish EASA to become their competent authority.

In addition, the current average age for turbine rotorcraft in Europe is 21 years. A generation of older machines will be retired from operation, and a number of new designs are expected to enter the market. This is a good time to encourage this transition, and to set the right standards for new rotorcraft.

I.5 Rotorcraft safety records

There is on average one rotorcraft accident per week in Europe.

In Europe, there is on average one non-fatal rotorcraft accident per week, and 1.3 fatal accidents per month. In 2017, 139 accidents involving rotorcraft worldwide were reported to EASA, and 38 of these accidents led to 102 fatalities. In Europe, there were 16 fatal accidents, with 34 fatalities involving rotorcraft that occurred in 2017, as well as 55 non-fatal accidents. EASA publishes an Annual Safety Review (ASR) that provides an overview of the accident statistics from the previous year. **The statistics show that the rate of accident has been almost constant for the last 10 years.**

In order to make the most impact, it will be necessary to focus the available resources on the most critical subjects. Some operations are more exposed to high risks than other operations. The prioritisation of actions should be based on data, and the team urges EASA and the Members States to work together in order to collect and aggregate data at a European level.

The dataset that was taken by the team for the use of the roadmap was the **civil rotorcraft accident worldwide data from 2008 to 2017**. This dataset is large enough in order to extract statistically meaningful information.

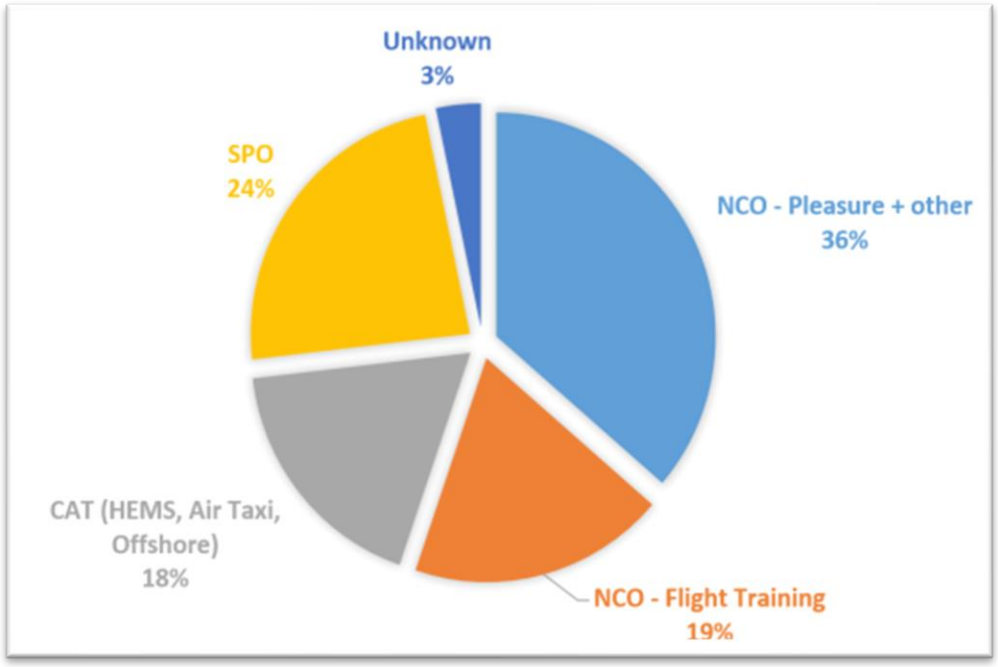


Figure 1 - Accidents Reported to the Agency 2008 - 2017 by Type of Operation[2]

Figure 1 provides information about the type of operation at the time of the accident, covering the period 2008 – 2017.

The current 10 most utilised types of helicopters flying in Europe are presented below. It can be seen that mainly light single engine types are used for a wide variety of operations, including aerial work and general aviation leisure.

R44	1 014
H125 / AS350	670
R22	611
H135 / EC135	379
Bell 206	357
Hughes 269	283
AW109	280
AS355	200
H120	200
H145 / EC145	136

Top 10 types on Europe.[3]

The focus of the roadmap will be on light rotorcraft (i.e. R22/R44, H125 / AS350 and H135 / EC135 and Bell 206). The offshore sector is a significant market in Europe, in particular for support to oil and gas platforms, and accidents in this sector usually have a high profile. Following a number of tragic accidents, several initiatives have been taken, and the community is striving to improve safety through HeliOffshore and other organisations. The offshore industry is mature and well advanced in terms of safety management systems (SMS) compared to other rotorcraft sectors. Therefore, it was decided to focus the roadmap on areas where the greater safety benefits could be realised.

[2] Source EASA. Average over the period 2007-2016
[3] Source FlightGlobal (aka Ascend) database.

At strategic level, there should be the opportunity to take benefit from work done in the frame of other strategic activities (such as the GA Roadmap) and connect the actions where appropriate. For example actions on aircraft conspicuity will be successful only when taken at a system wide level.

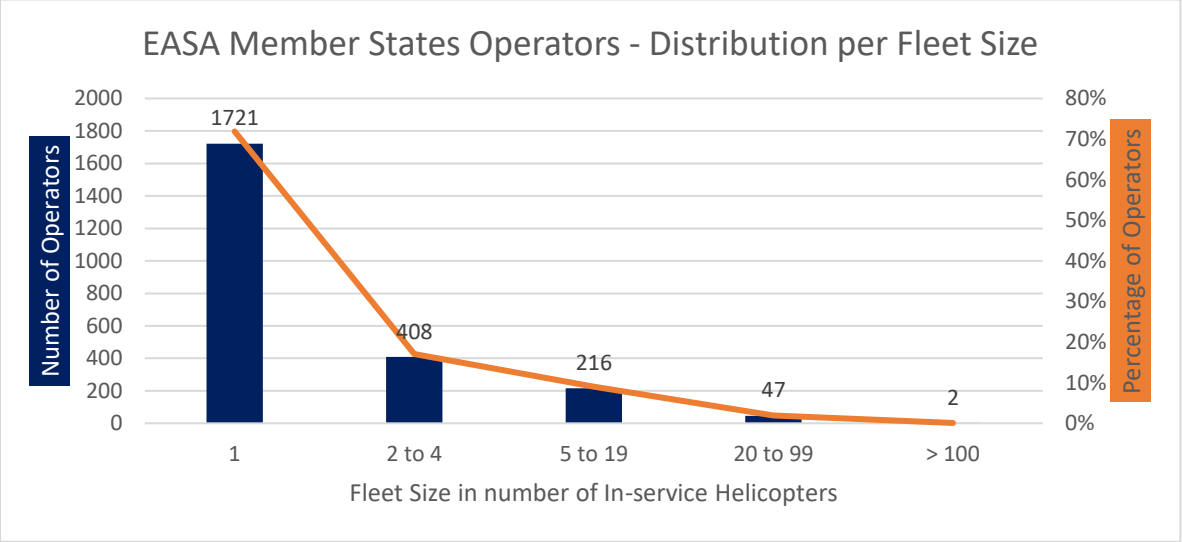


Figure 2 – Distribution of EASA MS Operators by fleet size of In-service Helicopters. Source: FlightGlobal (aka Ascend)

There are 1 721 operators in EASA Member States that only have one helicopter (representing 72% of the total number of EASA MS operators), and 2 025 operators with a fleet of less than 5 helicopters, and these together represent 89% of the total number of operators in EASA MSs. The distribution of operators in EASA Ss by the number of in-service helicopters shows that the fleet across the EASA MSs is fragmented. Data indicates that the efforts of the roadmap should be focused on working with and supporting **small operators**.

II Vision and strategic objectives

II.1 Vision

Achieving significant safety improvement for Rotorcraft with a growing and evolving aviation industry

The intent is to achieve the highest level of safety by focussing on appropriate initiatives that are prioritised to result in the greatest amount of improvement in rotorcraft safety. Whereas it was recognised that 0 accidents is the only acceptable target from an industry perspective, the team decided that such a target is not realistic, and the target of 0 accidents would only be achievable by having no rotorcraft flights.

The group decided to propose a vision that strives for improvements in safety in the existing rotorcraft fleets, and sets safety standards that are intended to make Europe the safest region in the world. Influencing behaviour is a long and complex process than can only be partially driven by regulatory actions. For aspects such as airworthiness, for which EASA is the competent authority, an ambitious goal would be to reduce the number of accidents caused primarily by technical failures by one order of magnitude. The EASA Executive Committee (ExCom) gave the objective to the team to 'develop a top-down strategic approach' to deliver this vision.

II.2 Strategic Objectives

The following strategic objectives were defined in order to deliver the vision:

Objective 1: Improve overall Rotorcraft safety by 50% within the next 10 years.

- Most of the accidents are attributed to operational causes, and it is recognised that influencing behaviour is a complex process in which changes are difficult to achieve in the short term. If we look more specifically at accidents that are caused by technical failures (which is a mall part of the overall accidents), an ambitious target is set to reduce the number of accidents caused primarily by technical failures by one order of magnitude.

Objective 2: Make positive and visible changes to the Rotorcraft safety trends within the next 5 years.

- This objective is pushing for quick implementation of key safety measures.

Objective 3: Develop performance-based and proportionate solutions that help to maintain competitiveness, leadership and the sustainability of European industry.

- This objective is also intended to consider the safety challenges and opportunities that come with new technology, and to support the development of new business models.

II.3 Safety performance indicators

A set of safety performance indicators or Key Performance Indicators (KPIs) is needed to be able to measure the success of the actions when they are implemented. A first indicator (1) will be used for

communication to the general public, and a more detailed set of indicators based on the European Risk Classification Scheme will be used to better assess the impact of the actions (2). In addition, a work-stream will be launched in order to tackle the systemic issue with data (3).

1. The number of Rotorcraft accidents in Europe with at least a fatality or a serious injury.

Although fatal accidents can be monitored with a high level of confidence in the completeness of the data, the fatal accidents are not fully representative of the overall risk levels. The team recommends using instead the number of serious injuries as a metric by which to measure the level of safety. The benchmark used for the Roadmap will be the number of Rotorcraft accidents in Europe with at least a fatality or a serious injury in 2017, including all types of EASA Operations. There were **25** occurrences in this category in 2017.

2. Additional KPIs based on the European Risk Classification Scheme (ERCS)

Expanding the scope to include non-fatal accidents and serious incidents improves the size of the available dataset, and addresses the societal concerns and the costs of serious accidents, which are usually underestimated.

However, the risk levels of accidents and serious incidents can vary widely. In some cases, an occurrence that was classified as a 'serious incident' was a higher risk than another occurrence that was classified as an 'accident'". To provide a better overview of the actual risk levels, performance will be monitored using the European Risk Classification Scheme (ERCS). This scheme identifies high risk occurrences independently from the ICAO Annex 13 definitions. This provides a more consistent measure of safety performance to determine the effectiveness of the Roadmap. As EASA now classifies all Accidents and Serious Incidents using the ERCS, and uses the classifications within the Annual Safety Review, this measure could be used to provide a more accurate measure of the risk of occurrence. Amber and Red occurrences from the ERCS matrix are used as indicators.

3. Data collection activity to provide a comprehensive safety intelligence picture for Rotorcraft

The data available on fatal accidents is generally of high quality, and the occurrence reporting regulation provides a framework for reporting occurrences. However, the lack of consolidated data on the number of rotorcraft operated in Europe and the number of flying hours makes it impossible to assess the level of safety. A work-stream should be initiated by EASA together with the OEMs in order to work on improving the collection of data, and to work towards expanding the Data4Safety initiative to Rotorcraft.

Data4Safety (D4S) is a data collection and analysis programme that is intended to collect and gather all the data that may support the management of safety risks at the European level. D4S is a collaborative partnership programme. This includes safety reports (or occurrences), flight data (i.e. data generated by the aircraft via the flight data recorders), surveillance data (air traffic data), and weather data, these being only a few types of data from a much longer list.

The objective is to obtain enough data to enable us to work on accident rates instead of on accident numbers.

This work-stream will engage with OEMs in collecting and aggregating flight hours and data on the number of cycles of their products, and will put in place a framework to exchange information with EASA in a manner which is mindful of personal data protection. In addition, the EASA/NAA Network and Analysis group will engage with the NAAs in order to facilitate the collection of fleet and flight hours from the NAAs.

Data work-stream

Objective: Data driven decisions
Actions:
- EASA to engage with Industry OEMs, Operators and NAAs to collect and consolidate exposure data and other relevant statistics.
- Establish Safety analysis capacity at European-level
- Introduce Rotorcraft in EASA D4S Initiative

Timelines:
- Safety Analysis Team for Rotorcraft definition of data needs
- Collection of initial dataset.
- Estimates of relevant statistics including number of flight hours available.
- Finalise a process and requirements in order to a collect and aggregate data at European level.

In order to facilitate and promote reporting, new ways to report data, such as automatic reporting, will be investigated. The last action of this work stream will look at encouraging the carriage of on-board recorders (when they are not already required by the regulations).

III Enablers

A number of proposed actions were collected from several sources and discussed by the team. The actions were then organised for the sake of clarity into coherent sets. The enablers are ways to 'Incentivise' Safety, and this includes several actions.

III.1 Create market incentives to push for Safety / Environmental improvements

The most important aspects that resulted from the discussions with stakeholders were the needs to find ways to 'Incentivise' Safety by using market forces. The operation of some types of rotorcraft may be authorised in terms of their airworthiness, but it not make sense in terms of business. Mechanisms to create incentives are used in a number of other industries such as the automotive and mobile phone industries. Operational limitations for rotorcraft that do not implement certain 'safety improvement actions' could be investigated. For example, a rotorcraft of an old design without crashworthy fuel tanks could still be allowed to operate, however, that type will not be authorised to commercially transport passengers.

Incentivising Safety

Objective: Quicker implementation of safety actions
Actions: Define way to incentivise Safety with regards to airworthiness and environmental standards. Develop an initial concept. Example such as Operational limitations linked to Safety level.

It is recognised that the current Part-21 Changed Product Rule does not cover the introduction of new technologies into older designs. The use of operational limitations could compensate for this in a proportionate manner. **A close integration between OPS and Airworthiness is a clear priority, and is a central element of the strategy for Rotorcraft**.

In addition, operational limitations could be introduced by using environment policies. Experience in the automotive industry shows that very few cars more of than 30 years old are still being driven. Strict operational limitations are put on cars that are not compliant with the latest environmental requirements. In some European cities, older cars are even prohibited from accessing the city centre.

Operational limitations based on noise are also going to be investigated. For example, above a certain limit of noise, operations over congested areas would not be allowed. These restrictions are already in force at a local level, but there is no consistent European approach. The New Basic Regulation is also for the first time opening this possibility.

Safety rating scheme: It is proposed to learn from the experience in other industries that have already put in place a safety rating classification, such as the EuroNCAP for cars. This mechanism could lead to safety enhancements both on the manufacturer's and the operator's side. On one hand, it is an effective way for manufacturers to identify improvement areas and focus on safety performance. On the other hand, this can be used as a valuable marketing tool that provides detailed data to operators on the safety characteristics of their rotorcraft.

The task will be to define the mechanisms to setup such scheme including the responsibilities and update of the criteria.

The intent is to encourage the decision makers who buy rotorcraft or purchasing helicopter based services to take advantage of advances in technology to install new safety equipment on their helicopters, through the establishment of a Rotorcraft Safety Rating Scheme to:

Rotorcraft Safety Rating

Objectives: Incentivise Safety by introducing an industry-led Rotorcraft Safety rating scheme.

Actions:

- Enable Operator and Customer to make informed decisions based on the safety performance of the product.
- Make a comparative review of the Schemes available in other industries. Define an initial concept with the intended objectives and framework.
- Progress the concept definition and engage with European Manufacturers. Identify the technologies granting safety benefits.
- Finalise a proposal for the introduction of a Rotorcraft Safety rating scheme to be presented to the wider industry. (Presentation at R.COM and Paper)

- Incentivise the renewal of fleets, and the use of up-to-date technology and equipment
- Encourage the use of safer rotorcraft
- Raise customer awareness regarding rotorcraft safety (i.e. safety promotion)
- Motivate designers to improve the overall safety-related performance of their helicopters beyond the CS requirements

III.2 EU Financial support for Safety action implementation

The European Union has a number of instruments to support the creation of an internal market and to support pan-European initiatives nationally. These funds support the EU strategy on research and innovation. Historically, the rotorcraft community has not benefited from these funds. Financial support would help operators, and in particular small operators and General aviation pilots, to introduce safety enhancing equipment or to carry out additional training. The example of the financial support provided to buy 8.33 kHz Radios and the financing of the PBN upgrades were mentioned. In this case, the Innovation and Networks Executive Agency (INEA) covered part of the costs of the equipment[4].

Enhancing the visibility and understanding of the various instruments available at the European level to provide financial support is a challenging exercise, and the Rotorcraft community needs to organise

[4] https://www.caa.co.uk/General-aviation/Aircraft-ownership-and-maintenance/8-33-kHz-funding-application/

itself to meet this challenge. Better networking between the main OEMs would help them to work together.

Institutional support: Try to find a way to provide financial support to implement changes. This type of financial support may be very useful when pushing for the installation of additional equipment to improve safety in light rotorcraft. The industry should approach the various organisations in a coordinated manner and make a case for financial support for rotorcraft.

Make the case for Rotorcraft: The team discussed how to make the case for the rotorcraft community when it is competing for funding against other modes of transport and much larger industries. Together with industry, we should try to influence research priorities to allocate an increasing amount of research funding to vertical take-off and landing operations. EC funded projects and involvement in the Horizon 2020 Work Programme are also enablers for larger scale projects with possible EASA participation. Some national authorities and other national entities (such as the German Ministry of Economic Affairs) are funding research, or have the capacity to perform aviation related research.

Financial support for Safety

Objective: Quicker implementation of Safety actions. Find a way to provide financial support to implement changes.

Timeline:

- Create a helicopter Safety case at EC and Member states using one voice
- Select the potential equipment/technologies for which support would be needed
- Define the appropriate Business Case
- Start engaging with the relevant stakeholders.
- Rotorcraft voice pushing for Safety" heard.

Research: Establish contact with the Association of European Research Establishments in Aeronautics (EREA), UFO, Onera and CAA UK. Some universities have developed high-levels of competence in aviation. It is recommended to identify the universities with which cooperation could be established on rotorcraft, and engage in discussions with them. EASA should develop a partnership with universities who are specialised in aviation, and in particular, in rotorcraft.

III.3 Training in flight

Training is seen as a risk area, and also as an opportunity. A large number of the in-flight accidents happen during training. The team proposed ways to increase the volume of training provided, while also reducing the risks associated with it. For example, training on full autorotation is provided on a daily basis for less experienced pilots and for those who fly less forgiving rotorcraft. Some of lighter rotorcraft have low rotor inertia, which also make this type of training more risky. Some training scenarios are known to carry a high level of risk. For example, training for a loss of hydraulic power in flight on some rotorcraft is a difficult case. It could be argued that the risks taken in training are higher than the actual risks that are faced in operation. A review of the most critical training scenarios should be performed. If the risk of training for a particular failure situation is higher than the risk of suffering that failure in operation, then that in-flight training scenario should be reduced, and the training should be conducted instead on simulators. This analysis should focus on the most common types of rotorcraft that are used for basic training.

Reduce high-risk training scenarios in flight

EASA and the NAAs should take action to strongly limit the risks during flight training by taking action on the airworthiness side, in particular on single hydraulic system light rotorcraft, and on reviewing the training scenarios. Simulation should be more widely used to rehearse At-Risk scenarios. The use of simulators should be promoted for high-risk training scenarios. Part of this activity will be the review for applicability in Europe, and consider the recommendations from the International helicopter safety team and ESPN-R: Promote the Teaching of Threat and Error Management, Incorporate Progressive Approaches to Autorotation Training, Develop Standard Training on Autorotation and Emergency Aircraft Handling, Improve Make & Model Transition Training, Develop Recommended Practices for Students Regarding Pre-Flight Risk Assessments.

Training Safety work-stream

Objectives: Better safety awareness
Actions:

- Introduce a Mandatory Safety Awareness in recurrent training
- Review Regulations to promote less checking more training
- Reduce high-risk training scenarios in flight
- EASA to raise awareness on the risks of some training scenarios
- EASA to review the timeline associated to the RMT.0194 Modernise the European pilot training system.
- Align the licensing recurrent requirements for rotorcraft with the one for GA fixed wing.

Timeline:

- Produce Safety promotion material (e.g video) for recurrent training
- Implement the necessary regulatory changes (in the frame of the RMT.0599)

The group recommends EASA to increase the priority given to the RMT.0194 Modernise the European pilot training system and improve the supply of competent flight instructors and in particular the extension the principles of threat and error management (TEM) to all licences and ratings, as applicable.

The EASA system of having individual type ratings for helicopters, and the subsequent training and checking, does not seem to produce the expected safety effects/benefits, and it is not economically justifiable. This will be part of the overall evaluation of the EASA Rules to be performed under work-stream on simplification.

Some parts of the pilot community are difficult to reach though safety promotion actions such as Safety events or brochures. Pilots have to go through recurrent training, and instructors are the best people to pass on safety messages. Type ratings and the recurrent training and checking of pilots should be reconsidered so that there is 'Less checking and more training'. It is recommended to introduce a mandatory Safety Awareness element into recurrent training for pilots. Combine Operational Proficiency Checks (OPCs) and training with a flight instructor instead of the actual

Less checking more training

required training and checking. Conduct flight reviews with a qualified flight instructor instead of license proficiency checks (LPC) with examiners (see FAA FAR Section 61.56). The goal is to have periodic assessments of flying skills, with proficiency evaluations, and to enhance the learning experience of pilots. The benefit will be to tailor each review to the individual pilot and their competency. This would also solve the existing issues with the current LPC/examiner system.

III.4 New training devices and simulators

Simulators have proven to be an effective, safe, and affordable means to provide pilots with experience. The use of new training devices and simulators is the most promising action in terms of its potential to improve safety.

Develop an innovative approach for training devices: The aim will be to enable the use of affordable training devices, and to give associated credit for crew licensing for Rotorcraft GA types for specific dangerous manoeuvres that are currently performed in flight.

This approach includes a paradigm shift to focus on training scenarios and on operational training. The aim is to make training more efficient: training should not be limited to a set of emergencies as is generally the case at present, but instead to simulate more complete and realistic scenarios to fully immerse trainees in their daily operational environments (EMS, SAR, aerial works, …). Artificial Intelligence could be also used to animate virtual entities and to provide more realistic training scenarios.

Training Devices work-stream

Objective: Enable to development of new and more affordable training Devices for helicopters

Objectives:

- Encourage the development of new types of training devices to better address light and medium helicopters in operation
- Paradigm shift to focus on the training scenario and on operational training
- Put in place credit (for LAPL) and increase credit for the use of new training devices
- Perform a training needs analysis and define the training capacities and limitations for each types of training devices
- Develop Mission Specific training recommendations and best practices

The main actions will be to remove regulatory blockages in CS FSTD for the use of advanced technologies and new types of simulators which are not yet considered by the standard (the standard is limited today to FFS, FTD and FNPT, and only these training devices can provide training credit). Work should include the relation with EBT tasks (RMT.599).

Encourage the development of new types of simulators to better address light and medium helicopters such as the R22/R44, H125 / AS350, Cabri G2, Bell 206 and the Hughes 269.

For the types having already simulators, encourage the increase of numbers.

New types of simulators based on new technologies such as Virtual Reality and Augmented Reality reduce the cost of the hardware and improve the immersion of the trainee in the simulation. Reconfigurable simulators can reuse the same hardware for different types of helicopters: simplified cockpits based on touchscreens can be a solution.

Perform a training needs analysis and define the training capacities and limitations for each type of simulator (in particular for new types of simulators which integrate new technologies). Once the training objectives are determined, provide guidance to optimize the use of the current training devices/tools or the new types of simulators.

Improve the access to simulation either by distributing lower cost simulators in small ATOs or operators, or by providing remote access to simulation via the Cloud. Develop or encourage a new 'Cloud simulation' approach for training which doesn't require complex or specific hardware (for example for avionic trainers or other desktop trainers).

Provide new capacities in simulators to better assess the performance of the trainees and to improve the efficiency of the training in relation to the EBT requirements. This trainee assessment could include additional human behaviour monitoring to assess the behaviour of the trainee during the training scenario (e.g. their levels of stress, levels of attention, consistency of trainee reactions to the scenarios, etc …). This can use new technologies such as Artificial Intelligence to adapt the training in function of the experience.

It is recommended to remove barriers in the CS FSTD and AMCs to introduce new technologies and put in place credit for the use of new means of simulation.

Develop groups/classes of types with respect to type ratings, and organise familiarisation training for types within a group or class.

III.5 Continued Aviation Education (CAE)

Accidents usually happen due to a combination of failures of several layers of safety defence. The pilots act as 'the last line of safety defence', so they are usually the main focus in the investigations of such adverse events. In addition, supervisors, nominated persons (e.g. NPFOs, NPCAs etc.) and the accountable managers (AMs) must be considered, as they have to be able to create an environment for safe operations, which includes maintenance and quality assurance.

For all these stakeholders, very few requirements currently exist for continued aviation education (CAE) that promotes safety. This can even lead to a lack of awareness of the state-of-the-art safety measures, and of the current regulations.

Continued Aviation Education
Objectives: Develop the concept Continued Aviation Education using experience from the continued medical education (CME) for Accountable Managers, Nominated Personnel, Pilots, Instructors, Examiners/Inspectors, and maintenance staff.

Besides these deficiencies in the supervisory layer, there are also deficiencies in safety promotion for general aviation (GA) pilots. These pilots only have to maintain a small number (2) of flight hours, including one check flight every 12 months. For fixed-wing GA pilots SEPL, it is 12 hours.

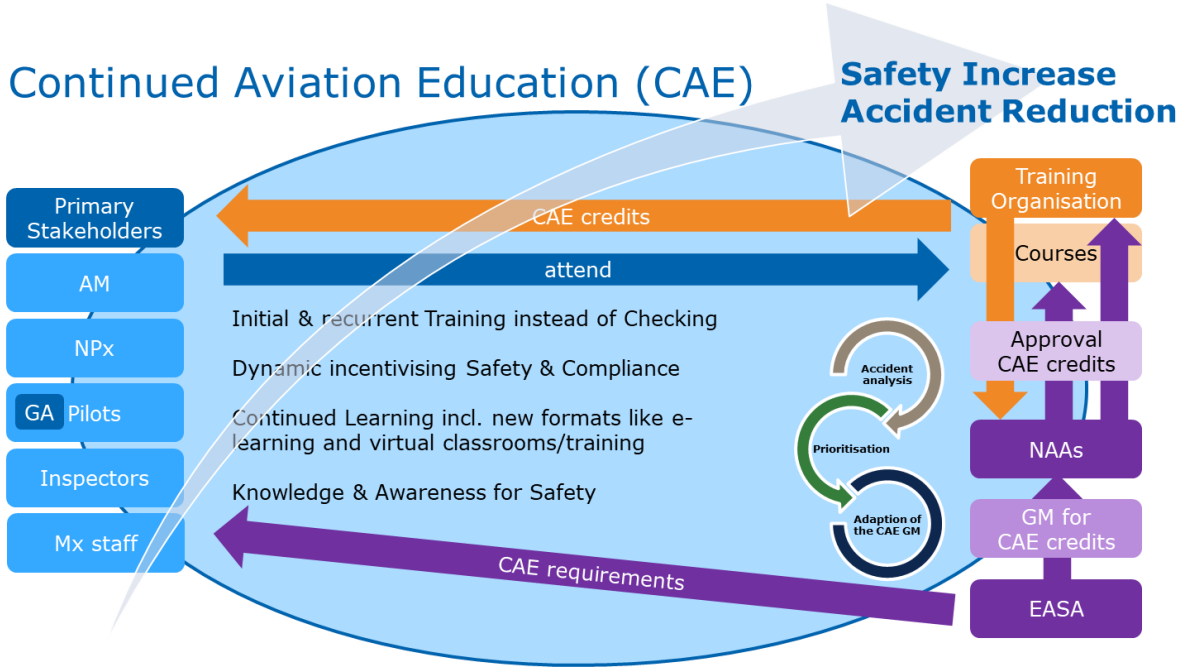
Safety can only be enhanced in a holistic approach by pilots, supervisors, operators, associations and the regulator. All these required stakeholders must be involved in an overall regulatory requirement for continued aviation education.

To overcome this problem, a dynamic system for continued aviation education (CAE), with a certain minimum number of credits per year/term for all stakeholders, would be a powerful tool. In a credit-based system, EASA could pro-actively incentivise the necessary continued training topics and the respective credit value that the various stakeholders could achieve after successfully attending a certified course. The already existing regulatory training requirements can be easily and smoothly included in such a system. In addition, A CAE system would be also capable of reacting very quickly to new safety challenges, and easily addressing the ideal target group by amending the topics that are studied and the amount of credit given to the various stakeholders.

The CAE initiative could be introduced in the same way that continued medical education (CME) has been established in Europe — also could achieve the same safety and quality benefits. Due to the dynamic nature of the system, EASA can steer the training according to the current and also the future safety needs.

The ambition will be to **require mandatory training for management personnel**. Currently the qualification requirements for management personnel (accountable managers, NPFOs, NPCTs etc.) are stated in guidance material (GM). No mandatory recurrent training of management personnel is foreseen. Oversight actions by NAAs have shown that there is plenty of room for improvement in the competence of management personnel. Especially for small operators, it is a challenge to find competent management personnel and to maintain their competence of these.

This work-stream will further develop the concept of Continued Aviation Education using experience from the continued medical education (CME) scheme. A system for management personnel should be evaluated that is similar to the system for medical practitioners. A certain number of classes with specific training objectives should be required. As in the medical field, where specific courses are valued with points, a similar system could also be applied to the training of management personnel.



III.6 Strategic safety partnerships, Safety promotion and communication

Communication and Safety Promotion are powerful means to raise awareness, to change behaviours and enhance safety. Public statements and promotional material produced by Authorities and high-profile organisations (influencers) have a significant impact on the wider aviation community. For example, the Roadmap team mentioned that an EASA Safety Information Bulletin (which is a non-binding safety instrument) influences the target audience (pilots and other personnel, operators, insurers, etc.) without creating any regulatory obligations. EASA should develop an understanding of how public statements can be used, what the legal implications are, and define the necessary internal procedures. EASA Communication and Safety Promotion should be used, where appropriate, to replace or accompany regulatory actions. As part of this, EASA should ensure that the potential legal implications of this are fully understood.

Another key aspect of Safety Promotion is the need to reinforce the existing Strategic Safety Partnerships, which bring together rotorcraft stakeholders and create synergies across the community both in Europe and worldwide. The International Helicopter Safety Team (IHST) brings together the various regional safety initiatives at global level including the European Safety Promotion Network Rotorcraft (ESPN-R), established by the R.COM in 2017 as a successor to the European Helicopter Safety Team (EHEST) that was closed in 2016. It is recommended to further develop cooperation with the IHST to exchange data on subjects of common interest, and to reinforce the ESPN-R, which needs more recognition and support.

Within the new EASA Safety Promotion Strategy, the strengthening of these collaborative activities is already envisaged with EASA taking a much stronger leadership role in the ESPN-R.

Safety Promotion

Objectives: Communicate effectively on safety topics in order to change behaviours in a sustainable way.

Timeline: Develop an annual Rotorcraft Safety Promotion Plan together with stakeholders. Implement the agreed Rotorcraft Safety Promotion Plan.

Safety Promotion is a powerful instrument to improve operational safety, in particular for light rotorcraft, where the most common contributing factors to accidents are mainly of an operational nature. The EASA Safety Promotion Strategy aims to reach out and raise awareness to influence safety behaviours. The Strategy is fully adapted to a wide variety of target audiences, including small operators and General Aviation. EASA's Safety Promotion activity will be carried out using the "*Safety Together*!" brand, under which there will be a specific Rotorcraft Domain so that promotion in this area can be targeted specifically to the needs of that community. EASA will be one of the key Rotorcraft Safety Promotion leaders and will coordinate with stakeholders within the ESPN-R as well as with IHST. There is much more benefit to be gained from the coordinated development and launch of safety promotion material and key messages than can be achieved through each organisation alone.

The Roadmap will be a strong driver for the Rotorcraft section of the European Plan for Aviation Safety (EPAS) and specifically the Safety Promotion actions contained within it. ESPN-R will contribute to developing and implementing the EPAS Rotorcraft Safety Promotion actions, and also to disseminating to distributing and promoting deliverables.

The Rotorcraft Safety Promotion Plan will focus on the high priority risk factors identified in the Safety Risk Portfolios that are derived from the analysis of safety data. This Safety Promotion Plan includes, as a minimum, the following subjects and more will be included as further needs are identified: Inadvertent entry into IMC, Decision making, Over-confidence and complacency, Airmanship and Pre-flight planning.

As part of the Rotorcraft Roadmap, EASA will launch specific Safety Promotion work on Rotorcraft GA leisure flights, to increase outreach and better engage with this specific community. The campaign will capitalise on the existing material and actions, building, for instance, on the Helicopter Association International (HAI) "Land and Live" and "go local" campaign, and will focus on decision-making and inadvertent entry into IMC (Degraded Visual Environment and Aircraft Upset/ LOC-I). Another aspect related to communication is a recommendation to EASA to improve its outreach and communicate activities at important conferences and events to provide the industry with a better awareness of Safety Topics and also to give more visibility regarding the direction of future EASA policies. This will help industry to shape their long term planning accordingly, and enable early investment in solutions where needed.

III.7 Simplify and reduce administrative burdens for operators

Identify and reduce administrative burdens on operators: it is proposed to create a group with representation from ops and maintenance to review the Regulations and identify the main sources of inefficiencies and administrative burdens. Unnecessary administrative burdens on the operators that do not improve safety should be identified and reviewed together by the NAAs and EASA. The objective will be to reduce the administrative burden on operators so that they can concentrate on safety-related tasks, and to secure their buy-in for other measures.

Recommendation on easy access to Rules: eRules is a convenient way to present Regulations, AMCs, and related materials in one single consolidated document. EASA has published Easy Access Rules (eRules) on some of the various domains that fall under EASA's scope, such as Gliders or Balloons, providing a consolidated, easy-to-read format for the applicable Implementing Rules (IRs), Applicable Means of Compliance (AMC) and Guidance Material (GM). It is proposed to publish a set of eRules for Rotorcraft, covering OPS, Air Crew (FCL) and SERA with everything that a pilot needs to know. This could be further divided into VFR and IFR sections. This action is of particular benefit for Rotorcraft, as most of the operators are small organisations.

Simplify work-stream

Objective: Better use of resources
Objectives: Perform an evaluation and address the unnecessary administrative burden put on operators.
Timeline: EASA to perform an Evaluation of the Rotorcraft rules. A sub task will look at having individual type ratings for helicopters.

Regulatory partnership between EASA and the National Aviation Authorities (NAAs): EASA should leverage knowledge and experience of the NAAs, and their closeness to the field of use, so as to share good practices and exchange information between the authorities. Some NAAs could develop focussed expertise that can be leveraged. One example is the expertise of the UK CAA and CAA Norway with oil and gas offshore operations. We should build such frameworks to enable us to leverage the knowledge and experience of the NAAs.

This cooperation will also help to bridge the gaps between the reporting schemes for Airworthiness and the one for operations. The EASA/NAAs Helicopter Offshore Coordination group is a voluntary initiative from the EASA Rotorcraft Department, which aims to facilitate the coordination and exchange of information with the participating NAAs on rotorcraft issues that are specific to offshore operations. The current reporting schemes lead NAAs to manage the occurrences of their operators and EASA to take care of airworthiness related occurrences through the Part 21 reporting obligations placed on Type Certificate holders. There is currently no systematic feedback loop for NAAs to gain visibility of important airworthiness actions that are progressed at the EASA level, while EASA may benefit from more awareness of certain operational issues. This means that EASA and the NAAs may see different sides of similar issues. In addition, some NAAs are more exposed than others to offshore operations, and have developed specific expertise that could be valuable to share with the other NAAs and EASA. In this context, bridging the communication and information gaps requires a joint coordinated effort, for which a dedicated collaborative exchange forum should be established to focus on the most significant issues of the moment, which may be related to airworthiness, OPS, maintenance or training topics.

International Cooperation: promote the European system worldwide, and support European industry in achieving this objective. The markets in China and India are likely to grow in the coming years.

III.8 Design and maintenance

As a general policy, design objectives should be segmented into the types of operations. For Rotorcraft commercial air transport operations, the target should be to achieve the same level of safety as with

fixed wing large commercial aeroplanes. This not only implies maintaining the current level of safety, but also finding ways to further improve the safety of rotorcraft operations.

Regulatory actions have been initiated in order to increase the number of flying rotorcraft that are fitted with crashworthy fuel tanks and crashworthy seats. In parallel with the regulatory actions, we should publish joint authority/industry statements on this subject.

Regarding maintenance, the priority for actions will be on CAMOs in emerging countries, on the training of engineers, and the use of simulation in maintenance training.

OEMs to present **product specific safety improvement roadmap** to EASA: EASA to review and challenge. For crashworthy fuel tanks, seats and bird strikes, this should be aligned with the ARAC recommendations.

Helicopter Design improvement

Objective: Improve design
Objectives:

- Reduce the number of rotorcraft flying in Europe without crashworthy fuel tanks and seats.
- OEMs to develop and deliver to EASA product specific safety improvement roadmap
- Develop Safety Continuum in Rotorcraft

For new products: the grandfathering of rules needs to be carefully considered: for OEMs, the current changed product rules enable rotorcraft that are derivatives from older models to maintain the use of the original type certification basis. The FAA study showed that for the requirement for crash worthiness fuel tanks that was introduced in 1994, only a minority of the rotorcraft flying in the US are currently compliant. EASA, together with its partners, should try to address this issue.

Principles: **proportionality** and consideration of operations in our policies. Offshore, HEMS, non-commercial operations with complex motor-powered aircraft (NCC), Aerial Work and VIP operations all have different operational constraints, and the expectations from the respective communities are different. Proportionality and the types of operations should be considered in the definition of the overall safety target.

III.9 Net Safety benefit

A system or piece of equipment must comply with all the relevant certification requirements before it can be installed. In older helicopters, new equipment could provide additional safety benefits compared with the previous equipment. This positive contribution is not currently considered in certification policies, which makes the installation of new equipment more difficult. The operational safety benefits of these new features is so large that their availability is a compelling argument for putting them into service, as has already been seen in other transport sectors (e.g. automotive).

Since the development, certification and introduction of these safety features all have cost impacts for the stakeholders, a cost-benefit analysis should be conducted to assess the best combinations that should be pursued, using a proper scoring system. This should form the basis of any implementation initiative. A method will be defined to scrutinize the barriers to defining a scoring system.

The final ranking of the design features will be then complemented with an estimation of their implementation costs, and an estimation of their ‘retrofittability’.

This will be intended to provide a measurable and verifiable method to drive implementation policies and incentives for these features, which would also lead to operational restrictions being placed on older aircraft if necessary. Since system failures and malfunctions remain high in the list of priorities, this method could also be used to drive the priorities for changes to basic systems.

Net Safety Benefit

Objective: New Technologies for forward fit and retrofit
Objectives:

- EASA to establish a policy on the net safety benefit approach and to facilitate the introduction of new technology (in coordination with the GA Roadmap),
- Define the process to identify the systems and equipment providing safety benefits

Timeline:

- As part of RMT.0727 "Part 21 — simple and proportionate rules for GA" introduce the requirements.

The NLR published a study on 'the Potential of Technologies to Mitigate Helicopter Accident Factors'. The report stated that technology provides a variety of solutions that can (directly or indirectly) address the identified safety issues and contribute to preventing various types of accidents, or to increasing survivability in accidents. This report presents an update regarding the status of the identified 'highly promising' helicopter technologies. Some of these are listed below:

- Autopilots for improved stability,
- Wire Strike Protection Systems (WSPSs)
- Helicopter Terrain Awareness and Warning Systems (HTAWS) and detailed obstacle data bases with near-real time obstacle updates,
- Connectivity (access to open-world data such as weather or other real-time data during flight, …) to improve flight safety,
- Synthetic Vision Systems (SVSs) , Head Up (including head mounted displays) or Head Down Displays for situation awareness with regards to terrain and obstacles,
- Laser radar or other technologies for obstacle and terrain avoidance systems (Proximity Warning Systems)
- Miniature Cockpit Voice and Flight Data Recorders (CVFDRs)
- Full Authority Digital Engine Controllers (FADECs),
- Helicopter Flight Data Monitoring Programme (HFDM) systems including light helicopters.

The introduction of these new technologies into light rotorcraft will be facilitated by the introduction of proportionality into CS 27.1309.

III.10 Operations and Safety Management (including Safety culture)

To encourage the development of a positive safety culture across the board will be a key element in improving safety. The operational focus will be on airmanship, the sharing of information, and just culture.

Safety culture for accountable managers: accountable managers take responsibility for a number of activities, and would benefit from more exposure to recent regulatory changes and/or good safety

management practices in the industry. The team proposed the creation of dedicated mandatory initial and recurrent training for accountable managers and nominated post holders.

Losses of control due to inadvertent entry into IMC: Create a more proportionate training path for pilots to gain instrument flying qualifications. With better access to IFR flying, GA pilots would be able to perform flights with more confidence in safely completing them. Before the publication of the Opinion on 'Easier access for general aviation pilots to instrument flight rules flying' (**RMT.0677**), or as a follow-up task, EASA should evaluate and extend the scope of its application to rotorcraft. This task is currently limited to pilots that fly typical single- and multi-engine piston GA aeroplanes in non-commercial operations.

SMS for small operators: facilitate the implementation of safety management systems (SMS) for small operators by providing good practices. There should be a pool of NAA/Industry OPS experts to support small operators and create competency clusters.

The group recommends to promote the benefits of HFDM. The results of the HFDM analysis is feeding into the SMS of operators.

The group recommends to promote App-based pre-flight safety assessment checklist.

In the certification and oversight domains, transitioning from a compliance culture to a safety culture: compliance sets the minimum bar to enter the market. Moving towards more performance-based regulations will drive a discussion on the trade-offs involved. Compliance is not sufficient in some cases. In some other cases, safety benefits could be gained from the use of systems that do not fully meet all the certification requirements.

III.11Encourage and facilitate new technology development

One element of the strategy is to encourage and facilitate the introduction of new technologies in rotorcraft. This can be done by promoting the use of technologies that are already available in other industries, and finding ways to facilitate their installation in rotorcraft. Emerging technologies are now at levels of maturity than they can be introduced into the aviation sector. There are significant operational and safety benefits to be drawn from installing new technologies.

Keep Certification Specifications up to date: This includes evaluating the necessary shift towards a more performance and risk-based approach to safety regulations that reflects technological and market developments. GAMA/ASD made a proposal to modernise CS-27 and CS-29. The FAA and EASA agreed to develop coordinated roadmaps for improving and modernizing CS/Part 27 based on a building block approach. The intent is not to go for a complete rewrite all at once, but instead to have a phased incremental rulemaking approach. The focus of the roadmap should be on CS/Part 27, however, where identical requirements exist in CS/Part 29, improvements of CS/Part 29 will be considered on a case-by-case basis. A prioritization of rulemaking activities that leverages the rulemaking capabilities of both authorities will be considered in the roadmaps. The modernization of the regulations also requires revisions and updates to be made to the associated guidance material (ACs, AMCs or other guidance material). These changes will involve the development of new industry consensus standards, the utilization of existing guidance material, or the need to update the existing guidance material. This will require a commitment from the rotorcraft industry to support the development of any consensus standards.

CS Modernisation
Objectives: Setup up a project team to work with the industry on the modernisation of the CSs **Timeline:** Coordinated roadmaps for Improving and Modernizing CS/Part 27

Digitalisation: The rotorcraft community is moving towards digitalisation. This technology brings new opportunities, but also new risks that need to be understood and mitigated. EASA should develop its understanding of the rotorcraft industry's approach to digitalisation, which is in line with EASA's Digitalisation Roadmap. In practical terms, EASA should:

- Facilitate the access to and the correct use of reliable real-time weather and traffic information on board,
- Open data and collaborative platforms: assess the feasibility of developing a common European dynamic and collaborative obstacle database for rotorcraft.

IV Conclusion

There is a window of opportunity to initiate an ambitious European initiative aimed at improving rotorcraft safety. The focus has to be on light rotorcraft and small operators. It is expected that the implementation of the above actions will deliver the expected safety improvements and assist the industry in making the transition.

This roadmap was developed in 7 months on the basis of inputs provided by a group of external experts, and on EASA internal feedback. This roadmap was handed over on the 22 November 2018 to Patrick Ky and the Chair of the EASA Management Board.

The Agency will engage with NAAs and industry in order to deliver to implement the actions for each of the work-streams and deliver the safety improvements. The progress will be reported on a regular basis to the Stakeholder through the Rotorcraft Committee (R.COM) and Member State advisory body and publicly during the annual EASA Rotorcraft Symposium.