From ETOPS to Helicopter EHOPS
The way forward

EASA 11th Rotorcraft Symposium

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Helicopter operations have come under scrutiny due their safety record that is lagging behind the equivalent for fixed wing operations.

Although in many regards there are specific peculiarities behind this, complacency on this situation cannot be an acceptable answer in particular where effective and affordable solutions are available for many key aspects.

What we propose in the next slides is an approach to challenge the current status.

Every year the EASA Annual Safety Review stipulates the risks associated with helicopter operations by means of a Safety Risk Portfolio. This includes rotorcraft.

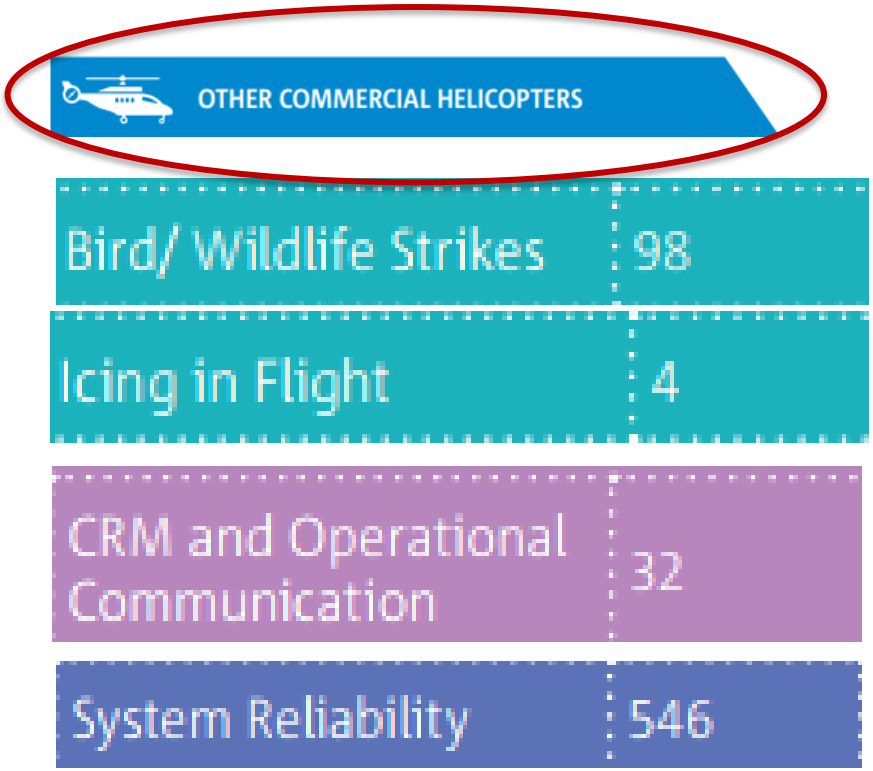
Risks vary depending on the geographical area and environment, type of operation, class, etc. They are made visible by looking at the occurrences already reported. A time interval spanning across many years provides an idea of the cumulative risk representing a precious piece of information.

Some examples..

OFFSHORE

Bird/ Wildlife Strikes	44
Icing in Flight	7
CRM and Operational Communication	59
System Reliability	1 659

Some other examples..



The same analysis is performed by a number of other organizations providing a full picture of the challenge.

By digging deeper and deeper two main points can be made:

1. BAD NEWS: There is a serious gap between the criteria we follow in our Airworthiness certifications and the way the helicopters are used which are tied to Operational rules.

2. GOOD NEWS: There is success story helping us to tackle our problem where a high risk scenario linked to commercial flights over the Ocean was addressed in 1985 by introducing **E**xtended **T**win Engine **O**peration**s** then extended to multi-engine ops in general over hostile environments

Hence we have focussed in an effort to set up a similar approach that we have named Extended range Helicopter Operations or EHOPS.

STARTING POINT

- AMC 20-6 Extended Range Operation with Two-Engine Aeroplanes - ETOPS Certification and Operation

WHAT DOES IT COVER?

We can map the AMC 20-6 with the aim the identify the topics of interest:

1. System requirements and design
2. Safety Requirements for ETOPS Operation
3. Maintenance Requirements for ETOPS Operation
4. RFM Procedures for ETOPS Operation
5. MMEL/MEL for ETOPS Operation
6. Human Factors & Operational Aspects
7. Training Aspects

SYSTEM REQUIREMENTS AND DESIGN (1/4)

AMC 20-6 introduced ETOPS Significant Systems:

"*ETOPS Significant System means the aircraft propulsion system and any other aircraft systems whose failure could adversely affect the safety of an ETOPS flight, or whose functioning is important to continued safe flight and landing during an rotorcraft diversion".*

They are divided in:

Group 1 where there is a dependency of the SS from the number of engines.

Group 2 where there is no dependency.

As a matter of fact there is no obstacle in doing it for EHOPS whereas data are available in Safety Assessments that can be tailored accordingly.

SYSTEM REQUIREMENTS AND DESIGN (2/4)

We can look at systems and their performance differently within this new framework.

Moreover the analysis can point to some requirements and safety barriers specific to a peculiar EHOPS (e.g. Ice Protection and associated SS are relevant above a certain latitude)

NOTE:

Specific requirements can be grouped in a dedicated Appendix to CS (equivalent to IFR requirements, Icing etc.) or they can be added on top of the basic certification requirements potentially as part of Operational Requirements……

SYSTEM REQUIREMENTS AND DESIGN (3/4)

All aircraft systems,

Rotorcraft Flight Manual Normal and Emergency Procedures

Rotorcraft Flight Manual Limitations/ Performances

Safety Provisions embedded in the design

Etc.

can be analyzed with these new criteria establishing the best way to minimize the identified risks.

Let’s make a cross check with what we have available today..

SYSTEM REQUIREMENTS AND DESIGN (4/4)

Risks associated with:

Engine failures → Cat. A Performance is already available

Drive System failures → Dry run capability demonstrated by test is already there, Damage Tolerance on all rotating parts is now a reality

Bird Strikes→ Bird strike Resistance including Threat assessment at System Level is a reality

Lightning Strikes → Latest more thorough protection has been demonstrated

Fatigue induced failures → Damage Tolerance is now applied all over.

Icing → Full or Limited Icing Protection System are already there

Crash and post crash fires → Latest rules have been applied for years

Collisions → HTAWS, TCAS, automations are already a reality

In general, technology and solutions are already available..

SAFETY REQUIREMENTS FOR ETOPS OPERATION (1/2)

The objective is to identify provisions to reduce the likelihood of failures that would result in a diversion and then consider, should a failure occur, how to manage the risk exposure during the diversion to meet a prescribed safety target or find a safer place to perform a ditching. The following aspects can therefore be considered. For example:

1. EHOPS should be included in the list of Operations/Flight Conditions to be assessed as part of the “traditional” XX.1309 Safety Process
2. Cumulative Probability of Occurrence per FH for all the Hazardous Failure Conditions resulting in a ditching can be established thus requiring a specific assessment of those failures leading to a “Land Immediately” RFM instruction (Mission Related Safety Target);
3. Diversion Time requirements for Engine and any other significant system can be evaluated and included as a specific requirement

NOTE: Diversion Time acceptable for helicopters to be identified considering also the operational evironment (Sea Vs, hostile environment) and type of operation (Off-shore Vs. SAR)

SAFETY REQUIREMENTS FOR ETOPS OPERATION (2/2)

However, typical helicopter Rotor and Rotor Drive System designs, which are addressed by 29.547(b) and 29.917(b), have hundreds of single Hazardous and Catastrophic failure modes which would not be able to benefit from the EHOPS approach.

The application of EHOPS principles to these systems would not be possible without radically changing the design architecture of the helicopter (i.e. to multiple redundant rotor designs):

→ application of ETOPS principles to Rotor-drive systems, may, therefore, be managed, by imposing Design Assessment requirement while proper consideration should also be given to possible means to provide health and usage monitoring.

MAINTENANCE REQUIREMENTS FOR EHOPS OPERATION

In addition to the “traditional” Maintenance requirements:

EHOPS maintenance tasks & intervals should be evaluated and identified as necessary in order to achieve the necessary levels of reliability, to control various aspects of the aircraft design and to achieve the reliability / capability required for the target EHOPS duration.

This approach is mainly intended for helicopter systems which are subject to 29.901(c) and 29.1309.

RFM PROCEDURES FOR EHOPS OPERATION

In addition to the “traditional” RFM procedures:

Specific EHOPS flight procedures necessary to attain the safety objectives should be evaluated and identified as necessary.

This requires a new mindset. For example this means that ditching is not always an option and the use of all available resources and procedures should be aimed at avoiding the need for it in an emergency.

MMEL/MEL FOR ETOPS OPERATION

In addition to the “traditional” MMEL/MEL:

Specific EEHOPS MMEL/MEL necessary to attain the safety objectives should be evaluated and identified as necessary

HUMAN FACTORS & OPERATIONAL ASPECTS

The following aspects should be addressed:

1. Availability of dedicated RFM procedures;
2. Specific Crew Resource Management (CRM) topics;
3. Flight planning and dispatch program appropriate to EHOPS;
4. Availability of meteorological information of the EHOPS routes to be flown;
5. Availability of MEL appropriate to EHOPS;
6. Flight crew and dispatch personnel familiar with the EHOPS routes to be flown;
7. experience of flight crews, continuing airworthiness personnel with EHOPS operation;

FCOM specifically developed for ETOPS

TRAINING ASPECTS

The following aspects should be addressed:

Initial and recurrent training and qualification program for EHOPS related personnel, including flight crew and all other operations personnel.

Training should include: Flight planning and Dispatch Considerations, Flight performance progress monitoring , Diversion Procedures and Diversion ‘decision making’., Navigation and communication systems, including appropriate flight management devices in degraded modes, Fuel Management with degraded systems, Area of Operation , etc.

CONCLUSION

It can be done…
The EHOPS concept can be applied to helicopters thus improving the safety of operations of helicopters in high risk environments like over water or hostile environments

Considering helicopter design it is possible to identify systems similar to those of ETOPS Significant Systems for fixed wing aircraft.

This approach allows the identification of a minimum time period for these systems to continue operation in the event of a malfunction, thus providing sufficient time to make a safe landing rather than a ditching.

Specific requirements for Rotor and Rotor Drive Systems (e.g. DRY-RUN Capability) combined with rotors and transmission design assessments, monitoring systems and, as a last ditch, still the capability to performed a controlled landing into water (a huge difference with respect to PART 25) is a way forward to improve safety.

THANK **YOU** FOR YOUR ATTENTION

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