MASTER MINIMUM EQUIPMENT LIST (MMEL) / ENGINE TIME LIMITED DISPATCH (TLD) ON HELICOPTER

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Abstract
The certification regulations published by Joint Airworthiness Authorities (JAA), European Aviation Safety Agency (EASA) or Federal Aviation Administration (FAA) require that all equipment installed on a helicopter must be operative in compliance with the airworthiness standards and the operating rules. However, the rules (e.g. in JAR-MMEL/MEL or CS-MMEL) permit the publication of a Minimum Equipment List (MEL) where compliance with certain equipment requirements is not necessary in the interests of safety under all operating conditions. Experience has shown that with the various levels of redundancy designed into helicopter, operation of every system or installed component may not be necessary when the remaining operative equipment can provide an acceptable level of safety. Hence helicopter utilization is improved and more convenient and economic air transportation for the public is provided thereby.

In order to enable the aircraft operators to establish their individual MELs, the Master Minimum Equipment List (MMEL) is developed as a basis for the MEL by the type certificate holder of the respective aircraft as part of the Operational Suitability Data (OSD) and approved by the competent authority. The MMEL includes those items of equipment related to airworthiness and operating regulations and other items of equipment which the competent authority finds may be inoperative and yet maintain an acceptable level of safety by appropriate conditions and limitations.

Special attention has to be paid if engine related items shall be implemented in the MMEL. As engines have their own type certificate (TC), engine related parts cannot be directly implemented in the aircraft MMEL by the aircraft manufacturer. To implement these items, a “permission” given by the engine manufacturer is needed. To have this permission officialised, the competent airworthiness authority has to approve it in the TC.

To obtain the approval, a “Time Limited Dispatch” (TLD) approach needs to be performed for failures leading to redundancy failures in the engine control system. For failures not leading to redundancy failures, the “classical” MMEL approach can be conducted.

The compliance demonstration is based on the list of relevant failures leading to redundancy failures in the engine control system. These failures have to be justified by appropriate means, e.g. fault tree analyses, taking into account that one failure has already occurred.

For the TLD approach also new analysis methods need to be applied taking into account the requirements of the certification specification for engines (CS-E). Airbus Helicopters performed this approach as the first helicopter manufacturer in the world successfully in a joined approach together with the engine manufacturer.

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1. MASTER MINIMUM EQUIPMENT LIST

1.1. Background

The certification regulations published by various airworthiness authorities require in § 27.1301 or § 29.1301 that all equipment installed on a helicopter must be operative in compliance with the airworthiness standards and the operating rules.

But after some years the airworthiness authorities provided a proposal to the helicopter manufacturer to publish a Master Minimum Equipment List (MMEL) which allows the dispatch of the helicopter with certain equipment inoperative under well-defined limitations and restrictions for a given period of time.

This proposal is based on the experience gathered over the years, as with the various levels of redundancy implemented into helicopter, operation of every system or installed component may not be necessary when the remaining operative equipment can provide an acceptable level of safety. There are also more and more systems or components installed on a helicopter which are not required for each mission, e.g. IFR-equipment, if a VFR flight is performed or dedicated mission equipment, if this particular mission is not performed.

1.2. Intent and Content

Based on the MMEL, each operator is able to establish an individual Minimum Equipment List (MEL) for each helicopter, the operator is using, which takes into account the particular helicopter configuration and special operating requirements. By using the MEL, the helicopter utilization is improved and more convenient and economic air transportation for the public is provided thereby, as the availability of the helicopter is increased.

The MMEL includes those items of equipment related to airworthiness and operating regulations and other items of equipment which the competent authority finds may be inoperative and yet maintain an acceptable level of safety by appropriate conditions and limitations, e.g.

- AFCS,
- additionally installed navigation equipment for IFR operation for VFR flights,
- non required communication systems,
- mission equipment,
- lights during day operations,
- redundant vehicle and engine indications, or
- heating and/or cooling systems, if not required for the actual environmental conditions

It does not contain obviously required items such as

- rotor blades,
- flight controls,
- hydraulic systems,
- main/tail rotor gear box,
- engines and engine control systems, or
- structural parts,

1.3. Level of Safety

To introduce an item in the MMEL, the TC holder has to prove that a certain level of safety is still maintained. Therefore proof of compliance according to e.g. CS MMEL.140 is mandatory for the helicopter manufacturer.

The following factors have to be taken into account [1]:

- reduction of aircraft functional capabilities and/or safety margins,
- change in crew workload and/or degradation in crew efficiency,
- consequence(s) to the aircraft and its occupants of the next failure(s) having the worst safety-related impact on the aircraft's take-off, continued flight and landing when dispatching in a known degraded configuration, and
- consequence(s) to the aircraft and its occupants of the next external event(s) for which the item was designed to protect against, if applicable.

An acceptable level of safety can be maintained for an MMEL item through one or a combination of the following means:

- adjustment of operational limitations,
- transfer of the function/information to an operating system/component performing the required function or providing the required information, provided the change in crew workload and/or crew training remains acceptable,

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- development of operational procedures (e.g. such as alternate procedures, additional pre-flight checks), provided the change in crew workload and/or crew training remains acceptable, and/or
- development of maintenance procedures (such as deactivating and securing the system/component of concern or additional verification tasks) [1].

1.4. Regulations

The following airworthiness regulations have to be taken into account for the preparation of a helicopter MMEL:

- As the helicopter certification in full-up configuration is performed according to
    - JAR/CS/FAR Part 27 Normal Category Rotorcraft or/and
    - JAR/CS/FAR Part 29 Transport Category Rotorcraft,

  the requirements published in these regulations have to be also taken into account
- Furthermore JAR-MMEL/MEL or CS-MMEL shall be used as a basis for the establishment of a MMEL, as these regulations provide all relevant requirements concerning MMEL.

At least the following paragraphs have to be justified:

- CS MMEL.120: Format and content of the MMEL: it has to be shown that the MMEL is written in a format that is accepted by the EASA (refer to figure 2)
- Accomplishment instructions for the operational and maintenance procedures identified in the
- CS MMEL.125: Operational and Maintenance Procedures: it has to be shown that operational and maintenance procedures are developed and validated by the TC holder and that these procedures are indicated in the MMEL, where applicable
- CS MMEL.140: Level of safety: refer to chapter 1.3.
- CS MMEL.145: Justification of MMEL items: refer to chapter 1.7.
- CS MMEL.150 Multiple inoperative items: refer to chapter 1.7.

1.5. Process

To prepare a MMEL or to introduce new items in an existing MMEL the following process is applied at Airbus Helicopters:

- First items to be implemented in the MMEL are collected. The inputs are coming from the chief engineering, the design engineers, the system design responsible or the customer support team.
- After that a MMEL working group meets to discuss the different items and to prepare a draft version of the MMEL itself if a new MMEL is prepared or of the new entry for the item to be newly introduced in the MMEL. The working group consists of the design engineer or the system design responsible, members of the safety department, the technical publication department, the airworthiness department and the flight test department.
- After the draft is available, the MMEL board, consisting of members of the approving airworthiness authority, Airbus Helicopters and if interested, of different customers, meets to finally discuss the MMEL entry.
- At the same time the justifications showing proof of compliance for the paragraphs mentioned in chapter 2.4 are prepared and submitted to the approving authority.
- When all required documents are available at the authority, they will be finally checked and the MMEL will be approved, if all requirements are fulfilled.

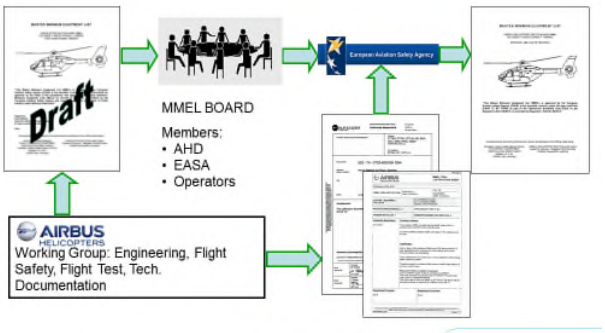

Figure 1: MMEL Preparation Process

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1.6. Format

The following content is provided in the MMEL sheets:

- column 1: “System & Sequence Numbers / Item” means the equipment, system, component, or function listed in the "Item" column.
- column 2: “Rectification Interval” means the category of rectification intervals determined for a specific item:
    - Category A: No standard interval is specified, however, items in this category shall be rectified in accordance with the conditions stated in the MMEL.
    - Category B: Items in this category shall be rectified within 3 consecutive calendar days, excluding the day of discovery.
    - Category C: Items in this category shall be rectified within 10 consecutive calendar days, excluding the day of discovery.
    - Category D: Items in this category shall be rectified within 120 consecutive calendar days, excluding the day of discovery.
    - Category ~: Items in this category shall be rectified according to the most restrictive of rectification interval(s) of the referenced item(s) in column 5.
- column 3: “Number Installed” is the number (quantity) of items normally installed in the helicopter. This number represents the helicopter configurations considered in developing this MMEL. Should the number be a variable (e.g., passenger cabin items) a number is not required.
- Column 4: “Number Required for Dispatch” is the minimum number (quantity) of items required for operation provided the conditions specified in column 5 are met.
- Column 5: “Remarks or Exceptions” in this column include a statement either prohibiting or permitting operation with a specific number of items inoperative, provisos (conditions and limitations) for such operation, and appropriate notes.

AIRBUS HELICOPTERS

MASTER MINIMUM EQUIPMENT LIST

AIRBUS HELICOPTERS DEUTSCHLAND GMBH
BK117 D-2 (EC145 T2) - SERIES

85 SPECIAL/MISSION EQUIPMENT

(1) SYSTEM & SEQUENCE NUMBERS ITEM	(2) RECTIFICATION INTERVAL	(3) NUMBER INSTALLED	(4) NUMBER REQUIRED FOR DISPATCH	(5) REMARKS OR EXCEPTIONS
85 SPECIAL/MISSION EQUIPMENT***				
1. (Dual) External Cargo Hook*** (AECMA 85-11)	D	~	~	(M) May be inoperative provided the inoperative system is deactivated, secured and placarded
2. Cargo Hook Mirror System (incl. Heating System and Positioning System)*** (AECMA 85-11)	D	~	~	(M) May be inoperative provided the inoperative system is deactivated, secured and placarded
3. Cargo Safety Device*** (AECMA 85-04)	D	~	0	May be inoperative or missing provided no cargo is transported in the cargo compartment
				OR
	D	~	0	May be inoperative or missing provided cargo is secured by other appropriate and certified means
4. External Hoist System (LH/RH)*** (AECMA 85-12)	D	~	~	(M) May be inoperative provided a) speed limits according to RFM supplement are observed, and b) the inoperative system is deactivated, secured and placarded
5. External Loudspeaker*** (AECMA 85-31)	D	~	~	(M) May be inoperative provided the inoperative system is deactivated, secured and placarded

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Figure 2: Example of MMEL Sheet

1.7. Justification

CS MMEL.145 clearly states that the justifications are provided by the applicant along with each MMEL item.

The justification method(s) has/have to be agreed with the approving agency in advance.

For each item to be introduced in the MMEL at least a qualitative safety assessment is required to [1]:

- evaluate the consequences of the proposed MMEL dispatch configuration on the aircraft functional capabilities, crew workload and discomfort to occupants and to show compliance with CS MMEL.140;
- evaluate the consequences of the next worst safety-related failure and, if applicable for the item, separately evaluate the consequences of the external event for which the item was designed to protect against, and ensure the combination of the MMEL dispatch configuration with the next worst safety-

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related failure or event do not correspond to an hazardous or catastrophic failure condition;

The quantitative safety assessment is requested as additional means of compliance when both of the following considerations are met:

- relief is proposed for items, functions and/or systems involved in catastrophic or hazardous failure conditions, and the severity of the failure condition under MMEL configuration is not mitigated by special operating conditions, limitations or procedures; and
- when the operation with the inoperative item leaves the aircraft one failure away from a hazardous failure condition, or one or two failures away from a catastrophic failure condition.

For catastrophic failure conditions a probability under dispatch condition of ≤ 1.10-8 1/FH has to be achieved, for hazardous failure conditions a probability of ≤ 1.10-6 1/FH. When these objectives are met, no calculation for a maximum allowable dispatch time is considered necessary.

The justifications for an MMEL item include the list of functions associated to the item, as well as the associated functional failure(s), failure effect(s) and as far as practical the failure cause(s).

Multiple inoperative items as per CS MMEL.150 have also to be taken into account and it has to be shown that the items do not rely on each other and that the cumulative effects of multiple inoperative items are in line with CS MMEL.140.

1.8. Preparation of MEL

Based on the MMEL published by the TC holder, each operator can prepare the MEL for the helicopter he is operating with.

Based on Basic Regulation 216 / Annex IV for Air Operations 8.a.3. and according to ORO.MLR.105 “Minimum equipment list (MEL)” each operator is obliged to establish a MEL or an equivalent document, if he is operating a complex motor-powered helicopter[1] or if he is performing other than non-commercial operations with a non-complex helicopter.

The operator's MEL may exclude items contained in the MMEL, but cannot be less restrictive than the MMEL.

The MEL must be prepared for each individual helicopter and takes into consideration:

- the operator’s particular helicopter equipment configuration,
- the operator's relevant operational and maintenance conditions and
- the operational conditions and requirements which are applicable for the relevant helicopter configuration or for the kind of operation which is intended to be performed by the helicopter.

The MEL must not deviate from the helicopter flight manual limitations, emergency procedures or airworthiness directives.

An operator’s MEL, when approved by the national airworthiness authority, permits operation of the helicopter with inoperative equipment.

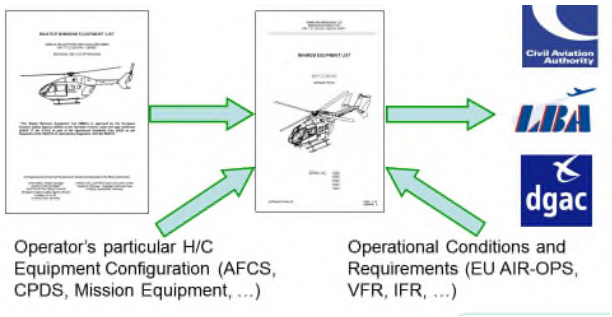

Figure 3: MEL Preparation Process

1 Definition of complex motor-powered helicopter:
- maximum certificated take-off mass > 3.175kg, or
- maximum approved passenger seating configuration of more than 9, or
- certificated for operation with a minimum crew of at least 2 pilots

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2. TIME LIMITED DISPATCH

2.1. History

The time limited dispatch (TLD) approach was introduced by the Joint Airworthiness Authorities (JAA) in Joint Airworthiness Requirement for engines (JAR-E) in 1986.

JAR-E 510 (e)(2) required the engine failure analysis to include: ”Justification for the inclusion in the MMEL of any engine-associated item permitted to be carried in an unserviceable state for specific periods”.

When the EASA published the initial issue of their certification specification for engines (CS-E), a new section CS-E 1030 was introduced.

2.2. Background/Introduction

As engines have their own type certificate (TC), engine related parts cannot be directly implemented in the aircraft MMEL by the aircraft manufacturer. To implement these items, a “permission” given by the engine manufacturer is needed. To have this permission officialised, the competent airworthiness authority has to approve it in the TC.

To obtain the approval, a “Time Limited Dispatch” (TLD) approach needs to be performed for failures leading to redundancy failures in the engine control system. For failures not leading to redundancy failures, the “classical” MMEL approach can be conducted.

The objective of TLD is to allow the dispatch of a helicopter for a specified period of time with redundancy faults present in the electronic engine control system (EECS), before repairs are required, without significantly affecting the fleet-wide average LOPC rates and hazardous engine effects rates.

2.3. Applicable Regulations and Guidance Material

All requirements concerning TLD are given through CS-E 1030 - time limited dispatch.

The main requirement is to carry out a time limited dispatch (TLD) analysis of the EECS to determine the dispatch intervals and maintenance intervals.

For each dispatchable configuration it must be shown by test or analysis that [2]:

- the engine remains capable of meeting all CS-E specifications for operability aspects and re-lighting in flight,
- the ability to control the engine within limits is maintained;
- protection is maintained against hazardous engine effects,
- a means is maintained to provide necessary signals to identify EECS faults;
- a further single failure in the EECS will not produce a hazardous engine effect;
- the engine continues to meet its certification specifications for external threats (rain, hail, bird strike, HIRF, lightning, …);
- the proposed dispatch interval is justified.

Guidance material can be found directly in CS-MMEL [1] in AMC-E 1030 and in AMC-20-3 [4].

Figure 4 shows the process to be applied for TLD approval.

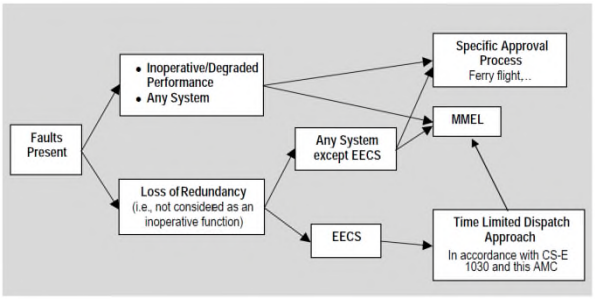

Figure 4: Time Limited Dispatch [1]

Faults leading to a loss of redundancy within the EECS must be justified following the TLD approach. All other engine or EECS failure can be directly implemented in the MMEL after justification is provided according to the MMEL approval process.

2.4. Technical Background

Two engines are installed on the Airbus Helicopter EC175 and BK117 D-2.

Each engine is controlled and monitored by a dual channel FADEC, which is composed of:

- an electronic engine control unit (EECU) with two redundant channels,

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- a fuel control unit (FCU),
- an engine data recorder (EDR),
- sensors and detectors providing engine parameters needed to control the engine (e.g. N1, N2, TQ, TOT, fuel and oil temperature and pressure, except fire detectors),
- specific sensors dedicated to monitoring systems.

The EECU is a dual channel digital engine control system that, in conjunction with FCU and a network of sensing devices, controls the engine gas generator and power turbine speeds in response to the torque demanded by the H/C.

The EECU provides an electronic interface between the engine sensors, the opposite engine's EECU and actuators as well as discrete and serial communication interfaces between the engine and the rotorcraft.

The FCU delivers the fuel flow in a desired quantity and modulates the engine fuel flow over the entire operational envelope of the engine.

Each engine comprises an engine data recorder (EDR). It is storage device, which is responsible for performing all internal memory management required to store and recall data blocks for maintenance and troubleshooting purposes.

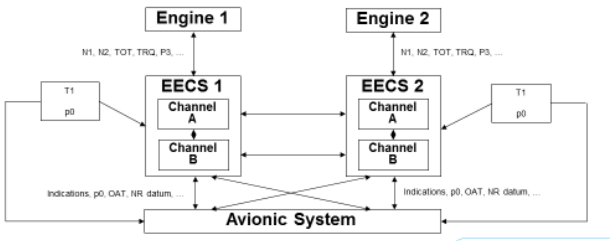

Figure 5: EECS Block Diagram

There are three levels of failure which are monitored and displayed to the pilot:

- level 1 failure / minor failure: the fault is detected by the EECU and automatically accommodated by the use of a redundant input or output. Only a minor degradation of the EECU functionality (e.g. loss of redundancy), but no degradation of the power plant functionality occurs. There is no effect on engine operation in flight: the fuel control functions are not affected and the engine performances remain nominal. No particular pilot action is required according to FLM during flight.
- level 2 / major failure: the fuel control functions are affected and the engine performances are degraded, but the essential control functions are still performed.
- level 3 / critical failure: the automatic control is no longer available and the EECU is no more able to control the fuel flow. The engine power is frozen at the actual level.

2.5. Process

The aim of the TLD approach is to obtain approval to introduce EECU related redundancy failures in the helicopter MMEL. As engines have their own type certificate (TC), engine related parts cannot be directly implemented in the aircraft MMEL by the aircraft manufacturer. To implement these items, a “permission” given by the engine manufacturer is needed. To have this permission officialised, the competent airworthiness authority has to approve it in the TC.

The TLD approach was performed at Airbus Helicopters as a joined approach with the engine manufacturer due to the following reasons:

- The engine manufacturer does not know the failure effects on helicopter level and is therefore only able to justify the effect on engine level.
- The unavailability of data to be provided by different helicopter systems could also contribute to one or more failures on engine level.

To initiate the process, the engine manufacturer had to apply for a TLD approval. At the same time AH had to apply for an approval of the updated helicopter MMEL with a new item concerning EECU redundancy failure introduced.

Afterwards the engine manufacturer prepared the time limited dispatch analysis on engine level including a list of TLD relevant failures. To do so, several tests and inputs from other supplier, but also an update of the safety analysis on engine level were necessary.
This document was reviewed by the AH in order to ensure that the information contained therein was sufficient and compatible with the AH MMEL substantiation process.
AHD comments were communicated to and integrated into the document by the engine manufacturer.

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Finally the document was presented to EASA in support of certification of the engine under TLD conditions.

The engine manufacturer´s qualitative and quantitative substantiations from this TLD analysis had been integrated in MMEL substantiation report on helicopter level.
The analysis has been completed with H/C level substantiation, limitations, etc.
After completion this document was also submitted to EASA for review.

In the end time limited dispatch was approved by EASA and the EECU related failures were introduced in the helicopter MMEL.

2.6. Justification

The engine manufacturer justified in the time limited dispatch analysis on engine level that the engine remains capable of meeting all CS-E specifications for operability aspects and re-lighting in flight and that the requirements concerning hazardous engine effects and loss of power control (LOPC) rates remain acceptable with the proposed rectification time limits.
In the SSA on engine level the engine manufacturer had to take into account that already one failure had occurred (failure rate of this failure equals to 1) and that the occurrence of a former second failure has now changed to a first failure.

The justification of the introduction of the EECU related redundancy failures in the helicopter MMEL was based on the facts that:

- In the presence of one or several level 1 failure on one and/or both engines, the behaviour of the affected engine remains unchanged compared to normal operation in full-up configuration. As the control law does not change, the automatic control system shows the same behaviour of as under full-up configuration.
- Apart from the pre-flight procedures and limitations, there is no additional workload for the flight crew.
- Once the engine is operative, the same level of automatic control is available as under full-up configuration.

Based on these facts the different redundancy failures were classified as “minor” on helicopter level.

As engine related MMEL items are involved in helicopter level failure conditions classified as “hazardous” or “catastrophic”, the compliance with applicable requirements for qualitative and quantitative analysis was demonstrated by AH on helicopter level.
Therefore the SSA for the engine integration on helicopter level was updated taking into account the results of the time limited dispatch analysis on engine level.

As the engine manufacturer only takes into account the occurrence of failures on one engines, the combination of failures on both engines installed on the helicopter had to be analysed on helicopter level by AH.

The following combinations were analysed:
Prerequisite is a redundancy failure on one EECU, followed by

- another redundancy failure on the other EECU, or
- degraded EECU (same or other EECU), or
- FADEC FAIL on same or other EECU, or
- in-flight shut-down (IFSD) of one engine, or
- loss of cross-talk between both EECUs

The worst case failure classification of these failure combinations is “major”.

All redundancy failures do not evolve to other failure scenarios than those already identified and analyzed in the FHA and SSA on H/C level. The worst case subsequent failure identified is a commanded or uncommanded in-flight shutdown (IFSD) of the other engine, because no other single failure having worse consequences than an IFSD has been identified in the SSA.

The effects on crew workload and H/C safety margins are similar under MMEL and full-up conditions, as the remaining engine operating under MMEL conditions remains fully functional. Therefore the combination of a level 1 failure on one engine and an IFSD on the other engine is also classified “Major”.

The period of time used for time limited dispatch with detected redundancy failures was assessed and justified by the engine manufacturer in accordance with CS-E 1030, meaning that only half of the time used for the calculations is used for the TLD approval.
Due to that conservative approach, the interval

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can be directly used as remaining flight time under TLD/MMEL conditions and does not need to be shortened by the flight time of the previous flight after the particular redundancy failure occurred. This approach is in line with CS-MMEL [1].

2.7. Procedures and Limitations

As a result of the TLD analysis, a number of procedures and limitations was identified which have to be followed before flight under this MMEL condition to ensure that safety margins are maintained.

2.7.1. Procedures

The following procedures must be applied before dispatch under TLD/MMEL conditions:

- Reset both EECUs.
- Ensure that rotor brake is disengaged before first engine start according to pre-flight check procedure.
- If automatic engine power check (EPC) is not possible within the requested time interval, perform manual EPC according to FLM charts.
- Count engine cycles manually.
- Perform an air-bleed valve test prior to each flight to confirm that it can close if required.

2.7.2. Limitations

The following limitations must be followed before dispatch under TLD/MMEL conditions:

- No other EECU or engine related alerts are displayed.
- The training mode shall not be used.
- The ultimate backup shall not be used for training purpose, but remains available for emergency situation.

2.8. New Indication Concept

On EC175 and BK117 D-2 there are three levels of EECU failure which are displayed to the pilot:

- Level 1 failure lead to a FADEC REDUNDANCY advisory displayed in white (refer to figure 6).
- Level 2 failure lead to a FADEC DEGRADED caution displayed in amber.
- Level 3 failure lead to a FADEC FAIL caution displayed in amber.

This indication concept remains unchanged on BK117 D-2, as all level 1 failure are dispatchable. No other indication is necessary and due to that fact there is also no need for the flight crew to identify failure source, as no particular pilot´s action is required during flight, but only general procedures have to be followed and general limitations have to be obeyed on ground before the next flight.

On EC175 the FADEC REDUNDANCY advisory is replaced by two new indications:

- Non-dispatchable failures that prohibit the next flight if they are not fixed are indicated to the flight crew in flight or on ground with an ENG NO DISPATCH advisory displayed in white.
- dispatchable failure for a limited period of time are indicated to the flight crew only when the engine is in STOP or IDLE mode, with an ENG LIMITED DISPATCH advisory displayed in white.

The indications for level 2 and level 3 failures remain unchanged.

Figure 6: Cockpit Indications

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2.9. Documentation

During the TLD process the following documents were prepared and submitted to EASA by the engine manufacturer to show proof of compliance

- list of failure candidates for TLD to be dispatchable at engine level
- analysis of hazardous engine effects
- demonstration, that under the influence of external threats there will be no reversion of the channel in command to the other channel affected by the failure concerned
- update of safety analysis on engine level
- LOPC-rate (with and without TLD (fleet average and instantaneous rate))
- list of failure impacting the LOPC-rate

Airbus Helicopters prepared a substantiation report as basis for the MMEL justification sheet.

The substantiation report was submitted to EASA together with the justification sheet and contains the following means to show proof of compliance:

- List of limitations derived from list of failures for TLD, which must be listed in the MMEL, with justification and explanation
- List of failure scenarios from H/C level engine SSA affected by TLD (HAZ and CAT events only)
- Update of safety analysis (fault trees affected by TLD)
- List of next worst failure in combination with first failure

3. CONCLUSION

The introduction of EECU related failures in the helicopter MMEL and the approval of these entries by the certifying airworthiness authorities will only be successful, if the TLD approach will be followed. A close relationship between engine manufacturer and helicopter manufacturer is necessary to exchange the information needed to prepare the justification documents. Also an early involvement of the authorities is beneficial, as a lot of loops in the TLD/MMEL approval process can be avoided.
By following this approach the introduction of EECU related failures in the helicopter MMEL was accepted and approved by the EASA for EC175 in July 2015 and is expected on BK117 D-2 by end of this year latest.

4. ABBREVIATIONS

AFCS:	Automatic Flight Control System
AH:	Airbus Helicopters
AHD:	Airbus Helicopters Deutschland
AMC:	Acceptable Means of Compliance
CMR:	Certification Maintenance Requirement
CS:	Certification Specification
EASA:	European Aviation Safety Agency
EDR:	Engine Data Recorder
EEC:	Electronic Engine Controller
EECS:	Electronic Engine Control System
FAA:	Federal Aviation Administration
FADEC:	Full Authority Digital Engine Control
FAR:	Federal Aviation Regulation
FCU:	Fuel Control Unit
FH:	Flight Hour
FHA:	Functional Hazard Assessment
HIRF:	High Intensity Radiated Fields
IFR:	Instrument Flight Rules
IFSD:	In-Flight Shut-Down
JAA:	Joint Airworthiness Authorities
JAR:	Joint Airworthiness Requirement
LOPC:	Loss of Power Control
MEL:	Minimum Equipment List
MMEL:	Master Minimum Equipment List
MPD:	Maintenance Planning Document
MRB:	Maintenance Review Board
N1:	Compressor Rotor Speed
N2:	Power Turbine Speed
OSD:	Operational Suitability Data
SSA:	System Safety Assessment
TC:	Type Certificate
TCDS:	Type Certificate Data Sheet
TLD:	Time Limited Dispatch
TOT:	Turbine Outlet Temperature
TQ:	Torque
VFR:	Visual Flight Rules

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5. REFERENCES

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