



Introduction to Aircraft Maintenance Programs

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Aircraft Maintenance General





What makes the aviation special?





Aircraft as a technical device

- → Average narrow body transport category aircraft is:
 - → In essence a huge pressurized tube with average mass of 90 tons, which is moving through open space at the altitudes up to 15 000 meters, with approximate speed of 900 km/hr.
 - \rightarrow It is the only transport vehicle (aside submarines) that travels in 3D space.
 - → Flying is being achieved by the aircraft being supported by the moving air which creates adequate aerodynamic force to hold the whole weight of the aircraft in the air. Therefore, the aircraft can not stop in the air.
 - → To be able to produce required thrust throughout the flight, aircraft has to have tens of tons of highly combustible fuel on board.
 - → Operations are carried out in almost all visibility conditions, day and night.
 - → Take-off and landing typically take place at speeds between 130-300 km/h and it is performed on the runways 2-3 km long and 30-70 meters wide.



Aviation is a "high risk" human activity

- → Aviation is classified into high risk industries, in the same category as oil rigs and nuclear powerplants.
- → Due to their nature, high risk industries are highly regulated and have to continuously carry on activities to keep the risks at the acceptable level:
- → Main risk abatement methods:
 - → Regulations
 - → Utilisation of new technologies aimed at risk reduction
 - → Procedures and standardization of the operations
 - → <u>Maintenance</u>
 - → Education of personnel

Technology and technical aspects

- → Taking into the account the specific conditions in which the aircraft operates, specific aircraft technologies had to be and are still being developed. Some of these technologies are unique to the aerospace industries.
- → To maintain adequate safety levels, safety relevant aircraft systems have to be designed to be failsafe. This is mostly achieved by introducing the redundancy into the system by installing parallel systems with same functionality that can be deployed in case the primary system fails.



Technology and technical aspects

- → There is the increasing number of the aircraft systems that are being introduced with the sole purpose of increasing the flight safety (ACAS, GPWS...)
- → Downside of this improvements is that modern aircraft today are very expensive machines
- → To be able to amortize such high aircraft prices, they are projected to have economic life of more than 20 years, or for narrow body, typical structure design life is between 50.000-80.000 flights.



Objectives of Aircraft Maintenance





Objectives of Aircraft Maintenance

→ The complexity and longevity of current commercial aircraft, particularly in line with the imperative to assure adequate level of flight safety, determines the scope and objectives of aircraft maintenance.



Objectives of Aircraft Maintenance

- → In accordance with MSG 3 (Maintenance Steering Group) definition, aircraft scheduled maintenance is a set of activities that has following objectives:
 - a) To ensure realization of the inherent safety and reliability levels of the aircraft.
 - b) To restore safety and reliability to their inherent levels when deterioration has occurred.
 - c) To obtain the information necessary for design improvement of those items whose inherent reliability proves inadequate.
 - d) To accomplish these goals at a minimum total cost, including maintenance costs and the costs of resulting failures.



The Limitation of Aircraft Maintenance

- → These objectives recognize that scheduled maintenance, as such, cannot correct deficiencies in the inherent safety and reliability levels of the aircraft.
- → The scheduled maintenance can only prevent deterioration of such inherent levels.
- → If the inherent levels are found to be unsatisfactory, design modification is necessary to obtain improvement.



Sources of Aircraft Deficiencies or Defects

DESIGN

- TOLERANCES TO LOOSE (specifications)
- IMPROPERLY UNDERSTOOD ENVIRONMENT.
- INADEQUATE TESTING, DESIGN NOT CONFIRMED.
- COMPONENT RELIABILITY NOT UNDERSTOOD.
- MANUFACTURING
 - MATERIAL SUBSTITUTIONS.
 - IMPROPER PROCESSES (MFG. AND ASSEMBLY).
 - CONTAMINATION.
 - MACHINE OPERATIVES NOT PROPERLY TRAINED.
 - IMPROPER MATERIAL TREATMENT

OPERATION

- LOADS EXCEED PREDICTED ENVIRONMENT.
- NEW ENVIRONMENT (also storage).
- POOR ERGONOMICS (human engineering)



Effects of Maintenance on the Quality of Operation



YEARS or Operating Time



Technical Status of Aircraft – Share of Responsibilities





Classification of Maintenance





Classification of Maintenance

- → There are several ways to classify Maintenance. From the point of view of the Maintenance Program, it can be divided in:
 - → Scheduled maintenance maintenance that is repetitively performed in intervals in accordance with defined Maintenance Program, generally speaking it is preventive maintenance
 - → Unscheduled maintenance maintenance that is carried out in order to restore designed condition of the aircraft after failure or damage occurred, frequently named reactive maintenance
 - → Modifications by definition are not considered to be maintenance, but are performed by AMOs



Classification of Maintenance Relative to the Maintenance Scope





Aircraft Maintenance

- → It includes maintenance of the airframe and aircraft systems performed directly on the Aircraft:
 - → Aircraft systems maintenance
 - → Engine & APU "on wing" maintenance
 - → Aircraft Structure maintenance & repair
 - → Generally includes all maintenance activities that are defined in relevant AMM and SRM

→ Aircraft maintenance is usually divided on Light Maintenance and Heavy Maintenance.

→ Light Maintenance comprises of:

- → Line Maintenance and
- → Lower checks of Base Maintenance (A, C check)



Line & Base Maintenance - EASA definition

- → Line maintenance means any maintenance that is carried out before flight to ensure that the aircraft is fit for the intended flight. It may include:
 - \rightarrow trouble shooting;
 - → defect rectification;
 - → component replacement with use of external test equipment, if required. Component replacement

may include components such as engines and propellers;

scheduled maintenance and/or \rightarrow checks including visual inspections that will detect obvious unsatisfactory conditions/discrepancies but do not require extensive in depth inspection. It may also include internal structure, systems and powerplant items which are visible through quick opening access panels/doors;



Line & Base Maintenance cont'd

- → minor repairs and modifications which do not require extensive disassembly and can be accomplished by simple means;
- → for temporary or occasional cases (Airworthiness Directives, hereinafter AD; service bulletins, hereinafter SB) the quality manager may accept base maintenance tasks to be performed by a line maintenance organisation provided all requirements are fulfilled. The Member State will prescribe the conditions under which these tasks may be performed.
- → Base Maintenance means any task falling outside the criteria that are given above for *Line Maintenance*.



Workshop Maintenance

- → Workshop maintenance is maintenance carried out in the workshops on aircraft engines or aircraft components that have been removed from the aircraft.
- → As a rule, workshop maintenance is performed in accordance with Component Maintenance Manual (CMM), or Overhaul Manual (OHM)
- → Workshops are specialized for a narrow scope of components within specific aircraft systems due to the technology and equipment that is being used to perform maintenance tasks





Maintenance Program Regulatory Requirements





- → (a) Maintenance of each aircraft shall be organised in accordance with an aircraft maintenance programme.
- → (b) The aircraft maintenance programme and any subsequent amendments shall be approved by the competent authority.



- → (c) When the continuing airworthiness of the aircraft is managed by a continuing airworthiness management organisation approved in accordance with Section A, Subpart G of this Annex (Part-M) or when there is a limited contract between the owner and this organisation in accordance with point M.A.201(i)(3), the aircraft maintenance programme and its amendments may be approved through an indirect approval procedure.
 - → (i) In that case, the indirect approval procedure shall be established by the continuing airworthiness management organisation as part of the Continuing Airworthiness Management Exposition and shall be approved by the competent authority responsible for that continuing airworthiness management organisation.
 - → (ii) The continuing airworthiness management organisation shall not use the indirect approval procedure when this organisation is not under the oversight of the Member State of Registry, unless an agreement exists in accordance with point M.1, paragraph 4(ii), transferring the responsibility for the approval of the aircraft maintenance programme to the competent authority responsible for the continuing airworthiness management organisation.



- \rightarrow (d) The aircraft maintenance programme must establish compliance with:
 - \rightarrow (i) instructions issued by the competent authority;
 - \rightarrow (ii) instructions for continuing airworthiness:
 - → I issued by the holders of the type-certificate, restricted type-certificate, supplemental type-certificate, major repair design approval, ETSO authorisation or any other relevant approval issued under Regulation (EU) No 748/2012 and its Annex I (Part-21), and
 - → I included in the certification specifications referred to in point 21A.90B or 21A.431B of Annex I (Part-21) to Regulation (EU) No 748/2012, if applicable;
 - → (iii) additional or alternative instructions proposed by the owner or the continuing airworthiness management organisation once approved in accordance with point M.A.302, except for intervals of safety related tasks referred in point (e), which may be escalated, subject to sufficient reviews carried out in accordance with point (g) and only when subject to direct approval in accordance with point M.A.302(b).



- → (e) The aircraft maintenance programme shall contain details, including frequency, of all maintenance to be carried out, including any specific tasks linked to the type and the specificity of operations.
- → (f) For complex motor-powered aircraft, when the maintenance programme is based on maintenance steering group logic or on condition monitoring, the aircraft maintenance programme shall include a reliability programme.
- → (g) The aircraft maintenance programme shall be subject to periodic reviews and amended accordingly when necessary. These reviews shall ensure that the programme continues to be valid in light of the operating experience and instructions from the competent authority whilst taking into account new and/or modified maintenance instructions promulgated by the type certificate and supplementary type certificate holders and any other organisation that publishes such data in accordance with Annex I (Part-21) to Regulation (EU) No
 EA\$48/2012.

- → The term 'maintenance programme' is intended to include scheduled maintenance tasks the associated procedures and standard maintenance practises. The term 'maintenance schedule' is intended to embrace the scheduled maintenance tasks alone.
- → The aircraft should only be maintained to one approved maintenance programme at a given point in time. Where an owner or operator wishes to change from one approved programme to other, a transfer check or inspection may need to be performed in order to implement the change.
- → The maintenance programme details should be reviewed at least annually. As a minimum revisions of documents affecting the programme basis need to be considered by the owner or operator for inclusion in the maintenance programme during the annual review. Applicable mandatory requirements for compliance with Part-21 should be incorporated into the aircraft maintenance TEA A programme as soon as possible.

- → The aircraft maintenance programme should contain a preface which will define the maintenance programme contents, the inspection standards to be applied, permitted variations to task frequencies and, where applicable, any procedure to manage the evolution of established check or inspection intervals.
- → Repetitive maintenance tasks derived from modifications and repairs should be incorporated into the approved maintenance programme.
- → Appendix I to AMC M.A.302 provides detailed information on the contents of an approved aircraft maintenance programme.



→ A maintenance programme may indicate that it applies to several aircraft registrations as long as the maintenance programme clearly identifies the effectivity of the tasks and procedures that are not applicable to all of the listed registrations.



 \rightarrow An aircraft maintenance programme should normally be based upon the maintenance review board (MRB) report where applicable, the maintenance planning document (MPD), the relevant chapters of the maintenance manual or any other maintenance data containing information on scheduling. Furthermore, an aircraft maintenance programme should also take into account any maintenance data containing information on scheduling for components.



- → Instructions issued by the competent authority can encompass all types of instructions from a specific task for a particular aircraft to complete recommended maintenance schedules for certain aircraft types that can be used by the owner/operator directly. These instructions may be issued by the competent authority in the following cases:
 - → in the absence of specific recommendations of the Type Certificate Holder.
 - → to provide alternate instructions to those described in the subparagraph 1 above, with the objective of providing flexibility to the operator.



- → Where an aircraft type has been subjected to the MRB report process, an operator should normally develop the initial aircraft maintenance programme based upon the MRB report.
- → Where an aircraft is maintained in accordance with an aircraft maintenance programme based upon the MRB report process, any associated programme for the continuous surveillance of the reliability, or health monitoring of the aircraft should be considered as part of the aircraft maintenance programme.



 \rightarrow Aircraft maintenance programmes for aircraft types subjected to the MRB report process should contain identification cross reference to the MRB report tasks such that it is always possible to relate such tasks to the current approved aircraft maintenance programme. This does not prevent the approved aircraft maintenance programme from being developed in the light of service experience to beyond the MRB report recommendations but will show the relationship to such recommendations.



- → Some approved aircraft maintenance programmes, not developed from the MRB process, utilise reliability programmes. Such reliability programmes should be considered as a part of the approved maintenance programme.
- \rightarrow Link to EASA Requirements





Aircraft Maintenance Program





Responsibility of the Operator to Develop the Maintenance Program

- \rightarrow Why is it operator's responsibility?
- → Operation of the same type of the aircraft can be largely different between different operators:
 - → Geographical region (tropic-polar; sea-land; high regions low regions...)
 - → Type of the operation (short haul long halul; scheduled charter...)
 - → Utilisation (Low utilisation, High utilisation)
 - → Operating and maintenance procedures and standards (flight planning, fuel policies, MEL application, preventive maintenance....)
- → Therefore, to account for all specifics to its operation, each operator is required to develop its own maintenance program.
- → MPD is being developed by the manufacturer as a baseline program recommendation, reflecting the average operation and specified (average)
 range of aircraft utilisation

Definition of AMP (EASA)

→ AMC M.A.302 Aircraft Maintenance Programme (definition) "1. The term "maintenance programme" is intended to include scheduled maintenance tasks the associated procedures and standard maintenance practices."

→ As it is visible from the definition, focus is on scheduled (preventive) maintenance.



Basis for the Development of the Maintenance Program

→ Modern Maintenance Programs are based on the approach developed by ATA - MSG (Air Transport Association - Maintenance Steering Group).

→ Today, we have two versions of MSG documents that are in use by the industry: Maintenance Steering Group-2 (MSG-2), as older logic that is still in use with some older aircraft and Maintenance Steering Group-3 (MSG-3) being the current document in use for all modern aircraft.



Optimisation of Maintenance









MSG-2





MSG2 original definitions

- → Maintenance programs generally include one or more of the following primary maintenance processes:
 - \rightarrow Hard Time Limit (HT):

A maximum interval for performing maintenance tasks. These intervals usually apply to overhaul, but also apply to total life of parts or units.

 \rightarrow <u>On Condition (OC)</u>:

Repetitive inspections, or tests to determine the condition of units or systems or portions of structure (Ref.: FAA Advisory Circular 121-1).

 \rightarrow <u>Condition Monitoring (CM)</u>:

For items that have neither hard time limits nor on condition maintenance as their primary maintenance process. Condition monitoring is accomplished by appropriate means available to an operator for finding and resolving problem



FAA AC 120-17A Definitions

- \rightarrow (1) Hard-Time (HT). This is preventive primary maintenance process. It requires that an appliance or part be periodically overhauled in accordance with the carrier's maintenance manual or that it be removed from service.
- \rightarrow (2) On-Condition (OC). This is a preventive primary maintenance process. It requires that an appliance or part be periodically inspected or checked against some appropriate physical standard to determine whether it can continue in service. The purpose of the standard is to remove the unit from service before failure during normal operation occurs.
- \rightarrow (3) Condition-Monitoring (CM). This is a maintenance process for items that have neither "Hard-Time" nor "On-Condition" maintenance as their primary maintenance process. CM is accomplished by appropriate means available to an operator for finding and solving problem areas. The detailed requirements for the condition-monitoring process are included as appendix 1 to this circular. 43

MSG2 – cont'd

- → EASA in Part M uses the term CM as being preventive process and OC as being non-preventive which is oposite to the definition in the source MSG 2 document. This kind of interpretation is not rare and causes a lot of confusion in the industry.
- \rightarrow Per EASA interpretation,
 - → Condition Monitoring is a preventive maintenance process. It requires that the component or a system be periodically tested and checked in accordance with defined standards and criteria, using adequate methods, to determine if the tested component/system is in condition that allows its operation untill next such scheduled inspection/test.
 - → On Condition is not a preventive maintenance process, it allows failures to happen and relies on in-service data or pilots reports to determine and rectify existing faults.



MSG3 original definitions

The content of the scheduled maintenance itself consists of two groups of tasks

- → a) A group of scheduled tasks to be accomplished at specified intervals. The objective of these tasks is to prevent deterioration of the inherent safety and reliability levels of the aircraft. The tasks in scheduled maintenance may include:
 - \rightarrow (1) Lubrication/Servicing (LU/SV or LUB/SVC)
 - \rightarrow (2) Operational/Visual Check (OP/VC or OPC/VCK)
 - \rightarrow (3) Inspection/Functional Check (IN*/FC or */FNC)
 - \rightarrow * General Visual Inspection (GV or GVI)
 - * Detailed Inspection (DI or DET)
 - * Special Detailed Inspection (SI or SDI)
 - * Scheduled Structural Health Monitoring (S-SHM)
 - \rightarrow (4) Restoration (RS or RST)
 - \rightarrow (5) Discard (DS or DIS)



MSG3 original definitions

 \rightarrow b) A group of non-scheduled tasks which result from:

- → (1) The scheduled tasks accomplished at specified intervals.
 (2) Reports of malfunctions (usually originated by the operating crew). (3) Data analysis.
- The objective of these non-scheduled tasks is to restore the aircraft to an acceptable condition.



MSG – 2	MSG – 3
Separate analysis for: ➤ Systems ➤ Structures	Separate analysis for: ➤ Systems ➤Structures ➤Zonal
Process Oriented	Task Oriented
Bottom-Up Approach Airplane System Component Unit	Top-Down Approach Airplane System Component Unit
Maintenance Process : HT / OV / CM Maintenance	Maintenance Tasks : LU, SV, OP, VC, IN, FC, RS, DS



Contents of MSG-3 Document

- → Working portions of MSG-3 are contained in the next four (4) sections.
 - → Systems/Powerplant, including components and APU's, are considered in [Section 2-3].
 - → Aircraft Structures is considered in [Section 2-4],
 - \rightarrow Zonal Inspections in [Section 2-5] and
 - \rightarrow L/HIRF is considered in [Section 2-6].
- → Each section contains <u>its own</u> explanatory material and decision logic diagram (as appropriate); therefore, it may be used independently of other MSG-3 sections.



Systems/Powerplant Section

- → Determination of MSI (Maintenance Significant Item):
 - → … process of identifying Maintenance Significant Items is a conservative process (using engineering judgment) based on the anticipated consequences of failure.
 - → The top-down approach is a process of identifying the significant items on the aircraft at the highest manageable level.
- → Determination of FEC (Failure Effect Category) level 1
 - → Safety (FEC 5), operational (FEC 6), economic (FEC 7), hidden safety (FEC 8) or hidden non-safety (FEC 9)
- → Determination of applicable and effective maintenance tasks level 2
- → Definition of task intervals



Aircraft Structures Section

- \rightarrow Requirements for detecting:
 - \rightarrow Accidental Damage (AD),
 - \rightarrow Environmental Deterioration (ED),
 - \rightarrow Fatigue Damage (FD), and
 - \rightarrow procedures for preventing and/or controlling corrosion

form the basis for the MRB structural maintenance.

- → Determination of SSIs (Structure Significant Items):
- → "A Structural Significant Item (SSI) is any detail, element or assembly, which contributes significantly to carrying flight, ground, pressure or control loads, and whose failure could affect the structural integrity necessary for the safety of the aircraft."



Zonal Inspection Section

- → The Zonal Inspection Program (ZIP) provides for the consolidation of a number of General Visual Inspection (GVI) tasks for each zone.
- → The ZIP contains a series of GVI tasks generated from standard zonal analysis procedures. Detailed inspection (DET) and Special Detailed Inspection (SDI) are not to be contained in the ZIP.
- → The ZIP contains GVI tasks derived from EZAPs as well as standard zonal analysis procedures. EZAP (Enhanced Zonal Analysis Procedures) takes into account zones with wiring/combustible material mix (EWIS).

L/HIRF Protection Analysis

- → In order to narrow the focus of the analysis, the following concepts are accepted:
 - → All visible L/HIRF protection (wires, shields, connectors, bonding straps, or raceways between connectors or termination points) may be covered by the Zonal Inspections.
 - → L/HIRF protection within conduit or heatshrink, is covered in the Zonal Inspections by confirming integrity of the protective covering.
 - → Inherent conductivity of the aircraft structure is covered by the Zonal Inspections.
 Corrosion concerns are addressed by the Structural Inspections.
 - → Composite fairings with conductive mesh are covered by the Zonal Inspections.
 - → Where the Zonal Inspections are not effective, additional analysis may produce other scheduled maintenance tasks.



Airworthiness Limitations

- → AWLs are items that the type certification process has defined as critical from a fatigue or damage tolerance assessment.
- → The inspection frequency of such items is mandatory and they should be treated in the same way as a CMR*
- \rightarrow AWLs are:
 - → <u>Life Limits</u> Approved mandatory replacement times for life limited components,
 - → <u>ALI inspections Approved mandatory structural inspections and related</u> intervals,
 - → Critical design configuration control limitations (CDCCL) Approved mandatory tasks related to fuel tank safety.



Certification Maintenance Reqirements

- → Tasks determined within the type certification process (independently of MRB process) that represent items critical for airworthiness.
- → They are published in CMR Document by the aircraft type certificate holder.
- \rightarrow There are two types of CMR tasks:
 - → CMR* ("One Star Tasks") prescribed task interval can be extended only by type certifying authority based on the recommendation of type certificate holder.
 - CMR** ("Two Star Tasks") prescribed task interval can be extended or
 approved to be extended by authority of the state of the aircraft register.

A319/A320/A321 Certification Maintenance Requirements (FAA version)

SECTION 2: CMR "TWO STAR" TASKS

MSI	MSI AND TASK DESCRIPTION	INTERVAL
21.28.00 21.43.00	CARGO COMPARTMENT, VENTILATION, HEATING, AND GROUND COOLING SYSTEM	
	Operational test of ground cooling isolation valve to verify closing in case of smoke warning (MRB Report task 2128/4300- 4)	6000 FH
	(Task applicable only if cargo compartment ground cooling system is installed)	
24.20.00	AC GENERATION	
	Operational test of static inverter (A319 and A321) (MRB Report task 242000-2a)	500 FH
26.16.00	CARGO COMPARTMENT SMOKE DETECTION (If installed)	
	Operational test of cargo compartment smoke detection by CFDS to confirm isolation valve latching circuit integrity (MRB Report task 261600-2)	450 FH
26.23.00	CARGO COMPARTMENT FIRE EXTINGUISHING (If installed)	
	Check firing circuit continuity (MRB Report task 262300-3)	8000 FH
	Check fire extinguisher lines for leakage and obstruction (MRB Report task 262300-4)	14000 FH
27.40.00	TRIMMABLE HORIZONTAL STABILIZER (THS)	
	Operational test of THS actuator with individual hydraulic systems (MRB Report task 274000-1)	400 FH
	Operational test of THS actuator jamming protection device (MRB Report task 274000-2)	4000 FH



Service Bulletins (SB)

- → Aircraft manufacturers, engine manufacturers or component manufacturers are publishing Service Bulletins which contain:
 - → approved aircraft, powerplant or component modification procedures and/or
 - \rightarrow additional inspections inspection procedures
- → Service Bulletins for the aircraft are published in one of four versions:
 - \rightarrow Alert, Mandatory, Recommended i Optional.
- → Service Bulletins classified as Alert i Mandatory <u>are not mandatory unless they</u> <u>are requested by adequate AD Note</u>.
- → Service Bulletins classified as Recommended have the status of recommendation and SBs classified as Optional are usually developed for specific Operator on his request.



Airworthiness Directives - AD Note

- → Civil Aviation Authorities and type certifying Authority in particular may publish AD whenever there is a need to perform certain modification or maintenance task to maintain or recover airworthiness of an aircraft type, a group of the aircraft or a single aircraft.
- → Such AD can mandate: a one time action, a repetitive action or a combination of the two.
- → Aircraft operator is responsible to implement the AD whithin the deadlines as specified in the AD.
- → All repetitive AD's have to be introduced in Maintenance Program.

 EASA

MRBR – Maintenance Review Board Report

- → MRBR contains the regulatory minimum scheduled tasking/interval requirements for a particular aircraft and on-wing engine maintenance programs.
- → It is based on the Maintenance Planning Proposal that is developed by the Industry Steering Commitee (ISC).
- → ATA MSG3 analysis process and procedures is being used for the development of an MRBR for all new aircraft or engines.
- → The development of MRBR goes in parallel with Type Certification process

→ In general, MRBR contains the same sections as MSG3 Document EASA

Process of the MRBR development







Maintenance Planning Document

- → MPD is a publication issued by type certificate holder and it represents compilation of all requirements that need to be implemented in the Aircraft Maintenance Program. It is treated as the recommendation to the operators and it is not considered as mandatory.
- → It is also linked with AMM, SRM and other manufacturer's manuals and publications using ATA 100/AMTOSS system of task numbering



Integration of sources in MPD





The content of the Operator's AMP





Links to the Example Documents

- → MSG2 (AC120-17A)
- → MSG3 (Rev2009)
- → MRBR Procedure (AC121-22C)
- → A340 MRBR (Rev11)
- → A320 MPD (Rev48)
- → Ageing Aircraft Programs
- → Operators Aircraft Maintenance Program







End of presentation

Thank you for your attention!

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