Continuing Airworthiness domain

Return to service of aircraft after storage:
Guidelines in relation to the COVID-19 pandemic

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Revision record

Issue	Date of issue	Summary of changes
01	20-07-2020	Initial issue
02	04-11-2020	Update following the results of the EASA Return to Normal Operations project on storage, Safety Item SI-5011, which led to further details incorporated into this Guidance, concluded in the two added appendices.

1. Purpose of these guidelines

This document provides guidance for Continuing Airworthiness Management Organisations (CAMOs) and Approved Maintenance Organisations (AMOs) to support the Return to Service (RTS) of aircraft that have been parked/stored due to the extraordinary situation resulting from the COVID-19 pandemic. Combined Airworthiness Organisations, owners and Competent Authorities (CAs) are also recommended to consider these guidelines.

While the purpose of the guidelines is to maintain the level of safety of the aircraft during the RTS activity, these guidelines also highlight potential undesirable operational constraints and/or financial implications.

2. Introduction

Aviation operations have been affected heavily by the COVID-19 pandemic and an unprecedented number of aircraft that have been parked/stored. The lack of demand in air travel has caused severe financial pressure on air operators, as well as on their service.

Gradually, as travel restrictions are being lifted and as operators are preparing to resume passenger flights and demand increases, operators will need the aircraft that have been parked/stored and return them back to service. Due to the high number of aircraft involved and the limited supporting resources available to perform the work due to the COVID-19 crisis, organisations and personnel are expected to experience difficulties and increased risks.

Organisation Management Systems play an essential role in identifying the hazards, developing control measures to mitigate the associated risks and thus in ensuring a safe RTS of all aircraft.

3. Analysis

The RTS activities include customised elements for each operator and the CAMOs leading the activities should start by conducting a robust analysis and developing a dedicated RTS process and plan. The analysis should include the identification of hazards stemming from past RTS experiences, the condition of the aircraft in their fleet and organisational aspects. In addition, it should be ensured that the existing hazards are reassessed, and new threats are identified by taking the pandemic into consideration. Subsequently, the resulting required mitigating actions and maintenance work have to be determined and accomplished in order to ensure that the risks are properly managed. Hence, these RTS activities by the CAMO should be performed in close cooperation with the contracted AMO(s). During the actual accomplishment of maintenance work, the AMO(s) should provide feedback to the CAMO on any defects found, to ensure in particular that the work order contains all necessary tasks.

3.1 Proactive identification of hazards

During the RTS process, the CAMO, in consultation with the AMO(s), should consider, for instance, the following:

Starting point and status of each individual aircraft:
- What was the defect status and maintenance forecast of the aircraft prior to parking/storage?
- Were Type Certificate Holder (TCH) and other Design Holder (DH) storage procedures followed throughout the full parking/storage period?
- Was all work carried out by an appropriately rated AMO?
- Have there been enough protective covers available for the entire fleet or has the AMO used alternate methods?
- Was there sufficient tooling and ground equipment available?
- Has the Airworthiness Review Certificate (ARC) expired?

- What schedule maintenance tasks became overdue during the parking/storage period?
- What is the current Airworthiness Directive (AD) status?
- Does the post storage check content take into account new recommendations from the TCH?
- Have parts been robbed from the aircraft?
- Has any environmental or accidental damage occurred to the aircraft during parking/storage?
- Does the aircraft match its damage chart?
- What is the current aircraft deferred defects status (including MEL / CDL)?
- Is there any maintenance task previously carried forward?
- Is the status of the aircraft software updated to the latest version?
- Have cybersecurity checks been considered to ensure that no security breaches have occurred? (especially, in cases where staff have been working from home)

Further items to be considered:

- **Fuel condition**: have the TCH instructions on aircraft fuel and fuel system contamination and biocide treatment (if applicable) been used since parking/storage started?

- **Supply chain:** Will parts and materials be available as needed? Are the tools and other necessary equipment available at the AMOs? Have any parts expiry dates or calibration dates been compromised? Are proper supply chain agreements in place to ensure that the work can be performed as agreed? Have lessors and/or other aircraft/component owners been informed as needed?

- **Human resources:** Are the staff that need to work on the different stages of the process available? Is the availability of the required competences, qualifications and authorisations ensured? Will the current health and safety recommendations affect the way the staff work? Are human factors performance limitations considered? Are staff able to access the premises? Have the organisations taken the necessary steps to minimise the effect on the working practices and conditions due to the COVID-19 pandemic? Are the staff correctly briefed on the procedures required during the RTS work?

- **Information access and exchange:** Is the required information regarding the aircraft accessible to all relevant staff and organisations involved? Can the ICA be accessed as required? Can staff communicate properly within the organisation and between different organisations? Do all parties have access to the required IT systems (to facilitate virtual meetings etc.)?

- **Procedures:** Has the responsible CAMO provided necessary adapted procedures and interface documents covering the RTS process? Are they available and have the staff been briefed? Does the staff understand their roles and reporting lines?

- **Combination of above elements**: Is the combination of multiple elements above considered with the determination of the level of risk for the RTS?

Cooperation and communication with external parties:

Are other organisations involved aware of the intentions of the CAMO and does the CAMO understand its customer's needs? In particular:

- **TCHs:** clarification of the instructions to be followed, additional support in the form of a non-technical objection or repair designs due to any damage that occurred on the aircraft during the parking/storage, additional instructions in case the parking/storage procedures were not complied with.

- **Flight ops department**: coordination with the CAMO to identify inputs before the first revenue flight to determine if a maintenance check flight is needed, discussion on the status of the deferred

items and consequences for the flight crew. A maintenance check flight is required if the maintenance tasks to return the aircraft to service are not conclusive or there are some checks that need to be conducted in-flight. The coordination with the crew should also cover identification of special attention items that the flight crew should focus on during the first flight, such as possibility of discrepancies in speed and altitude indications and engine parameters. The coordination should also include special checks before flying Reduced Vertical Separation Minimum (RVSM) operations, Extended-range Twin-engine Operations (ETOPS), Low Visibility operations.

- **Lessors and other equipment owners of the aircraft and its parts:** assess impact of decisions on existing commercial contractual agreements and if needed discuss possible solutions;

- **Any other service provided by any third party**: consider any additional input or need of coordination, for instance in relation with line maintenance support at any destination.

- **Competent Authority (CA)**: contact them in advance for any request such as exemptions, Permits to Fly, Aircraft Maintenance Programme variations, issuance of ARCs, approval of procedures, or expiration of certifying staff licenses.

3.2 Reactive identification of hazards (data collection from the AMO and analysis)

It is important that any information related to defects, findings and conditions found by the AMO on aircraft while preparing it for RTS and which can be reasonably assumed to be linked with parking/storage is collected. This includes any finding that can be connected to a fleet of aircraft being stored in the same or similar condition, as same aircraft types stored at the same time and same environment are expected to behave in the same way. This data should be submitted to the CAMO to enable the content of the RTS work order to be defined and/or to make any improvements to the work order. Some findings may also need to be communicated to the TCH and to the competent authority as required (see (EU) 376/2018 and AMC 20-8).

Where possible, when aircraft have been stored in similar conditions, the CAMO may elect to perform sample inspections to gather information to verify the condition of the fleet.

Post RTS, the CAMO / AMO should follow serviceability trend analysis and decide if maintenance procedures need to be amended, e.g. daily check, weekly check.

3.3 Examples of occurrences related to prolonged parking/storage with a serious impact on airworthiness

- Sticking / high friction of valves in engine bleed air system leading to pneumatic system issues during flight (e.g., bleed air loss, in one particular case this led to an in-flight shut down).
- Erroneous air data information including contaminated / blocked pitot-static systems and Angle of Attack (AOA) vanes failure.
- Fuel system contamination caused by non-adapted water drainage intervals or lack of available biocide.
- Emergency batteries, post parking or storage procedures, not at the expected state of charge.
- Depletion of aircraft parking brake accumulator pressure leading to damaged aircraft in ground incident.
- Wildlife nesting in the aircraft / engines while parked/stored, including insects, birds and rodents.

4.   Examples of hazards, mitigating strategies and best practices

A timely analysis of the process to be followed to RTS a significant number of aircraft will lead to the identification of hazards and related risks for which mitigating strategies can be defined in advance. The number and level of risks will vary between organisations. EASA together with industry representatives identified a list of hazards along with associated potential mitigating strategies. This document also contains examples of general best practices. Both can be found in the Appendices 1 and 2 by clicking the hyperlinks below and further relevant EASA material can be found here.

Appendix 1: Examples of HAZARDS AND MITIGATING STRATEGIES

1. Lack of current knowledge and skills of staff.

2. Lack of sufficient staff.

3. Lack of required parts and materials.

4. Lack of appropriate procedures and TCH/DH instructions.

5. Procedures and/or instructions are not followed.

6. Lack of appropriate tools and equipment.

7. Unsuitable environmental parking/storage conditions.

Appendix 2: Examples of BEST PRACTICES

1. Continued aircraft airworthiness status and work planning/control.

2. Recordkeeping.

3. Quality & safety policy, promotion and management.

4. Monitoring of the RTS process and continuing airworthiness.

5. Changes, novel and alternative processes.

5.   Conclusions

The purpose of this Guidelines is to raise awareness of possible hazards and suggest possible mitigating strategies to the risks associated to aircraft RTS after parking/storage. However, a dedicated risk management is recommended to be applied by the relevant organisations, proportionate and taking into account their particular situation and activities. This customised safety risk management should identify the novel hazards, assess the related risks and determine appropriate mitigating measures. Once the analysis has been conducted, appropriate cooperation and communication between the concerning organisations and the competent authorities have to be established and maintained in order to allow all parties to plan ahead and to ensure a proper and controlled process to return all concerning aircraft back to service.

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Appendix 1: Examples of hazards and mitigating strategies related to parked/stored aircraft returning to service

Potential hazards	Mitigating strategies to consider by CAMOs and AMOs

1. **Lack of current knowledge and skills**
 	
Link to further EASA material
	The significant reduction in traffic due to the pandemic means that most aviation professionals are not performing their normal tasks, sometimes not at all or at a substantially reduced frequency. Therefore, the following is to be considered:
	• Awareness of skills and knowledge degradation:
	   o Identify the procedures that these staff need to know before they re-start to work.
	   o Identify which skills and persons are most at risk, and provide tailored training as much as reasonably possible.
	   o Assess the actual competence and determine training needs, before staff can re-start to work.
	   o Assign all-time-available supervisors to support staff regaining their currency.
	   o Review of and training on common maintenance errors.
	• Briefing of staff, including management, on the importance of policy principles, including 'just culture' and the expectation to apply this in case of mishaps.
	• Preparation of training for staff, including management, customised to meet the needs of the organisation and addressing the current situation. It should include all relevant aspects, such as, but not limited to:
	   o Relevant procedures and their changes, covering the essential elements, intentions and application of procedures.
	   o The need to apply procedures correctly, including MEL / walk around inspection / technical Log.
	   o The need to consider and apply Q&S policy, Human Factors and Human Performance limitations, such as stress/fatigue management and assertiveness, occurrence reporting, etc..
	• Introduce pre-shift briefings to update personnel of recent and on-going changes, and group briefings on return to service, with focus on difficulties with procedures, work instructions and availability of resources.
	• Prepare leaflets and communicate key messages on a regular base.
	• Establish a proper communication channel for retrieving support from specialists.
	• Prepare checklists to support (inexperienced and recently hired) staff in performing their job again after idleness, when relevant.

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Potential hazards	Mitigating strategies to consider by CAMOs and AMOs

2. Lack of sufficient staff	• Realistic manpower planning, including:
	    ○ Number of staff available, considering specific competences, qualifications and authorisations that are required.
	    ○ As tasks may take longer due to the restrictions caused by the COVID crisis, this should be considered in all stages of the planning and the work process.
	    ○ The time to be allocated for tasks may have to be adapted as a reduced tempo can be expected due to reduced skills such as additional time to allow for increased inspections, more cross-checking, etc., while at the same time ensuring the safety culture.
	    ○ Location and environment to perform the work.
	• Nominate adequate deputies for the essential activities to ensure continuity.

3. Lack of required parts and materials	Establish a pro-active supply chain management.
	• Ensure the continued availability of parts and materials, including the proper condition and certification.
	• Ensure the continued availability of services, e.g., NDT, boroscope, component maintenance, avionics service.
	• Consider the continued availability of suppliers and subcontractors and their possibility to ensure continued on time delivery and consider that alternative sources will have to be found.
	    ○ For the case parts, materials and services have to be purchased from alternate sources, ensure that purchasing and receiving inspection procedures and the awareness and application by staff are adapted to the increased risk of receiving substandard deliveries.
	    ○ Reinforced attention for unapproved parts and parts with ambiguous historical and technical status is important, when reverting to alternative sources.
	• If required spares are removed from serviceable aircraft, ensure the correct procedures are followed and that the status of the cannibalised aircraft are properly recorded and monitored.

4. Lack of appropriate procedures and TCH/DH instructions	• Ensure that current TCH maintenance instructions are available, in particular related to parking/storage. • Contact the TCH when instructions are not clear, complete or correct and request proper support and instructions. • Contact the aircraft/engine TCH to decide if additional maintenance tasks are required based on parking/storage duration. • Adapt or include, and timely implement procedures that consider long term parking and storage, including e.g.: ○ Long term storage based on TCH instructions, in-service information and considering varying parking/storage and environmental conditions (e.g. humidity, salt, dust, hail, severe winds, etc.).

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Potential hazards	Mitigating strategies to consider by CAMOs and AMOs
	○ Post-storage process to Return to service; how to determine what is needed to prepare the aircraft back to service. - Inform the TC holder of any findings raised as a result of the parking/storage period.
5. **Procedures and/or instructions are not followed**	- Ensure that management and staff have received update and awareness training focussed on the pandemic consequences: ○ Explain the essential elements, rationale, intentions of the concerning procedures. ○ The need to follow procedures correctly. ○ The need to consider and apply Q&S policy, Human Factors and Human Performance limitations, such as stress/fatigue management and assertiveness, occurrence reporting, etc.. - Promote and monitor application of above training elements and encourage staff to remain assertive. ○ Reporting of occurrences should include the above training elements, e.g. high time pressure, incorrect procedure. - Ensure that procedures, instructions, work cards are clear, correct, complete and validated. - Ensure that required and appropriate resources (qualified staff, work order, work cards, maintenance data, parts & materials, tools & equipment, support and supervision) are available when staff have to perform their tasks. - Introduce pre-shift briefings to update personnel of recent and on-going changes, and group briefings on the return to service of aircraft, with focus on difficulties with procedures, work instructions, availability of resources. - Ensure accurate administration of the work performed; proper sign-off of tasks after verification, in particular for critical maintenance tasks. - Prepare dedicated checklists (for novel and complicated tasks) to support (inexperienced and recently hired) staff in performing their job again after idleness, when relevant. - Provide a proper communication channel for staff to be able to consult allocated specialists. - Consider implementing a dedicated audit programme for aircraft in storage to ensure (by sampling) that required tasks are planned and actually accomplished.
6. **Lack of appropriate tools and equipment**	- Establish a pro-active management to ensure the availability of special tools & equipment, in particular when hired. The owner may not be able to deliver. - Ensure that sufficient proper protective equipment and materials are available and used, e.g., covers, caps, blankets. - When alternatives have to be used, ensure that: ○ They do not compromise the state or condition of the aircraft/engine. ○ The appropriate control procedure is followed.

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Potential hazards	Mitigating strategies to consider by CAMOs and AMOs

	o A proper administration is kept.
	• Ensure that all protective equipment and materials have been removed at the end of the parking/storage period.
	   o Ensure the Return to Service work order includes the removal of alternative protective equipment and materials, e.g. tape used to cover pitot/static ports, tape to seal doors and panels, and plastic foil to protect engine inlet cowling.
	   o Ensure proper cleaning when applicable, e.g. removal of tape residue.
	• Report cases where proper protective equipment and materials have not been applied.

7. Unsuitable environmental parking/storage conditions	• Monitor and adjust procedures and work packages for environmental / weather conditions at the various locations.
	• Contact the aircraft/engine TCH for dedicated instruction and support in order to decide if additional adapted maintenance tasks are required based on the parking/storage duration and location.
	• Consider newly amended TCH instructions and whether additional protection is needed (e.g., protective coating of engine inlets and leading edges, seat cover and cushion removal due to mould).
	• Procedures may need to be developed based on the parking/storage conditions at various locations.
	• Plan work orders during the parking/storage period, considering above procedures and instructions.
	• Ensure that the environmental conditions and actual parking/storage accomplishment are reviewed during the preparation process prior to returning aircraft back to service and consider the need for additional adapted maintenance tasks to:
	   o Remove alternative protective equipment and material.
	   o Remove possible insect/bird nests and rodents.
	   o Conduct analysis for fuel contamination.
	   o Ensure the continued function of the lower fuselage drain system and check for ingress of water in lower zones.
	• Inform the TC holder of any findings raised as a result of the parking/storage of aircraft at various locations.

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Appendix 2: Examples of best practices related to parked/stored aircraft returning to service

Best practices

1. Continuing airworthiness status and work planning/control

Sufficient time should be allocated by CAMOs / AMOs in all stages of the planning and maintenance process as a reduced tempo of operations can be expected due to reduced skills, additional time to allow for increased inspections, cross-checking, etc., while at the same time ensuring the safety culture.

- The CAMO to assess the airworthiness status of the aircraft after parking/storage and prepare the work package for the AMO(s).
- The AMO to plan work considering the need for additional communication, support, inspections and verifications.
- Remote access to various IT tools/systems; ensure the integrity of connected tools/systems, that no illegal software has been installed or connected to the aircraft and that no illegal aircraft system access or modification has taken place during parking/storage.
- Consider cleaning and disinfection of the aircraft. Is a well-defined aircraft disinfection process in place, considering guidelines set by authorities (airworthiness, public health, environment) and/or TC holders and is it communicated to subcontractors and contractors (e.g. at line stations)?
- Consider conducting a sampling program of the fleet to assess the overall condition of the aircraft and prepare the RTS work.
- Contact the aircraft/engine TCH to decide whether additional maintenance tasks are required based on parking/storage duration.
- Assess the need to perform a supplemental physical aircraft inspection and ground test preferably with inputs from the TCH.
- Assess the need to perform a maintenance check flight.
- Take into account additional constraints at remote locations, e.g. concerning staff, environment, tools, equipment and parts.
- Consider the examples of paragraph 3.3 concerning occurrences related to prolonged parking/storage with a serious impact on airworthiness.
- Consider the need for additional maintenance tasks:
  - Perform a specific inspection to determine whether the parking/storage instructions have been complied with. If not take proper action.
  - Remove alternative protective equipment, e.g., tape used to cover pitot/static ports or to seal doors and panels.
  - Check whether Circuit Breakers have been left in open status without a proper identification label and/or relevant tech log entry.
  - Ensure the continued function of the lower fuselage drain system and check for any ingress of water in lower zones.
  - Check the correct function of draining valves installed on pitot-static pressure lines.
  - Check bacterial contamination in the potable water system.
  - Conduct fuel analysis for contamination.
  - Evaluate condition emergency batteries.
  - Remove possible wildlife nests, such as insects, birds, rodents.

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Best practices
- Consider proper balancing of work and required resources.   - The Return to Service work package should consider previous aspects and ensure the aircraft continuing airworthiness and the serviceability of operational and emergency equipment.

2. Recordkeeping

- Ensure clear records (what has been done and what still needs to be done and when) and timely administration of records.
- Ensure that IT systems are up to date, e.g. software status and that continuing airworthiness and maintenance records are entered.

3. Quality & safety policy, promotion and management Link to further EASA material

Due to the COVID-19 pandemic and consequently the many uncommon circumstances induced by it, significant changes with respect to financial, operational, organisational, social and human aspects can be expected. Limited financial and staffing resources and re-allocation of task and activities will increase uncertainty, work pressure, fatigue and eventual lack of motivation. This consequently will have an influence on the performance of many activities and consequently this should be acknowledged by senior management and carefully addressed during daily management.

- Accountable managers and senior management are aware of and take their responsibilities with respect to continuous compliance with the regulations and the culture and attitude needed to achieve this. Whenever required resources and environment are not available and appropriate, concerning tasks must not be commenced and performed.
- Ensure a proper (adapted) quality and safety policy, which is implemented, actively promoted and will not be compromised. Promote and ensure a just culture environment whereby making employees sufficiently assertive to communicate and report concerning degraded safety levels without the fear of reprisal. Increased vigilance is necessary in all activities since protective barriers can be weakened by the COVID-19 crisis.
- Communication of safety issues should be promoted.
- Risk assessments developed before the pandemic may no longer be adequate due to the changes driven by the pandemic and may need to be re-visited.
- Ensure COVID social distancing rules are respected and that the use of Personal Protective Equipment does not prevent staff from working safely.
- Consider in advance what tasks/activities may be affected by health recommendations and consider them in the planning.
- Ensure that Human Factors principles and Human Performance limitations are consciously considered and counter measures planned and applied.
- Consider the potential hazards and mitigating measures addressed in Appendix 1 and control and monitor the actions deemed necessary.

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Best practices
4. Monitoring of the RTS process and continuing airworthiness of the fleet

• Adapt auditing and monitoring to cover the current situation, including e.g.:
   o remote and on-desk audits; and
   o continuous monitoring and analyses of hazards, risks, findings, occurrences, quality and safety performance.
   o review and validate the actual configuration the aircraft hardware and software, since the aircraft may have been exposed to removal of parts (e.g. aircraft cannibalisation) and to software obsolescence / expiry during the parking/storage period.

5. Changes, novelties and alternative processes
• Remind all staff to report problems or previously unknown situations and information. • Assign people to assess the changing circumstances, analyse the impact on systems, processes, behaviour and aircraft safety. • Determine the necessary measures, actions and conditions and manage them, considering social and human behaviour. • Communicate to staff the novel and alternative processes and the decisions taken and explain them.