Technical Airworthiness Authority – Operational Airworthiness Authority Advisory (TAA-OAA Advisory)	
Title	**Development of an Initial Master Minimum Equipment List**
Advisory Number	**2013-07e**
Effective Date	**1 June 2017**
Reference	**TAM Part 2, Chapter 6**
OPI / Telephone	**DTAES 4 / 819-939-4761** **SSO OA / 204-833-2500, ext. 6649**
RDIMS File	**2182D-1027-812-6 – VOL 1** **AEPM #1360576 (English)** **AEPM #1744710 (français)**

1 Purpose

1.1 This joint Technical Airworthiness Authority (TAA)-Operational Airworthiness Authority (OAA) Advisory is intended to assist organizations in the development and approval of their initial Master Minimum Equipment List (MMEL).

1.2 This advisory is not mandatory, nor does it constitute a regulation. It describes a means acceptable to the TAA and OAA, but it is not the only means to demonstrate compliance with the regulation(s). If the applicant elects to use this advisory, then all its important aspects must be followed.

2 Applicability

2.1 This joint TAA-OAA Advisory is applicable to organizations involved with the development and approval of their initial MMEL.

3 Related Material

3.1 Definitions:

a. Master Minimum Equipment List. An approved document created specifically to regulate the dispatch of an aircraft type with inoperative equipment. The MMEL contains the conditions, limitations and procedures required for operating the aircraft with these items inoperative while maintaining the level of safety of the aircraft type dictated by the type of operation for which the aircraft was certified and the minimum standards specified in the Basis of Certification (BoC).

b. Repair Codes. Specific intervals of time (calendar time or flying hours) used in categorizing an inoperative item that indicate the maximum time an aircraft is allowed to operate with the respective inoperative item until its repair.

3.2 Regulatory References:

a. C-05-005-001/AG-001 – *Technical Airworthiness Manual* (TAM), Part 2, Chapter 6;

b. Royal Canadian Air Force (RCAF) *Flight Operations Manual* (FOM);

c. Transport Canada TP9155 – Master Minimum Equipment List / Minimum Equipment List Policy and Procedures Manual;

d. Transport Canada – *MMEL Guidance Book*.

4 Discussion

4.1 Overview

4.1.1 The material provided in this joint TAA–OAA Advisory is based on industry standard format. The applicant is required to submit, or provide access to, appropriate engineering justification with sufficient detail of each item of equipment identified for inclusion in the MMEL. This justification documentation, which is mandatory and requires TAA and OAA's review and approval, is necessary to ensure the level of safety dictated by the type of operation for which the aircraft was certified and the minimum standards specified in the type certification basis, as defined in the BoC, are maintained. A MMEL should be set out in a manner that clearly identifies the equipment in question, provides the repair code, number of items installed and number of items required for dispatch. Any other limitations or exceptions that are required in order to allow dispatch of the aircraft should also be provided. It is important to note that any items related to the airworthiness of the aircraft, and not included in the MMEL, must be operative prior to flight. Items required by the Royal Canadian Air Force (RCAF) Flight Operations Manual (FOM) (reference 3.2.b.), which are not listed in the MMEL, are also required to be operative for dispatch. Within the RCAF, aircraft are normally acquired as a type design that has been modified before delivery to fit the intended operating role. In addition, there is only one operator of the aircraft type. For this reason, the Department of National Defence and the Canadian Forces (DND/CF) Airworthiness Program does not require that an initial MMEL be converted into a Minimum Equipment List (MEL). Instead, a single document called MMEL is maintained.

4.1.2 MMEL should be seen as a list of TAA-OAA-approved deviations authorizing organizations to quickly dispatch an aircraft with inoperative equipment without having to engage their Type Certificate Holder organization for a deviation approval. It should be noted that a MMEL does not preclude an organization to temporarily extend the repair interval of a deferred equipment due to operational circumstances. However, organizations seeking to temporarily extend repair intervals must comply with a TAA-approved deviation procedure.

4.2 Methodology/Development Process of a MMEL

4.2.1 The development of an initial MMEL is an iterative process and is heavily dependent on the aircraft manufacturer as the primary source of information on any new aircraft and its systems. Although not a mandatory airworthiness requirement or a condition of aircraft type certification, all new RCAF fleets should have a MMEL developed as part of their contractual requirement and, the approval process for such MMEL should take place concurrently with the type certification process. The subsequent paragraphs provide guidelines and identify the requirements of the development of a MMEL. Further guidance can be found in the Transport Canada documents (references 3.2.c. and 3.2.d.). These documents contain information with respect to the philosophy, development and approval of MMELs. They may be consulted for further reference and are to be used for guidance purposes only.

4.3 MMEL Format/Description

4.3.1 The following material should be included as part of the MMEL document:

a. Cover Page. This page clearly identifies the aircraft for which the document has been approved and the current revision number and date;

b. Table of Contents;

c. Manual Approval Page;

d. Record of Revisions Page. This page should list all revisions that have been issued since the last complete re-issue or initial revision;

e. List of Effective Pages. A List of effective pages is used to ensure that each MMEL is current. It lists the date of the last amendment for each page of the MMEL. The date and revision

status of each page of the MMEL should correspond to that shown in the List of Effective Pages;

f. Abbreviations, Acronyms and Symbols. Explanations for all abbreviations and acronyms used in the document;

g. Preamble. The purpose of the MMEL preamble is to provide direction to personnel on the applicability, scope, condition and limitations for use of the MMEL in the context of RCAF operations;

h. Equipment. A complete listing of the equipment approved for inclusion in the MMEL document.

4.3.2 The MMEL is normally published in a four-column format, where columns contain the following information for each item on the list:

a. Item. This column identifies the system or item and sequence number (e.g., Air Transport Association (ATA) system identifier, work unit code (WUC)) that has been approved for inclusion in a MMEL. Also included is the Repair Code (right justified) for each item;

b. Number Installed. This column indicates the quantity of the identified items installed on the aircraft;

c. Number Required for Dispatch. This indicates the quantity of the identified items that are required to be operative (serviceable) to allow for dispatch; and

d. Remarks or Exceptions. This should contain information regarding any limitations or additional operational or maintenance requirements. Notes may also be used in this column to further clarify the information.

4.3.3 If deemed useful for the operators of the aircraft type, additional columns may be added to the MMEL page format. For example, a “Mission Code” column may be inserted to indicate the items that must be operative for different mission types.

4.3.4 A sample template for the MMEL format is attached to this advisory at Annex A. Internally, within DND, this template is available in RDIMS under AEPM number 1667979. If you do not have access to RDIMS and wish to obtain a copy of the MS Word template, please contact the OPI for this advisory.

4.4 Repair Codes

4.4.1 The following repair interval categories are normally used in MMELs:

a. **Category A**. Items with a category “A” repair interval are considered significant with regards to the failure condition identified. The time frame allotted to this category is such that exposure to the failure condition is minimized and the aircraft is only dispatched for return to base or to a facility where repairs can be carried out. This category can also be used to define an alternate time frame that does not fit in with the other repair categories (this should be identified in the Remarks or Exceptions column);

b. **Category B**. Items in this category should be repaired within one of the following time intervals:

(1) Three (3) consecutive calendar days (72 hours), excluding the day the malfunction was recorded in the Maintenance Record Set (MRS). For example, if the unserviceability was recorded at 1000 hours on January 26th, the 3-day interval would begin at midnight on the 26th and end at midnight on January 29th; or

(2) The flying hours defined in the MMEL preamble.

c. **Category C**. Items in this category should be repaired within one of the following time intervals:

(1) Ten (10) consecutive calendar days (240 hours), excluding the day the malfunction was recorded in the MRS. For example, if the unserviceability was recorded at 1000 hours on January 26th, the 10-day interval would begin at midnight on the 26th and end at midnight on February 5th; or

(2) The flying hours defined in the MMEL preamble.

d. **Category D**. Items in this category should be repaired within one of the following time intervals:

(1) One hundred and twenty (120) consecutive calendar days (2880 hours), excluding the day the malfunction was recorded in the MRS. For example, if the unserviceability was recorded at 1000 hours on March 1st, the 120-day interval would begin at midnight on March 1st and end at midnight on June 29th; or

(2) The flying hours defined in the preamble; or

(3) The interval between the reported unserviceability and the next major maintenance activity (periodic) scheduled.

4.4.2 To be approved for Category D, the item needs to meet the following criteria:

a. The absence of the item cannot adversely affect the crew members' workload;

b. The crew members do not rely on the function of that item on a routine or continuous basis; and

c. The crew members' training, subsequent habit patterns and procedures do not rely on the use of that item.

4.4.3 Industry standard repair codes are generally specified in calendar time, while some RCAF fleet MMELs convert this calendar time into appropriate flying hour limitations. The flying limitations allow for a certain amount of flexibility for military operation purposes. When converting calendar time into a flying hour equivalent, the typical operational mission length and the typical number of missions per day for that fleet are considered and applied to the number of days indicated by the repair code. For example, for an item with a C repair code (ten (10) consecutive calendar days), a fleet typical operational mission length of three (3) hours and one (1) mission per day, the same item would have a C repair code flying hour equivalent of maximum thirty (30) hours.

4.5 MMEL Justification

4.5.1 Each MMEL candidate item is required to be supported by an appropriate engineering justification. This engineering justification should ensure that the level of safety is maintained with the item being inoperative. In cases where the level of safety is not maintained, special procedures and/or limitations must be incorporated. The level of justification relates to the critical nature of that item being inoperative. For example, fire protection, ice and rain protection systems are considered in this manner. It is important to note that the TAA will be reluctant to approve the degradation of any emergency systems and retains the right to reject the inclusion of such systems in the MMEL. Therefore, the engineering justification of such systems will be thoroughly scrutinized by the TAA during its review.

4.5.2 There are five acceptable justification methods, described as follows:

a. Equipment, including mission kit, is considered optional. When aircraft are approved with optional equipment on board that is over and above the required equipment, there is no need for such equipment to be operative if it is in excess of that required for safe operation for a particular flight condition or flight route. Inclusion in the MMEL can be accepted on this basis;

b. Equipment is considered redundant. If the purpose or function of the considered component/system can be carried out by some other items or equipment, then it may be accepted on a redundancy basis with the provision that the alternative equipment can be

confirmed to be operative. Redundancy cannot be claimed as justification for inclusion of an item, if two (or more) sources of the function or information are required by the aircraft type certification basis. In this case, another means of justification, such as the safety analysis method, should be used;

c. Quantitative Safety Analysis.

(1) Modern aircraft are increasingly dependent on the safe operation of their complex systems, resulting in the development of structured techniques to achieve the necessary level of safety. This level of safety is based upon the principle that the hazard resulting from an event should be inversely proportional to the probability of its occurrence. Compliance is usually demonstrated by conducting a system safety assessment.

(2) The safety assessment establishes the major, hazardous or catastrophic situations, or failure conditions that the system is capable of producing and the allowable probability of occurrence. For those systems whose failure is critical, i.e., a failure results in hazardous or catastrophic situations, a numerical probability analysis is usually required to demonstrate compliance with the allowable probability of occurrence. For non-critical components/systems, the safety assessment may be greatly simplified. The risk of any specific failure condition is a function of the failure rate, the number of such systems and the time of exposure to risk.

(3) When items or equipment from systems performing critical functions are included in the MMEL, the impact of their inoperability should be included in the safety assessment. The additional risk resulting from occasional flights with such equipment inoperative should be established and compatible with the allowable probability of occurrence established during the certification process.

d. Qualitative Analysis Method**.** If an item is considered acceptable for inclusion in a MMEL, a qualitative analysis should be used, where applicable, to consider the impact that the proposed inoperative item has on all other aspects of the aircraft's operation. The qualitative analysis should consider the impact on crew workload, the impact of multiple MMEL items, and the complexity of maintenance and/or operational procedures. It may reflect experience with previous MMEL approvals of similar aircraft systems; and

e. Applicability of Regulations and Standards to Military Operations. Airworthiness regulations and standards applied to support such activities as passenger carrying operations may be considered too restrictive when applied to military operations. Relief may be justified in these situations by controlling the exposure time associated with the inoperative equipment.

4.5.3 If an item cannot be justified by the five previous means or criteria, then the item should not be included in the MMEL. A sample template for the engineering justification sheet is attached to this advisory at Annex B. Internally, within DND, this template is available in RDIMS under AEPM number 1667980. If you do not have access to RDIMS and wish to obtain a copy of the MS Word template, please contact the OPI for this advisory.

4.6 MMEL Defect Deferral Record

4.6.1 The purpose of the MMEL Defect Deferral Record is to enter the basic deferral information (Item No, Date, Name entered by, MOS ID and Time) for this item onto the TAA-approved MMEL Defect Deferral Record contained in the MRS (DND 3163 - *Record of Minimum Equipment List (MEL) Deferral by an Aircraft Captain*).

4.7 MMEL Approval Process

4.7.1 The approval of an initial MMEL is an iterative process. The Directorate of Technical Airworthiness and Engineering Support (DTAES) 4 staff, in conjunction with various DTAES Subject Matter Experts (SMEs) will conduct, on behalf of the TAA, detailed reviews of the initial document

submitted. Prior to submitting the initial MMEL to the TAA for approval, the applicant will need to ensure that:

a. the level of safety is maintained as established during the type certification and defined in the BoC;

b. the MMEL does not contradict the Approved Flight Manual (AFM) and Aircraft Operating Instructions (AOI);

c. the MMEL does not include items reducing aircraft survivability; and

d. the MMEL does not include prohibited items.

4.7.2 If, during the review process, the TAA finds that any of the criteria listed at para 4.6.1 is not met, then the MMEL will be returned to the applicant for rework prior to TAA approval.

4.7.3 The applicant should also provide access to appropriate engineering justification to the TAA and OAA for their review and approval. Prior to submitting the MMEL to the TAA for approval, the applicant should ensure that the material listed under para 4.3.1 is included. If any of the material listed at para 4.3.1 is missing, a request will be made to the applicant to provide it prior to granting the approval for the MMEL.

4.7.4 DTAES 4 staff (on behalf of the TAA) will also engage various DTAES SMEs to review the engineering justification and the initial MMEL. All observations raised from the DTAES 4 and DTAES SME reviews will be provided to the applicant. In some circumstances, these observations will lead to amendments of the initial MMEL and will require rework prior to resubmittal.

4.7.5 Once the TAA is confident that the level of safety is maintained, the TAA approval will be granted. The initial MMEL will then be submitted to the OAA for approval. Until both airworthiness approvals are granted, release of the MMEL for use is prohibited.

ANNEX A
TO TAA ADVISORY 2013-07
DATED 1 JUNE 2017

MASTER MINIMUM EQUIPMENT LIST PAGE TEMPLATE

MASTER MINIMUM EQUIPMENT LIST			DOCUMENT NO.		
Aircraft:		**Revision:**	**System No:**	**21 – Air Conditioning**	
a. Item		**b. Number Installed**	**c. Number Required for Dispatch**	**d. Remarks or Exceptions**	
21	AIR CONDITIONING				
-1	ECS Pressure Regulating/Shut-off Valve (PRSOV)	A	1	0	May be inoperative (failed closed) at the discretion of the aircraft captain dependent on passenger comfort considerations. May be inoperative (failed open) provided: ECS Temperature Control Valve is operative; or (O) Limitations regarding flight with PRSOV failure, contained in the aircraft flight manual (ECS Valve caption), must be adhered to.
-2	ECS Temperature Control Valve (TCV)	A	1	0	May be inoperative (failed closed) at the discretion of the aircraft captain dependant on passenger comfort considerations. May be inoperative (failed open) provided: PRSOV is operative; or All three engine bleed shut-off valves are operative.
-3	Air Conditioning Pack(repair code A is for operations in hot climate)	A B	1	0	May be inoperative at the discretion of the aircraft captain dependant on passenger comfort considerations. May be inoperative.
-4	ECS Avionic Bay Fan	A	2	1	(O) Limitations regarding flight with Avionics Bay Fan failure, contained in the AFM, must be adhered to.

(Template: RDIMS # AEPM 1667979)

ANNEX B
TO TAA ADVISORY 2013-07
DATED 1 JUNE 2017

ENGINEERING JUSTIFICATION SHEET TEMPLATE

MMEL Candidate Engineering Review Data Sheet		
Document No:	**MMEL 21-1**	
Component:	**Cabin Heat Control System**	
S1000 Code:	**SYSTEM 21 Environmental Control**	
LCN 22-12-00	**A. (Operator's Manual)**	C-12-XXX-F00/MB-001 AOI
	B. (Maintenance Manual)	N/A
	C. (FHA/SSA)	N/A
	D. (Other)	N/A

Describe the normal aircraft and system operation:

The heater is located in a compartment on the right forward end of the cabin, ahead of the cabin door, and provides the only means for heating the aircraft. A fuel control unit draws fuel from the right side fuel system and controls the pressure and flow to the heater combustion chamber. The fan draws air from outside through the air inlet duct and forces it through the heater. Some incoming air is diverted to the combustion chamber where it is mixed with fuel and ignited. The remaining air is heated and sent through the duct network. The ignition unit supplies a high voltage current that produces a continuous spark in the heater combustion chamber to ignite the fuel and air mixture. Unburned fuel is drained overboard.

The heater system is protected from overheating by three thermostatic switches; the switch either engages disengages the heater when the set temperature is reached. This creates a low-maintenance thermal device, as it doesn't require the crew to operate the power switch; it simply turns off when the desired temperature is reached.

A differential air pressure switch shuts down the heater when there is not enough air for safe operation. Switches on the overhead panel control heater operation. A temperature controller adjusts the cabin thermostat se□ng. Push-pull controls in the cockpit regulate air flow through the ducting.

A three-position heater function switch is located on the HTG control panel in the overhead switch panel. Selecting HTR ON energizes the various units of the heater once the HTR START switch is depressed. The heating and ventilating system is shut down when the switch is set to OFF.

System Failure Description

Identify the aircrew annunciation for MMEL candidate equipment failure(s):

Inoperative

None

Identify other indications that would be present to the crew should the MMEL equipment failure exist:

Inoperative

Crew perception of temperature

Describe the aircraft and system operation with the MMEL candidate failure present:

Inoperative

If the heater control system fails to turn on there may not be sufficient heating for cold weather operations, extended operations in cold weather may incapacitate the crew causing the potential loss of crew and vehicle. An increased workload may occur; the crew would have to trouble shoot the heater control system. Operational procedures may include cold weather clothing and blankets.

Describe the effect on aircraft and system operation and the consequences of subsequent failures should the MMEL candidate failure exist at take-off:

Inoperative

There are no subsequent failures of the aircraft that could further degrade the margins of safety.

Identify Acceptable Modes of Degraded System Operation:

The heater may not be necessary in all operational environments i.e. hot climates.

Method of Substantiating Level of Safety

☐ **The equipment, including mission kit, which is considered optional**

☐ **The equipment is considered redundant**

☐ **A quantitative analysis**

☒ **A qualitative analysis**

☐ **Applicability of regulation standards to military operations**

Supporting Documentation for Substantiating Level of Safety

Inoperative

Summarize the hazard, risk, and potential scenarios for the MMEL candidate equipment failure:

The heater is only needed for cold temperature operational environments; therefore operational needs will dictate the need to have a functional heater.

Identify the hazard and risk of the next failure should the MMEL candidate equipment failure exist at take-off:

Operational controls may include cold weather clothing and restricted flight. A subsequent failure will not further degrade the level of safety if the heater is not available in cold environments.

Summarize the RM assessment for the MMEL candidate:

Total MTBF for the heater control system is 290 hrs (3.44e-3 failure rate).

Recommended Remarks or Exceptions

Inoperative

(O) May be inoperative provided crew can operate the aircraft safely at ambient temperatures.

Quantity Installed	1	**Quantity Required**	0

Recommended Repair Code

C Maximum 25 Hours Flying Time

Recommendation

The item/system as described in this report is acceptable for inclusion in the CHXXX MMEL

Prepared By (Position)		**Date**	
Recommended By (Position)		**Date**	