National Defence / Défense nationale

DRMIS/SIGRD

Defence Resource Management Information System/
Système d'information de la gestion des ressources de la Défense

DRMIS Master Data

Business Guidelines

ISSCF fleets - Air Force

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Document Information

Revision History

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2.0	20 December 2010	Document revised and expanded	Wilfried Quade
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1 Introduction

The Defence Resource Management Information System (DRMIS) is an integrated ERP[1] system providing support for executing Materiel Acquisition and Support (MA&S) activities, including materiel management and weapon system maintenance.

The supported business processes require a set of master data for each weapon system that will need to be created in the DRMIS system before a maintenance organization can use DRMIS to maintain the weapon system. The required master data for a weapon system can be grouped into the following categories:

- Material Master Data
- Technical Structures
- Maintenance Task Lists
- Maintenance Program

The preparation and loading of the required master data is a process that includes both technical and business aspects. The technical aspects are covered by the DRMIS Materiel Data Protocol (MDP) including data elements as required for a weapon system and load file structures.

This document applies to ISSCF[2] managed weapon systems fleets for the Air Force. The document focuses on the business aspects and will provide guidelines for setting up master data in accordance with the business requirements for the weapon system and the Air Force maintenance processes.

No explicit references are made to technical details such as data elements, specific values such as work order types etc. These may be specific to a particular weapon system and the DRMIS data protocol will be used as the tool to determine required details as required for a specific weapon system. The business rules however will generally apply to any ISSCF Air Force fleet and only minor adjustments should be necessary for a specific weapon system.

[1] ERP: Enterprise Resource Planning
[2] ISSCF: In Service Support Contract Framework

2 Material Master Data

2.1 Material Master Records (MMR)

A Material master record (MMR) identifies an item of procurement or supply. An MMR is required before the item or part can be referenced or transacted upon in DRMIS:

- Supply transactions can be executed, e.g. procurement
- Inventory can be managed including goods receipts and goods issues

For Air Force ISSCF managed weapon systems, materiel is always identified by the combination of the manufacturer CAGE code and the Manufacturer Part Number (MPN). For example, all materiel related supply processes, e.g. material demands and receipts are executed using the CAGE/MPN combination. It is therefore critical that the DRMIS materiel records be perfectly aligned with the OEM materiel records, by CAGE/MPN.

Even if the ISSCF transactions use the CAGE/MPN combination only, DND policy requires that all parts fitted on a weapon system will be codified with a valid NSN, hence the reason why the OEM also has to provide that piece of information.

A material master record includes many pieces of information required to:

- identify the materiel, such as NSN, CAGE, part number, item name and description, and
- manage the materiel, such as: Source of supply, Unit of issue, Stock type, Repairability, Hazmat information, serialisation, batch & shelf life management requirement

2.1.1 Material Identification (MI) Process

MMR are created in DRMIS as an outcome of the DND Material Identification (MI) process.

During the MI process, Canada's NATO Codification Bureau (which is connected to the NATO Master Catalogue of References for Logistics (NMCRL)), adopts the NSN submitted by the OEM so that DND can use them. This automatically creates MMR in DRMIS for all CAGE/MPN combinations within the NSN family, as determined by the NMCRL.

The MI process also allows for the creation of DND internal stock numbers (often referred to as Permanent System Control Numbers (PSCN)), for materiel where a valid NSN cannot be found. Every effort should be made to avoid the creation of PSCN.

Depending on the codification status of the materiel, e.g. whether it has already been assigned an NSN or not, whether the NSN has been adopted by DND or not, whether the CAGE/MPN combination provided by the OEM is in line with NMCRL, etc… the MI process can be quite complex and may take several weeks to execute, especially if alignment is required between the OEM system and NMCRL.

Because MMR are technically a mandatory prerequisite to creating weapon system technical structures and maintenance planning data, it is essential that material identification and management data be supplied to DND as early as possible, so that the MI process may be triggered well in advance of the maintenance master data creation.

2.1.2 MMR rules

The following rules apply to MMR:

- All MMR referenced in other master data objects (e.g. technical structure, maintenance task lists, maintenance plans) have to be identified in the MMR list
- All MMR referenced in the allowed structure as material variants or referenced in an EMR have to be identified in the MMR list accordingly (EMR indicator = “Y”)
- The provided CAGE code has to be a valid 5 digit code in accordance with the Business Identification Number Cross-Reference System (BINCS)
- When an NSN is provided (it is expected that most of the MMR records will be assigned to a NSN, as required by DND policy)
    - The last nine (9) digits of the NSN (known as NIIN) have to be a valid NIIN as per the NATO Master Catalogue of References for Logistics (NMCRL)
    - The NCAGE/MPN combination has to be part of the NSN family as per the NMCRL. However, if the Illustrated Parts Breakdown (IPB) is not in line with the NMCRL, the IPB will prevail, and the IPB NCAGE/MPN will be accepted and loaded, but not associated with the NSN
    - MPN values have to be spelled (including dashes '-' , spaces, slashes '/', etc…) exactly as spelled in the NMCRL

2.2 Management of fully interchangeable parts (FFFC)

If, for a given part, other fully interchangeable parts may be provided instead of the originally demanded part, then a Form-Fit-Function class (FFFC) must be created.

An FFFC identifies a group of fully interchangeable parts/materiel in DRMIS and allows substitution of parts in the procurement and supply processes. Once created, any materiel within that FFFC can be substituted in a work order, purchase order or during goods receipt. Inventory is also visible for all FFFC materiel.

Alternate parts for serialized parts installed in the weapon system structure will also be identified in the allowed structure. However, the alternate parts defined in the allowed structure support only the configuration check and not the procurement and supply processes.

FFFC may be created to support materiel interchangeability within the supply process, for serialized and non-serialized parts such as consumables or additional hardware.

The following rules apply to FFFC:

- Each materiel within an FFFC has to exist as an MMR

3 Technical Structures

3.1 General

A weapon system will be managed in DRMIS using two types of technical structures:

- **<u>Allowed Structure:</u>** This structure represents the allowed configuration of the weapon system fleet as authorized by the technical authority. One allowed structure will exist for each fleet.
- **<u>Actual Structure:</u>** This structure represents the actual and current "as-maintained" configuration for each instance (e.g. each aircraft) of a weapon system. Each actual structure can be validated against the allowed structure (configuration check)

Each weapon system will thus be represented in DRMIS by multiple actual structures and one allowed structure. For instance, each aircraft will have its dedicated actual structure and there will be one allowed structure for the fleet as illustrated in *Figure 1* below.

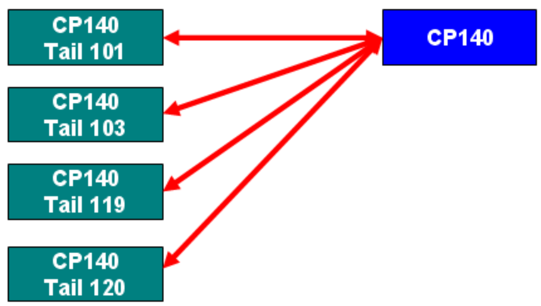

Figure 1: In DRMIS a weapon system is represented by one allowed and multiple actual structures

Both types of technical structures are built as a hierarchical multi-level tree structure using the same building principles. The following key principles apply to both the allowed and actual structures:

- Both the allowed and actual structures include (only) those parts identified and tracked by serial number (serialized parts, equipments). Non-serialized parts (attaching or supporting hardware) are excluded
- In addition to the included equipments there are also structuring elements included to allow for navigation within the structures, providing a functional system breakdown of the structures (on the upper indenture levels) and identifying physical locations of installed equipments
- For the equipments levels in the structure it is important to build an indented structure using a physical breakdown, applying the principle of "order of disassembly". That is, equipments that physically are part of an assembly have to be made subordinate to the higher assembly equipment in DRMIS as well. This key principle is important for the following reasons:
    - The physical equipment hierarchy ensures that the subordinate equipments are included when the parent equipment is removed from a structure - the complete assembly including all subordinate parts is removed in one DRMIS transaction
    - The parent-child relationship between the assembly equipment and its sub-equipment also indentifies the physical location of the sub-equipments. For example, a fuel pump installed into the left-outer engine is identified as being part of that engine by being made a subordinate equipment to that engine assembly in DRMIS

3.2 Allowed Structure

The allowed structure represents the authorized or "as designed" configuration of the weapon system. For each weapon system one allowed structure is defined that will represent and include all configuration variants within the fleet. The allowed structure is created using the following objects:

- Access node
- View nodes
- Structure nodes
- Material variants

Both allowed and actual structures are created using the same breakdown and will mirror each other. Therefore each node in the allowed structure will represent corresponding objects in the allowed structures. The access node represents the root functional locations (Floc), view nodes represent the subordinate Floc and the structure nodes represent the installed equipments (EMR).

To further emphasize the relationship between allowed and actual structures; essentially the same naming convention will be used to identify the nodes and the functional locations.

3.2.1 _Access Node

Each allowed structure has exactly one access node as the root node. The access node will have typically one material variant representing the MER installed in the actual structures. The access node will be identified by the fleet identifier (e.g. C130J) defined for the weapon system.

3.2.2 View Nodes (Floc representation)

View nodes represent Floc. The following rules apply:

- The naming convention used to identify view nodes is essentially the same as used for identifying Floc except that the view node uses only the fleet identifier without the specific tail number. A separator is used between indenture levels, the underscore (_); whereas for Floc the dash (-) is used. A separator is required between the fleet identifier and the remaining part of the view node; subsequent indenture levels may or may not be separated by the separator character, this again has to be consistent between view node and Floc names

  For example, if a view node is identified as *C130J_JA2510* the corresponding Floc will be identified as *C130Jnnn-JA2510* where nnn will be the tail number of the respective aircraft. Thus there will be one view node for this fleet and as many Floc as aircraft within this fleet

- The number of view nodes will directly correspond to the number of Floc for one weapon system instance
- Material variants are not allowed for view nodes

3.2.3 Structure Nodes (EMR representation)

Structure nodes represent installed EMR. The following rules apply:

- The naming convention as defined above for view nodes applies to structure nodes as well, adding indenture levels as required. However, EMR are assigned a DRMIS internal number and thus the structure node ID does not apply to the represented EMR

- If multiple EMR referencing the same part number are installed under the same superior object only one structure node shall be created. The number of EMR represented by this node is defined by the quantity in the node's material variant(s)
- The number of structure nodes and the number of installed EMR has to match - taking into account the material variant quantity

3.2.4 Material Variants

Material variants are required for the access node and all structure nodes. Each structure node requires at least one but potentially more material variants that define the allowed parts that can be installed as an EMR in that location. The following rules apply:

- Each structure node requires at least one material variant. Additional material variants can be defined for fully interchangeable parts (alternate parts) that can be installed as well
- If EMR with different alternate parts are installed in the fleet at a location, material variants have to exist at the corresponding structure node for all used alternate parts
- All material variants for a structure node shall have the same quantity
- MMR have to exist in DRMIS for all material variants in the allowed structure. These MMR have to be created as serialized materials

3.2.5 Object Dependencies & Individual Configuration

Normally all material variants defined for a structure node are valid and applicable across the whole fleet. There are, however, situations where material variants are only valid or applicable for part of the fleet. In order to restrict and control applicability of parts (material variants) the following master data set-up is needed:

- **Configuration Parameter:** For each fleet a set of parameters are defined that allow for controlling part applicability. For example, the applicability can be controlled by tail number, aircraft model or role configuration. For each configuration parameter the technical format (length) and a set of possible values is defined as required for the fleet
- **Individual Configuration (MER):** Each weapon system instance is assigned a specific value for each of the fleet's configuration parameters that represent the current configuration of this specific system, e.g. an aircraft. The individual configuration is defined in the master equipment record (MER)
- **Object Dependencies:** For each material variant with a restricted applicability the combination of configuration parameter values is defined for which the material variant is valid. For variants with unrestricted applicability no object dependencies are defined. During the configuration check the individual configuration of the checked aircraft will be used to determine if the installed equipments are valid

For example, an aircraft fleet is comprised of five aircraft with two different models. Most of the EMR are identical for both models but there are some differences between the two models.

Configuration Parameter:	Aircraft Tail number, parameter: MPL_CH47F_0001 Tail number codes: 101, 102, 103, …, 115
Individual configurations:	Tail numbers #147101: Configuration parameter = '101' Tail numbers #147102: Configuration parameter = '102' ::: ::: :::

Tail numbers #147115: Configuration parameter = ‘115’

Structure node: Pump, Hydraulic

Variant 1: Part number: ABC123-1
Object dependency: MPL_CH47F_0001 IN (‘101’,’102’,’103’,’104’)

Variant 2: Part number: ABC123-2
Object dependency: NOT MPL_CH47F_0001 IN (‘101’,’102’,’103’,’104’)

In the above example the two hydraulic pumps are **not** interchangeably and therefore object dependencies are defined for the two pump variants. Variant 1 is valid only for the first 4 aircraft and variant 2 is valid for all remainder of the fleet. As a result, a pump with part number ABC123-12 cannot be installed in tails 101 to 104; the configuration check during install will result in an error.

The following syntax is used to define object dependencies:

Operator	Example
AND	COLOR = ‘red’ AND BASIC_MATERIAL = ‘wood’
OR	COLOR = ‘red’ OR BASIC_MATERIAL = ‘wood’
IN	COLOR IN (‘red’, ‘green’, ‘blue’) This is equivalent to COLOR = ‘red’ OR COLOR = ‘green’ OR COLOR = ‘blue’
	Parentheses can be used if required
	Values for parameters defined as Character are to be enclosed in single quotes: ‘A’
	Naming convention for the configuration parameter: MPL_FFFFF_nnnn where FFFFF is the five character fleet identifier (e.g. CH47F) and nnnn is a running number. The first parameter is assigned 0001, the second parameter (if required) is assigned 0002 etc.

3.3 Actual Structure

Each instance of a weapon system, e.g. each aircraft, will have its own actual structure. An actual structure in DRMIS will be build as a two-tiered hierarchical breakdown using two master data objects, Functional Locations (Floc) and Equipments (Equipment Master Records - EMR)

3.3.1 Functional Locations (Floc)

The Functional Locations represent the static part of the technical structure, with the lowest level Floc representing installation positions where equipments can be installed. The following rules apply to functional locations:

- The Floc structure should be a location-based hierarchical breakdown of the weapon system structure that can be effectively and efficiently used by maintenance technicians
- The lowest level Floc represent installation positions where equipments (Line Replaceable Units - LRU; Complex Assemblies) are installed. These Floc represent physical location on or within the weapon system
- For Air Force ISSCF weapon systems, each Floc is uniquely identified by its thirty (30) character long Floc name. Each Floc name begins with a five (5) character fleet identifier followed by the three (3) character tail number. The first eight characters identify the individual

aircraft. Separated by a Dash (-) the remaining characters identify the individual Floc: XXXXXnnn-XXXXXXXXXXXXXXXXXXXXX

- The Floc hierarchy is defined by identifying, for each Floc, its superior (next higher) Floc. Hence each Floc within one Aircraft will require a superior Floc - the root (or top) Floc of the Aircraft structure being the only exception
- The Floc structure defined during initial data load has to be complete and comprehensive, that is, all Floc referenced in other PM master data, e.g. superior Floc in Floc and EMR or Floc in Maintenance plans, have to be defined in the initial Floc load

3.3.2 Equipment Master Records (EMR, Equipments)

Equipments represent the rotable elements of the aircraft, that is, the parts or assemblies that can be removed from and installed into the weapon system. Equipments are individual materials represented in DRMIS by an Equipment Master Record (EMR) that is uniquely identified by a part number (Manufacturer part number and manufacturer CAGE code) and a serial number (manufacturer serial number). EMR will also be required for any spares inventory as well as serialized support and test equipment (STE).

The following rules apply to EMR:

- EMR are uniquely identified by a reference to a material master record (MMR) and an individual manufacturer serial number (MSN). For aircraft EMR the MMR is identified by its Manufacturer Part Number (MPN) and Manufacturer CAGE code, each EMR is thus uniquely identified by MPN, CAGE and MSN
- All MMR required for the identified EMR have to exist in DRMIS prior to creation of the EMR
- (Complex) assemblies will be represented by EMR hierarchies, that is, EMR installed under a superior (next higher) EMR. Such EMR hierarchies can be removed or installed as a unit with one transaction. It is important to properly build such EMR hierarchies to correctly represent the physical assembly. All serialized components of an assembly are to be installed under a common superior EMR - multi-level EMR hierarchies are possible
- All EMR referenced as superior EMR or as maintenance items have to be included in the initial data load
- There are two important data elements - equipment object type and equipment location - that have to be accurately assigned from predefined lists of values.

3.3.3 Master Equipment Record (MER)

The Master Equipment Record or Master Equipment is an EMR representing the complete weapon system instance, that is, the aircraft itself. It is installed under the root Floc of each actual structure. The following rules apply to the MER:

- The MER is identified by a part number determined by DND and the CAGE code plus the Manufacturer Serial Number. An MMR with the DND part number CAGE has to be catalogued in DND for the MER
- A unique DND identification number (e.g. for aircraft the six character DND fleet + tail number) will be assigned to each MER

- The MER is installed under the root Floc for each weapon system instance and in the allowed structure the MER will be defined as a material variant under the access node using the DND MMR
- If object dependencies are required for a weapon system each MER has to be assigned an individual configuration, that is, the MER have to be assigned specific values for the configuration parameters defined for the fleet

3.4 Configuration Check

The configuration check is a DRMIS function that compares an actual structure with the allowed structure. It can be executed at any time once the initial data is loaded in DRMIS. The configuration check can only be executed for one actual structure (that is, for one aircraft) at a time.

3.4.1 Link between allowed and actual structures

As a prerequisite for executing a configuration check the actual structures have to be linked to the fleet's allowed structure. This link is established by assigning each weapon system MER to the allowed structure's access node.

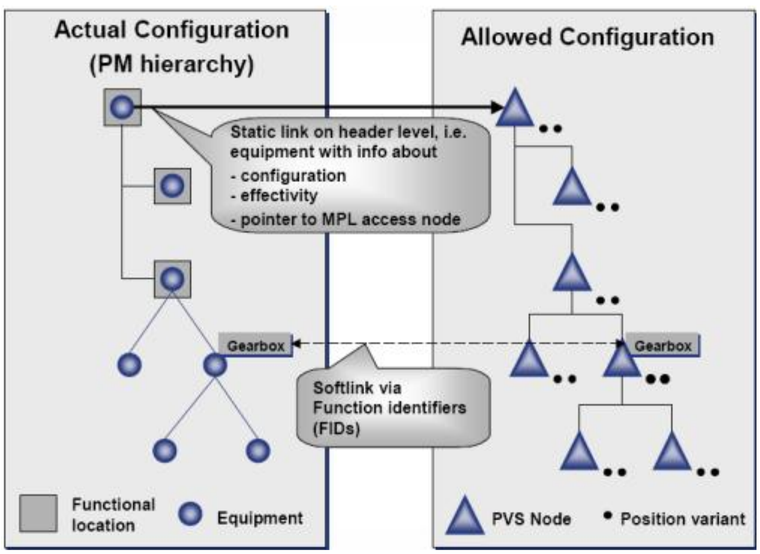

Figure 2: Link established between actual and allowed configuration to allow enable configuration check

In addition, the installed EMR are linked to the corresponding structure nodes. For each structure node all EMR that match any of the node's material variants and that are installed under the corresponding superior objects as the structure node are assigned the structure node as their functional identifier (FID) in the EMR (see *Figure 3* below).

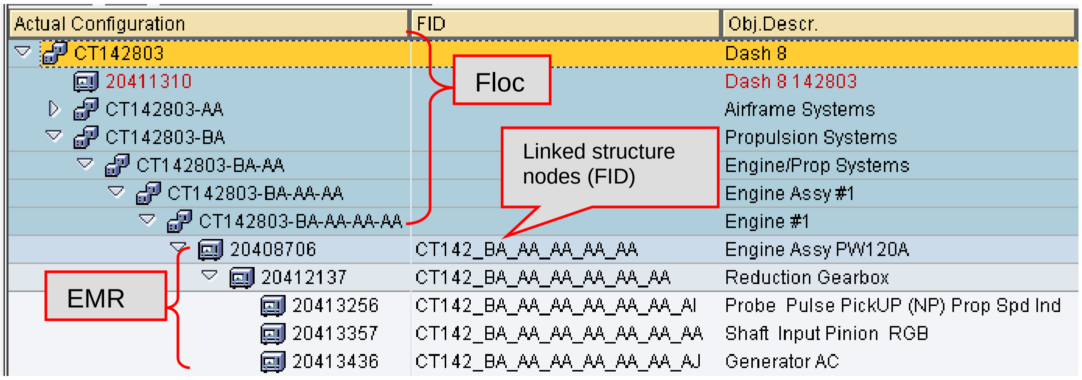

Figure 3: Expansion of one actual structure showing the link of installed EMR to the corresponding structure nodes (column FID)

3.4.2 Configuration check logic

The configuration check compares the installed EMR with the structure nodes from the fleet's allowed structure that is assigned to the EMR as a FID. Floc and view nodes are not evaluated during the configuration check. The following comparison logic is used:

- For each installed EMR the MMR assigned to the EMR (part number and CAGE code) is compared against the material variants of the structure node the EMR is assigned to (EMR functional identifier). If the MMR of the EMR is included as a material variant with matching MMR in the structure node, the EMR is valid. If no matching material variant is found at the structure node, the EMR is flagged as invalid and an error message is produced
- If a valid material variant for the EMR MMR exists at the structure node, the quantity ad defined in the material variants is checked: If the variant quantity = 1, only one EMR with this assigned structure node may exist. If the variant quantity = 3, for instance, then three (3) EMR with the assigned structure node must exist in the compared actual structure. If the quantity check fails, the node gets flagged as invalid and error message is produced
- If no structure node can be assigned to an EMR in the compared actual structure, the EMR is flagged as invalid and an error message is produced
- Likewise, if no EMR is found for a structure node, the node is flagged as invalid and an error message is produced
- If at least one error is produced during the configuration check, the overall check is flagged as "failed'
- If an object dependency is maintained for a material variant the individual configuration defined for the MER is compared with the object dependency to determine if the material variant with the object dependency is valid for the checked MER

Note:

After an actual aircraft structure has been loaded into DRMIS, the configuration check shall produce a successful "all green" result.

3.5 Measuring Points

Measuring points define the various measurements and their units of measure that are recorded for a weapon system instance and that schedule preventive maintenance routines. The individual measured values (measurement readings) are recorded as time-stamped measurement documents for the respective measurement points. Measurement points are created for and assigned to objects of the actual structures such as Floc or EMR.

All measurement units required for a weapon system have to be defined and exist in DRMIS prior to initial data load. Typically a translation table between the external OEM unit and the DRMIS unit will be required.

DRMIS distinguishes between non-cumulative measurement points that just record measurement readings and cumulative measurement points where the system also accumulates a total of all recorded measurement readings. Cumulative measurement points are created as counters and are also called counters. In DRMIS, non-cumulative measurement points are not used to schedule preventive maintenance routines, whereas counters are created in order to schedule preventive maintenance.

3.5.1 Measurement point categories

The Air Force uses three different measurement point categories to identify the business context. The technician portal uses the category to select (only) measurement points that are relevant for the flight check or armament work orders

- **Air Force Flight Check:** All measuring points recorded as part of a flight check work order are assigned this category. They are created for each MER of the weapon system and include both non-cumulative measurements (e.g. tire pressure, fuel loaded, etc.) as well as counters (e.g. Airframe hours, APU hours etc.)
- **Air force Armament:** These measurement points record usage of armament such as rounds fired, chaffs/flares loaded etc. Armament measurement points are created for each MER. Generally, armament measurement points are non-cumulative, but depending on requirements counters count be required as well. The measurement readings are recorded as part of an armament work order
- **Air Force General:** This category is assigned to all counters required for objects with a performance-based maintenance routine. This applies to all measurement points at the root Floc and all subordinate Floc and EMR in the technical structures that require a maintenance plan

3.5.2 Measurement Point hierarchies

The performance based maintenance plans will determine which counters are required and for what objects in the technical structures these counters need to be created. Every reference object in a maintenance plan referencing a counter will require a counter with the appropriate unit.

Measurement point readings (e.g. Airframe hours, Engine hours) are entered into DRMIS at the MER as part of a flight check order. When creating the required measurement points for all objects of the technical structures the lower-level measurement points have to be linked to the right higher-level measurement points up to the MER to ensure proper flow of measurement readings from the point of entry to the maintenance plan at the technical object. When the lower-level measurement points are correctly linked the measurement readings are automatically transferred from the MER down to the lower-level measurement points.

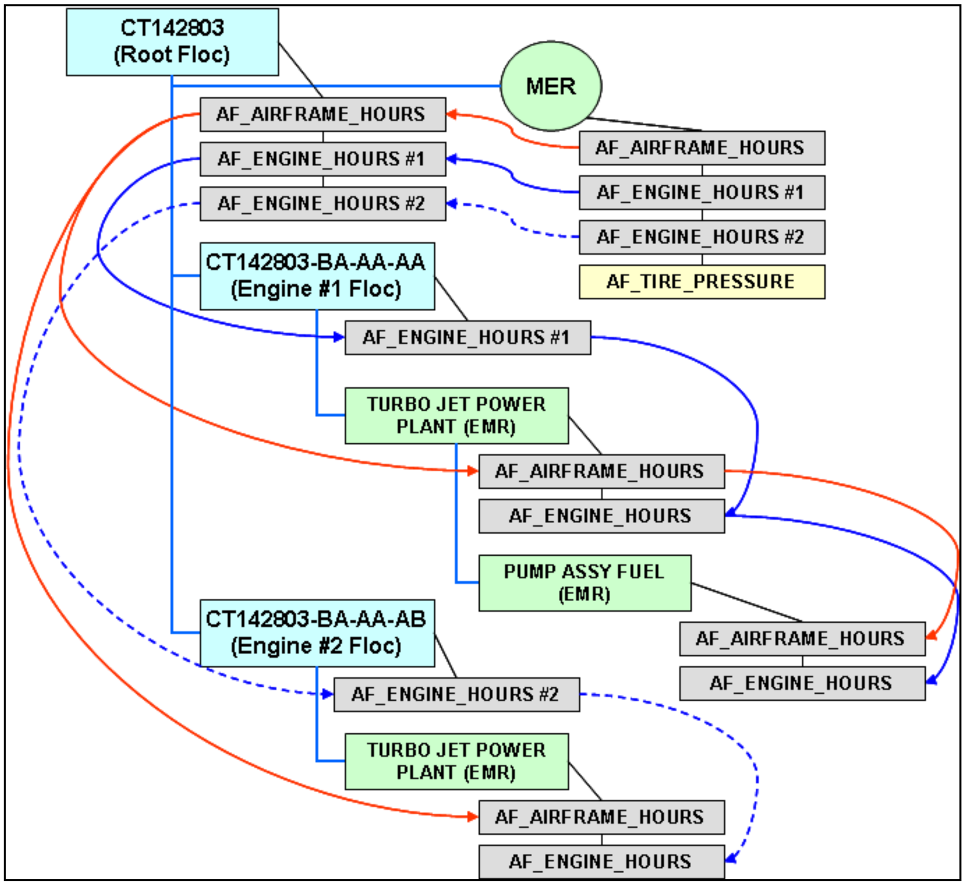

Figure 4: Measurement hierarchy and transfer of measurement readings

Figure 4 above shows an example of a measurement point hierarchy. Linking lower-level counters as shown in *Figure 4* above will ensure the following:

- Counter measurement readings are entered once at the MER level and automatically passed down to lower-level objects
- Removing an EMR (e.g. one of the engines in the above example) from the aircraft will disconnect the counters at the engine from the superior Floc counters. The links between the engine counters and the counters of the subordinate EMR are not affected
- Installing an EMR into the structure will automatically propose a superior counter to link to. In the above example installing the engine will propose the counter of the superior Floc into which the engine EMR is installed thereby reconnecting the EMR counter back to Floc counter

In the above example an engine counter is created at each immediate superior Floc in addition to the engine counters at the root Floc. This ensures that an installed engine will be connected to the correct engine counter depending on installation position. As there is only one counter for airframe hours both engine counters can be connected directly to the root Floc counter.

The measurement point hierarchy as shown in *Figure 4* ensures not only that measurement readings recorded at the MER are transferred downwards in the structure but also that the correct superior measurement point is proposed for linking when an EMR is installed, especially where position-dependent measurement points exist.

3.5.3 Measurement point rules

The following measurement point rules apply:

- For all manually recorded measurement readings measurement points are to be created at the MER using either category “Flight Check” or “Armament” as applicable. Cumulative measurement points requiring the total of all measurement readings have to be identified as a counter
- All measurement points required within the technical structure at the Floc or EMR level have to be created at the root FLoc as well and linked to the corresponding MER measurement point
- Measurement points (counters) are required for all Floc and EMR referenced in a maintenance plan item. This will also include EMR currently dismantled from the aircraft that are in e.g. a repair shop awaiting maintenance or repair work
- Generally, linking all measurement points for Floc and EMR below the root Floc will to the corresponding measurement point of the root Floc will be sufficient to propose the correct superior measurement point during EMR installation
- For complex assemblies (equipment hierarchies) all counters of subordinate EMR are to be linked to the topmost EMR of the equipment hierarchy and **not** to the corresponding measurement point at the root Floc
- Position-specific measurement points require a measurement point at the installation-point Floc in addition to the one at the root Floc in order for the link to the correct superior measurement point to be proposed during EMR installation

4 Maintenance Task Lists (MTL)

Maintenance task lists (MTL) in DRMIS define tasks and resources required to execute maintenance work. Typically, MTL do not include the detailed work instructions but rather identify the work step on the level where signatures are required and reference the technical publication that includes detailed work steps and work instructions.

Maintenance task list serve as templates for maintenance work orders. For DRMIS maintenance plans MTL are required and when a new work order or notification is scheduled for a maintenance plan the MTL referenced in the maintenance plan item is automatically copied into the work order or notification.

In addition to the required MTL for scheduled maintenance, MTL should also be created for any other maintenance work such as conditional maintenance (e.g. bird strike, hard landing), fault isolation, corrective maintenance (Remove and Replace) and servicing tasks. This will allow the technician to (manually) copy the MTL into the work order and have all the MTL information available in the work order, including materials or PRT required.

MTL will also be required for engineering changes requiring work on the weapon system, e.g. embodiment of modifications.

4.1 Maintenance Task List structure

The following information is included in a maintenance task list:

- One task list header
- One or more operations. Each operation identifies a task or work step that will have to be digitally signed by the technician when the MTL is copied into a work order. The operation identifies the trade (DRMIS: work center) and work or duration
- Operations can have sub-operations if additional signatures are required for an operation
- Components can be assigned to an operation to identify any material (removable parts or consumables) required to execute a work step. Materials allocated as components will create a part demand for the work order when the MTL is copied into the order
- Support and test equipment (DRMIS: Production Resources and Tools - PRT) can be assigned to an operation to identify any support material. Assigned PRT will **not** create a demand for supply

In DRMIS sub-operations should only be included for an operation that requires additional signatures. This is a business requirement in the following cases:

  - Independent check required
  - Critical juncture
  - Additional trade

The following functions are only available for operations and are **not** supported for sub-operations:

  - Assignment of components and PRT
  - Assignment of maintenance packages - for MTL used in strategy-based maintenance plans
  - Scheduling - duration and/or work in a sub-operation is for information only and is not evaluated for scheduling

4.2 MTL rules

The following rules apply to MTL:

- Each maintenance plan item will require a corresponding task list. If the maintenance plan is a strategy-based, the strategy has to be referenced in the MTL header. For MTL referenced in maintenance plan items it is important that MTL and maintenance plans are build along the same principles
- Each operation and sub-operation will require an electronic signature in order to close a work order. It is thus important not to include more operations or sub-operations than are necessary to meet signature requirements
- There must be at least one operation for each MTL
- Each operation will include the number of people required and the duration and/or work needed to execute the operation
- Each operation identifies exactly one generic trade that will have to exist as a generic performing work center in DRMIS. Additional trades shall only be included as sub-operations if separate signatures are required
- Components and PRT can be assigned individually to each operation where they are needed or can be assigned to the first operation of the MTL. Component or PRT assignments are technically optional, but could be identified as business mandatory by the Weapon System Manager (WSM)
- Components and PRT are mutually exclusive, that is a part identified as a PRT cannot be assigned as a material component and vice versa
- The following functions are not supported for sub-operations:
    - Assignment of components
    - Assignment of PRT
    - Assignment of sub-operations to maintenance packages (for strategy-based plans)
    - Scheduling (duration values in sub-operations are for information only, for scheduling only operation data are evaluated)
- MMR must exist in DRMIS for each assigned component or PRT

5 Maintenance Program

5.1 Maintenance Plans

In DRMIS maintenance plans are used to schedule calendar or performance based maintenance routines. When a maintenance routine is due as determined by the maintenance plan either a work order or a maintenance notification is created. All necessary data elements required to create a work order or notification are part of the maintenance plan.

Maintenance plans are created for individual objects of the technical structures, e.g. functional locations or a specific EMR. A maintenance program will typically identify many maintenance significant items for, say, an aircraft structure. This maintenance program as defined in the relevant technical publication will result in many maintenance plans in DRMIS. For instance, each aircraft will have its own separate set of maintenance plans and there will be as many individual maintenance plans created for an aircraft as there are maintenance significant items included in the technical structure of the aircraft.

5.1.1 Maintenance plan types

Depending on the scheduling requirements three different types of maintenance plans can be created in DRMIS:

- ***Single cycle plan:*** This type of plan includes a single scheduling interval, either calendar or counter based. An example would be to repeat a maintenance routine every 12 month, another task would be required every 30 flight hours
- ***Multi Counter plan:*** This type of plan will be required where the schedule will depend on at least two different scheduling cycles of different dimensions. An example would be an oil change that will be due either every 12 month or every 30.000 km depending on what comes first
- ***Strategy-***based plan: In this type of plan the plan cycle is not defined in the maintenance plan itself but is created as a separate so-called strategy and referenced in the plan. Strategy-based plans use a single dimension, either calendar or performance based but allow for different scheduling intervals

5.1.2 Maintenance strategies

Maintenance strategies allow more complex scheduling of maintenance routines than singe cycle plans. Strategies are typically used to combine the schedules of different maintenance tasks into one schedule.

Take as an example a set of maintenance task (a “package”) required every 100 hours and another package of maintenance tasks required every 200 hours, resulting in the following pattern:

Package 1 (P1):	100	200	300	400	…	hours
Package 2 (P2):		200		400	…	hours

Two different single-cycle plans could be build, one plan for Package 1 (P1) with the 100 hour cycle and one plan with the 200 hour cycle for Package 2 (P2). However, with two separate plans the work schedules for the both packages are independent of each other. For instance, performing P1 at 90 hours instead of at 100 hours will create the next P1 order at 190 hours. But the P2 work will still be scheduled for 200 hours rather than 190 hours. If this scheduling behaviour is acceptable, separate single-cycle plans can be used.

However, more typical for periodic or phased maintenance, is the requirement to have the P2 schedule in the above example linked to the P1 schedule. That is, completion of P1 at 90 hours will result in both P1 and P2 being scheduled at 190 hours, effectively linking the schedules for both packages. This scheduling behaviour will be achieved by creating one strategy with two packages and one strategy-based plan.

Name	WQ_01
Description	Example - 2 packages
Scheduling indicator	3 Activity

Package No.	Cycl.length	Unit	Maintenance cycle text
1	100	HR	Every 100 hr
2	200	HR	Every 200 hr

Figure 5: Example of a maintenance Strategy with two packages

Strategy: WQ_01 Example - 2 packages

Package	Cycle text	100.0 HR	200.0 HR	300.0 HR	400.0 HR
1	100 hr	P1	P1	P1	P1
2	200 hr		P2		P2

Figure 6: Package sequence for the above example strategy

5.1.3 Maintenance plan header and item data

Maintenance plans have a header and one or more maintenance items:

- ***Maintenance plan header:*** The plan header identifies the cycle, the scheduling parameters and identifies the counter if this is a performance-based plan
- ***Maintenance items:*** The maintenance item identifies the object in the technical structure where the maintenance routine is to be executed. This can be either a Floc or an EMR. The item also includes all data required to create the work order or notification: Order or notification type and the maintenance task list (MTL) to be copied into the order/notification

The fact that the cycle and especially the counter are assigned at the plan header is important for deciding whether multiple items can be defined under the same plan. Only if all plan items can be scheduled the same can multiple items be used. This is typically the case where functional locations are referenced, e.g. different maintenance routines with the same periodicity are required in different (functional) locations.

Another example for multiple items are large periodic inspections where often several hundred tasks need to be executed. These tasks are typically defined for the aircraft. Therefore all tasks could in principle be consolidated in one MTL requiring only one item. In that case only one work order or notification gets created. However, for work planning and execution it is often deemed advantageous to create multiple orders. In that case the one MTL will have to be split into multiple smaller MTL and multiple items created within the overall plan. Then when a periodic is due multiple orders are created.

On the other hand, some parts will have a life specific to the individual part and maintenance routines need to be scheduled based on the individual counter value or start data for calendar-based routines. In these cases the reference object will be the individual EMR and only one maintenance item can be created because the counter for this plan will be the counter from the EMR defined in the item. These plans will follow the EMR.

5.1.4 Maintenance plan categories

Several maintenance plan categories have been defined for the Air Force. The maintenance plan category is used to differentiate maintenance plans according to business categories, e.g. plans for periodic inspections, discards, etc. The categories also determine whether work orders or notifications and what order or notification type will be created by the maintenance plan.

If the maintenance routine can be executed on wing a category calling a work order is to be assigned. If in order to execute a maintenance routine the part has to be removed from the aircraft (e.g. for an overhaul) a category calling a maintenance notification is to be assigned.

Note:

When work orders are created for maintenance plans corresponding notifications are created for each work order as well. If notifications are created for a maintenance plan, the corresponding work orders will be created manually at a later point in time.

5.1.5 Maintenance plan rules

The following rules apply to maintenance plans:

- In order to ensure correct scheduling it is important to determine the appropriate type of plan, e.g. single cycle, multi counter or strategy based
- For strategy based plans the referenced strategy has to exist in DRMIS
- For performance based maintenance the appropriate counter has to be assigned. This counter has to exist in the system and has to also exist for the technical structure object referenced in the maintenance item(s)
- The reference object in the maintenance item (Floc or EMR) has to be defined in the technical structure
- An MTL is required for each maintenance item, this MTL has to be defined
- The maintenance plan category has to be assigned appropriately. The order or notification type and maintenance activity type have to be the correct ones for the assigned category
- Maintenance plans, strategies and maintenance task lists have to be defined such that the resulting orders and notifications can be effectively managed and executed by the maintenance planners and technicians
- The weapon system maintenance program as defined in the relevant technical publication has to be accurately transformed into the necessary DRMIS maintenance plans taking into consideration that the maintenance program defines tasks objects and schedules generically for the fleet whereas in DRMIS maintenance plans have to be created and linked to all relevant technical objects and counters of all weapon system instances

5.2 Flight checks and conditional inspections

Flight checks and conditional inspections for e.g. bird strikes, hard landings etc. are not considered preventive maintenance routines in DRMIS and therefore no maintenance plans are created. However, maintenance task lists will have to be provided for all required conditional inspections and flight checks.

That a flight check or conditional inspection is required will be decided outside of DRMIS and a work order will be directly created. The applicable MTL will be copied directly into the created work order.

6 Sizing considerations

6.1 General

The size technical structures, maintenance task lists and the maintenance program have a direct impact on the transactional workload of the maintenance organization. It is therefore important to carefully consider the size of the critical master data objects that directly impact the maintenance transactions.

- Equipment Master Records (EMR) – Installed EMR
- Maintenance Task Lists (MTL) – Number of Operations
- Maintenance Plans (MP) – Number of Items

6.2 Technical Structures (EMR)

When building the technical structures, it will have to be decided which parts to track as serialized and hence to include as EMR in the structure. In general, only parts that have serial numbers assigned by the manufacturer will be tracked as individual EMR. These parts will typically be line replaceable units (LRU) - that is, parts that are replaceable on wing.

It is not necessary to include all parts identified as maintenance significant items in the structure as EMR. Maintenance routines that refer to parts that are typically not considered serialized such as e.g. gaskets, hoses etc. but that need to be regularly inspected should **not** be defined as EMR. The maintenance plans will instead refer to assembly EMR, e.g. an APU or a landing gear assembly and the parts to inspect will be identified in the inspection instructions.

Especially under the ISSCF maintenance concept, maintenance-significant items with scheduled maintenance executed outside of DND shall **not** be included. Typical examples would be internal engine parts not touched by DND maintenance

The number of equipments included in the technical aircraft structure will determine the number of install and dismantle transactions that have to be executed in addition to supply transactions. The number of EMR should therefore be limited as much as possible and should include the following items:

- Life-limited parts replaced by DND
- Items subject to scheduled maintenance where the maintenance tasks are scheduled based on the usage of the individual item rather than the system or assembly in which they are installed
- Items tracked individually due to their criticality, high value or DND requirements
- Items required to show on DND forms such as:
  - Major (complex) assemblies, e.g. Engines, APU
  - Software (if to be shown on DND software form)
  - Cartridge Actuated Devices (CAD), Pressure Actuated Devices (PAD)

6.3 Maintenance Task Lists (MTL)

The number of operations (and sub-operations) in a task list determine the signatures required on a work order. Each operation and sub-operation has to be digitally signed by the maintenance technician.

It is therefore important to keep the number of operations and sub-operations as minimal as possible.

6.4 Maintenance Plans (MP)

The number of maintenance items determines the number of work orders created when the plan becomes due. For most maintenance plans only one work order is necessary, hence most maintenance plans will have one item only.

The large periodic inspections should be the only exception but the number of work orders should still be kept minimal.