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# Electronic Information Environment (EIE)

## Industry Maintenance Services Operational Model
### For Industry-performed Maintenance.

**EIE Project**

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# 1 Overview

In the context of Performance-Based Contracting (PBC) Canada performs first line maintenance, and may perform second line maintenance. As such Canada will use Canada Maintenance Management System (CMMS) to record the maintenance activities.

The industry partner is responsible for defining and providing all of the required information that needs to be populated within CMMS. Industry is measured on the effectiveness of the maintenance regime and thus is interested in data collected that will enable industry to monitor and report serviceability of a fleet based on the maintenance data that is captured within CMMS.

The Industry performed maintenance operational information exchange model has been designed and implemented with awareness as to the use of the data and the immediacy needs for the data in support of operations and on-going maintenance by Canada following execution of Industry performed maintenance.

The data that is generated during Industry performed maintenance work will be based on the scope of the Industry work package. This could impact configuration data, repair and replacement of components that are on the platform, or the introduction of new structures. Across all of these considerations Canada will require the related data to be sent in order to be inducted into CMMS to support on-going maintenance of the platform by Canada following Industry performed maintenance work.

The specific periodicity and the associated maintenance events that result in data is required to be collected by the Industry provider and then subsequently dispatched to Canada is specified in the related process model [Ref. 1]

A class of the data that is gathered during conduct of maintenance contributes to the measurement of the Performance Management aspect of the PBC program, while other slices of the data are required for industry to conduct its technical functions of Maintenance and Reliability of the platform.

## 1.1 Intended Audience

The intended audience for this business use case includes:

- Industry partners who require detail of their business service-level interactions, benefits, and obligations under PBC.

- Canada Program Management Offices implementing PBC.

- Solution Architects who will define a Business Service Model for the business service(s) described here.

- Functional Testers who will use the business use case to define test scenarios for Integration testing.

- Designers who will perform detailed design and unit test.

## 1.2 References

[Ref. 1]    a.   Annex K: Third Line Maintenance Process Model - In the Context of In-Service Support Contracting Framework (ISSCF)

               b.   Annex L: Navy Maintenance Process Model - In the Context of Performance Based Contracting (PBC)

[Ref. 2]    Electronic Data Exchange (EDE) Service Interaction Model[1]

[Ref. 3]    DRMIS Master Data Business Guidelines ISSCF fleets – Air Force

Note1: Only applicable references will be made available to industry partner based on the adoption by the platform authority within Canada – DND, since not all references are applicable to all platforms/fleet

Note2: In order to determine the specific version of references included in here, the reader is advised to read the accompanying 'Release Notes" for the Maintenance business domain that accompanied the release of this document.

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[1] - The equivalent document that has been defined by industry partner and submitted to Canada as part of deliverable for the establishment and sustainment of the In-Service-Support solution

## 2    Principles of data capture and subsequent exchange

The driving principles of data capture for exchange with Canada are established based on the need for the data to broadly support the following categories of the Weapon System Program in the In-Service-Support (ISS) phase namely:

- Reliability and Maintainability of the Platform by Canada following Industry performed maintenance

- Configuration Management Requirements for the As-Maintained Configuration following Industry performed maintenance

- Accessibility to the data related to Industry performed maintenance contained within Industry systems

- Performance Based Accountability (PBA) – support as required

Each of the above categories warrants data to be captured with various characteristics as per the discussion below.

### 2.1    Reliability and Maintainability

Reliability and Maintainability (R&M) in this context looks at the data with a bias towards supporting operations and maintainability of the platform and thus requires data with regards to measurement readings of various sub systems on the platform. As well as the structural changes that may result while conducting maintenance and other related aspects.

The data captured for this category is typically at the conclusion of maintenance significant activity and will be triggered based on system lifecycle for the specific business process and the associated event. An example of this type of Maintenance Data is, a completion of Work Order results in all data that is present at the time of completion is captured such as: Operations that were executed, deferred or not planned to be executed, completion status of the work order as being completed or incomplete.

The transfer of this class of data will be conducted using web services, which will react to business process system events that fall into a lifecycle that resembles the conclusion of the maintenance activity; e.g., completing a work Order.

### 2.2    Configuration Management Requirement

A Configuration Management (CM) data requirement falls into a category of data as to what configuration item from a platform perspective is being modified or replaced.

The data captured as part of this group typically falls into a Maintenance Action that impacts the structure or configuration characteristics of the Weapon System (WS)/platform. An example of this type of maintenance action: A Maintenance technician recording the removal of a system/ subsystem and installation of a replacement system/subsystem.

The data in this category can be captured and transmitted at the conclusion of all the maintenance actions and as such can be packaged and transmitted similar to the R&M model.

The web services that are enabled for this type of data transfer will contain multiple types of business objects; for example an Equipment master record (EMR) its un-installation reference with the regards to the structure object with all of its sub object types as defined in the [Ref.1] and the timestamp that

reflects the when the actual un-installation was conducted and recorded in the Industry's maintenance management system. Similarly the installation of an EMR should contain the related information as described in the un-installation event.

Additionally the required measurement readings associated with the equipment being installed, date the measurement reading was recorded should be sent along with the maintenance plan as applicable.

## 2.3   Performance Based Accountability

The third category of data for Performance Based Accountability (PBA) is sensitive to the specific event and time when the event has occurred. Hence, this data determines the posture of the maintenance activity and by extension the posture of the weapon system/platform.

The information capture model during the execution of maintenance in this category will have time component and additionally may be augmented with other context data with regards to the event.

The data that will be made available will be based on the input received from industry following execution of maintenance along with related data that is captured within CMMS in support of Industry performed maintenance.

The data captured for this purpose will have discrete web services that are reflective of the business event type and data generated by the business event.

# 3 Constraints/Behaviours of the Data Exchange

1. Canada generates the primary notifications or work orders[2] and associated supporting objects to task Industry with maintenance activities, which will be based on the defined model as provided by industry partner who has the responsibility for the in-service-support (ISS) phase of the platform.

2. Canada and Industry partner collectively may include additional work orders to be completed during the conduct of Industry performed maintenance.

3. Industry partner's maintenance system will be used for Industry performed maintenance.

4. Canada's Maintenance Management System may also be used to fulfill a portion of the Industry performed maintenance work for maintenance being conducted by Canada personnel.

5. Maintenance data recorded within CMMS will be subject to operational authority policies as it relates to release of the data outside Canada Maintenance Management System.

6. Data will be subject to latency model that is commensurate with the type of data and the sensitivity as determined by the operational authority. Please see [Ref. 1 as applicable] for details.

7. The platform Weapon System Manager[3] (WSM) and industry partners are required to work within the constraints of data being released as defined by operational authority for the data.

8. A predetermined release model will be published to industry partner who will be receiving the data from Canada on initiation of Industry performed maintenance and up to and including the conclusion of Industry performed maintenance.

9. Industry partner and Canada will establish a release model for the Industry performed maintenance data that is originating as a result of Industry performed maintenance from the Industry's system of record.

10. Canada will acknowledge the receipt of Industry performed maintenance data with a distinct business acknowledgement. The business acknowledgment may take the form of a positive acknowledgment, or a negative acknowledgment in which case it will be in the form of a business error.

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[2] Industry tasking by Notification or Work Order is dependent upon the platform and related Industry interaction model

[3] Or equivalent for a given platform. Navy uses the term Class Program Manager (CPM)

## 3.1 Data Processing Model In Support of data alignment & Performance Profiling

1.  The maintenance data captures some raw data that will be used to compute the performance profile of the program. As such the data that is used for computing the performance profile during any given period needs to be clearly reconciled between source and destination. The source which will typically be Industry's system of record for maintenance data that indicates completion of work. The destination where the performance algorithms to measure Industry performed maintenance completeness could be industry systems.

2.  Canada' system will accept the required raw data following the conduct of maintenance performed by industry and process it within its systems.

3.  Canada will notify Industry with the required unique identifiers for each record of data that it received from Industry related to Industry performed maintenance and was able to process with/without errors.

4.  Industry will accept the acknowledgement data sent by Canada for Industry performed maintenance data, thus ensuring that all of the data that was sent was processed by Canada.

5.  In case of errors reported by Canada, industry will process the errors and retransmit the data with the required corrections and repeat until there are no outstanding Industry performed maintenance data that has not been completely accepted and recorded within CMMS.

6.  At this point both Industry partner and Canada should have the same picture and status of the Industry performed maintenance data that was required by Canada to be resident within CMMS in support of on-going maintenance, as well as for operational requirement of the platform.

7.  Both Industry partner and Canada have the exact same picture of the required Industry performed maintenance data to contribute to the performance management component of the PBC program, as well as to support on-going maintenance and operational support of the platform.

8.  Industry can perform its monthly, quarterly, and annual reporting functions against the data with a degree of confidence that all of the data that Canada had released was the data that was used in the performance metrics.

9.  Canada has the same visibility as to what data was sent from Canada and was successfully received by industry and would be used for the specific reporting period.

10. Industry and Canada now begin the process of conducting the required Industry performed maintenance acceptance processes as defined in [Ref. 1]

11. The maintenance history data that continues to flow from Canada for the remainder of the program will also include Industry performed maintenance data, but will be based on the triggering events that exists for the program and not specific to Industry performed maintenance activities.

## 3.2 Benefits

Based on the model described above, a summary of benefits is listed below:

a. A complete and accurate picture of the data related to Industry performed maintenance and which was required to be in CMMS is clearly established prior to the acceptance process of the platform by Canada following Industry performed maintenance.

b. A complete and accurate picture of the data being used is clearly established prior to the commencement of performance reporting.

c. Avoids inconsistency in interpretation of what data was used in arriving at the reported results.

## 3.3 Responsibilities

Based on the model described above, the associated responsibilities that both Canada and Industry have to accept are listed below:

a. Industry has to ensure that all qualified maintenance data is released to Canada in a timely manner, thus ensuring Canada has a sufficient processing window to validate the raw data that was received and accept into its system of record, namely CMMS.

b. Canada has to ensure that all qualified maintenance data provide by Industry is processed and acknowledgements or errors are reported to Industry. Thus ensuring industry partner has sufficient processing window to acquire the appropriate raw data with the observed deficiencies reported by Canada, institute the required corrections and retransmit the data to Canada.

c. The business acknowledgment lapse time from Canada should be reasonably short as the transactions are being processed in near real time.

d. Canada and industry will need to ensure that there is a defined window for acknowledgement by Canada for data that has been accepted by Canada.

e. The specific time lapse between receipt of data by Canada and electronically notifying Industry will be jointly agreed by both Industry and Canada.

f. Industry will also need to ensure that when errors are reported electronically via web services that the appropriate error handling and rectification required is conducted in a timely manner so as to enable the acceptance process for the platform coming out from Industry performed maintenance.

# 4   Industry Performed Maintenance History Service Execution Model

Industry performed Maintenance History services will operate using a request/response model as defined in [Ref. 2].

Industry performed Maintenance History services exposed by Canada to industry are invoked on as required basis. Canada will process the data in near-real time.

## 4.1   Pessimistic Model

The Figure 1 diagram illustrates the process under which Industry will transmit Industry performed maintenance history records to Canada in a pessimistic processing model.
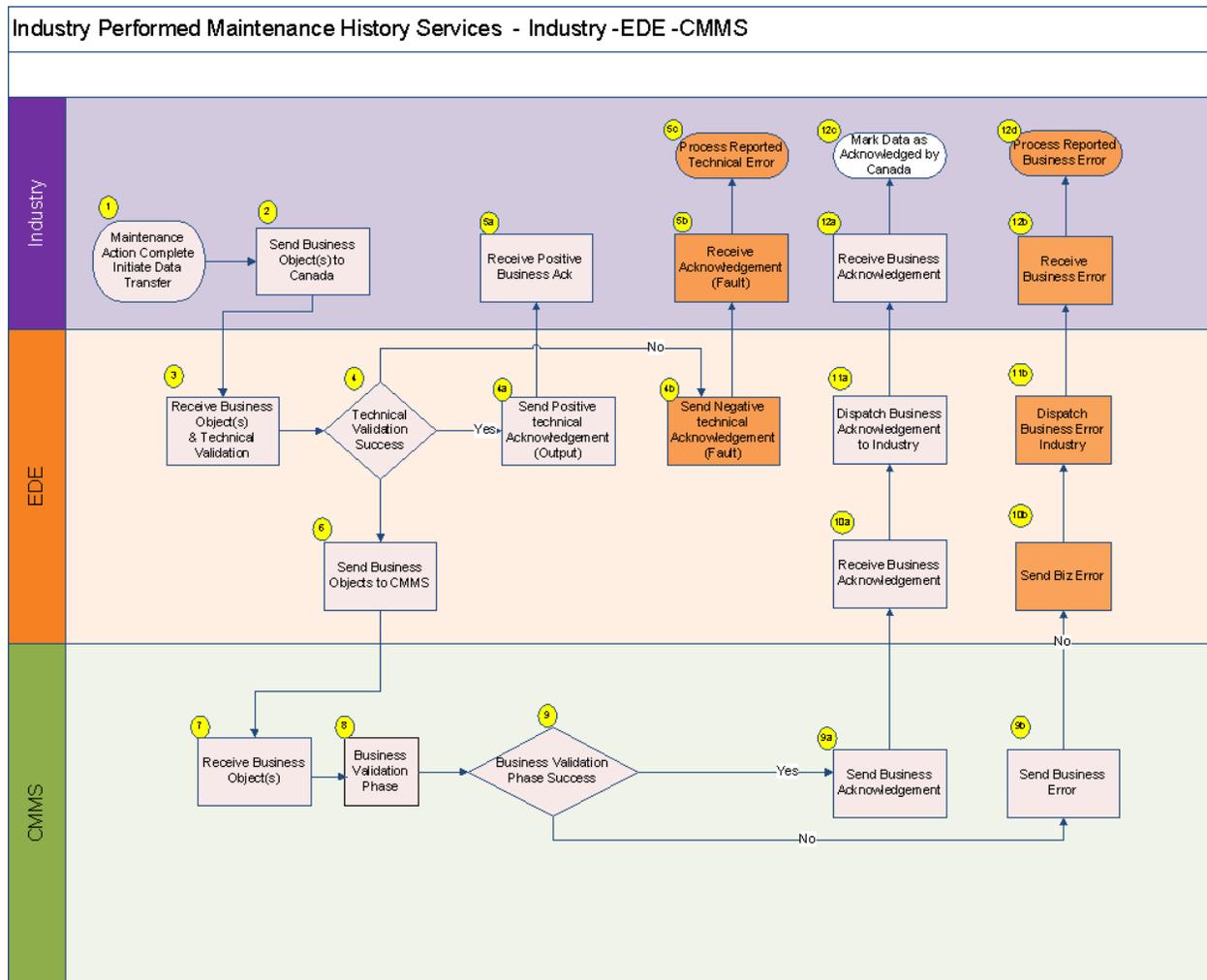


**Figure 1: Periodic Operational Model Industry performed Maintenance History – Pessimistic Model**

1. Industry partner determines that a maintenance package of work is complete.

2. Industry collects the required data and invokes the required services (step 2) to dispatch all the data that has been designated by Industry for release to Canada as per the [Ref 1].

3. Canada receives the data (step 3).

4. Canada EDE conducts basic technical compliance checking (step 4) as defined in the [Ref.2] as the technical validation phase.

    a. If the technical validation results in an acceptance of the message, Canada EDE sends a technical acknowledgement immediately following the technical validation phase, within the same technical conversation from a web services perspective (step 4a).

    or

    b. If the technical validation results in an failure of the message, Canada EDE sends a negative technical acknowledgement (fault) immediately following the technical validation phase, within the same technical conversation from a web services perspective (step 4b).

5. Industry partner system accepts the technical acknowledgement and has concluded the technical delivery (step 5a); or

6. Industry partner system accepts the technical fault reported and concludes that an unsuccessful technical delivery of a message has occurred (step 5b).

    a. Industry partner processes the technical failure and initiates a subsequent delivery and processing steps 2 – 5 will be repeated as required (step 5c).

7. Messages that have passed technical validation by Canada EDE and an associated technical acknowledgement has been sent to industry partner will now be sent to CMMS (step 6) for induction into CMMS.

8. CMMS receives the business objects (step 7) and conducts a business validation phase (step 8).

9. The business validation phase will conclude with one of the following: Successful Acceptance or Business Error.

10. Successful Acceptance:

    a. If the business validation is successful the data is posted into CMMS and a resulting business acknowledgement (step 9a) is sent to Canada EDE.

    b. Canada EDE receives the business acknowledgement (step 10a), records the status of business object(s).

    c. Canada EDE dispatches the business acknowledgement (step 11a) with the required business identifiers to the industry hosted business acknowledgement service for the specific business object being acknowledged.

    d. Industry partner systems receives the business acknowledgement message for one or more similar type of business objects within the message (step 12a)

e.   Industry partner systems record the acknowledgement of the business objects by Canada (step 12c).

11. Business Error. The alternative path of business validation (step 9) by CMMS, is if the data fails business validation

a.   CMMS then reports the business error with the required business identifiers (step 9b).

b.   Canada EDE receives the business error (step 10b), records the status of the business object(s).

c.   Canada EDE dispatches the business errors (step 11b) with the required business identifiers to the industry hosted business errors service for the specific business object(s) being acknowledged.

d.   Industry partner systems receives the business errors message for one or more  similar type of business objects within the message (step 12b)

e.   Industry will investigate the error reported and take the appropriate action to respond to the error and keep track that the specific business object(s) has not been accepted by Canada. Once the reported error is resolved by Industry partner.  Industry partner systems will issue the rectified/corrected business object following the same model beginning (step 1)

# 5 Service Execution In Support of Industry Performed Maintenance

The following services may participate in Industry Performed Maintenance specifically as it relates to data that is coming in from Industry partner systems to Canada[4].

- Notification
- Work Order
- Equipment Master Record – Uninstall - *
- Equipment Master Record – Install - *
- Measurement Point - *
- Measurement Document  - *
- Maintenance Plan - *
- Unit of Work (UOW)[5]

*- As a result of Industry Performed Maintenance, data that results in any of these services being invoked then it is typically governed by UOW and as such these services will participate in a UOW construct.

*- The UOW constructs in brief implies that the industry partner provides a declaration of the number of objects that will be transmitted across each of the above services.  Canada EDE will wait for the entire declaration to be completely transmitted across the respective services, prior to dispatching the data for processing by CMMS.

Industry partners are responsible to ensure that all of the declaration of the counts of business objects across each service in the initial UOW message is delivered to Canada EDE; within the parameters established for the delivery of the declared business objects.

## 5.1 Industry Performed Maintenance Work Order Services

These services enable industry partners to submit the work order information to Canada as industry performs and completes maintenance, in accordance with the applicable process model [ref. 1].  Work Order services are not subject to a manifest construct.

The specific processing of the Work Order and the rules are captured in the service specification for Industry Performed Maintenance Work Order.

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[4] The specific services used are dependent upon the WS being supported.

[5]  - Equivalent services that provides a manifest of the related set of data across the services identified with an (* - asterisk)

## 5.2    Industry Performed Maintenance Notification Services

These services enable industry partners to submit the notification information to Canada as industry performs and completes maintenance, in accordance with the applicable process model [ref. 1]. Notification services are not subject to a manifest construct.

The specific processing of the Notification and the rules are captured in the service specification for Industry Performed Maintenance Notification.

## 5.3    Weapon System Configuration and Master Data – with Manifest

When Industry has determined that it is has completed a maintenance work package that has resulted in changes to EMR's on the WS structure, or has accrued hours on the platform, Industry will send the appropriate  EMR uninstall, EMR install, Measurement Document, Measurement Point or Maintenance Plan (MP) data in the context of a UoW Manifest[6]. The manifest is declared within a UOW.  Note that each Weapon System may have different requirements in terms of which additional data sets are required.

In this case, Industry will send a UOW message with a manifest which declares what other message types are to be expected.  Please note that the additional data sets required is dependent upon the requirements of the platform being supported – not all platforms require all of these listed data sets, namely EMR Uninstall, EMR Install, Measurement Document, Measurement Point or Maintenance Plan (MP) data.  The Manifest has a unique identifier known as a Unit of Work ID. Industry will then send the following messages, if required:

- EMR Uninstall

- EMR Install

- Measurement Point

- Measurement Document

- Maintenance Plan

All of the above five messages are optional (although at least one must be there), and all will include a reference to the Unit of Work ID in the message header.  Industry may send these messages in any order, once the UoW Manifest has been sent and acknowledged by Canada EDE.

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[6] Please refer to the appropriate DRMIS Master Data Business Guidelines document  [Ref. 3] for a definition  or an equivalent document provided by the specific platform/fleet Project Management office (PMO) for which parts require additional master data, since it is contingent on the specific maintenance program requirement and model of the platform/fleet.
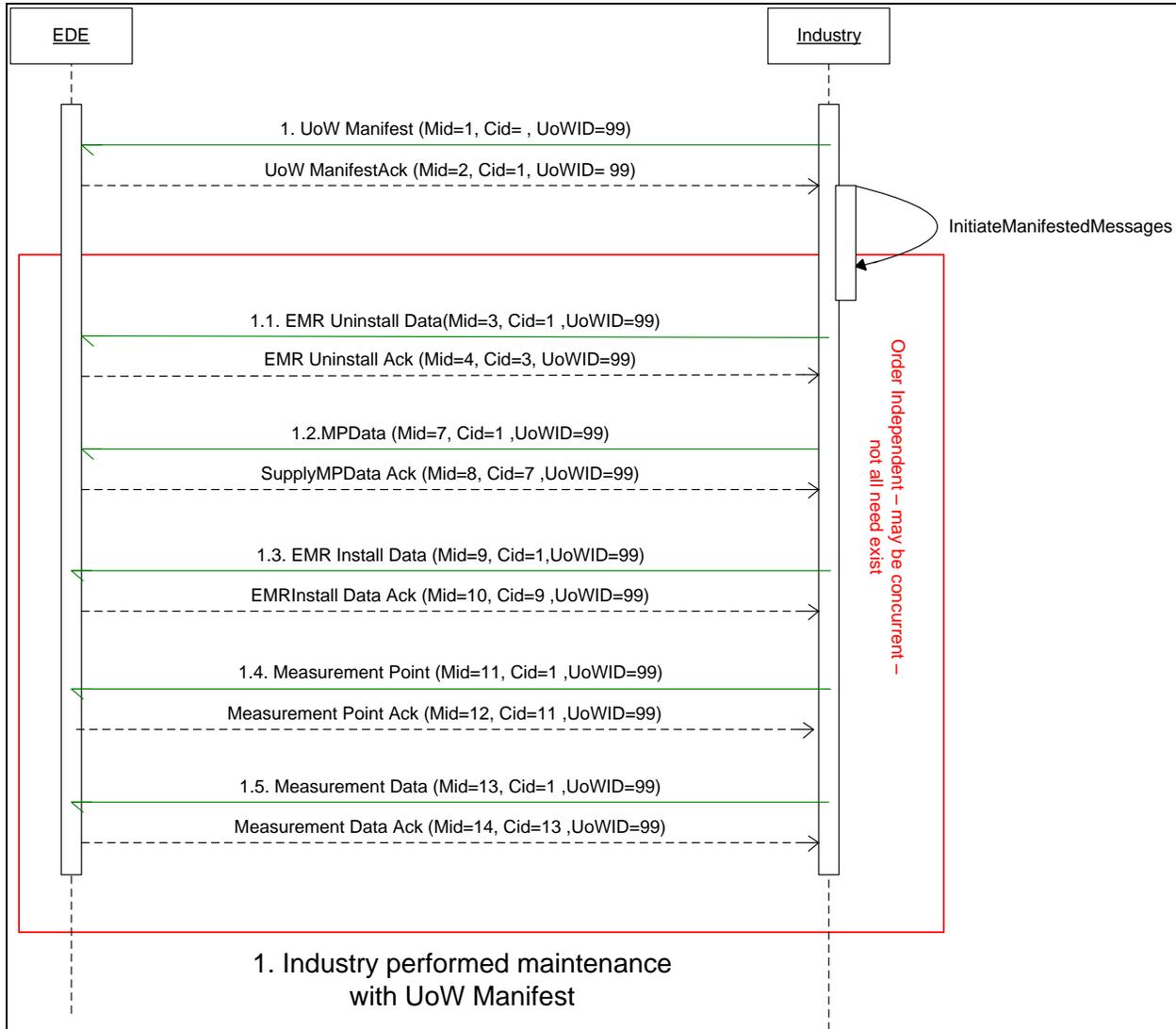
**Figure 2 Data Manifest**

## 5.4 Business Rules UoW Manifest Message (Industry-> EDE)

- UoW Manifest message is consumed by EDE and used to govern delivery to CMMS as applicable.

- The Manifest must declare included message types and object counts ( EMR Uninstall, EMR Install for each uninstall or install, Measurement Document, Measurement Point, Maintenance Plan (MP))

- A Manifest may be comprised of any combination of the above five message types. The actual message types applicable is dependent upon the WS being supported.

  - All subsequent messages that reference the Manifest must include Manifest Unit of Work ID in their message header.

- o EDE will validate that the Unit of Work ID is known, and that it aligns to a Manifest message type.

- Canada will respond with an acknowledgement message, through the service Output message definition. This Output message will include a correlation ID that ties back to the Manifest message's messageID.

- Industry will not send any Manifest-related messages (EMR Uninstall, EMR Install for each uninstall or install, Measurement Document, Measurement Point and MP) until EDE returns an acknowledgement for the initial Manifest message through the Manifest output message definition.

- All subsequent messages that reference the Manifest must include Manifest message ID in their Correlation ID as well as the UOW ID that was initially declared in the Manifest message.

- o EDE will validate that the CorrelationID and UOW ID are known, and that it aligns to a Manifest message type.

- For each subsequent message type, EDE will count message business objects, and verify against Manifest declared business object count.

- Error conditions

- o In the event of any technical error condition against any message associated with a Manifest, EDE will not process any further associated manifest messages.

- o EDE receives too many objects vs. Manifest count

- EDE returns a fault against the message (EMR Uninstall, EMR Install for each uninstall or install, Measurement Document, Measurement Point or MP) that triggered the error condition

- EDE marks the Manifest message as being in an error state

- EDE returns a fault against any subsequent manifest-related messages received.

- o EDE does not receive all objects within Manifest Time-to-Live (TTL)

- EDE marks the manifest message to be in an error state and will send an error message to Industry partner via the exposed error interface of the manifest service

- EDE returns a fault against any subsequent manifest-related messages received.

- EDE invokes the UOW of Error Service [7] to report the manifest having timed-out.

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[7] - Required to report errors particularly to ensure that industry partners are aware that the delivered messages will not be processed as it was incomplete

- o If EDE encounters any error while processing Manifest-related messages, EDE will not forward any Manifest-related data to Canada Maintenance Management System (CMMS).

- o Manifest Declaration Failure

    - ▪ If EDE cannot process the original manifest since the listed content is not valid. EDE will reject the manifest message by issuing a Manifest Fault Message

- o Manifest Message Delivery Incomplete – Content Delivered does not match declaration

    - ▪ If EDE cannot reconcile the content delivered to manifest declaration. EDE will respond with a Fault Message for specific message type and will not accept any subsequent messages against the UOW reference and the associated manifest

- o Manifest TTL has expired and new content arrive with expired Manifest reference

    - ▪ EDE will reject the new content with a fault message.

## 5.5  Manifested Messages (Industry->EDE)

Manifested messages can include EMR Uninstall, EMR Install, Measurement Document, Measurement Point and Maintenance Plan messages. The following rules apply to each of these messages.

- For Manifested message, Unit of Work ID must be populated with Manifest Unit of Work ID and the correlation id should refer to the original manifest messageID .

- The manifested message must be received within the UoW Manifest Time-to-Live (TTL)

- For each manifested message, Canada will respond with an acknowledgement message, through the service Output message definition.  This Output message will include a correlation ID that ties back to the manifested message's messageID, and Unit of Work (UOW) ID.

- The business objects within the manifested message are counted and compared to value provided in the UoW Manifest declaration.

- Industry will not send any further manifested messages until EDE provides an acknowledgement on the UoW Manifest message.

- Manifested messages are not sent to CMMS until all declared Manifest objects are received.

## 6     Business Acknowledgement and Error Reporting

## 6.1   Business Acknowledgement

Each of the maintenance message services (Notification and Work Order), as well as manifested message services (EMR install, EMR Uninstall, Measurement Document, Measurement Point and Maintenance Plan) will have a distinct and independent business Acknowledgement service that will be hosted by Industry partner. Specifically these are Notification Acknowledgement for each Notification

service, Work Order Acknowledgement service, EMR Acknowledgement for Install and Uninstalls, Measurement Point Acknowledgement, Measurement Document Acknowledgement and Maintenance Plan Acknowledgement, depending upon services required to support a given Weapon System. Canada will report via these exposed services the acceptance of the data into CMMS, thus providing industry partner with a confirmation that the data is available for review and use by personnel in Canada.

The exposed services will be capable of accepting an acknowledgement against one or more relevant business objects.

Detail technical specifications of the service are available in the associated Service Specifications – Maintenance Notification Service Specification, Maintenance Work Order Service Specification, Equipment Master Record Service Specification, Measurement Point Service Specification, Measurement Document Service Specification, and Maintenance Plan Service Specification.[8]

## 6.2    Business Error Reporting

Similarly, each of the manifested message services will have a distinct and independent business Error service that will be hosted by Industry partner. Specifically these are Notification Error for each Notification service, Work Order Error service, EMR Error for Install and Uninstalls, Measurement Point Error, Measurement Document Error and Maintenance Plan Error. Canada will report via these exposed services the rejection of the data by CMMS based on the violation of the agreed business rules for the specific business object type.

The exposed services will be capable of reporting an error against one or more relevant business objects.

In the event of a reported error, Industry will correct and resubmit data through relevant exposed interface.

Detail technical specifications of the service are available in the associated Service Specifications – Maintenance Notification Service Specification, Maintenance Work Order Service Specification, Equipment Master Record Service Specification, Measurement Point Service Specification, Measurement Document Service Specification, and Maintenance Plan Service Specification[9].

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[8] -For services subscribed to in order to support a given WS

[9] -For services subscribed to in order to support a given WS

# 7    Definitions, Acronyms, Abbreviations

| Term | Description |
|------|-------------|
| BO | Business Object |
| CM | Configuration Management |
| CPM | Class Program Manager |
| CMMS | Canada Maintenance Management System |
| DND | Department of National Defence |
| EDE | Electronic Data Exchange |
| EIE | Electronic Information Environment |
| EMR | Equipment Master Record |
| ISS | In Service Support |
| ISSCF | In Service Support Contracting Framework |
| MP | Maintenance Plan |
| PBA | Performance Based Accountability |
| PBC | Performance Based Contracting |
| R&M | Reliability and Maintainability |
| UoW | Unit of Work |
| WS | Weapon System |
| WSM | Weapon System Manager |

# 8    Document History

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