ANNEX D – GENERIC DEFENCE SUSTAINMENT INFORMATION

1.1 The Army Structure of Sustainment – Lines of Support

1.1.1 The Army works from a sustainment continuum that stretches from national resources to the individual soldier. Capabilities along the continuum are organized into layers, most commonly referred to as echelons or lines of support. Although the flow is generally linear, one line of support to the next, the system operates on the principle of flexibility that allows, and indeed encourages, the bypassing of lines of support where and when appropriate. The allocation of capabilities within each line conforms to the level of need, the threat as well as the requirement for mobility and protection. The grouping of capabilities into lines of support ensures that each level of command is effectively sustained, but without the burden of holding capabilities better held elsewhere. A line of support may contain a number of sustainment units.

1.2 Lines of Maintenance Support

1.2.1 First Line. A maintenance organization allocated to a unit (i.e. Battle Group, Units). A first line maintenance organization generally performs repairs of limited duration, must have mobility to match the supported unit, and is designed to be the interface with the equipment operators to diagnose faults. 'Limited duration' generally refers to repairs that take four or less hours.

1.2.2 Second Line. A maintenance organization allocated to a formation (i.e. Brigade or Brigade Group). A second line maintenance organization is characterized by its ability to perform maintenance tasks of a longer duration than a first line organization. It generally has access to a greater range of parts and tooling. 'Longer duration' is generally defined as repairs that take between 4 and 12 hours.

1.2.3 Third Line. A maintenance organization allocated to a base or theatre of operations. Third line maintenance augments second line and can provide support to the Materiel Management and Distribution System through component repair and calibration. At third line, repair facilities are more robust and static in nature and repair resources are dedicated to production rather than battlefield survivability. An example is a maintenance workshop at a theatre base on operations, or base level facilities in Canada.

1.2.4 Fourth Line. A national level maintenance organization. Fourth line support is provided from static facilities outside the theatre of operations. It includes national resources such as 202 Workshop Depot, civilian manufacturers, and contractors.

1.3 Types of Maintenance

1.3.1 Preventive Maintenance. Systematic and/or prescribed maintenance intended to reduce the probability of failure. This includes preventative maintenance servicing by both operators and technicians.

1.3.2 Corrective Maintenance. Maintenance actions carried out to restore a defective item to a specified condition.

1.4 Canadian Armed Forces Maintenance Technicians

1.4.1 Canadian Armed Forces Maintenance Technicians who could be involved in the maintenance of the delivered Defence systems (in general terms):

1. Electronic-Optronic Technicians: Inspect, test, identify faults in, adjust, repair, recondition and modify electrical, electromechanical, electronic, electro-optic and mechanical equipment, optical instruments, and control systems for weapons and missiles.
2. Army Communication and Information Systems Specialist Techs: Perform preventive and corrective maintenance on all types of radios, radar and data processing, cryptographic, terminal, audio and video equipment.

1.5 Supply Chain

1.5.1 The Canadian Armed Forces has two main supply depots in Canada (Edmonton and Montreal) in which materiel from suppliers arrive and are catalogued. From each of these locations, materiel is shipped to Canadian Armed Forces bases for distribution to units who are the end user. In terms of spare parts, there is typically a stock level assigned to each location based on the dependent unit's fleet types, fleet size and training frequency, as well as the type of maintenance that can be performed at that specific unit. The stock levels, totaled across all depots and supply locations, are called scaling. A single supply depot is normally assigned for a significant portion of materiel being shipped to international operations.

1.6 Integrated Logistic Support

1.6.1 Integrated Logistic Support plans and directs the identification and development of logistic support and system requirements for military systems, with the goal of creating systems that last longer and require less support, thereby reducing costs and increasing return on investments. Integrated Logistic Support therefore addresses these aspects of supportability not only during acquisition, but also throughout the operational life cycle of the system. The impact of Integrated Logistic Support is often measured in terms of metrics such as reliability, availability, maintainability and system safety.

1.7 Sustainment Requirements – Integrated Logistic Support Services

1.7.1 Logistic Support Analysis. Logistic Support Analysis is the process by which the logistic support necessary for a new system/equipment is identified. It is comprised of tasks and actions needed to identify and quantify logistic resource requirements, and to optimize the type, quantity, and distribution of these resources with respect to life cycle costs and availability. Logistic Support Analysis will include data associated to preventative and corrective maintenance tasks. Additionally, the resources required to complete the maintenance tasks will be identified. These resources include spare parts, consumables, Special Tooling and Test Equipment, and personnel.

1.7.2 The support analysis data are required to be structured as a Logistic Support Analysis Record. The Logistic Support Analysis Record Database normally includes the following items:

a) All components (including repairable parts and consumables);

b) Manufacturer information, total Line Replaceable Units/Spares and Unit Costs Estimate;

c) Recommended Spares/Parts. The recommended Spares/Parts will be used to create the Recommended Spares Parts List; and

d) Indicate if item is a Maintenance Significant Item.

1.7.3 The Logistic Support Analysis Data listed below are populated in the Logistic Support Analysis Record if identified as a Maintenance Significant Item:

a) Failure Rate;

b) Mean Time to Repair (Hours);

c) Shelf Life (Months);

d) Maintenance Concept; and

e) Preventative Maintenance Frequency.

1.8 Initial Provisioning, Spare Parts and Special Tooling and Test Equipment

1.8.1 Industry will be asked to recommend an initial scaling of spare components and sub-systems, in sufficient quantities to support the determined availability of the fleet. The scaling of spare components and subsystems will reflect the data within the Logistic Support Analysis. Defence projects are responsible for acquiring the initial spare parts and two (2) years of annual replenishment spares in addition to the test equipment and

consumables, which must be sufficient to sustain the Canadian Armed Forces during the initial provisioning period of 2 years, based on the scaling agreed upon between the Project Management Office and contractor.

1.8.2 Spare Parts – The initial provisioning period will allow data to be recorded in terms of performance metrics and spare parts usage. This data will be used to properly formulate the basis of the sustainment requirements for the remaining life of the fleet.

1.8.3 Spare Parts Management – Defence projects investigate the capabilities of industry to perform spare parts management, such as warehousing, maintaining and distribution.

1.8.4 Special Tooling and Test Equipment – The Original Equipment Manufacturer will be expected to identify and provide all Special Tooling and Test Equipment required to service, diagnose and repair the fleet as outlined in the Line Support Analysis.

1.9 Contracted Maintenance and Training Services

1.9.1 Operator Training. When procuring a new fleet, operator training is typically coordinated up front as part of the initial procurement. This allows the Canadian Armed Forces to operate the fleets upon initial delivery. Initial Cadre Training is provided by the contractor to a specific quantity of operators and operator-trainers. Ongoing training on operation of the delivered Defence systems will be provided at the Canadian Forces School of Communications and Electronics located at various Canadian Armed Forces schools, as well as at the formation and unit level. Ongoing training may also be delivered as part of a long-term support contract if required. Defence projects investigate the capabilities of industry to provide ongoing operator training as part of a long-term support contract if required.

1.9.2 Technician Training. When procuring a new fleet, technician training is also typically coordinated up front as part of the initial procurement. This allows the Canadian Armed Forces to maintain the fleets upon initial delivery. Initial Cadre Training is provided by the contractor to a specific quantity of maintainers and maintainer-trainers. Ongoing training on maintenance will be provided by the Royal Canadian Electrical and Mechanical Engineers School. The Defence Projects are investigating the capabilities of industry to provide ongoing technician training as part of a long-term support contract if required.

1.10 Field Service Representatives

1.10.1 Field Service Representatives are individual technician representatives of a supplier to provide maintenance or training services at a site chosen by the Canadian Armed Forces. Depending on the fleet, Field Service Representative services may be requested at a variety of Canadian Armed Forces locations, potentially world-wide or in theatre of operations.

1.10.2 Maintain. Field Service Representatives could be employed to carry out maintenance tasks and technical investigations in order to sustain the fleet at the predetermined availability.

1.10.3 Train. Field Service Representatives could be employed across Canada at the major base hubs to train a predetermined number of operators and/or technicians.

1.10.4 Repair and Overhaul. Field Service Representatives could be employed across Canada at the major base hubs to undertake or assist in repair and overhaul activities.

1.11 Service Facilities

1.11.1 Similar to Field Service Representatives, support could be provided at contractor facilities. Defence projects also seek information from industry on the capabilities to complete repairs, training, and Repair and Overhaul in commercial service facilities both within Canada and internationally.

1.12 Excluded Maintenance Services

1.12.1 Operational requirements dictate that 1st and 2nd line support in expeditionary operations be provided by Canadian Armed Forces technicians. Any contracted support in these instances would be from a 3rd line role,

providing support from a theatre base of operations. Tasks of such a contractor arrangement could include support to 1st and 2nd line organizations when operational tempo and geography allow.

1.13 Engineering Services

1.13.1 Defence projects explore the capabilities of industry to carry out engineering and technical tasks, which are critical to continuously ensuring availability of the system.

1.13.2 Engineering Services. Work may include modifications, system/sub-system/component reliability assessments or failure analysis. Mechanisms for such tasks might include: Technical Investigation and Engineering Support contract; Special Investigations and Technical Studies contract; Additional Work Request; or In-Service Support contracts.

1.14 Embedded Contractors

1.14.1 Defence projects will investigate the ability of industry to work embedded in Department of National Defence facilities in order to enhance communication and provide responsive technical solutions, and industry (acquisition or in-service contractors) would need to work effectively with any of DND's embedded contractors.

1.15 Technical Data Package

1.15.1 Communication. Access to Technical Publications and Original Equipment Manufacturer updates/modifications is critical for the effective management of any fleet.

1.15.2 Provision of Technical Publications. There will be a requirement to provide Original Equipment Manufacturer technical publications such as operator manuals, preventative & corrective maintenance manuals, and available commercial part numbering listings (as procured by Original Equipment Manufacturer).

1.15.3 Defence projects investigate the capabilities of industry to provide updates to technical publications over the life-cycle of the systems.

1.15.4 Defence projects investigate the capabilities of industry to provide Technical Drawing Packages.

1.16 Configuration/Obsolescence Management

1.16.1 There will be a requirement to conduct Configuration Management to establish and maintain consistency of the performance, functional, and construction attributes of the deliverables with the requirements, design, and operational information.

1.16.2 The project is investigating the capabilities of Industry to provide Configuration Management services over the life-cycle of the system.

1.16.3 There will be a requirement to conduct first article inspection and pre-delivery inspections.

1.16.4 There will be a requirement to conduct functional configuration audits and physical configuration audits.

1.16.5 Obsolescence Management. There will be a requirement to provide obsolescence management during the initial provisioning period, which is expected to include but is not limited to high risk components/sub-systems list and obsolescence management issues reports (as required). Defence projects investigate the capabilities of industry to provide obsolescence management services, to ensure that the effects of obsolescence in terms of equipment support, effectiveness and support costs are mitigated by a combination of reactive and proactive management activities.

1.16.6 Hardware Pre-Determined Hardware Upgrades. It is anticipated that it will not be cost effective to maintain a portion of the hardware for the lifecycle based on low maintainability and changing hardware requirements for the software solutions. Defence projects investigate the capabilities of industry to provide hardware upgrades at pre-determined intervals for non-maintainable equipment.

1.17 Software

1.17.1 The system will have a software requirement that in itself will be complex due to integration and will require some or all of the aforementioned Integrated Logistic Support services throughout its lifecycle. The software for the system must be given due consideration with respect to configuration management, incremental improvements, and obsolescence management such that it is able to keep pace with current technology and user expectations.

1.17.2 Local/Field Software Updates. There will be a requirement for the system to provide qualified Canadian Armed Forces technicians with the capability to perform software updates to isolated offline system components (that are software updatable) while the system components are deployed to a theater environment.

1.17.3 Private Cloud-Based Services. While it may not be feasible to have tactical equipment always connected to a private cloud-based services, Defence projects investigate the ability for industry to provide secure updates for software systems when security measures permit (e.g. at home within Canada).

1.17.4 Software-as-a-Service Subscription Based Payment Model. It may be desirable for Canada to enter a long-term subscription-based payment model for the delivered Defence software to avoid obsolesce issues and to maintain always an up to date software baseline. Canada is investigating the ability of industry to provide Defence software, including updates, at a fixed firm cost over the lifecycle.

1.17.5 Network Architecture. It is anticipated Tactical Command and Control Information System Modernization and Tactical Communications Modernization Projects will require access to networked data. Defence projects investigate the most appropriate network architecture, technical interface, redundancy, and data storage method to reach the desired system availability and uptime.

1.18 Testing

1.18.1 There will be a requirement to prove defined delivered Defence capabilities in a test setting. This may include, but is not limited to:

1.18.1.1 Department of National Defence User Trials - Test & Evaluation to demonstrate that the system meets the requirements and specifications; and

1.18.1.2 Contractor Capability Testing – Testing could include but is not limited to: Interference, compatibility with allies, level of noise emission, start-up, operation, conducting various tasks, extreme weather operations.

1.19 Intellectual Property

1.19.1 Canada must have sufficient Intellectual Property access to ensure it is able to sustain the system throughout its life. Canada intends to use standard acquisition clause and condition 4006 – ‘Contractor to Own Intellectual Property Rights in Foreground Information’ to achieve this aim. Similarly, standard acquisition clause and condition 4003 – ‘Licensed Software’ will be used for the software.

1.20 Preliminary Concept of Sustainment

1.20.1 Maintenance

1.20.1.1 First line performed in expeditionary operations by Canadian Armed Forces technicians. Domestically, Canadian Armed Forces technicians may be supported by Field Service Representatives. Third and fourth line maintenance is anticipated to be conducted by contractor or Field Service Representatives both domestically and on operations.

1.20.1.2 An initial period of maintenance support to be provided by the contractor, with an additional support contract to be considered separately over the lifecycle of the delivered Defence system. Maintenance of any specialized system (such as simulation) is anticipated to be provided by the contractor should it have unique maintenance requirements from the delivered Defence system.

1.21 Supply

1.21.1 Defence projects may acquire two years spares and technical stores to the appropriate Canadian Armed Forces depot(s). The depot(s) will hold an additional operational stock of at least 30 days of supply of parts, but options for contractor housing of spares and technical stores delivery will be explored.

1.22 Integrated Logistic Support Services

1.22.1 It is expected that configuration management, engineering support, technical data packages, and operator and maintenance manuals will be part of a long-term service contract. Access to data for logistic support analysis will be essential, as will the integration of fleet data with the Canadian Armed Forces' SAP enterprise resource planning tool, Defence Resource Management Information System.

1.23 Lifecycle and Repair & Overhaul

1.23.ISSP is already in Implementation. ISSP will be finalized in 2023 vice Definition Phase.

1.24 Software Support

1.24.1 The preferred software support system will be a subscription model services that ensures improvements and continued integration with Canadian Armed Forces and allied systems over its lifecycle.

1.25 Training

1.25.1 Initial cadre training for both operators and maintenance personnel to be developed and delivered by contractor, with training materials transferred to the Canadian Armed Forces to be adapted for our own use. The number of serials will depend on the length and complexity of the training package, but the end state will be achieved when training responsibilities are transferred successfully to Army and long-term arrangements are made for contracted training (if needed).

1.26 Key Performance Indicators by which sustainment may be measured

1.26.1 Of prime concern is the availability of any delivered Defence system to perform its mission. The following are a few common metrics that we are considering to measure the sustainment system performance. While the metrics below emphasize mean values, other measures of central tendency may be examined (i.e. median, mode) if appropriate.

1.26.1.1 Mean time to repair (MTTR). The mean time to conduct a corrective maintenance action by technicians.

1.26.1.2 Mean operating time between failures (MTBF). For a stated period in the life of a functional unit, the mean value of the lengths of operating time between consecutive failures under stated conditions.

1.26.1.3 Mean downtime (MDT). Downtime consists of all preventive and corrective servicing and repair time plus time awaiting parts or labour and other administrative delays.

1.26.1.4 Uptime. Represents the time the equipment is operated and available for use.

1.26.1.5 Mean time to deliver spare parts. Mean time from when order placed in Defence Resource Management Information System to delivery of part to appropriate maintenance organization.

1.26.1.6 Mean time between maintenance (MTBM). For a stated period in the life of a functional unit, the mean length of operating time between maintenance. Mean time between maintenance only considers preventative and corrective maintenance performed by technicians, not that which is considered operator maintenance.

1.26.1.7 Availability. The probability an item is in operable and committable state at the start of a mission when the mission is called for at an unknown (random) time. We will quantify availability in three ways:

1.26.1.7.1 Inherent availability: $= \frac{MTBF}{MTBF+MTTR}$

This expression of availability is a characteristic of the equipment being maintained and does not reflect on the maintenance environment.

1.26.1.7.2 Achieved availability: $= \frac{MTBM}{MTBM+MDT}$

This measure reflects the reliability and maintainability of the equipment as it only includes preventive and corrective maintenance activities.

$$\frac{Uptime}{}$$

1.26.1.7.3 Operational availability: $= \frac{}{Downtime+Uptime}$

Operational availability reflects on the maintenance environment as well as the equipment. This is the measure of availability which gives the true availability of the system for operators.