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Solicitation No. - N° de l'invitation W8486-200731/B	**Amendment No. - N° modif.** 003
Client Reference No. - N° de référence du client W8486-200731	**Date** 2022-01-21
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File No. - N° de dossier 055ra.W8486-200731	**CCC No./N° CCC - FMS No./N° VME**

SOLICITATION AMENDMENT
MODIFICATION DE L'INVITATION

The referenced document is hereby revised; unless otherwise indicated, all other terms and conditions of the Solicitation remain the same.

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Canada

Purpose:

The purpose of this amendment is to publish DLCSPM Standard – System Engineering Plan (SEP), ***that was not included in amendment 002***, to seek industry feedback. The SEP is provided herewith as an attachment.

Respondents are requested to provide feedback to the Contracting Authority as identified on the main page of the RFI.

Respondents are requested to send their feedback by 28th February 2022 at the following email address:

TPSGC.PADivisionQD-APQDDivision.PWGSC@tpsgc-pwgsc.gc.ca

All other terms and conditions of the RFI remain unchanged.

National Défense
Defence nationale

DLCSPM STANDARD

LAND C4ISR CAPABILITY

SYSTEMS ENGINEERING PLAN

14 Dec 2021

Prepared by:
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National Defence Headquarters
Director Land Command Systems Program Management
National Printing Bureau
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AUTHORIZATION AND APPROVAL

Document Title	Land C4ISR Capability Systems Engineering Plan
Date	14 Dec 21

Approval Authority	**Approver Name**	**Approval Date**
DLCSPM Chief Engineer	J. Costello	

REVISION SHEET

DOCUMENT NO.	VERSION	DATE	COMMENTS
TBI	V1.4b	19 Jan 22	Initial Draft - RFI

Draft Version 1 Release Notes:

- Version 1 of this document is the initial draft of the DLCSPM Engineering Plan. It is NOT a complete document, and should not be read as such.
- This version of document expresses the intent and direction that DLCSPM will be moving to with respect to documenting DLCSPM's engineering process as well as introducing the Functional Grouping concept.
- Many concepts are introduced in this document, but many of those concepts are not fully complete and will not be until version 2 is published. Input on those concepts are welcome, but the reader of this draft should note that the details of many concepts have yet to be written. Version 1 of this document expresses INTENT, with more details to follow.
- The reader will also note that entire sections have yet to be developed. These will be developed over time, but the drafting of version 1 focused on the development of the Engineering Process itself, especially with respect to the Functional groupings.

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1. INTRODUCTION

1.1. Overview

1.1.1. General. The System Engineering Plan (SEP) is the principal authoritative document describing the approach to the definition and execution of all engineering activities within the Land C4ISR Capability. It is to be used and applied by all Director Land Command Systems Program Management (DLCSPM), Original Equipment Manufacturer (OEM) and sub-contractors. It adopts a framework of Total Systems Responsibility (TSR) and applies User Centered Design (UCD) principles.

1.1.2. Purpose. This SEP identifies the processes and stages required for all engineering activities ranging from the development of the simplest of products through to the integration, verification, validation and fielding of complex systems that form the Land C4ISR capability and its life cycle. This SEP provides the guidance required for all stakeholders to deliver a cutting edge Land C4ISR capability. This SEP demands all stakeholders work collaboratively under the guidance of Land C4ISR Integrated Product Teams (IPTs).

1.1.3. Scope. This SEP addresses the delivery of goods and services by describing the complete suite of technical management methods, techniques, workflows, and the engineering processes associated with the performance of the engineering and engineering management activities. It provides the framework for all engineering activities throughout the entire program life cycle. It defines the roles and responsibilities of the IPTs and Working Groups (WGs). It describes baselines and the specific engineering efforts to address major, minor and patch releases. Finally, it describes the engineering processes required to gain acceptance and fielding approval to the Canadian Army.

1.1.4. Document Structure. The main body of this SEP is written to explicitly follow the high level engineering phases and processes. It includes clear governance and management roles and responsibilities. It includes relevant references, however it offers appendixes to allow the SEP to be used as a stand-alone, authoritative document.

1.1.5. Program Overview. The Land C4ISR engineering program is established to meet the current and future needs of the Canadian Army. It requires long term financial commitments to allow DLCSPM to engage industry through well-defined and well executed support contracts. These, in turn, require sound governance and management to ensure that the Land C4ISR capability is trusted, used and sustained for as long as the CA requires it to carry out its missions. All of the above is only achievable if there is a well-defined, well documented System Engineering Plan that is executed effectively. Figure 1 below, depicts a summary of how DLCSPM conducts engineering business and is the foundation upon which the System Engineering Plan is built. A more detailed flowchart of the DLCSPM engineer process can be found in appendix A.

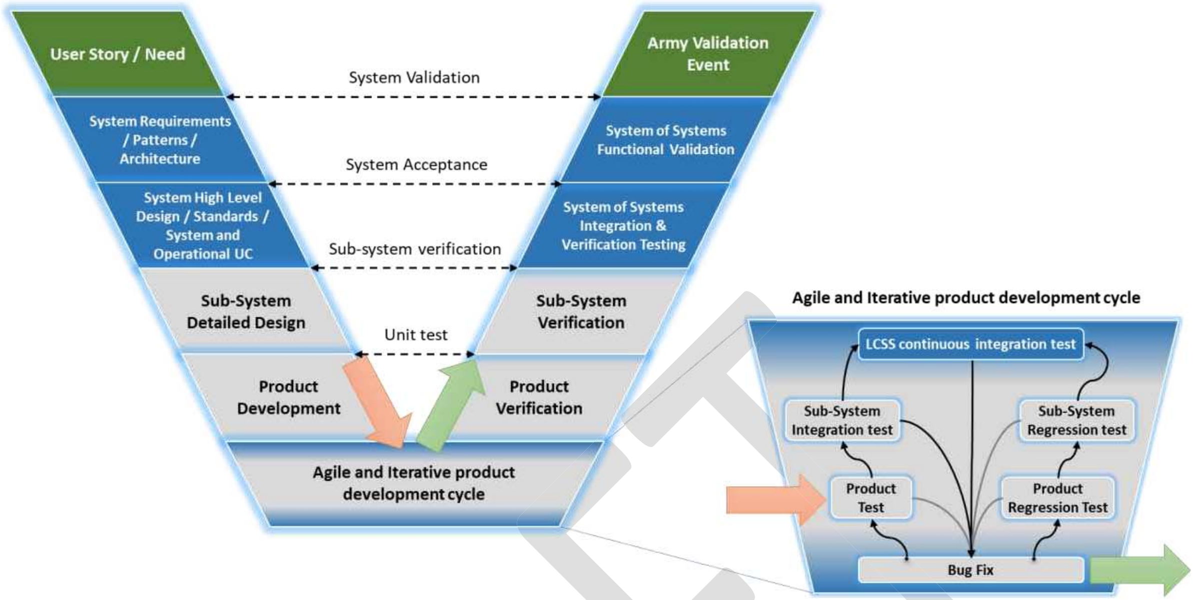


Figure 1– DLCSPM Engineering Process Summary (V Model)

2. LAND C4ISR CAPABILITY OVERVIEW

2.1. Overview

2.1.1. Land C4ISR High Level Objectives

2.1.1.1. The Land C4ISR Capability primarily supports the Canadian Army in operations by providing commanders with the information and information services required to make effective and timely Command and Control (C2) decisions about their forces. As such, it enables the Canadian Army to:

a. Plan and direct operations.
b. Manage operational information.
c. Achieve situational awareness.
d. Exchange information.

2.1.2. Land C4ISR Capability Description

2.1.2.1. The Land C4ISR Capability is an interconnected network of digital communications and information systems by which the data needed to plan, direct, and control tactical land operations is communicated, stored, processed, and displayed. Figure 1 - Land C4ISR Capability Conceptual Diagram shows a high-level diagram of the Land C4ISR Capability, depicting the installations, the vehicles, the dismounted soldiers, and the sub-networks that interconnect them. The Director Land Command System Program Management

(DLCSPM), as the TA for the Land C4ISR Capability, retains Total System Responsibility (TSR), and is responsible for the life cycle management of the Land C4ISR from architectural development through systems engineering and integration, fielding, in-service support, and finally disposal. As such, DLCSPM will manage the sustainment of the Land C4ISR Capability within an integrated environment leveraging a hierarchy of Integrated Product Teams throughout the engineering process.

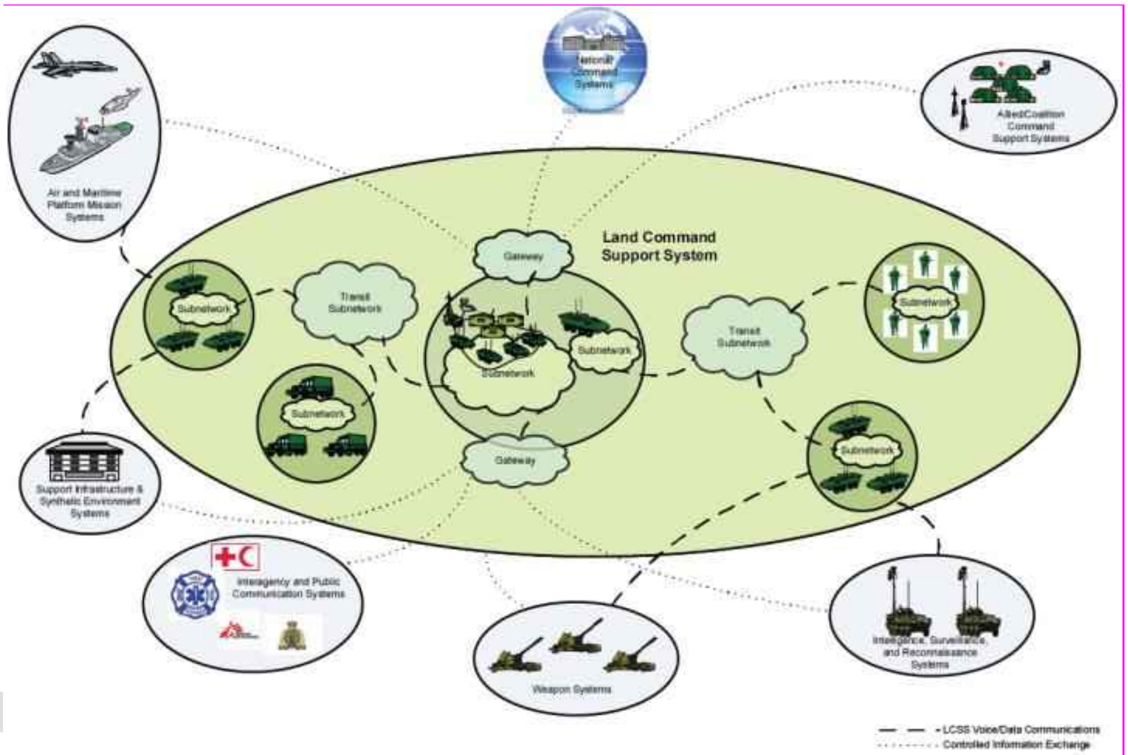


Figure 2 - Land C4ISR Capability Conceptual Diagram

2.2. <u>Land C4ISR in Doctrine</u>

2.2.1. Doctrinally the Land C4ISR Capability is divided into the following constituent systems:

2.2.1.1. **Tactical Command and Control Information Systems (TacC2IS)**: TacC2IS are the interconnected Information Systems (IS) that provide an integrated network of computers with specific software applications that deliver information processing support for commanders and staffs at all levels.

2.2.1.2. **Tactical Communications (TacComms)**: TacComms are the physical Communications Systems (CS) that enable commanders at all levels to have access to a fully integrated, secure communications network that provides the capability to exercise C2 through voice and data communications. TacC2IS services are transported over TacComms.

2.2.1.3. **Intelligence, Surveillance and Reconnaissance (ISR):** ISR are the sensors and analysis capabilities used to gather and process tactical information into useful intelligence

2.3. Land C4ISR in Practice

2.3.1. The practical application is more complex than the doctrinal description above. The current Land C4ISR Capability is divided into essentially three domains or systems and two enablers that encompass the Land C4ISR System of Systems (SoS). These domains (or systems) are characterized by their information and security requirements, and thus resulted in two technical implementations. Each system is the combination of various Sub-Systems that deliver a capability to the CAF. The key difference from the doctrine described above is that all three of the doctrinal sub-systems are present in the three domains as well as the two enablers to a varied degree. The domains and enablers in the Land C4ISR Capability are:

2.3.1.1. **Soldier Domain.** The soldier domain is characterized by the smallest information requirements. It is normally found in the dismounted (non-vehicle based) environment from the soldier up to the company level. It is short range, small data, and operates at the secure, but unclassified level.

2.3.1.2. **Mobile Domain (MD).** The MD is normally employed in mounted (vehicle based) environment from platoon to the Battle Group (BG) level. Generally it is characterized by a mobile ad-hoc network (MANET), with a medium data requirement operating at the SECRET security classification. The primary means of communication remains voice. The supporting data network is highly mobile and is based on the idea of digitizing a soldier's paper map. It is not client-server based and there is no expectation of guaranteed delivery of messages.

2.3.1.3. **Headquarters Domain (HQ Domain).** The HQ Domain is normally employed at the BG and higher in the command elements of these units and formations. It is characterized by high and rich data requirements. Fundamentally, it operates like a field deployable enterprise network, running a variety of client-server applications and data bases. It also is the domain that links to National or Coalition systems via gateways. It can be described as transportable, but not mobile; meaning network laydown and configuration is relatively stable. It also operates at the SECRET level, with increased security protection due to the volume of data utilized on this network.

2.3.1.4. **ISTAR enabler.** ISR contains the sensors and analytical tools enabling the Canadian Army to conduct Intelligence, Surveillance, Target Acquisition and Reconnaissance (ISTAR). It delivers substantial capability to the Canadian Army. Some products and sub-systems leverage or connect to the

MD and HQ Domain to transport or store their information, while others operate as stand-alone systems in their own right and provide capability without any of the three domains.

2.3.1.5. **Simulation enabler.** Simulation contains the simulation Systems, Sub-Systems, and Products to enable the Canadian Army to train (tactics and C2 procedures), force generate, and force develop. It delivers an engineered and integrated Synthetic Training Environment (STE) in support of the Future Integrated Training Environment (FITE). These simulation enablers connect to the MD and HQ Domain to support Canadian Army constructive training, and DLCSPM experimentation and systems engineering emulation and network testing

2.4. Land C4ISR SoS Functional Groupings

2.4.1. In order to manage the engineering, development and delivery of the Land C4ISR systems and enablers, the overall SoS is broken down into 4 functional groupings. Each functional grouping is defined by the services it provides into the larger Systems and Enablers, and overall SoS. This breakdown allows for a more harmonized delivery of similar items. The four functional groupings are:

2.4.1.1. **Land C4ISR SoS E&I.** This functional grouping is based on systems and services that satisfy the define user need. The primary role of this functional grouping is to integrate Core Network, Applications and ISTAR functional groupings into a fully functioning system and system of systems. This functional grouping is over all responsible for Human Factors Engineering, Architecture and Systems of Systems Engineering for the Land C4ISR capability. It is also responsible for System Engineering for the Soldier, Mobile and Headquarters domains. It is not comprised of products and sub-systems like the other functional groupings with the main deliverables from this functional grouping are user needs, requirements, and communication and interface standards. It is overall responsible to integrate and delivery the Land C4ISR Capability to the Canadian Army.

2.4.1.2. **Core Network**. This functional grouping is based on all services that are common across all of the domains, and forms the backbone or backend of the overall Land C4ISR System. Engineering activities under this functional grouping revolve around utilizing the standards and connecting patterns developed in the Land C4ISR Integration & Cyber functional grouping and applying them to the sub-system and product design of the Land C4ISR Core network. It is comprised of hardware, firmware, software and some databases.

2.4.1.3. **Applications**. This functional grouping is based on all user facing services and software which leverage the MD and HQ Domains to provide capability to the end user. Information generated by services and software in this functional grouping is then transported by the Land C4ISR Core Network sub-system from its origin to destination. This functional grouping is information based and comprised largely of software and databases, with no involvement in hardware or firmware development.

2.4.1.4. **ISTAR**. This functional grouping is all services that allows the CAF to conduct information collection, processing, dissemination and communication assets which are designed, structured, linked and disciplined to provide situational awareness (SA), support targeting and support to commanders in decision making. Intelligence, Surveillance and Reconnaissance (ISR) are the sensors and analysis used to gather tactical information. This functional grouping remains similar to the practical support concept, comprising of standalone systems, integrated sub-system and products for specialized ISR services. When integrated into the MD and HQ Domains, the sub-systems and products pass information over the Land C4ISR Core Network and interact with the Land C4ISR applications.

2.4.2. Simulation and Cyber activities do not have their own functional grouping per say, but are incorporated throughout the other functional groupings as supporting enablers.

3. ENGINEERING PROCESS OVERVIEW

3.1. General

3.1.1. The DLCSPM Engineering Plan takes a User centered approach to design. It blends the User Centered Design, the agile process for complex systems and the traditional Waterfall processes. The CA user is involved at the very start and continually throughout the process. This process focuses on delivering the right capability the right way, focusing on simplicity and usability to enable the CA user to be more effective in performing their tasks. The overarching intent of this hybrid process is to not only develop a capability that does not require training, in that the Land C4ISR capability that the army needs but also be designed and developed in a way to minimize the effort required to train operators and sustainers.

3.1.2. In its simplest form, this means building the base or core of the capability around the basic user needs, ensuring that it is solid and stable, with minimal training effort required. Once that is complete, the process then starts to layer more complex or advanced capabilities.

3.1.3. The process and design model will also center on building a system that works for the Canadian Army. Multi-national interfaces and commitments will be achieved via gateways and filters as opposed to imbedded within the Canadian System.

3.2. The DLCSPM Engineering Methodology

3.2.1. The 'V' Model illustrates the three primary, and distinct, phases of the engineering process where TSR is applied;

a. Requirements and Design.
b. Integrate.
c. Verification & Validation (V&V).

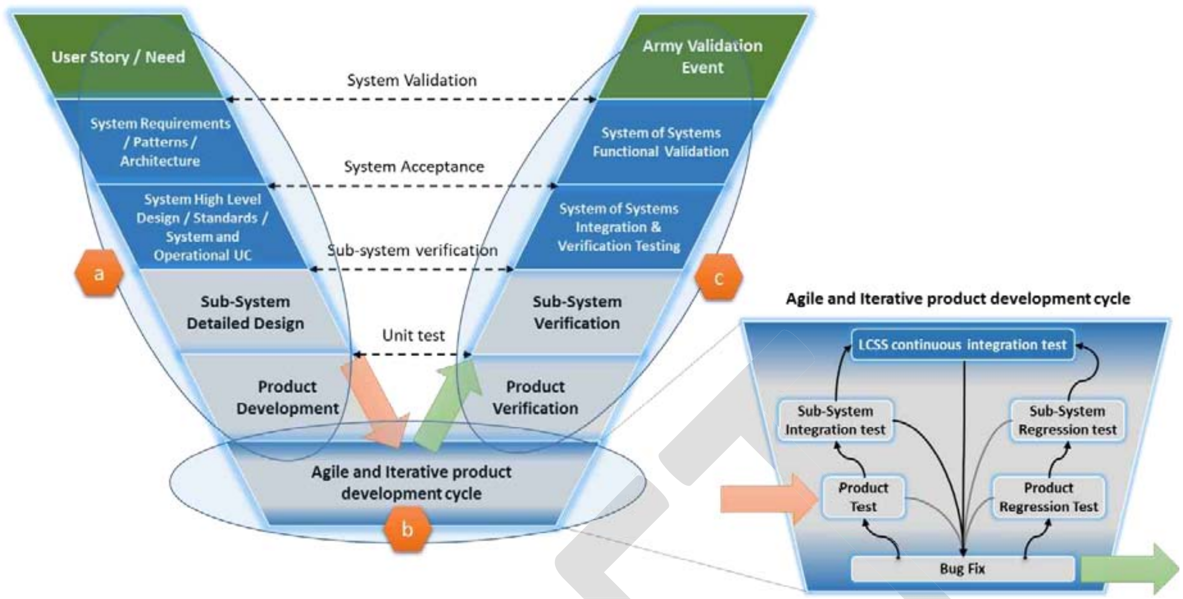


Figure 3 – Phases of Engineering

3.2.2. These phases are, by design expected to use a combination of 'waterfall' and 'agile' engineering and management processes. Requirements and development will typically follow a waterfall approach, Integration, by nature of its iterative process will be 'agile'. The Verification and Validation process will be primarily waterfall with minor 'agile' activities related to regression testing at the product, sub-system and system level. An important component of the 'V' model is due diligence to a User Centered Design philosophy where all stakeholders (CA, DLCSPM, contractors and sub-contractors) commit to initial User inputs to the requirements capture process and subsequent User Centered Designed 'audits' throughout the engineering processes. The 'V' Model also illustrates that it may be appropriate to transfer Design Authority between the Crown and its contractors at certain stages of the engineering process to expedite activities more efficiently, where expertise resides totally with contracted resources, or when resources are constrained and risks can be mitigated.

3.2.1. User Centered Design Process. The User Centered design process is the corner stone of the DLCSPM engineering process. It's the top layer that ensures that the CA is involved all the way through the design process at all levels. At periodic intervals throughout this process, there is a check back with the User community to ensure that what is being designed is the right system and they have the opportunity to correct at the appropriate moments. The CA user will change as the process flows down the V Model (in Figure 3 – Phases of Engineering) Starting from Army Headquarters at the top of the V, down to individual Combat Arms and Signals users during the Sub-Sub-System and Product Development phases. User Centered Design Working Groups and Workshops are key to defining the need, refining the requirement and ensuring System Engineering and Development is focused on those user needs. The overall UCD input in the DLCSPM Engineering Process is depicted in Figure 4 below.

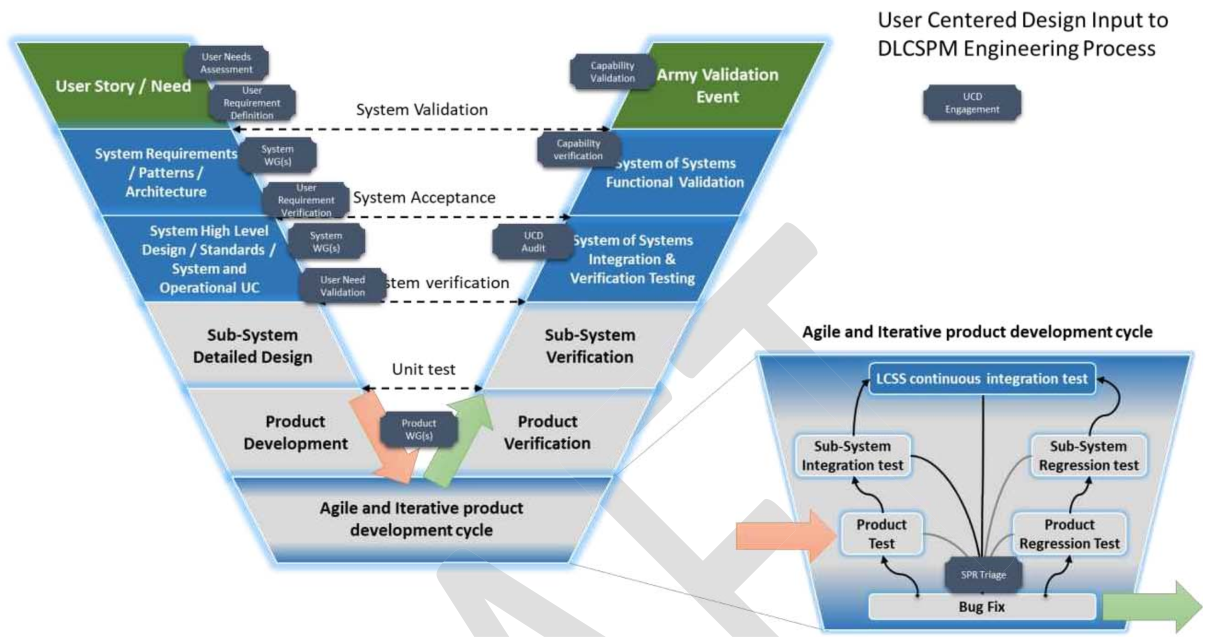


Figure 4 – User Centered Design Input into DLCSPM Engineering Process

3.2.2. Agile Methodology. The agile (or concurrent) methodology used in DLCSPM's engineering model is adapted from a complex agile model. It incorporates the concepts of Integrated Product Teams, Continual Integration / Continual Delivery, Program Increment Planning and others. This process, primarily used in the Development and Integration processes, is situated at the bottom of the V-Model in Figure 3 – Phases of Engineering Some of the concepts are used in the Engineering and Validation processes, however due to the complexity and variation of the components of the Land C4ISR Capability, it isn't viable to implement a fully agile process during these phases. During this phase of the process, it is more likely that Design Authority will be delegated.

3.2.3. Waterfall Methodology. The Waterfall (or sequential) process is used for the overall Engineering Process during the Baseline Definition, Engineering and Validation phases of the V-Model in Figure 3. Due to the complexity of the Land C4ISR Capability, its interdependencies, internal and external interfaces, and primarily impact on the CA user of getting it wrong, a step by step process is preferred to a fully agile model. This process, while slower, does introduce hard decisions and gates ensuring that the "right system is designed the right way" and all factors have been considered in design and confirmed during validation. It is more deliberate, and driven by more senior levels within the process. DLCSPM or the

CA will retain Design Authority during these phases of the process.

3.3. Total System Responsibility and Design Authority

3.3.1.1. DLCSPM retains TSR as well overall Design Authority over all work done throughout this engineering process. As the Capability is broken down through SoS and system, Design Authority could be delegated to the SoS E&I contractor for System design, but this will be done by exception.

3.3.1.2. Once the system(s) have been decomposed and defined in sufficient detail to hand over to the various Functional Groupings responsible for development, in many, if not most cases, Design Responsibility may be delegated from DLCSPM to the Functional Grouping Sustainment Contractor for implementation, however Design Authority always rests with Canada. As detailed in the FG IPT in Integrated Product Team 4.3. CA and DLCSPM will continue to be involved and hold voting and decision authority throughout the process.

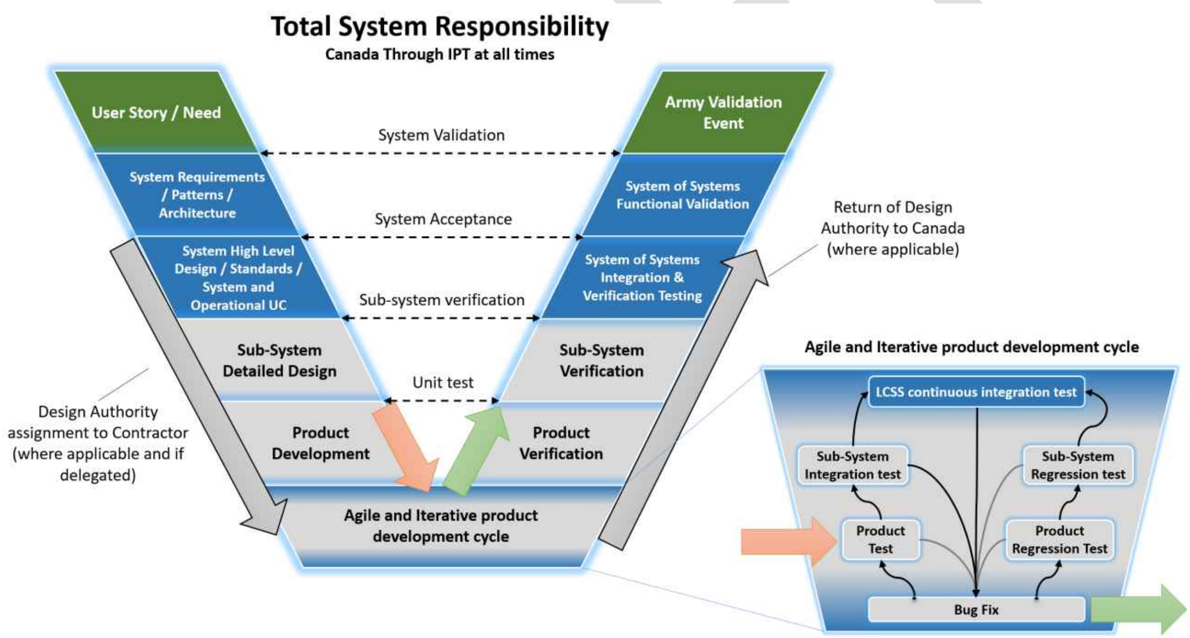


Figure 5 - TSR in the Land C4ISR Engineering Process

4. GOVERNANCE AND MANAGEMENT

4.1. Governance Overview

4.1.1. This section outlines the authoritative roles and responsibilities within the DLCSPM Engineering Process. This governance model aims to reduce overhead by giving the appropriate freedom of moment for all teams to decide, act and maintain momentum whilst sharing the appropriate levels of information to all teams, allowing them to operate in the best informed and transparent manner. In order to delineate roles, responsibilities and authority to make decisions, IPTs, decision making meetings and working groups are described below.

4.1.2. This process is governed by clearly identifying each of the bodies responsible for making a decision and identifying whom is able to officially state a position on a decision that must be considered. This is the foundation of the IPT as it is comprised of all parties with a stake in a particular decision. This is further discussed in section 4.3.

4.1.3. There are two main types of gathering of the IPT. One to make decisions and the other to discuss and propose resolution to decisions. The decision making gathering can have many titles, most notably Steering Committees (SCs) or Configuration Boards. Discussions are held at various Working Groups (WGs) by either the IPT itself or a subset of its membership or delegated members. WGs are not empowered to make decisions, only prepare recommendations for a SC or Configuration Board.

4.2. Management Overview

4.2.1. Planning

4.2.1.1. The general time block used throughout this SEP is the 'Work Increment' (WI). A WI will be based on an approximate three month block that includes a short period at the beginning of each WI for planning. Each WI can be decomposed into 'sprints' to facilitate work progress and testing to ensure that a minimal viable product is produced and its evolution is allocated the appropriate level of effort.

4.2.1.2. For product teams in particular, the WI is broken down further into a series of 2 week increments called Sprints. In an agile development process, the product team is expected to deliver a version of their product each sprint for integration into its respective sub-system.

4.2.1.3. There are two distinct elements to SEP scheduling:

a. The establishment of an appropriate 'battle rhythm' or standing schedule for IPTs, WGs, SC's and teams to meet with emphasis on not over scheduling and avoiding 'meeting for the sake of meeting'.

b. The actual engineering schedule for teams, contractors and sub-contractors to conduct actual engineering in support of development, integration, verification and validation at the product, sub-system and system level.

4.3. Integrated Product Team

4.3.1. IPTs are used in complex development programs and projects for review and decision making. DND manages support of the Land C4ISR Capability within an IPT environment. An IPT is a multidisciplinary group of people who are collectively responsible for delivering a defined product or process. The emphasis of the IPT is to maintain involvement of all stakeholders (users, customers, management, developers, and contractors) in a collaborative forum. In order to manage the Land C4ISR Capability, while working in a collaborative manner, each IPT member serves as a conduit for information between each individual area of responsibility and associated stakeholder community.

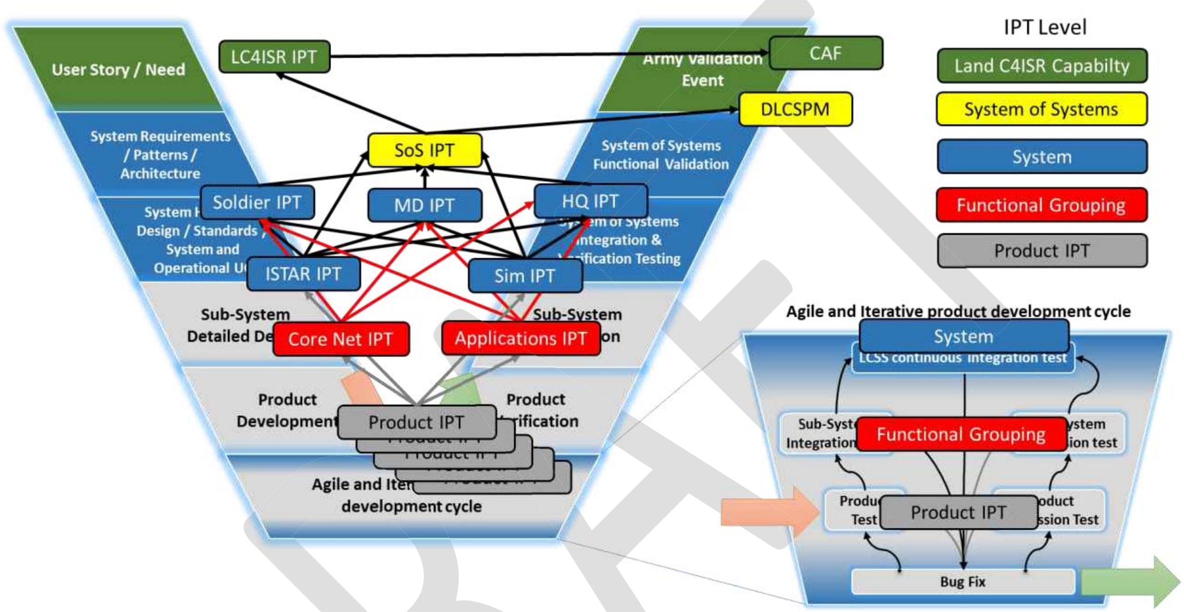


Figure 6 – DLCSPM IPT Hierarchy

4.3.2. Figure 6 – DLCSPM IPT Hierarchy outlines the overall structure of the various IPTs that exist within the DLCSPM Engineering Process and at what level of the Capability they are responsible for. Due to the complex nature of the Land C4ISR capability, the IPTs are interconnected with each other with many of the IPTs responsible to deliver to more than one layer of the overall capability. The details of each of the IPTs are listed further in this section, however, Figure 6 also shows two IPTs on the far right of the diagram. The CAF and DLCSPM IPTs here are a subset of the LC4ISR and SoS IPTs respectively and only comprise the Crown membership of those IPTs. These only exist in Validation activities, where the decision contribution of the Sustainment Contractors is no longer present during the fielding cycle as the system or SoS has been considered delivered to the Crown.

4.3.3. Structure & Roles of Integrated Product Team

4.3.3.1. The structure & roles of the IPT are defined below, however shown in the Land C4ISR Engineering Process (Figure 6), IPTs will exist at various levels.

Each IPT will have specific objectives, but all IPTs will meet the following goals:

a. Ensures the right system is being built by managing the involvement of all stakeholders, including government, Canadian Army and industry partners.
b. Establishes the objectives for each system release cycle.
c. Ensures system visibility and transparency amongst all IPT members.
d. Provides final approval of the master or sub-schedule, and prioritizes all work items.
e. Approves changes to the System Breakdown Structure (SBS) and appropriate baseline.
f. De-conflicts competing stakeholder requirements in collaborative environments.
g. Escalates issues to a higher IPT if members unable to resolve issues, or issues cross IPT responsibilities.

4.3.3.2. Design Authority. Within each IPT there is an overall authority that essentially is the person with which Design Authority resides. That person must take the advice of the voting members of the IPT, but the final decision rests with them.

4.3.3.3. Voting Members. These members of the IPT consist of the key staff from the respective stakeholders of the IPT. They speak formally for their organizations and are authorized to present official opinions (or votes) on any decision presented to the IPT. Voting members opinions must be taken into account by the Design Authority when rendering a decision on a particular topic.

4.3.3.4. Regular Members. Regular members are those that are part of the IPT but do not formally represent their organizations. They are authorized to speak on behalf of their organization as part of the IPT. Their opinion should be considered, but is not required to for the Design Authority to render their decision.

4.3.3.5. By Invitation or Observers. These are not regular members of the IPT, but can attend by invitation. This can either be to observe for situational awareness or if they are presenting an issue for decision. They generally have no speaking role (unless presenting) and there is obligation for the Design Authority to consider their opinion.

4.4. <u>Land C4ISR Capability IPT (Land C4ISR IPT)</u>

4.4.1. Description. This IPT resides at the highest level, and is led by the Canadian Army. This IPT is the decision body that manages the User Centered Design process. It manages and defines these capabilities, and this IPT also validates that the capability has been delivered as required and recommend acceptance to the TA.

4.4.2. Mandate. The mandate for this IPT is as follows:

a. Initiate Annual Program Audit.
b. Develop Engineering Process Master Schedule.
c. Lead the UCD Working Group.
d. Define the user Requirements.
e. Establish and approve the Functional Baseline.
f. Verification and Validation of Design Baseline.
g. Analyse Risks of fielding if Requirements are either not met or met with exceptions / limitations.
h. Analyse that Verification has been completed.
i. Develop Validation and fielding plan.
j. Baseline Management and Configuration Control of the following baseline:
    i. Requirements Baseline.
k. Management of user facing document and training products.
l. Management of UCD artifacts (Personas, User journeys, Land C4ISR Style Guides etc).

Authority & Decisions. The authority and decisions for this IPT are:

a. Determine Engineering process stream (Major Release, Minor Release or Patch, or combination)
b. Decide Major or Minor release stream
c. Approve Design Baseline
d. Accept or reject requirements that are either not met or met with exception during the Verification and Validation process.
e. Accept or reject that a reported failure that has been identified to be re-spun has been fixed correctly.
f. Authorize Baseline to proceed to Validation from Verification
g. Approve Fielding Candidate Baseline
h. Decide if Baseline requires field validation
i. Makes all fielding decisions.

4.4.3. Membership (Total Members: 17)

4.4.3.1. The membership for this IPT is:

a. Design Authority: Canadian Army (CA)

b. Voting Members (7)
    ii. Canadian Armed Forces (CAF) Force Generator (FG) / Force Employer (FE)

1. Director Land Communication Infrastructure (DLCI) Rep – LCSS Program Manager
2. Director Land Requirements (DLR) C4I Rep (DLR 4)
3. DLR ISTAR Rep (DLR 2)
4. CA Army Training Authority Rep (Canadian Army Doctrine and Training Center)
5. Canadian Joint Operations Center (CJOC) J6

iii. DLCSPM: Chief Engineer

iv. Long Term Sustainment Contractor: SoS E&I Chief Engineer

c. Regular Members (11)

i. DLCSPM

1. Mobile Domain Lead Engineer
2. HQ Domain Lead Engineer
3. ISTAR Lead Engineer
4. Simulation Lead
5. Cyber Security Lead Engineer

ii. Long Term Sustainment Contractor

1. SoS E&I Contractor
    a. Mobile Domain Lead Engineer
    b. HQ Domain Lead Engineer
    c. Cyber Security Lead Engineer

2. ISTAR Contractor
    a. ISTAR Lead Engineer

3. Applications Contractor
    a. Simulation Lead

4.5. <u>System of Systems IPT (SoS IPT)</u>

4.5.1. Description. This level of the IPT structure is led by DLCSPM and is the decision body that manages the Land C4ISR System of Systems, its internal and external interfaces and standards. It is responsible to the Land C4ISR Capability IPT, and to ensure that all engineering processes follow the User Centered Design methodology. It provides the architectural and engineering guidance as well as direction to the various other support contracts within Land C4ISR Capability.

4.5.2. Mandate. The mandate for this IPT is as follows:

a. Define and develop System Requirements
b. Decompose User and System requirements into capabilities and themes
c. Manage System Architecture
d. Manage all Land C4ISR standards and interface patterns
e. Manage SoS level change request process
f. Plan and Conduct baseline release planning events
g. Manage the SoS Backlog(s)
h. Manage overall Engineering Process and System Engineering Plan
i. Baseline Management and Configuration Control of the following baselines:
    i. Design Baseline
    ii. Engineering Baseline
    iii. Integration Baseline
    iv. Pre-Acceptance Baseline
    v. Fielding Candidate Baseline
    vi. Fielding Baseline
    vii. In-Service Baseline
j. Plan and conduct SoS Integration activities
k. Determine the Verification Process path
l. Conduct the Failure Analysis / Risk Management process during V&V cycle
m. Conduct Root Cause analysis for System interfaces and gateways.
n. Analyze integration and verification test results
o. Management of Engineering interface documents, standards and SoS level engineering documents

4.5.3. Authority and Decisions. The authority and decisions are as follows:

a. Approve Engineering Baseline
b. Proceed from Baseline Definition / Design to development
c. Exit from Integration into V&V
d. Approve Pre-Acceptance Baseline
e. Approve SoS Integration Baseline(s)
f. Decide on full or condensed verification path
g. Determine pass, pass with exceptions or failure of System or SoS verification events
h. Recommend exit from Verification process to Land C4ISR IPT.

4.5.4. Membership (Total Members: 44)

4.5.4.1. The membership is:

a. Design Authority – DLCSPM Chief Engineer

b. Voting Members (11)

i. CAF FG/FE (1)

1. DLCI / DLR

ii. DLCSPM (5)

1. Mobile Domain Lead Engineer
2. HQ Domain Lead Engineer
3. ISTAR Lead Engineer
4. Simulation Lead
5. Cyber Security Lead Engineer

iii. Long Term Sustainment Contractor (5)

4. SoS E&I Contractor
   a. Mobile Domain Lead Engineer
   b. HQ Domain Lead Engineer
   c. Cyber Security Lead Engineer

5. ISTAR Contractor
   a. ISTAR Lead Engineer

6. Applications Contractor
   a. Simulation Lead

c. Regular Members (33)

i. CAF FG/FE (1)

1. CADTC

ii. DLCSPM (14)

1. SoS SEM
2. Mobile Domain SEM
3. HQ Domain SEM
4. ISTAR SEM
5. SoS Lead Architect
6. Mobile Domain Architect
7. HQ Domain Architect
8. ISTAR Architect
9. SoS System SI Lead
10. Mobile Domain SI Lead
11. HQ SI Lead
12. ISTAR SI Lead
13. SIM SI Lead
14. SoS ILS Manager

iii. Long Term Sustainment Contractor (18)
1. SoS E&I Contractor (10)
    a. SoS SEM
    b. Mobile Domain SEM
    c. HQ Domain SEM
    d. SoS Lead Architect
    e. Mobile Domain Architect
    f. HQ Domain Architect
    g. SoS System SI Lead
    h. Mobile Domain SI Lead
    i. HQ SI Lead
    j. SIM SI Lead
2. Core Network Contractor (2)
    a. Lead Engineer
    b. SEM
3. Applications Contractor (2)
    a. Lead Engineer
    b. SEM
4. ISTAR Contractor (4)
    a. Lead Engineer
    b. SEM
    c. Architect
    d. ISTAR SI Lead

4.6. System IPT (Sys IPT)

4.6.1. Description. This level of the IPT structure is led by the respective DLCSPM System Engineering Staff and features five system level IPTs: Soldier Domain IPT, Mobile Domain IPT, Headquarters Domain IPT, ISTAR IPT and Simulation Enablers IPT. These IPTs have overall responsibility to design and implement system architecture and standards from SoS and further decompose into system engineering and integration for their respective systems. They are responsible to the SoS IPT and to integrate the outputs from the 3 Functional Groupings and 2 enablers.

4.6.2. Soldier, Mobile and HQ IPTs. These three system IPTs are responsible for the respective Soldier, Mobile and HQ domains or systems. The IPT is responsible for the system level engineering, integration and verification of these IPTs. They provide direction to the Functional Groupings and enablers on the design, and integration of their sub-systems.

4.6.3. ISTAR and Simulation IPT. The ISTAR and Simulation System level IPTs differ from the Soldier, Mobile and HQ. They are at the same level as the other 3 system IPTs, but have a split focus. Both the ISTAR and Sim IPTs have products and sub-systems that deliver into the other three systems, but they also have independent systems that the IPT is responsible for end to end, responsive to the SoS IPT for integration.

4.6.4. Mandate. The mandate for these IPTs is as follows:

a. SoS CR decomposition into System CRs
b. System and Sub-System Architecture
c. System Engineering
d. Manage and evolve System Requirements
e. Develop System Requirements Specification (SRS)
f. Develop and manage System Roadmaps for CR and SPRs
g. Management of Backlog(s)
h. Conduct Work Increment Planning
i. Baseline Management of the following baselines:
   i. Recommend changes to Engineering Baselines
   ii. Manage Integration Baseline(s) as required.
j. System and Sub-system integration
k. System and Sub-system demo's
l. Conduct Sub-System Verification
m. Conduct Problem Management Process
n. System Root Cause analysis
o. Management of Engineering system documents, standards and system level engineering documents

4.6.5. Authority and Decisions. The authority and decisions are:

a. System Roadmap(s)
b. Approval of System CRs
c. SPR triage
d. Approval of Sub-System for integration
e. Sub-system integration complete
f. Product Verification complete (as required)
g. Recommend System integration complete, ready for SoS Integration or System Verification

4.6.6. Membership (Total Members: 25)

4.6.6.1. The membership is:

a. Design Authority – DLCSPM System Lead Engineer

b. Voting Members (13)

   i. CAF FG/FE (1)
      1. DLR C4I Rep (DLR 4) for Soldier, Mobile and HQ IPTs
      2. DLR ISR Rep (DLR 2) for ISTAR IPT

        3. DLR Sim Rep (DLR 4) for Sim IPT

    ii. DLCSPM (6)
        1. SoS SEM
        2. System Lead Engineer
        3. System SEM
        4. Cyber Security Lead Engineer
        5. System Lead Architect
        6. System SI Lead

    iii. Long Term Sustainment Contractor (6)
        1. SoS E&I Contractor
            a. SoS SEM
            b. System Lead Engineer
            c. System SEM
            d. Cyber Security Lead Engineer
            e. System Lead Architect
            f. System SI Lead

    iv. Regular Members (12+)
        1. CA (1)
            a. As required

        2. DLCSPM (6+)

            a. SoS Lead Architect
            b. SoS System SI Lead
            c. System ILS Manager
            d. Product Engineers as required
            e. LCMMs as required.
            f. Rep(s) from Other System (Soldier / MD / HQ / ISTAR / Sim) as required

        3. Long Term Sustainment Contractor (5+)

            a. SoS E&I Contractor's
                i. Lead Engineer
                ii. SEM
            b. Core Network Contractor
                i. Lead Engineer
                ii. SEM
                iii. Product Team Lead (as required)
            c. Applications Contractor
                i. Lead Engineer
                ii. SEM
                iii. Product Team Lead (as required)

d. ISTAR Contractor
    i. Lead Engineer
    ii. SEM
    iii. Product Team Lead (as required)

4.7. Functional Grouping IPT (FG IPT)

4.7.1. Description. This level of the IPT structure, is led by the respective Functional Grouping Contractor Staff. There are two FG level IPTs; Core Network and Applications.

4.7.2. They are overall responsible to design and implement sub-system architecture and standards from the System IPTs and further decompose into sub-system engineering and integration for their respective Functional Groupings. They integrate the outputs from their respective Product Teams and are responsible to deliver Sub-Systems to the System IPTs.

4.7.3. There is no ISTAR Functional Grouping IPT. The ISTAR IPT is responsible to deliver ISTAR Sub-Systems in to Mobile and Headquarters systems similar to the Functional Grouping IPT but because it delivers independent Systems it operates at the System level not the Functional Grouping Level.

4.7.4. Mandate. The mandate for this IPT is as follows:

a. Implementation of Sub-System Architecture
b. Sub-System Engineering
c. Provide input in to the System Roadmaps for CR and SPRs
d. Management of Backlog(s)
e. Participate in Work Increment Planning
f. Baseline Management
    i. Recommend changes to Engineering Baselines
    ii. Manage Integration Baseline(s) as required.
g. Sub-system integration
h. Sub-system demo's
i. Conduct Product Verification
j. Conduct Problem Management Process
k. System Root Cause analysis
l. Management of Engineering system documents, standards and system level engineering documents

4.7.5. Authority and Decisions. The authority and decisions are:
a. SPR triage
b. Approval of product for integration
c. Recommend Sub-system integration complete
d. Product Verification complete

4.7.6. Membership (Total Members: 25).

4.7.6.1. The membership is:

a. Design Authority – DLCSPM TBC

b. Potential Delegated Design Responsibility – Contractor's FG Lead Engineer

c. Voting Members (13)

    i. CAF FE/FG (1)
        1. DLR C4I Rep (DLR 4)

    ii. DLCSPM (6)
        1. System SEM (Mobile and Headquarters)
        2. Cyber Security Lead Engineer
        3. System Lead Architect (Mobile and Headquarters)
        4. Functional Grouping TA (Core Networks or Applications)

    iii. Long Term Sustainment Contractor (8+)
        1. SoS E&I Contractor
            a. System SEM (Mobile and Headquarters)
            b. Cyber Security Lead Engineer
            c. System Lead Architect (Mobile and Headquarters)
        2. Functional Grouping Contractor (Mobile and Headquarters)
            a. Lead Engineer
            b. SEM
            c. Product Team Lead (as required)

d. Regular Members (12+)

    i. CA (1)
        1. As required

    ii. DLCSPM (6+)
        1. System ILS Manager as required
        2. Product Engineers as required
        3. LCMMs as required.
        4. Rep(s) from Other System (Soldier / ISTAR / Sim) as required

    iii. Long Term Sustainment Contractor (3+)
        1. Core Network Contractor
            a. Personnel as required

2. Applications Contractor
    a. Personnel as required
3. ISTAR Contractor
    a. Personnel as required

4.8. Product Team(s)

4.8.1. Description. This level of the IPT structure, is led by the respective product team lead (either Industry or Crown). Each product within the Land C4ISR Capability will have its own product team. The size of the product team will be determined largely by the size / complexity of the product itself as it includes all developers. The Product teams in a fully agile scheme, where each member of the product team is part of the IPT. Each of the Product Teams are responsible to the Functional Grouping IPT to which they belong.

4.8.2. Mandate. The mandate for the Product Teams is as follows:

a. Product Development
b. Product Testing
c. Product Life cycling
d. Implementation of features from CRs
e. Product or component obsolesce management
f. Implementation of UCD artifacts (i.e. style guides)
g. Participation of UCD working groups as required
h. Product Demonstrations
i. Product Level documentation and training material
j. Root Cause Analysis
k. Product SPR / Bug Fix

4.8.3. Authority and Decisions. The authority and decisions are:

a. Recommended Product is ready for integration
b. Implementation schedule

4.8.4. Membership The membership is:

a. Design Authority – DLCSPM Tech OPI

b. Potential Delegated Design Responsibility – Contractor's Product Team Lead

c. Voting Members.
    i. CAF FG/FE. As Required

ii. Long Term Sustainment Contractor or Original Equipment Manufacturer (OEM). All product team members

d. Regular Members. None

4.9. Management Process

4.9.1. Decision Meetings.

4.9.1.1. The purpose of a decision meeting is to set a regular cadence for the respective IPTs to meet and make decisions. These meetings are generally referred to as either Configuration Control Boards (CCBs) or Steering Committees and are the only meetings that can produce decisions. As a guide, these meetings should have a deliberate pre distributed agenda and a subsequent Record of Decision (RoD). The RoD should be written and subsequently approved by the designated senior DND member or the appointed Chair (or a representative for the Chair) and distributed prior to the next meeting. It is expected that all RoDs are accepted at the beginning of any subsequent meeting. Meeting Terms of Reference (TOR) should include, but not be limited to:

a. Purpose –The purpose of meetings are to make decisions.
b. Scope – Meeting dependent.
c. Authority – IPT (LC4ISR, SoS and System IPTs)
d. Membership – Appropriate IPT augmented by the key members of the group asking for a decision to be made.

4.9.1.2. Further details on the cadence, scope and responsibility of each of the respective CCBs or SCs has yet to be determined.

4.10. Working Groups.

4.10.1. There will be standing Working Groups(WGs) established for the primary purpose of discussing issues and preparing material to present to the appropriate IPT or Steering Committee for subsequent decisions. WGs can be standing (on a regular cadence) or they can be established to investigate a specific thing. As a guide, all WGs should have a deliberate pre distributed agenda. Issues, discussions and concepts should be prioritised based on program and baseline release priorities presented by IPTs. Each WG should maintain a backlog. Each WG should produce a subsequent Record of Decision. The RoD should be written and subsequently approved by the designated senior DND member or the appointed Chair (or a representative for the Chair) and distributed prior to the next meeting. It is expected that all RoDs are accepted at the beginning of any subsequent meeting. Meeting Terms of Reference should include, but not be limited to:

a. Purpose – The purpose of the working groups are to discuss, develop and address issues and concepts.
b. Scope – Working Group dependent
c. Authority – Empowered to make decisions that do not need the full IPT authorization (decision triage)
d. Membership – Working Group dependent

4.10.2. Further details on the cadence, scope and responsibility of these WGs has yet to be determined, but an expected (non-exhaustive) list is:

a. User Centred Design Working Group (UCD WG)
b. Architecture Working Group (AWG)
c. System Engineer Working Group (SE WG)
d. Configuration Management Working Group (CMWG)
e. Problem Management Working group (PMWG)
f. Risk Analysis Working Group (RAWG)
g. Information Management Working Group (IMWG)

    i. Information management governance will be provided by the Information Management Working Group (IMWG). Information management (IM) concerns a cycle of organizational activity: the acquisition of information from one or more sources, the custodianship and the distribution of that information to those who need it, and its ultimate disposal through archiving or deletion. Information management embraces all the generic concepts of management, including the planning, organizing, structuring, processing, controlling, and evaluation and reporting of information activities related to the SEP. In line with the principles of IM described above, the Land C4ISR IMWG has two distinct roles:

        ii. IMWG acts as the technical implementation body for IM requirements and provides a forum for Army IM Officers (IMO) from the HQ Domain within Land C4ISR Capability to coordinate effort, and leverage IMO feedback from the Army. This activity is closely associated with the general concept of User Centered Design. Allow the information experts that will use the Land C4ISR capability to define and shape the fielded IM solution.

h. Security Working Group (SECWG)
i. Document Management Working group (DOCWG)
j. Training Working Group (TRGWG)
k. Fielding Working Group (FWG)
l. System Management Working group (SMWG)

4.11. Information Management

4.11.1. General. Managing Engineering information is critical to the overall success of building and fielding a functional system. DLCSPM will own the system of record for all engineering documentation produced. This will facilitate easier sharing of information between Functional Groupings and the various sustainment and OEM contractors that contribute to the overall Land C4ISR capability. This section will be further refined in a subsequent version of this document. Key components to a successful Engineering IM plan are:

a. Providing an Information Management plan to support all facets of the SEP for subsequent endorsement by the Land C4ISR IPT

b. Defining the framework for a transparent, accessible, effective and easy to use central information management repository for all system Engineering related information and documentation by all stakeholders, IPTs, WGs and steering committee members (including external stakeholders such as DLCI and DLR).

c. Overseeing the implementation of central information management repository that is DLCSPM Controlled, but likely managed by the SoS E&I Sustainment contractor.

d. Conducting regular audits on all System Engineering information and ensuring that all official system engineering documentation (including this SEP) are maintained and updated to reflect evolution and maturity of the key documents and associated references and appendices.

4.12. Documentation Management

4.12.1. Closely coupled with the Information management plan described above. There is a requirement for a robust Document management strategy and supporting document management system that provides storage, versioning, metadata, security, as well as indexing and retrieval capabilities. There are approx. 140 different document types with varying purpose and complexity used within the Land C4ISR program. At a minimum, all products, sub systems and systems will have key engineering documents produced and maintained throughout the life cycle of the product, sub-system or system. This section will be further refined in a subsequent version of this document. Examples of these documents are listed below:

a. Engineering documents

i. System Engineering Roadmaps
ii. Architectural SoS and System Diagrams
iii. Sub-System Design Document (SSDD)
iv. Interface Control Document (ICD)
v. Technical or Shop Drawings

vi. Messaging specifications

b. SM Documents
   i. Concepts of Employment (CONEMPs)
   ii. Procedures

c. User facing Docs
   i. Concepts of Operation (CONOPs)
   ii. CONEMPs
   iii. Build Books
   iv. Planning Guides
   v. Aide Memoires

4.13. System Management. The process by which the Land C4ISR capability is managed, both within the engineering and field environments is critical to its success. SM tools and procedures need to be intuitive and easy to use. This section will be further refined in a subsequent version of this document.

5. ENGINEERING PROCESS CONCEPTS & METHODOLOGIES

5.1.1. The DLCSPM Engineering process is a decision based process. It is based on the assumption that the process needs to be used as a change is being introduced into the Land C4ISR capability. It has three main workflows based the assessed level of risk of that change. These are fully described in section 5.4.5 – Release Streams. A high level summary is below:

a. Major baseline release: A change that impacts the core of the SoS or System, affects overall stability or has a large user impact (i.e. major change to training). The Major release stream is chosen if the risk assessment on the change determines that the change needs to be fully analysed, engineered, verified and validated. This generally results in a new release being developed.

b. Minor baseline release: A change that is low risk to the SoS, System or User community. The Minor release stream is chosen to pre-accept some decisions in the overall Engineering process and skip over steps in order to shorten the time from design to delivery of the identified change. This generally results in an update to the existing baseline.

c. Patch release to in service baseline: This is an extremely low risk change, with little to no user impact. It generally consists of operating or application updates or security updates (virus definitions), similar in concept to the Microsoft Windows updates. It is always an update to an existing baseline.

5.2. Baseline and Release Methodology

5.2.1. General

5.2.1.1. A baseline describes the list of products (requirements, hardware, software and firmware) that collectively form the System or System of Systems. They are primarily defined by the capability that they deliver to the CA. There are many forms of the baseline that can exist as they represent a particular viewpoint of the Land C4ISR Capability.

5.2.1.2. A Release is the combination of all baselines in the baseline lifecycle, including all their associated products that are required to deliver the requested capability to the Army. At any given time there will be at minimum 2 Releases that need to be managed concurrently, the one the CA currently is using in the field (the In-Service Release) and the Release that’s under development; these are further defined later. The DLCSPM engineering process generally assumes that there will be 4-5 Releases to manage concurrently; a major or minor engineering baseline, annual patch development for the In-Service Baseline, the In-Service Baseline itself and potentially a Fielding Baseline. All of these baselines are defined below.

5.2.2. Baseline Lifecycle

5.2.2.1. Once the decision is taken to start a new baseline or upgrade or patch a current baseline, the Release Development process begins. This process occurs for each baseline under development and ensures that the proper information is gathered and documented throughout the life cycle of any baseline. Figure 7 below depicts the flow of how each baseline flows into the next as part of release development. The colour coding indicates which IPT approves the respective baseline.

Figure 7 – Baseline Life Cycle

Table 1 – Baseline Lifecycle

Baseline Name	Definition	Output Product	Developer / Management Authority	Approval Authority
Requirement (Rb)	This baseline is driven by a combination of System changes as required by DLCSPM and the Engineering community and the desired and required changes from the User community. It is the list of high level requirements or capabilities that the baseline must achieve to satisfy a particular set of user needs. The output of this baseline is usually captured via a requirements roadmap to drive the development of the baseline cycle.	- Requirements List	Land C4ISR IPT	Land C4ISR IPT
Design (Db)	This baseline is the second of the requirements baseline and decomposes the Requirement Baseline into high level Themes[1]. During the development of this baseline each Theme is de-composed into discrete capabilities and eventually into System Engineering Change Requests (CRs). This Baseline is the output of the Engineering process and is situated in the top left of the Engineering V model. In addition to deliberate changes, a set of System Problem Reports (SPRs) or bugs will be included into this baseline.	- Baseline Capability Roadmap - System Engineering Roadmap(s)	SoS IPT	Land C4ISR IPT
Engineering (Eb)	This Baseline is simply the complete list of all hardware, software, firmware, documentation and training products and sub-systems that will be included in the release. Key to this is it also includes the version and media numbers for all of these products in order to track each of them through their development and integration cycles. It's is the superset of ALL baseline items that will be delivered to the CA. This Baseline also forms the background list for all integration baselines in a particular release stream.	- Full is list of versioned Products and Sub-systems that will be included in the Baseline	System IPT(s)	SoS IPT

[1] A Theme is an overarching Capability that the baseline will deliver. They are the macro view of what the baseline will deliver to the CA in terms of capability.

Integration (Ib)	The integration baseline (or sometimes referred to as the Baseline under test) is the list of all hardware, software and firmware included in a particular continuous integration test at the sub-system, system or SoS level. It is a sub-set of the Engineering Baseline that will be undergoing testing in any given test cycle. This list is continually updated until it is ready for formal verification and validation testing	- Versioned list of all Products and Sub-systems that will be integrated or tested in a particular event.	Varies depending on level of test being conducted	One level higher than the group conducting the test
Pre-Acceptance (Pb)	This is the Engineering Baseline that is the output of the integration cycle and the one identified to enter the formal verification and validation cycle. It should contain the list of hardware, software, firmware, documentation and System Management procedures for the System or SoS under test. This baseline can no longer be modified once it is defined for the duration of the testing cycle. Depending on the results of the test, the baseline can be modified for critical bug fixes before proceeding to the Candidate Fielding Baseline.	- Full is list of versioned Products and Sub-systems that will be included in the Baseline - List of completed Engineering Documentation - List of Draft User Documentation - List of planned training material	System IPT(s)	SoS IPT
Candidate Fielding (Cb)	This baseline is the result of a successful verification and validation of the Pre-Acceptance Baseline. It is similar in composition to Pre-Acceptance Baseline, however is the finalized list that will be presented to the Canadian Army for acceptance. It is normally the result of a Functional or Performance Confirmation Audit (FCA/PCA).	- Full is list of versioned Products and Sub-systems that will be included in the Baseline - List of completed Engineering Documentation	SoS IPT	Land C4ISR IPT

		- List of completed User Documentation - List of drafted training material		
Fielding (Fb)	The Fielding Baseline is created once the Fielding Candidate Baseline is approved. It is defined separately from the In-Service baseline to capture the transition or fielding period while the CA gradually replaces their current In-Service Baseline with the newer Fielding Baseline. Once fielding is complete, the old In-Service Baseline is deprecated and the Fielding Baseline becomes the new In-service Baseline. The Fielding Baseline and In-Service baseline will exist at the same time during the Fielding process	- Full is list of versioned Products and Sub-systems that will be included in the Baseline - List of completed Engineering Documentation - List of completed User Documentation - List of completed training material	SoS IPT	CA HQ
In-Service (Sb)	This is also defined as the "In-Service" Baseline and represents the current configuration of the Land C4ISR Capability that is currently employed by the Canadian Army.	- Same as Fielding Baseline, but for a previous version of the Land C4ISR Capability.	SoS IPT	CA HQ

5.2.3. Baseline Naming Convention

5.2.3.1. In order to maintain proper version control over each Release, everything contained within that release should follow a similar naming convention. Table 2 below outlines the naming convention for each of the baselines and their associated documentation, but can also be applied to products, training material and deliverables as part of that particular release.

5.2.3.2. It follows a 5 digit naming convention, "x.y.z.BaselineType.version#" where the first three digits define the release stream and version within that stream, where the second two are baseline and engineering version specific and are dropped once the Fielding Candidate Basely is approved.

Table 2– Baseline Naming Convention

x.	y.	z.	Bl.	Version (.1234)
Denotes the Major release number. This is only incremented a major capability has changed from the previous Baseline. Only incremented through the Major Release Cycle.	Denotes the Minor release or update to the major release. Incremented. Only incremented through the Minor Release Cycle.	Denotes the individual version of the baseline. All release baselines will use "1" as they flow through the engineering process. This increments to "2" and the last 2 digits are dropped once the Fielding Candidate Baseline is approved. It is then incremented through any monthly or annual patch that is delivered.	Defined by one of the following: Rb Db Eb Ib Pb Cb Fb Sb	Numerical counter for all iterations of a document or baseline during its development. Any change will increment this number.

Examples

2.7.1.Eb.0001	1^{st} version of the Engineering Baseline for the 7^{th} Minor Release to Baseline 2
3.1.1.Cb.0004	4^{th} version of the Candidate Fielding Baseline to the first release of a Major Baseline change
3.1.2	Approved Fielding and eventual In-Service Baseline for the first release of Major Baseline 3
3.1.10	8^{th} Patch or update to the first release of Major Baseline 3
3.2.4	2^{nd} Minor capability change and 2^{nd} patch to Major Baseline 3.

Speciality Variants

Speciality Variants	Example
Speciality Variants can occur at any point during lifetime of a baseline. These are generally caused by a change required for a specific CA training event or exercise, or for a special engineering variant for an international or coalition experiment. Once these baselines are approved, similar to a fielding baseline, the last digits are dropped, and the name of the exercise is added.	2.7.2.CDMN 2.7.2.ExUR21 2.7.2.OpNAME

5.2.4. Back-porting. Back-porting is a process where capabilities or bug fixes are taken from a developmental baseline and implemented in a previous version of the developmental baseline or if deemed important enough from the developmental release into the In-Service System. This process is deliberate, and done by exception.

5.3. Release Engineering Process

5.3.1. General

5.3.1.1. The DLCSPM Engineering process is a cyclical process. This does not mean that the Land C4ISR Capability is released to the Army on an annual basis, but certain activities are repeated annually to ensure the entire engineering and development process remains on track and continues to meet the Army's intent. Figure 8 below summaries the Release Engineering Process (left side of the V in Figure 3). This section will go into detail on each of the activities within this process.

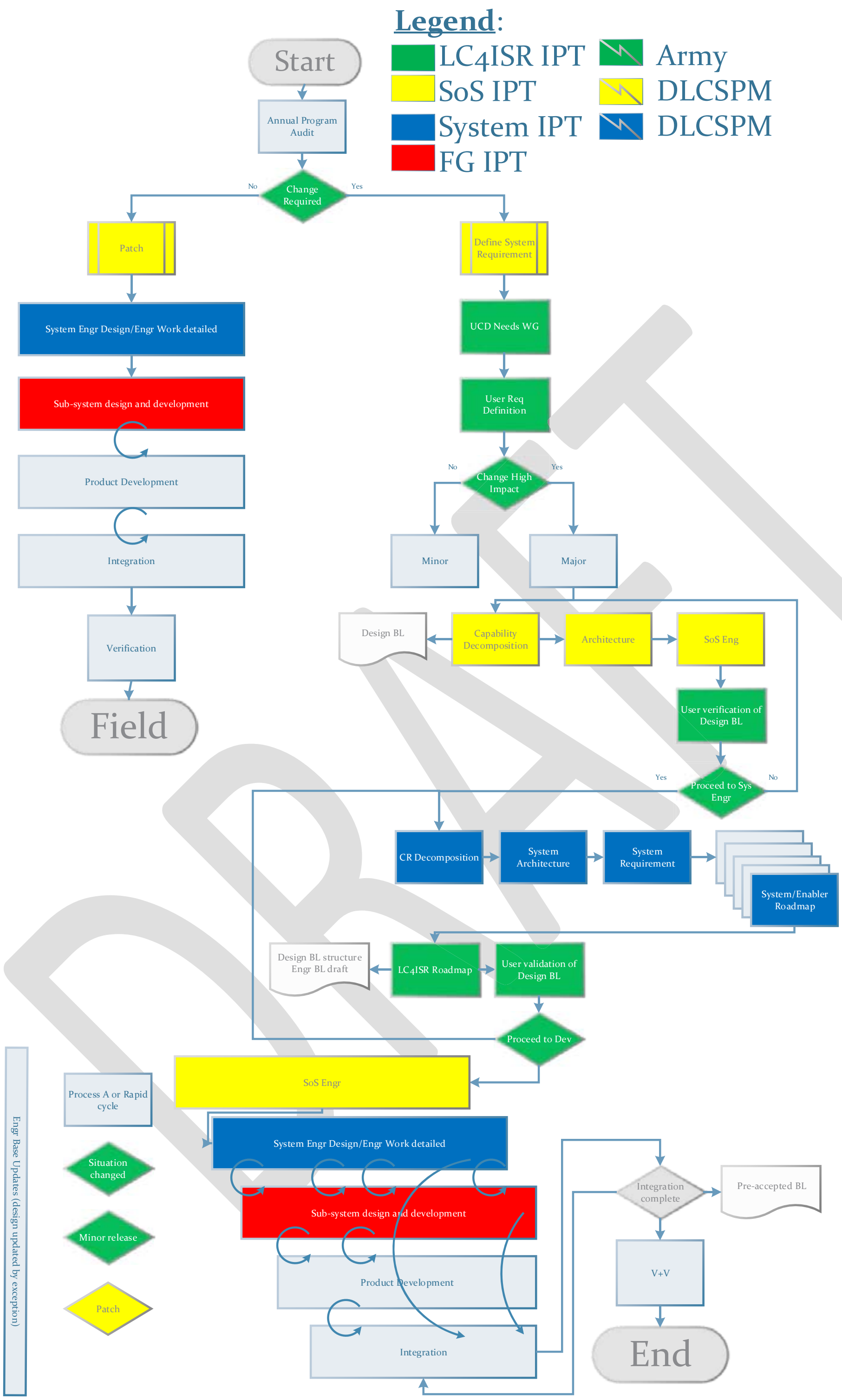


Figure 8 – DLCSPM Engineering Process Summary

5.3.2. Annual Program Audit. This activity is undertaken annually and is intended to confirm that the Land C4ISR Capability program is on track to meet the intent of both User and System needs and requirements. It consists of a review of all release streams in progress, an obsolescence review, and progress review of all ongoing engineering processes. Its output aims to answer the question: "Is a change required to the Land C4ISR system this year?" If not, the Patch Release stream is launched. If a change is required, it will trigger the Release requirements process to define the change that's needed.

5.4. Release Requirements Sub-Process

5.4.1. The aim of this process is to determine the level of change that is required for the Release. It captures both the User requirements and system requirements that both communities desire to be implemented into this release and an analysis of the impact to the system and training. It's broken into three distinct phases: System Requirements Definition, User Needs Definition and User Requirements Definition.

5.4.2. System Requirements Definition. During the first phase of the Release Requirements process, the Engineering community will analyse the current system and determine what changes should be implemented. This is primarily done through:

a. Obsolescence Management review (what system changes MUST be changed).

b. Backlog Triage what open Change Requests and open System Problem reports should be included (what system changes SHOULD be done).

c. Innovation Backlog. What changes to the system can be introduced to improve performance, Size, Weight and Power (SWAP), deployment time, etc.

5.4.3. User Needs Definition. This process is led by the Human Factors Engineering team and aims to determine what the deficiencies are in the current system as viewed from the User standpoint, as well as any other changes the users would like to implement in this iteration. It captures their raw needs, wants and desires and attempts to answer the question "What do the Users want?" Information can come into this definition process from a variety of sources listed below.

a. UCD Needs WG

   i. Journey's
   ii. Stories
   iii. Personas

b. Existing CAF information sources:

   i. SOCD

ii. User Feedback / AARs
iii. UCRs
iv. DND Operational Lessons Learned

5.4.4. User Requirements Definition

5.4.4.1. This phase takes the information gathered in the User Needs phase, analyses it and defines the set of user requirements for a particular release. It attempts to answer the question "What does the system need to do give the Users what they want". It develops a complimentary set of requirements to the system requirements. Combined they deliver the full set of requirements that are used to determine which release stream will be selected.

5.4.4.2. The Requirements Baseline is then developed and approved. It is used to determine which release stream will be followed for a change to the system.

5.4.5. Release Streams. Once the complete set of requirements has been defined and approved, a decision to launch a release stream needs to be made. There are three possible release streams depending on the level of change desired or the engineering capacity to build and develop that set of requirements. They are described below.

5.4.5.1. Major Release. This is characterized by a major, high risk or core change to the system, or a significant new capability added to a baseline that triggers a significant change to the way a User operates that baseline or a large impact to training. A major release can also be triggered by a high impact change to a System or SoS interface change or the deprecation of a capability. It has the longest development and integration timeframe as generally what's being changed could have a significant de-stabilizing effect to the system or User if implemented incorrectly. Examples of this could be the replacement of a Battle Command System, messaging or routing scheme change or introduction of a new RF bearer. It generally means a branch to code or an entirely new development streamed and is delivered as a new baseline.

5.4.5.2. Minor Release. A minor release is characterised by a low risk system change or a minor change to a capability. It is not a new baseline; the change is an update to the current In-Service or Fielding baseline. Minor releases are generally focused on system usability or stability. The intent of a minor release is to shorten the Engineering Process by accepting some risk and bypassing some of the steps that a Major Release must follow. The Engineering, Development and Integration phases are also generally shorter than a Major release due to the smaller changes being introduced. There is no formal verification of Products or Sub-Systems; the Minor Release heads straight to System or SoS verification. A Minor Release can also be triggered during a Major Release cycle through the Back-porting process if something in the Major Release is deemed stable and important enough to introduce into the

In-Service baseline as an update. Minor releases also will update training, but should not cause a significant change to institutional training.

5.4.5.3. Patch. A Patch release is similar in concept to a patch for any COTS software. It is characterized by a small update, generally to the backend of the system that does not have any effect on system use ability or training. It is done on the In-Service Baseline and Fielding Baselines, but also introduced during the development process of the Major or Minor Releases to ensure they field up-to-date. It's generally for maintenance of the baseline and is security or stability focused. There are two main types of Patch releases. The first is the monthly Security Patch, comprised of security updates for the base image and new virus definitions. The second would be the Annual Patch which is simply the accumulation of all of the monthly patches into a single install. This release is Engineering led and the only process that does not heavily involve the UCD process.

5.5. Release Capability Definition Process.

5.5.1. General. Once the Major or Minor release stream has been selected, the next phase of Release definition is defining the capability that will be delivered to the CA. There are three main blocks to this process; Capability Decomposition, Architecture and SoS Engineering.

5.5.2. Capability Decomposition. This aspect of the process aims to refine the system and user requirements into distinct capabilities that the release will deliver. System and User requirements are combined into large scale Themes for the release that form the high level description of the release and act as the guidance for all System Engineering and Development activities. They are described in terms of what the capability will do to satisfy either the system or user requirement (or both) in the language of the user (CA). The output of Capability decomposition is the start of the Release Capability Roadmap.

5.5.3. Architecture. Once the Capability Roadmap is drafted, the SoS and System Architects look to either define or update the SoS or System Architecture to support the identified capabilities. Architecture focuses on the large blocks of the system and how they go together (i.e. identifying interfaces, messaging or routing protocols etc). The end goal of the architecture is to describe the Land C4ISR System in a Lego ™ block concept, where blocks are described, and can all interconnect with each other either following a set of instructions, or how CA needs to accomplish the mission or operation they have been assigned. Changes to Architecture will follow the Change Request process, and only appear in a minor release by exception.

5.5.4. System of System Engineering. Once the Architecture has been defined or updated, SoS Engineering will look at it and the Capability roadmap together to detail what SoS changes need to be introduced to the Land C4ISR Capability. SoS engineering focuses on the System interfaces, and various standards (i.e. video, messaging, routing, Quality of Service (QoS) etc.) SoS Change Requests are then generated and entered into the backlog for System Engineering to pick up. Existing CRs are also analyzed to see which need to be included in the release. They are triaged according to the identified Themes and Architecture. Design effort on these CRs will be conducted later in the process, at this stage it is a high level scope definition and approval on what Systems and interfaces are likely to be affected by the CR. This is done in order to develop a projected scope of work for the System Engineering. Those that are not to be included in the Release are returned to the backlog, and will not be triaged again until another release is started. The output of SoS engineering is the draft of the Design Baseline and an updated Capability Roadmap.

5.6. Capability Verification

5.6.1. After the Capability release process finalizes its draft products, a back-check is completed with the User community through the UCD Process and Land C4ISR IPT. If the drafts of the Capability Roadmap, Themes and the SoS initial draft of the Design Baseline are approved by the Land C4ISR IPT (ensuring the identified user needs and requirements will be satisfied with the high level release plan), the plan is handed to System Engineering to further refine the plan at the system level.

5.7. Release System Definition Process

5.7.1. The Release System Definition commences after the Land C4ISR IPT and User community approve the draft of the SoS Release plan. Each of the System IPTs then decompose the CRs and Themes delivered to them from SoS into what effects the Sub-Systems within their respective systems. System Engineering would then triage CRs handed to them from SoS, their own CR backlog and raise any new CRs as required to satisfy the Capability's identified by the CA and SoS. Similar to SoS, design effort is not conducted at this stage, only an analysis of which sub-systems are likely to be affected by the change. Any further changes to the System Architecture are also refined at this stage. Once complete, the full set of System Requirements for each system are completed and each System will develop its own System Roadmap consisting of CRs and SPRs that will be addressed in the Release (that are known at this time).

5.7.2. Land C4ISR Roadmap. The output of the Engineering process is the Land C4ISR Roadmap and the Design Baseline. Each of the respective System Roadmaps are correlated and summarized to build the final Land C4ISR Roadmap and Design Baseline. Once complete, this baseline is sent for User validation and approval as a final confirmation that the development work to follow will satisfy both the System and User needs and requirements. The Engineering Baseline will also be drafted at this point before entry into the Release Development process. The Roadmap and development plan is a living document which is annually reviewed for critical changes during the Annual Program Audit (i.e. has the situation changed, or a new change identified that will affect the overall plan)

5.8. Capability Validation

5.8.1. The final decision before proceeding to development is the final validation of the Land C4ISR roadmap with the User community as part of the UCD process. This is the last back-check to ensure that the release about to be developed meets the user and system need and requirements both at the SoS and System levels. Release development cannot commence without approval from the Land C4ISR IPT.

5.9. Release Development

5.9.1. Release Development in its simplest form is the execution of the Land C4ISR Capability roadmap for a Major or Minor release, and the development of the Patches in a Patch release. It is done using the agile methodology with continuous engineering, development and integration, with exception of the initial entry in to the development process.

5.9.1.1. Initial Entry into Development. The vast majority of the Development process is done in an agile fashion, with the exception of the initial entry into the process. Starting with SoS Engineering, the CRs that were initial identified as part of the roadmap are developed. The output of these SoS CRs are the artifacts that are needed to define the System CRs, and fill the various System Backlogs. Until the initial work is done by SoS, the System Engineers do not have sufficient information to start work on the System Engineering for the Release. Until their development backlog is filled with items from SoS, the System Engineering staff can focus on setting up the release baseline and work on complex SPRs that were identified in the System Roadmap. This effect trickles down from SoS to System to FG to Product as the CR development backlogs are filled. Once the backlogs are filled with work items from previous levels, the agile development and integration process can begin.

5.9.1.2. Product Development. At the lowest level of the Development process is the actual design and build of the Products themselves. This can either be the coding of software or Firmware, testing of COTS or MOTS products, or the design, CAD modeling and pre-production runs of new hardware. Product teams are responsible for producing the actual product to be integrated into the Sub-system as well as testing their own products and making recommendations to the FG IPT on when it is ready to be integrated into the sub-system. They are also responsible to contribute or develop product level documentation and conduct root cause analysis on any issues found during higher level integration and testing.

5.9.1.3. Product Testing. Product testing is to be conducted by the product teams following each stage of development. This can be as simple as a nightly regression test on the work done during the day, scaled up to a full product test or verification before handing it to the FG for sub-system integration.

5.9.1.4. Development – Integration-Test cycles. Once the initial step is completed at each level, the execution of the roadmap continues in an agile methodology. Concurrently SoS Engineering is filling System Engineering backlogs who in turn fills FG and product backlogs. As features are completed by Product teams, they are continually tested and integrated into their respective Sub-Systems. Any integration issues (observations, bugs, SPRs) are then triaged and fixed as required. The process then repeats. The Development-Integration-Test cycle also occurs between Sub-System and System as well as between System and SoS and continually cycles until the exit from integration criteria are met. The full details of the Integration process are detailed in (Section 6) of the System Engineering Plan.

5.9.1.5. Concurrent to the Development-Integration-Test cycle is the ILS and UCD processes. The ILS process ensures that as the development process executes, the engineering and user documentation and training material is developed as part of the Release. The UCD process also ensures there is user involvement all the way down to product development. The end goal of both of these processes happening concurrently with the Development process is to identify any sustainment, support or usability issues at the earliest opportunity and allow time for them to be fixed before the Verification and Validation process starts, where there is little time to fix anything but high priority issues.

5.10. Engineering Sub-Processes or Standard Operating Procedures.

5.10.1. General. The following list are the individual sub-processes that are part of the top level Engineering Process. They are executed at various levels of the total Release process.

5.10.2. Configuration Change Management

5.10.2.1. The Core of the Configuration Change Management is the Change Request (CR). A CR is an artifact that details the change that is being made to the system. They exist at the SoS and System levels. SoS CRs are large scale changes that can span several work increments and decompose into potentially several System level CRs. Each of the System CRs should produce a portion of a capability, but must provide some function to the overall system (i.e. must build a Lego™ block). A System level CR should be able to be designed and it’s features handed to the FG IPT for development within a single Work Increment, but due to the complexity of some changes this is not always possible. CRs are identified by a unique identifier and are labeled with a priority and category for triage.

5.10.2.2. Priority. The Priority of a CR defines the overall risk or severity of an issue that implementation of the CR resolves on the SoS or System. It is described in user terms, not system terms. Priority of a CR is initially entered by the System Engineer developing the CR, but confirmed by the IPT on the level of the system from which it was raised.

5.10.2.3. Category. The category of a CR further describes the effect the CR has on the system. Where Priority describes risk and severity, the category details which part of the system is effected in very broad terms. Each CR must be categorized. Generally, this has no overall effect on the high priority (P1 and 2) CRs as they must all be resolved. The majority of CRs raised are in the lower priority and need an additional way to triage them as the full CR backlog likely will not be completed in a Release stream as it is continually being added to.

5.10.2.4. Inputs. CRs can be raised by the CA or Engineering staff at the SoS or System level. Other sources of CRs from the CA that would trigger a CR are:

a. Other Capital Projects. Other capital projects can introduce major changes to the Land C4ISR capability as well. They can be minor or major in nature depending on the scope of the capital project. Normally project staff would become part of an IPT for the component part of the system they are replacing, either as a voting member or simply a regular member if they are only introducing a sub-system into one of the systems. If the project scope is big enough (example: replacing one of the systems outright) the Engineering Process could be run internal to the project staff as a new, Major Release Stream producing a Fielding Baseline of its own through its own IPT. The current system IPTs would play a part in that project IPT. More information on this concept will follow in subsequent versions of this document.

b. Technical Failure Report (TFR). A TFR (form CF2239) is used by the Canadian Armed Forces (CAF) to report technical failures with CAF equipment. It is generated by the field force for items requiring national attention.

c. Unforecast Operational Requirement (UOR). An UOR is defined as a requirement that is essential to the safe and/or effective conduct of an operation that cannot be satisfied from existing stocks or ongoing authorized procurement. UOR submissions are to be used only for current or planned operations. They are not to be used to obtain equipment in anticipation of requirements.

d. Unsatisfactory Condition Report (UCR). A Unsatisfactory Condition Report (UCR) (form CF777 / CF777-A) used by the Canadian Armed Forces (CAF) to:
   i. Identify deficiencies in material (e.g. faulty design or workmanship, inadequate for the intended purpose, unreliable, inadequate operational performance, difficult to operate and maintain);
   ii. Identify deficiencies in policies or procedures (e.g. change in policy, poor operator or technical manuals)
   iii. Identify potential and actual hazards to personnel, material and property; and
   iv. Allow a formal means to transfer equipment (including software) knowledge and expertise between user Units and the Technical Authority (TA).

Table 3 – Change Management

Severity	Definition	Category	Definition	Development Release Implementation Target	In-Service or Fielding Baseline Implementation Target
1	Critical to fielding, system isn't functional and no workaround is possible.	Fundamental	Changes a fundamental part of a System or SoS. High Risk.	All identified	All Implemented within 2 work increments
2	Necessary for fielding, system is functional, but behavior workable. Work around exists, but is not operationally viable.	Stability	Change affects or improves the stability of the system	All identified	All Implemented within 3 work increments
3	Necessary for fielding, system is functional, but behavior isn't optimal. Work around exists and is operationally viable.	Usability	Change affects or improves usability	All: Fundamental, Stability, Usability, Documentation Preferred: Innovative	Fundamental, Stability, Usability only through annual Patch.
4	Not Necessary for fielding, current behavior is acceptable. Change is minor in nature and will improve user experience	Innovative	Change is not necessary but improves the system	All: Fundamental Preferred: Stability, Usability, Documentation Innovative	Fundamental, Stability, Usability only through annual Patch.
5	Not Necessary for fielding, current behavior is acceptable. Change is minor in nature will improve product, sub-system, or system performance.	Documentation	Change affects documentation or training.	Preferred: As many as possible.	None

5.10.2.5. CR States and transitions. As each CR transitions from an idea to ready for implementation, there are certain approvals that need to be achieved. The full process for this will be included in a subsequent version of this document.

5.10.3. <u>Problem Management</u>

5.10.3.1. The problem management process can be utilized at any level of the Release process and is used to identify, analyse and triage any issue raised on the system. Inputs can be from internal to the Engineering process on a developmental release, or from the CA on an in-service baseline.

5.10.3.2. <u>Developmental Baseline</u>

a. <u>Observations</u>. Observations are the primary form of issues raised in the developmental baseline. They form the initial entry / logging of an issue. They can be raised by any level, but primarily raised during a test event. Initial observations are typically raised informally (via a spreadsheet) until they are deemed real and not classified as test errors. They then become formal observations and are entered in to the SPR Database (SPRDB). The team who raises the observation is then able do the initial prioritization and categorization. At that point it can be turned into an SPR if the issue can be identified and fixed or left as an observation if the issue is on watch to see if it is identified again with more detail. The three states of an observation are:

    i. Closed – Not an issue.
    ii. Dealt With – Rectified without need for SPR
    iii. SPR – Issue needs further analysis, raise SPR.

5.10.3.3. In-Service or Fielding Baseline. These issues are raised through the field force and enter through the Army Network Operation Center (ANOC) to DLCSPM's National Engineering Support Service (NESS). They come in the following format:

a. Incident. The Information Technology Information Library (ITIL) defines an incident as an unplanned interruption to or quality reduction of an IT service. It differs from an SPR in that its goal is to return service to normal working levels, where an SPR aims to determine the root cause of a problem. Several incidents maybe combined to form an SPR. These are solely raised against the in-service or fielded baseline and are generally originated by the Canadian Army (user community).

Table 4 – Incident Impact

Severity	Definition	Target timeframe for initial response to incident
Critical	Any incident detected by the NOC or user that impacts the Mission Assurance posture, and therefore, affects the accomplishment of a mission essential capability, jeopardize safety, or operational security.	24 hours
High	Any incident reported by the NOC or users that cannot be mitigated using current capability, but that requires resolution.	2 working days
Medium	Any incident reported by the NOC or users that can be mitigated using current capability, but that requires resolution.	5 working days
Low	Any incident identified as a part of routine System Health Assessment of in-service operational systems.	10 working days
Trivial	Incident with no operational, safety, or security impact.	20 working days

5.10.3.4. SPR Triage. A System Problem Report (SPR) is generated when an issue is found with a product, sub-system or system within the Land C4ISR Capability and aims to determine and rectify the root cause of a problem. SPRs can be raised by anyone, and are normally raised in the development, integration and verification stages of the engineering process. SPRs in the Fielded Baseline generally originate from incidents. SPRs are recorded in a DLCSPM provided database for tracking and resolution.

Table 5 – SPR Priority & Categorization

Priority	Definition	Category	Definition	Target timeframe for initial triage of SPR
1	Any Problem that prevents the accomplishment of an operational or mission essential capability, jeopardize safety, security, or any other requirement designated critical. This can be further defined as any problem that causes, or has the potential to cause, a failure that results in a complete denial of a capability (robustness and reliability).	Fundamental	Changes a fundamental part of a System or SoS. High Risk.	Fielded Baseline - 24 hours Engineering Baseline – 1 work increment

Table 5 – SPR Priority & Categorization

Priority	Definition	Category	Definition	Target timeframe for initial triage of SPR
2	Any problem that causes the loss of or denies the use of a particular function of a capability, and there is, at the time, no reasonable work around.	Stability	Change affects or improves the stability of the system	Fielded Baseline - 5 working days Engineering Baseline – 1 work increment
3	Any problem that causes the loss of or denies the use of a particular function of a capability, and there is a reasonable work around.	Usability	Change affects or improves usability	Fielded baseline - 10 working days All implemented into Engineering Baseline
4	Any problem that results in user/operator inconvenience or annoyance, but does not prevent the user/operator from performing any function.	Innovative	Change is not necessary but improves the system	As many as possible implemented into the Engineering Baseline
5	Any other problems/defects or minor documentation issue.	Documentation	Change affects documentation or training.	Tech bulletin issued in 20 working days, formal change implemented in 1 work increment.

5.10.3.5. Aggregation of SPRs. During SPR triage, it is important to look at the entire SPR backlog periodically as one. It is likely that multiple lower SPRs can aggregate into a single, higher priority SPR that needs to be fixed. An example of this is if there are 6 P4 SPRs in a single user work flow. Individually they may have workarounds which the user can deal with, but the entire work flow may not be useable as it has up to 6 workarounds. Together these SPRs could become a P2 or P1 and must be fixed. Therefore categorization and linking of SPRs is critical to ensure aggregated SPRs to not cause a complete system failure.

5.10.4. Problem Resolution

5.10.4.1. The Contractor must establish a formal evaluation process that involves, but is not limited to, the following actions:

a. Establishing the criteria for evaluating alternatives;
b. Identifying alternative solutions;
c. Selecting methods for evaluating alternatives;
d. Evaluating the alternative solutions using the established criteria and methods;

e. Performing Technical Investigations and Engineering Support (TIES); and
f. Selecting recommended solutions from the alternatives based on the evaluation criteria.

5.10.5. ILS Process

5.10.5.1. The ILS process occurs concurrently within all other processes. It ensures the system is properly documented and supported throughout its lifetime. The ILS process is fully documented within the LCSS Support plan and includes the following activities:

a. Engineering Documentation Development
b. User Documentation Development
c. Training Development
d. Obsolesce Management
e. Software Obsolescence Roadmap
    i. Waiver Process
f. Hardware Obsolescence Roadmap
    i. COTS
    ii. MOTS
g. Life Cycle Material Manager (LCMM)
h. Annual Obsolescence Review

5.10.6. Failure Analysis Risk/Management

5.10.6.1. This process is similar to the Problem resolution process, however is undertaken during the verification and validation process only. During a release verification process, the Fielding Candidate Baseline is checked against its Requirements/ Design baseline. Each Requirement is then evaluated as met or failed. The Failure Analysis / Risk Management process is used to evaluate each failed requirement or capability. It has two major Phases:

5.10.6.2. Failure Analysis

5.10.6.2.1. This phase aims to analyse why the requirement was not met (failed). There are two decisions that result from this analysis:

a. Met With Exception. The requirement was met in principle, but not exactly (i.e. Requirement: Blue PA shall refresh every 10 seconds; System capable of every 12 seconds).

b. Fail. The requirement was not met at all (i.e. Requirement: Blue PA shall refresh every 10 seconds; System capable every 120 seconds).

5.10.6.3. Risk Analysis. After the failed requirement has been through the Failure analysis, the entire Baseline is assessed to determine if it can continue to fielding. If not it goes back to development. If it can, each of the exceptions need to be assessed in terms of risk to fielding, and if they are repairable before fielding.

5.10.7. Root Cause analysis

5.10.7.1. This process can occur at any time an SPR or defect is found and must occur if one is found during verification. It attempts to determine the foundational issue of the SPR, and remedy that vs attempt to remedy the symptom of the issue. It can be an extremely difficult process if the root cause is a foundational issue which is deep within the code or core of a product, but is essential for system stability.

5.10.8. Innovation Management

5.10.8.1. This is another process that can happen throughout, but only will effect a release at the beginning of the release process. The CA, DLCSPM and any sustainment contractor are encouraged to innovate. This could be by means of seeking updates to existing product fleet, researching disruptive technologies, identifying new capabilities or importing Allied capabilities seen on exercises or operations. It has its own innovation backlog and is analysed during the Annual Program Audit.

5.10.9. Product Retirement

5.10.9.1. Product retirement is a separate product resulting from Obsolescence management. It is the formal process to remove a product from a baseline.

5.10.10. Escaped Defect

5.10.10.1. This process occurs during verification and validation phases, and is used as a metric for measuring Engineering, development and testing performance. An escaped defect is an issue that should have been caught at a lower level of test, but is caught at a higher level (i.e. a product bug found at System Testing). Good test regimes at all levels aim to minimize Escaped Defects; however benefits to finding Escaped defects should trigger a review of the test process in order to improve it to catch those defects in the future.

6. INTEGRATION

6.1. Overview

6.1.1. General

6.1.1.1. The integration cycle starts after Product Development has been completed. It is a general process that works for Major, Minor and Patch releases. The main difference in process between the releases is the starting point and the initial risk on integration. The process is cyclical and continues until the exit criteria is met and ready to go to verification. Each of the integration activities associated with an integration cycle may occur simultaneously depending on the state of maturity of the system or sub-system undergoing integration.

6.1.1.2. The Integration Baselines for each test event can vary widely depending on the intent of the particular integration activity. When the verification stage begins, the test plans and Integration Baselines must be stabilized. There could be several Integration Baselines being managed concurrently for the various test and integration events being conducted.

6.1.1.3. The integration workflow is illustrated in Figure 9 below along with the IPT that is responsible for integration at the various levels. The full details of each level of integration are outlined in Table 6 – Integration Description.

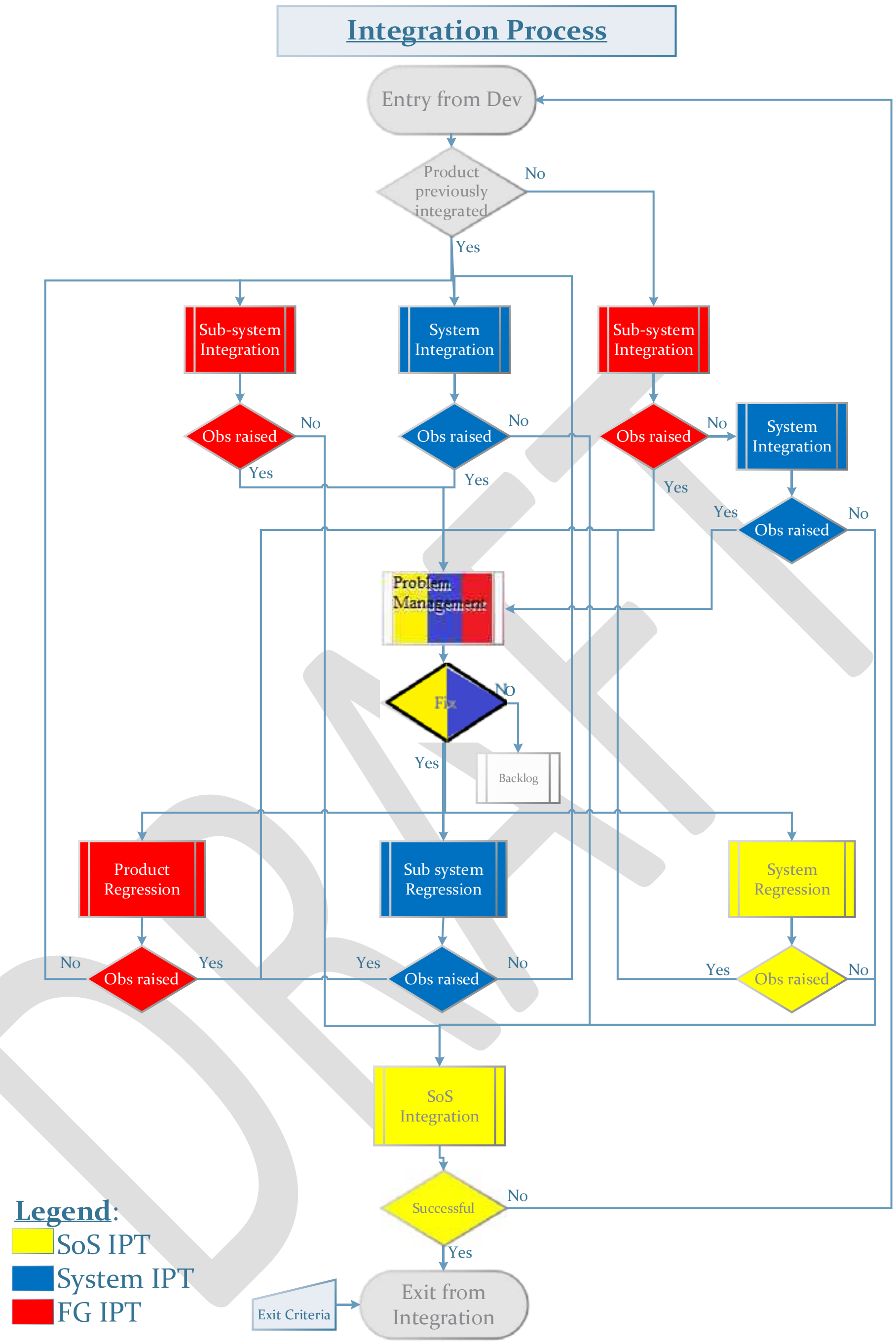


Figure 9 – Integration Process

6.2. Agile Integration

6.2.1. This process occurs in a fully agile framework where products are continually integrated and tested throughout their development. It is anticipated that products can be integrated into sub-systems and tested at the end of each sprint, with sub-system into System 2-3 times per WI, or at the very least at the end of each WI for a more rigorous System Integration test. Systems into SoS integration can also occur within a WI, but as this level of integration is more complicated due to the size of the Land C4ISR capability, formal integration testing is likely only to occur at most at the end of a WI, but likely 1-2 times per year. More details on these integration patterns will be delivered in a subsequent versions of this document.

6.3. Continuous Integration / Continuous Delivery (CI/CD)

6.3.1. The Agile integration relies on all integration teams having access to the right software / firmware and hardware immediately as they are published and ready for integration. This process is referred to as the CI/CD process. It is an informal method of delivering software that is outside of the DLCSPM Software library[2]. Daily builds of software can be uploaded into the pipeline for consumption by other Product, FG or System Integration teams. This ensures that all products are being developed together and can find integration issues as soon as possible, without waiting for a major test event. It is the cornerstone of the agile delivery process.

6.3.2. CI/CD Pipeline. This is the mechanism by which Product Teams deliver their software or firmware. It’s essentially a database that is owned by DLCSPM but likely managed by the SoS E&I contractor. The main purpose of DLCSPM owning the pipeline is to enable maximum access for all contractors that utilize the pipeline, while managing the appropriate industrial security precautions (i.e. TAAs). Products are delivered to this pipeline and integrated in to the FG or the System.

6.4. Integration Entry Criteria

6.4.1. Entry into the integration cycle is a deliberate decision made by one of the IPTs depending on the level of integration being considered. It cannot start until the Engineering Process is complete and the Product Teams have had sufficient time to build the initial versions of their products for the release. The recommendation is initially made by the Product teams that their Products are functional and ready to be integrated. The appropriate IPT then weights those recommendations against the following criteria:

a. Decision Authority: SoS IPT, System IPT or Functional Group IPT (Dependent on what level of integration)
b. Development Baseline complete
c. Engineering Baseline drafted
d. Design Baseline is complete, All CRs and SPRs that are to be implemented into the Engineering Baseline are identified and road-mapped.
e. Initial phase Product Development complete, tested and ready for integration.

[2] The DLCSPM Software Library holds all off the official, published versions of software and has a strict delivery process, which is good for formal delivery, but too slow for agile development.

6.5. Integration Model Decision

6.5.1. This initial decision in the integration cycle aims to direct the level and rigour that the integration cycle needs to take. This decision is particularly important in a minor release as some changes maybe updates to existing Products or sub-systems, or maybe introducing new ones. In a major release, the question is less important as the change has already been assessed as major, therefore requiring the full cycle of integration. It is a binary decision that determines if a fully agile integration (integration at all levels) can realistically be achieved, or if a more deliberate integration is required to mitigate any risks of a complex integration failing.

a. The question being asked is: Has the product been previously integrated into its Sub-System before? The Authority to make this decision is the SoS IPT.

i. If "Yes", proceed to simultaneous Sub-System and System integration
ii. If "No", proceed to waterfall Sub-System then System integration.

6.5.2. Once the decision on the integration model has been made, the integration cycle beings following the responsibilities outlined in Table 6 – Integration DescriptionTable 6 below.

Table 6 – Integration Description

	Sub-System Integration	System Integration	SoS Integration
Purpose	Integrate all Products to ensure compatibility between the Products in order to build the Sub-System. Validate any SPRs or problem reports that cannot be validated at Product testing. Presumes that all Product development and testing is complete and the Product functions as designed. Standard stability and robustness test; this is done in an engineering context with operational influence. Any bugs found at the integration or stability and robustness test are raised as SPRs. Any escaped defects from Product / Product level are identified. Contractor led test events.	Integrate all Sub-Systems to ensure compatibility between Sub-Systems in order to build System. Validate any SPRs or problem reports that cannot be validated at Sub-System integration and testing. Presumes that Product development and testing is complete and the Product functions as designed and focuses on interfaces between Sub-Systems, System operation as a whole and scaling to an operational size. Standard stability and robustness test; this is done in an engineering context with operational influence. Any bugs found at the integration or stability and robustness test are raised as SPRs. Any escaped defects from Sub-System level are identified. Contractor led test events. System integration and SoS integration tasks cannot run concurrently as the equipment and personnel to run both tests are likely the same (provided by the SoS E&I Contractor)	Integrate all systems to ensure compatibility between systems in order to build the Land C4ISR System. Validate any SPRs or problem reports that cannot be validated at Sub-System integration and testing. Presumes that System integration and testing is complete and the product functions as designed and focuses on interfaces between Systems, SoS system operation as a whole and scaling to an operational or international size. Standard stability and robustness test; this is done in an engineering context with operational influence. Any bugs found during the integration or stability and robustness test are raised as SPRs. Any escaped defects from System level are identified. Test events are typically contractor led. System integration and SoS integration tasks cannot run concurrently as the equipment and personnel to run both tests are likely the same (provided by the SoS E&I Contractor)
Scope	1. Product interface testing 2. Sub-System integration testing 3. Sub-System stability and robustness	1. Sub-System interface testing 2. System integration testing 3. System stability and robustness.	1. System interface testing 2. Gateway testing 3. SoS integration testing SoS stability and robustness testing
Scale	At appropriate level for Sub-System	1. Mobile Domain – Independent Battle Group	1. Soldier Domain – Individual user in Cbt tm or BG context

		2. HQ Domain – Mechanized Brigade headquarters with BG HQ 3. ISTAR – Sufficient scale to verify independent systems. 4. SIM - as defined by Canadian Army Simulation Center Kingston.	2. Mobile Domain – BG in a Bde Context 3. HQ Domain – Mechanized Bde in an international context 4. ISTAR – Systems integrated as Bde level enablers 5. SIM – as defined by Canadian Army Simulation Center Kingston.
Who	Core Network, Applications, ISTAR sustainment Contractors with DLCSPM observation	SoS E&I Contractor with DLCSPM oversight	SoS E&I Contractor with DLCSPM oversight
Input	To Be Developed	To Be Developed	To Be Developed
Output	To Be Developed	To Be Developed	To Be Developed

6.6. Regression Testing

6.6.1. Purpose. Re-running functional and non-functional tests to ensure the Product as previously developed and tested still performs after a change. Execute test of the Product. This is limited to all functionality that do not depend on interaction with other Products. Produce a Product test report. Process SPR (e.g. create, close, etc.) as they pertain to Product scope.

6.6.2. Scope: Same as initial integration test where issue was found

6.6.3. Scale: Same as initial integration test where issue was found

6.6.4. Who and where: Same as initial integration test where issue was found

6.6.5. Input & Output: To be developed.

6.7. Integration Criteria Met.

6.7.1. This decision point is only done at the System or SoS level. The goal of this decision is if a System or SoS has reach a maturity level that is ready for verification and eventually the field force. In the broad intent it is free of major issue and bugs, it is stable and useable and has the appropriate documentation and training packages drafted (they will be finalized through the Verification cycle).

6.7.2. Criteria to exit from Integration:

a. Pre-Acceptance Baseline defined prepared for SoS Steering Committee
b. Integration Test Report complete
c. All new features implemented, integrated and tested
d. All Priority 1 and Priority 2 SPRs are resolved
e. All Priority 3 Stability and Usability SPRs resolved.
f. Engineering documentation updated.
g. Build Books Drafted
h. System Management Procedures drafted
i. User facing documentation drafted.
j. Media formally submitted and accepted by DLCSPM Media Library

6.7.3. Outputs from Integration:

a. Pre-Acceptance Baseline
b. Working System or SoS that is stable and useable
c. Draft Engineering documentation, Build Books, System Management Procedures and User facing documentation
d. Training Development Documents

7. VERIFICATION AND VALIDATION (V&V) PROCESS

7.1. General

7.1.1. Overview. The full Verification and Validation Process is only kicked off if the baseline is intended to field to the Army. This is a formal process that uses the Waterfall methodology assuming that integration has been successful and a stable and usable system is entering the process. They key difference in these tests are primarily who conducts the test and the context that it's conducted. The process is depicted in Figure 10 below.

7.2. Context differential from Integration

7.2.1. Integration testing is done in a controlled, laboratory environment in a scientific manner. The system under test is always started from a clean state and one variable is introduced at a time to fully understand the impact of a change. Integration is primarily the responsibility of the Sustainment contractors. Once the V&V process commences, the responsibility shifts to the Crown (DLCSPM and CAF) to conduct the V&V events, with DLCSPM responsible for Verification and CAF for Validation. Verification testing is still done in a controlled manner, but with the underlying assumption the system or SoS is stable and usable, the tests are conducted in a more operational (real) environment without resetting between tests. Validation events are conducted in a fully operational, non-scripted environment. It is more of a free-play evaluation to see if the Capability delivered meets the defined User needs. More details on each process are detailed below.

7.3. Entry Criteria

7.3.1. The Decision Authority to enter the V&V process resides only with the SoS IPT. The entry criteria are defined below:

a. Pre-Acceptance Baseline defined and approved
b. Integration Test report complete
c. All new features implemented, integrated and tested
d. All P1 and P2 SPRs are resolved
e. All P3 stability and usability SPRs resolved.
f. Engineering documentation updated.
g. Build Books drafted
h. SM Procedures drafted
i. User facing documentation drafted.
j. Media formally submitted and accepted by DLCSPM Media Library

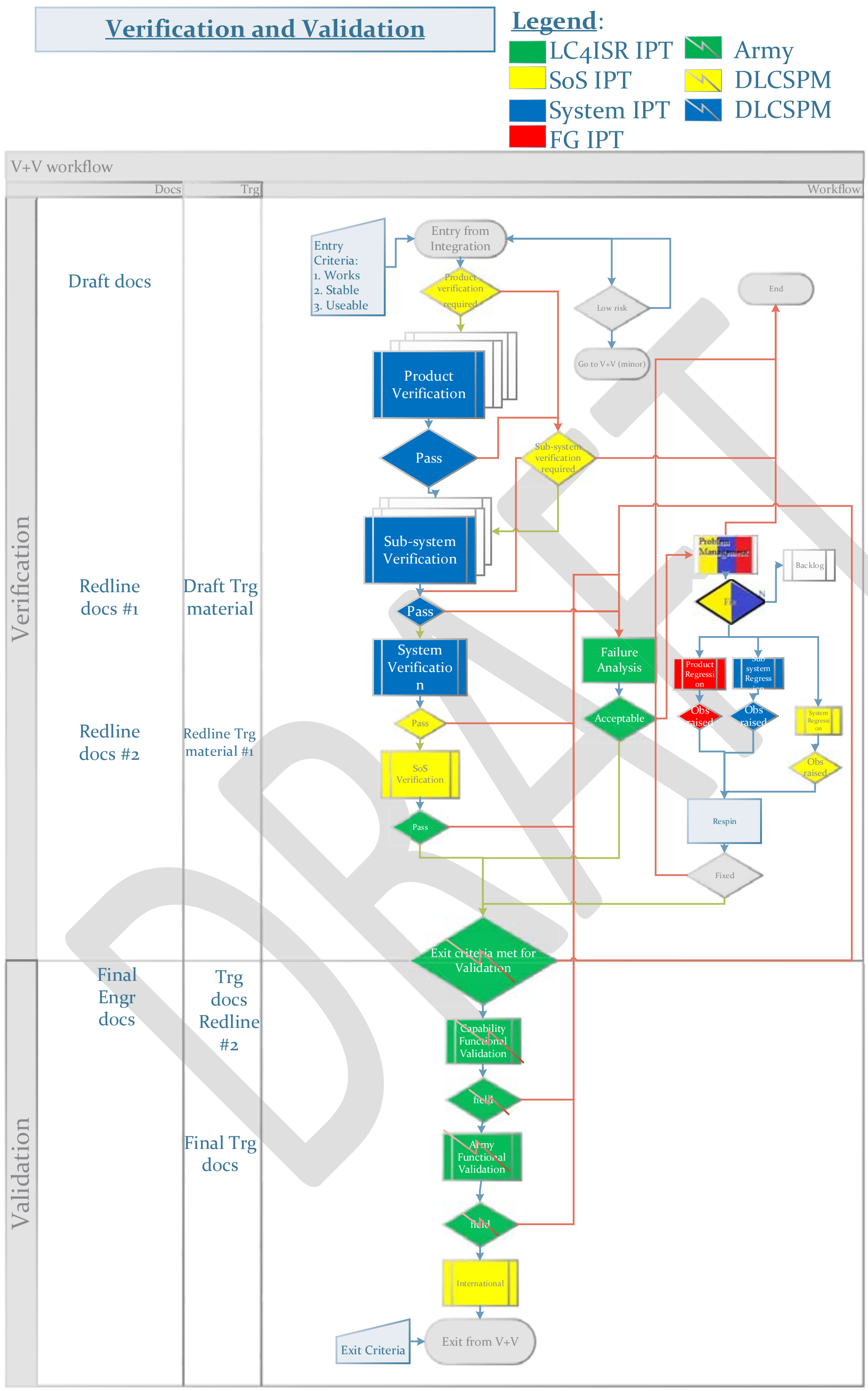


Figure 10 – Verification and Validation Process

7.4. Verification

7.4.1. Verification testing relates back to the approved requirement set and can be performed at different stages in the product life cycle. Verification testing includes: (1) any testing used to assist in the development and maturation of Products, Systems, or manufacturing or support processes and/or (2) any engineering-type test used to verify the status of technical progress, substantiate achievement of contract technical performance and certify readiness for initial validation testing. Verification tests use instrumentation and measurements and are generally accomplished by engineers and technicians in a controlled environment. The details are listed in Table 7 below.

7.4.2. Verification will be different based on the release stream that is chosen, with the decisions being on the risk the changes introduce. In all release streams, Product Verification is generally assumed to be completed by the System IPT, however DLCSPM reserves the right to do independent verification of Products or Sub-Systems at any point in either an audit function or if there are discrepancies in verification test reports that need an independent review.

7.4.3. Generally, a Major release will follow all steps in the Verification process, less Product. A Minor release assumes Product and Sub-System verification is not required and proceeds directly to System or SoS verification depending on the risk assessment of the introduced change. Product and Sub-System verification can still be done, however it is done by exception. The intent of this assumption in the Minor Release stream is to shorten the Verification timeline.

7.4.4. Verification test events are sometimes called Field Trials or Technical Validation Events (TVEs) in their most formal iteration.

Table 7 – Verification Description

	Independent Product Verification	Sub-System Verification	System Verification	SoS Verification
Purpose	1. This phase of the Product verification test is to ensure that the product functions as designed per the product requirements • Focus the verification on services and functions, features, No new features is expected here. • At this stage of testing, it is assumed that the development testing has been thoroughly accomplished and the sustainment contractor is ready/confident to deliver the product to DND and is requesting formal acceptance of the Product by DND. • Product Testing evaluates the requirements, functional and physical architectures and ultimately evaluates the implementation.	1. Sub-System verification is different from sub-system integration in the test environment that the tests are conducted in. Where Integration testing is normally done in a controlled environment, where variables are changed one at a time, verification is done in a more operational environment, where the sub-system is tested with an operational scenario (real or simulated), longer term where the sub-system is not reset and the end of a test day or test process. It is used as it is intended to conduct testing. 2. Not all sub-systems are required to be verified (i.e. those that fall into infrastructure or back end services), as they will be verified as part of System Verification Testing.	1. System verification modifies the test environment from a laboratory controlled context (system is reset to a clean state for every test) to an operational environment (system "live" and not reset after every test). It verifies in an operational context if the various sub-systems delivered by the Functional Groupings have been integrated correctly in an operational context and that a user is able to build, deploy, use and close out the system in an operational, but controlled environment (real or simulated). It not only test the system, but the supporting documentation and training material. 2. Tests are conducted by engineering staff with user assistance.	1. SoS verification is conducted in the same environment as system verification, only with a different operational context and scale. It primarily verifies that the various systems have been properly integrated and that integration supports the operational requirements.

Scope	1. Test Schemes a. Functional b. Regression c. Performance d. Usability	1. Long term testing (soak testing) 2. Performance testing 3. Testing to failure	1. Operational Requirements verification 2. Long term testing (soak testing) 3. Performance testing 4. Testing to failure 5. Usability 6. System build process and software installers using the provided build books and user facing documentation. 7. Redline Engineering and user facing documentation 8. Over the Air Testing 9. Develop and initial redline of training material	4. Operational Requirements verification 5. Long term testing (soak testing) 6. Performance testing 7. Testing to failure 8. Usability 9. Over the Air Testing 10. Redline Engineering and user facing documentation 11. Develop and initial redline of training material 12. Interoperability
Scale	1. No operational scale 2. Sufficient scale to get representative sample (product dependant)	At appropriate level for Sub-System	1. Mobile Domain – Independent Battle Group 2. HQ Domain – Mechanized Brigade headquarters with BG HQ 3. ISTAR – Sufficient scale to verify independent systems. 4. SIM - as defined by Canadian Army Simulation Center Kingston.	1. Soldier Domain – Individual user in Cbt tm or BG context 2. Mobile Domain – BG in a Bde Context 3. HQ Domain – Mechanized Bde in an international context 4. ISTAR – Systems integrated as Bde level enablers 5. SIM – as defined by Canadian Army Simulation Center Kingston.

Who	DLCSPM Test Facility (TSIL or SIL or ISTAR)	1.Functional Grouping Sustainment Contractor or 2.DLCSPM	1. DLCSPM TSIL Staff led conducted at the SoS E&I Contractor's integration facility with over the air and vehicle support from System Integration Lab (SIL) and SoS E&I Contractor and Canadian Army personnel support. 2. DLCSPM ISTAR 3. CA Sim Center	DLCSPM TSIL Staff led conducted at the SoS E&I Contractor's integration facility with over the air and vehicle support from SIL and SoS E&I Contractor and Canadian Army personnel support.
Input	1. Input from the Baseline Integration Test results that includes: 2. OBS 3. SPRs 4. Redlines / Updates Test Procedures and Product Technical Documents 5. Final SoS Test Report 6. Stakeholder Requirements/ analysis to ensure the validation of the product test meets the requirements. 7. Technical Data Package that includes: 8. Technical manuals and engineering drawings	1.Sub-system regression test reports 2.Other applicable test reports 3.Product Test Reports 4.Stakeholder requirement Traceability matrix 5. TDP's Functional Analysis includes the detailed package of documentation developed to analyze the functions and allocate performance requirements	1. System and Sub-system Integration Test Results 2. OUCs 3. SoS Test Plan 4. Integration Test Procedures 5. Candidate Baseline (Term to be confirmed at a later time) 6. Verification Cross Reference Matrix (VCRM) (This is an industry term; Term to be confirmed at a later time - checklist/tombstone of what has been completed to date in associated to the "task" in question) 7. Test Schedule 8. Product Technical Documents (System Management Procedures, Product and System Manuals, Installation Manuals, User Manuals, Version Description Documents (VDDs))	1. System and Sub-system Integration Test Results 2. OUCs 3. SoS Test Plan 4. Integration Test Procedures 5. Candidate Baseline (Term to be confirmed at a later time) 6. Verification Cross Reference Matrix (VCRM) (This is an industry term; Term to be confirmed at a later time - checklist/tombstone of what has been completed to date in associated to the "task" in question) 7. Test Schedule 8. Product Technical Documents (System Management Procedures, Product and System Manuals, Installation Manuals, User Manuals, Version Description Documents (VDDs))

			9. Test Configuration (Lab laydown, Simulation, Test Automation, Test Support) 10. Sub-System functional configuration audit	9. Test Configuration (Lab laydown, Simulation, Test Automation, Test Support) Sub-System functional configuration audit
Output	1. Updated Technical Data Package that includes: 2. Updated Technical manuals and engineering drawings 3. Verification provisions 4. Product support maintenance plan 5. Formal Product Test Reports 6. Formal Acceptance by DND to move to the next phase Sub-System Testing 7. Documents c. Product Acceptance Report d. Product Test Result Report e. Any new features, bugs, etc. to be flagged. However anything new will be included in the next baseline.	1.Sub-System verification Test Report against the plan. 2.Ensures Sub-System Engineering completeness by: f. System performance reports g. Validate specifications against matrix h. Technical compliance testing results against plans i. Qualification tests to ensure the sub-system works 3.Transitioning to a full LCSS system integration test. Functional configuration audit	1. OBS 2. SPRs 3. Redlines / Updates Test Procedures and Product Technical Documents 4. Final SoS Test Report	1. Candidate Release Baseline 2. Final Documentation 3. Draft Training Material Final SoS Test Report

7.4.5. The exit from verification occurs when the User and System requirements have been met satisfactorily by the Land C4ISR IPT. The Decision to exit from Verification into validation is held at this level. Verification Exit Criteria:

a. Test Report Summaries for Operational Test Cases
b. Final SoS Test Report
c. Physical Configuration Audit Report
d. Candidate Release Baseline Spreadsheet
e. Verification Cross Reference Matrix (VCRM) Updated
f. Candidate Release Baseline (Approved by SoS IPT)
g. Training Documentation Drafted
h. Engineering and User facing documentation updated and finalized.

7.5. Validation

7.5.1. Validation relates back to the concept of operations document. Validation testing is conducted under realistic conditions (or simulated conditions) on the Land C4ISR Capability to determine the effectiveness and suitability of the product for use in mission operations by typical users and to evaluate the results of such tests. Validation activities are only conducted by the CA or CAF, with DLCSPM and the Sustainment Contractors supporting.

7.5.2. Test events in Validation can be deliberate or combined with an existing exercise and validation done by the successful outcomes of the exercise. These test events are sometimes termed User Acceptance Tests (UATs).

Table 8 – Validation Description

	Land C4ISR Capability Functional Validation	Army Operational Validation
Purpose	1. Functional validation assumes that the system has met the defined operational requirements. The largest difference from SoS verification is the test is now conducted in a field environment with real field grade equipment (Field trial). Tests are still controlled through an engineering test plan, with an operational context. 2. Testing is conducted by Canadian Army personnel, with engineering staff supporting. 3. The SoS Functional Validation activity is the verification of the features/functions of the system to ensure that the 'right' system was built and is suitable and effective at meeting the needs of the Customer (Canadian Army). 4. Field test with engineering focus to validate the LCSS System meets the functional requirements stated by the Army / User as required. 5. Sometimes known as a “Technical Validation Event”. 6. System is run “over the air” with real bearers, on real equipment, ideally with real users, with LCSS System engineers managing the script. 7. Aim is to validate the system can work in a field environment, and not just in a laboratory environment. 8. DLCSPM Led test event.	1. Operational test by the Canadian Army of the System to determine / validate if the delivered System meets their user needs / Story and assess any further work required. 2. Canadian Army led test event with DLCSPM / sustainment contractor observing. 3. Can be deliberate test, or combined with Unit / Canadian Army level training exercise. 4. System is used as the Canadian Army sees fit, with no scripted tests. 5. Formerly known as User Acceptance Trial or Fit for Purpose Evaluation.
Scope	1. Operational Context in a field environment on field grade equipment 2. Over the Air testing 3. Validate user facing documents and SM procedures 4. Redline Training documentation	1. Operational Context in a field environment on field grade equipment 2. Free use of the system 3. Validate Training documentation
Scale	1. Soldier Domain – Individual user in Cbt tm or BG context	1. Soldier Domain – Individual user in Cbt tm or BG context

	2. Mobile Domain – BG in a Bde Context 3. HQ Domain – Mechanized Bde in a Joint, International Multilateral Partnership (JIMP) context (dependant on test event) 4. ISTAR – Systems integrated as Bde level enablers 5. SIM – as defined by Canadian Army Simulation Center Kingston. Equipment to be utilized: a. Real– As much as available from the Canadian Army b. Simulated – Remainder	2. Mobile Domain – BG in a Bde Context 3. HQ Domain – Mechanized Bde in an JIMP context (dependant on test event) 4. ISTAR – Systems integrated as Bde level enablers 5. SIM – as defined by Canadian Army Simulation Center Kingston. Equipment to be utilized: a. Real– As much as available from the Canadian Army b. Simulated – Remainder
Who	1. DLCSPM – TSIL Staff leading, with CA Personnel operating equipment. Engineering staff in support (FSR, UX, System and Product staff as required) 2. Conducted at a field unit as available. 3. DLR / DLCI observing	1. Canadian Army at a field unit, with DLCSPM staff supporting 2. DLR / DLCI Observing 3. Other Army Organizations 4. Sustainment Contractors Observing
Input	1. Fielding Candidate baseline approved from LCSS System Integration Testing 2. Candidate Release Baseline List approved for Fielding (Output from LCSS System of Systems Integration Testing	1. Army unit to be fully fielded with fielding Baseline.
Output	1. Confirmation from LCSS IPT that the Fielding Candidate Baseline is ready or not for large scale fielding. 2. Confirmation that the LCSS System meets the functional requirements, and architecture is suitable for field use. 3. Initial System level feedback from the user 4. New User Stories as needed for future systems 5. System Level SPRs as required	1. Confirmation from Land C4ISR the Fielded Baseline is certified for operational use. 2. Unsatisfactory Condition Reports (UCRs) for items not meeting the user need (note no SPRs are identified at this stage) 3. New User Stories as needed for future systems
Fielding Decision Point	Land C4ISR IPT Crown (DLR / DLCI)	Land C4ISR IPT Crown (DLR / DLCI / CA?)

7.6. Testing Schemes.

7.6.1. The following is a non-exhaustive list of test schema's that are envisioned to be developed through further versions of this Engineering Plan. The intent of these is to harmonize and clarify what testing is done at each of the test houses. Below is a one line overview of the large scale intent of each test scheme and what question the test should answer.

7.6.2. Product testing. Does the product work?

7.6.3. Integration. Did it integrate / combine with what it's supposed to? Do the interfaces work?

7.6.4. Simulation. Add traffic / vehicles or nodes to a test to increase scale

7.6.5. Regression testing. Verify that a previous SPR or bug that development or integration team said was fixed was actually fixed.

7.6.6. Throttle testing. How well does an applied throttle work? Is data leaking around or through the throttle causing downstream effects?

7.6.7. Stress testing. Test the product / sub-system / system or SoS outside of its normal operating parameters, but not pushing it to failure. Aim is to see how the system performs under a heavy load.

7.6.8. Testing to failure. Follow on to stress test, pushing the product / sub-system / system or SoS to the point where it starts to fail or does fail. It's pushed far beyond what is expected of it. Aim is to determine where and how a system fails (crash, or gracefully).

7.6.9. Performance envelope testing. Loading the system to its normal parameters and measuring the performance envelope in respect to speed, throughput, availably (time) etc.

8. FIELDING PROCESS (To Be Developed)

8.1. Overview

8.1.1. The information presented within this section is a placeholder only at this time for further development in a subsequent version of this document. The intent of this section is to describe how a release is delivered to the user community once it has passed its validation. Currently there is no documented process for this.

8.2. Release Package

8.2.1. This will describe the package of what is delivered to the field force at the end of the Validation cycle. It broadly includes:

a. Software / Firmware / Hardware lists

b. Engineering Documentation

c. User facing documentation

d. Training Packages

8.3. Delivery mechanism

8.3.1. This section will describe how products are delivered formally to DLCSPM to prepare for fielding activities. There are two main methods of delivery:

8.3.1.1. Hardware (depot, 7 Canadian Forces Supply Depot Kitting section)

8.3.1.2. Software (DLCSPM Media Library)

8.4. Production

8.4.1. This section will describe how items are produced. It primarily applies to hardware production. It has to main methods of production:

8.4.1.1. Things that DLCSPM build internally

8.4.1.2. Things that get delivered complete from OEMs

8.5. Fielding from Depot to Units

8.5.1. This section will describe the DLCSPM input to the DLR and DLCI fielding process. The intent is to describe how DLCSPM will prepare and make available equipment to the Army for fielding. It has the following broad methods:

8.5.1.1. Divisional Equipment Fielding Detachments (Div EFDs). Primarily vehicle Comm suite installation.
8.5.1.2. TSIL assembly. Primarily HQ Domain hardware build
8.5.1.3. Combined Build Teams and TAVs

8.6. Training systems

8.6.1. This section will cover the various training systems that are fielded with the Land C4ISR capability. They are in addition to documentation and training material.

8.6.1.1. MDCT
8.6.1.2. DRAT

9. IN-SERVICE SUPPORT (To Be Developed)

9.1. Overview

9.1.1. The information presented within this section is a placeholder only at this time for further development in a subsequent version of this document. The intent of this section is to describe the in-service support of a release. The vast majority of this is already documented in the LCSS Maintenance plan, the intent is to copy the key tenants from that document, and how describe how it feeds the engineering process.

9.2. Key tenants from LCSS Maintenance Plan

9.2.1. This section will highlight the key themes and thoughts from the LCSS Maintenance plan. It is not intended to replace the plan, only summarize. Potentially key concepts from the Land Equipment Maintenance System (LEMS) doctrine (Lines and Levels of Maintenance) will be covered to provide context for the In-Service Release Problem Management Process and how it differs from the Engineering Release Problem Management process.

9.3. In-Service Release Problem Management Process

9.3.1. The intent of this section is to document how the user community (CA or CAF) engages the DLCSPM Engineering Process to fix an issue identified in the In-Service or Fielding Baselines.

9.3.1.1. Army Feedback
9.3.1.2. Service Request (DWAN)
9.3.1.3. Technical Failure Report
9.3.1.4. Foreman of Signals Technical Chain of Command
9.3.1.5. Incident Management

9.4. Support Request Triage

9.4.1. The intent of this section is to describe the triage process of an incident once it's received from the user community. It aims to describe the various organizations involved and how they fit or engage the DLCSPM Engineering Process. It is not meant to describe non-DLCSPM or Sustainment Contractor organizations, only highlight their role in this Engineering Plan.

9.4.1.1. Army Network Operations Center (ANOC), managed by the CA G6.

9.4.1.2. Cyber Security Operations Center (CSOC)
9.4.1.3. National Engineering Support Service (NESS), Managed By DLCSPM
9.4.1.4. DLCSPM Operations
9.4.1.5. DLCSPM Life Cycle Material Managers (LCMMs)

9.5. Field Support

9.5.1. The intent of this section is to describe how DLCSPM and the Sustainment Contractors will provide on-site field support to the In-Service or Fielding Baselines.

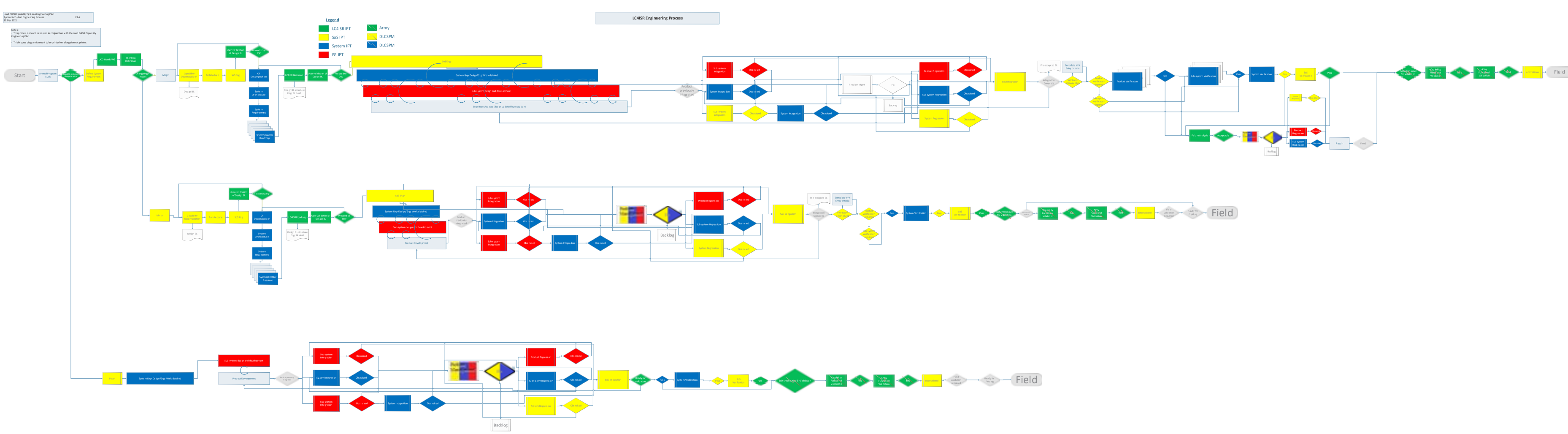
9.5.1.1. FSR (Field Support vs Service Rep) – Sustainment Contractor or OEM provided resource.
9.5.1.2. DLCSPM Technical Assistance Visit - Custom built depending on the issue

Appendix 1 – Acronyms

ANOC	Army Network Operation Center
AWG	Architecture Working Group
Bde	Brigade
BG	Battle Group
C2	Command and Control
C4ISR	Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance
CA	Canadian Army
CADTC	Canadian Army Doctrine and Training Centre
CAF	Canadian Armed Forces
CBT	Computer Based Training
Cbt tm	Combat Team
CJOC	Canadian Joint Operation Command
CMWG	Configuration Management Working Group
COTS	Commercial Off The Shelf
CR	Change Request
DA	Design Authority
DLCSPM	Director Land Command Systems Program Management
DLCI	Director Land Command and Information
DLR	Director Land Requirements
DND	Department of National Defence
DOCWG	Document Management Working group
E&I	Engineering & Integration
FG	Functional Grouping
FWG	Fielding Working Group
HQ	Headquarters
ILS	Integrated Logistic Support
IM	Information Management
IMO	Information Management Officer
IP	Intellectual Property
IPT	Integrated Product Team
ISR	Intelligence Surveillance and Reconnaissance
ISS	In-Service Support
ISTAR	Intelligence Surveillance Target Acquisition Reconnaissance
ITIL	Information Technology Information Library
Land C4ISR	Land Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance
LCMM	Lifecycle Material Manager
LCSS	Land Command Support System

MOTS	Military Off The Shelf
NESS	National Engineering Support Service
NP	National Procurement
OEM	Original Equipment Manufacturer
PM	Project Manager
PMWG	Problem Management Working group
R&D	Research and Development
R&O	Repair and Overhaul
RAWG	Risk Analysis Working Group
RFI/LOI	Request for Information/Letter of Interest
RFP	Request for Proposal
ROD	Record of Decision
SE	System Engineer
SECWG	Security Working Group
SEM	System Engineer Manager
SEP	System Engineering Plan
SI	System Integrator
SIM	Simulation
SMWG	System Management Working group
SoS	System of Systems
SPR	System Problem Report
SSE	Strong, Secure, Engaged
TacC2IS	Tactical Command, Control and Information System
TacComs	Tactical Communications
TDP	Technical Data Package
TFR	Technical Failure Report
TIES	Technical Investigations and Engineering Support
TOR	Terms of Reference
TRGWG	Training Working Group
TSR	Total System Responsibility
UCD	User Centered Design
UCR	Unsatisfactory Condition Report
UOR	Unforecast Operational Requirement
V&V	Verification & Validation
VCCI	Voluntary Control Council for Interference
VCRM	Verification Cross Reference Matrix
VDD	Version Description Documents
WG	Working Group

Appendix 2 – Full Engineering Process


Land C4ISR Capability Systems Engineering Plan
Appendix 2 – Full Engineering Process
12 Dec 2021
V1.4
Notes:
- This process is meant to be read in conjunction with the Land C4ISR Capability Engineering Plan.
- This Process diagram is meant to be printed on a large format printer.
LC4ISR Engineering Process
Legend:
LC4ISR IPT
SoS IPT
System IPT
FG IPT
Army
DLCSPM
DLCSPM
Start
Annual Program Audit
Define System Requirement
UCD Needs WG
User Req Definition
Change High Impact
Major
Capability Decomposition
Architecture
SoS Eng
User verification of Design BL
CR Decomposition
System Architecture
System Requirement
Design BL
LC4ISR Roadmap
User validation of Design BL
Proceed to Dev
Design BL structure Engr BL draft
Sub-system Integration
System Integration
Product previously
Backlog
Field
Field
Field