NCIA Liaison Office

NCIA/SSTRAT/NLO/2016/08428/TT-2753

26 July 2016

To:	NATO Office of Resources Management and Implementation Branch Attn: Branch Chief NATO HQ
Information:	See Distribution
Subject:	**Request for authorisation to Develop and Deliver Increment 2 of Land Command and Control Information Services (LC2IS)** **(Project 2011/0IS03076)** CIRIS MER-0IS03076 Provide Land C2 Informat Work ID: 0005713 PSC-0IS03076 Provide Land C2 Informat Work ID: 0005714
References:	A. AC/4-DS(2015)0001 – Authorization of APF for LC2IS Increment 2, dated 16 Feb 2015 B. [ACT] 6300/TSC FCX0010/TT-150945/Ser:NU0605 – Implementation Perspective Document for LC2IS Increment 2", dated 15 July 2015.

1. NCIA requests authorisation of € 29,323,754 to implement the capabilities required by the Strategic Commands as detailed in reference A.

   As described in the TBCE in enclosure 2, this project will develop LC2IS Increment 2 and deliver the capability to the applicable Commands in the NATO Command Structure and to the required education, training, exercise and support organizations in NATO. The new capability will replace the existing (LC2IS Increment 1) capability and enhance the Functional Services support for Land Command and Control.

2. The Project Price Proposal at Enclosure 1 outlines the NCIA Project Service Costs and the total project expenditure profile in the format agreed by the Investment Committee.
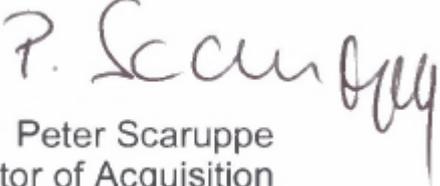
NATO Communications and Information Agency

Agence OTAN d'information et de communication

Avenue du Bourget 140
1140 Brussels, Belgium

www.ncia.nato.int

3. The price proposal is € 25,438,429 of investment cost, split into:

    o *€1,973,950 for Thales Communications & Security (France)*
    o *€19,923,274 for the winners of two new ICB's in this Project*
    o *€681,545 for the winners of the BOA/EA in this Project*
    o *€ 2,859,660 for winners of six ICB's issued in other Projects*

    - € 560,030 of Internal Engineering Services (IES) that will be used to provide knowledge transfer, support for test, integration and engineering support for analysis and design.

    - € 3,489,935 of Project Service Costs (PSC), less € 164,640 of Advance Planning Funds (APF) already authorised.

4. NCIA requests authorisation of the procurement method as follows:

    o WP1 (Upgrade of LC2IS INC-1 Software), sole source to Thales Communications & Security (FRA), owner of the intellectual property rights on the background LC2IS INC-1 software
    o WP2 (Implement LC2IS INC-2), International Competitive Bidding (ICB)
    o WP3 (Implement C4ISR-IOP Component for LC2IS), ICB, distinct from WP2 in order to maximize the re-usability of the C4ISR-IOP component
    o WP4 (Procure COTS Equipment), Enterprise Licence Agreements, BOA
    o WP5 (Augment IT infrastructure), sole source to the ITM Project Contractor, providing the rest of the IT infrastructure
    o WP6 (Provide Independent Verification and Validation), sole source to the PMIC Project Contractor, providing the same services for all other FS's
    o WP7 (Augment cyber-defence capability), sole source to the NCIRC Project Contractor, providing the same services for the IT Infrastructure
    o WP8 (Support the Integration of C4ISR-VIZ Component), sole source to the Triton/C4ISR-VIZ Contractor, providing the C4ISR-VIZ capability within the Triton project
    o WP9 (Support the Integration of SOA Services), sole source to the SOA/IDM Project Contractor, providing the SOA Services under that project
    o WP10 (Upgrade C4ISR-VIZ Component for LC2IS), sole source to the Triton/C4ISR-VIZ Contractor.
    o IES (Internal Engineering Services), sole source to NCI Agency
    o PSC (Project Support Cost), sole source to NCI Agency

5. SHAPE is requested to confirm that the Operations and Maintenance Costs as outlined in the Project TBCE (Enclosure 2, Section 7, Table 19) are affordable.

6. The responsible Service Line Chief is Dr. Paul Howland and accountable Director is Mr. Guy Feat.

7. The Management and Implementation Branch is requested to screen this request and to submit it to the Investment Committee for first stage authorisation.
   For what regards the urgent "Upgrade of the LC2IS INC-1 Software" (WP1) NCI Agency also requests exemption of ICB procedures and authorization to issue IFB.
   Any remarks regarding this request should be addressed to the NCIA Liaison Office.

Peter Scaruppe
Director of Acquisition

Enclosures:
1. Project Price Proposal
2. Project Type B Cost Estimate (TBCE)
3. Project Type B Cost Estimate (TBCE) - Appendices

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Attn: Infrastructure Adviser

HQ SACT
Attn: NSIP Branch, R&M
Attn: C2DS Programme Management, Mr Warren Low
7857 Blandy Road, Suite 100
Norfolk Virginia 23551-2490

ACO Representative to the Investment Committee
Urgent Capabilities Management Branch
Resources Directorate
Building 101
7010 SHAPE

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NCIA BiSC AIS Program Implementation Office (Sherri Aker)
NCIA Project Manager (Roberto Porta)
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PRICE PROPOSAL
Develop and Deliver LC2IS Increment 2

I.   NSIP DATA

Capability Package: 9C0107
Project serial: 2011/OIS03076

II.   Project Cost Estimate

Cost Elements	Cost (€)
Investment Costs (-0)	25,438,429
Engineering Services (-8)	560,030
Project Service Costs (-9)	3,489,935
Advance Planning funds (if any)	- -164,640
Total Fund Request	**29,323,754**

III. EXPENDITURE PROFILE

Investment costs	Authorised funds (€)	Current request (€)	Future requests (€)
Expenditure to date	0	0	0
3Q 2016		0	
4Q 2016		0	
1Q 2017		0	
2Q 2017		0	
3Q 2017		0	
4Q 2017		0	
2018		3,403,925	
2019		4,578,082	
2020		9,360,975	
2021		6,490,711	
2022		1,604,736	
Total	0	25,438,429	0

IES	Authorised funds (€)	Current request (€)	Future requests (€)
Expenditure to date	0	0	0
3Q 2016		0	
4Q 2016		0	
1Q 2017		0	
2Q 2017		25,589	
3Q 2017		12,794	
4Q 2017		12,794	
2018		56,123	
2019		126,830	
2020		143,853	
2021		182,046	
2022		0	
Total	0	560,030	0

PSC	Authorised funds (€)	Current request (€)	Future requests (€)
Expenditure to date	115,000		0
3Q 2016	22,012		
4Q 2016	22,012		
1Q 2017	5,616	133,927	
2Q 2017		139,543	
3Q 2017		139,543	
4Q 2017		139,543	
2018		723,137	
2019		716,413	
2020		576,042	
2021		563,547	
2022		193,602	
Total	164,640	3,325,296	0

REQUIREMENTS

This project will develop LC2IS INC-2 and deliver the capability to the applicable Commands in the NATO Command Structure and to the required education, training, exercise and support organizations in NATO.

The new capability will replace the existing (LC2IS Increment 1) capability and enhance the Functional Services support for Land Command and Control. It will also improve the integration with the other Functional and Core services being planned and implemented and enable an optimization of the O&M cost across the Bi-SC AIS.

IV. MILESTONES

Milestone	Existing schedule (APF request)	Revised by current request
IC Authorization	06/2015	02/2017
Second stage		10/2017
IFB release		12/2017
Contract Award		09/2018
Project completion		12/2021
Submission of JFAI request	06/2019	06/2022

V.   EXPECTED USE

The expected use of LC2IS Increment 2 is to provide the Land User Community an improved capability supporting Land C2 Processes, including in particular:

- Enhanced Operational Planning Support
- Improved Operation Execution Support, with improvements to Battlespace Management, Land track management, Engineering and Land Targeting Support.
- Enhanced Operational Assessment Support, with improvement of the Battle Damage Assessment and better integration with NATO Operational planning tools

In addition, LC2IS Increment 2 will improve the usability, interoperability and maintainability with respect to the existing Increment.

VI. Price Proposal for Project Service Costs (-9) for 'Develop and deliver LC2IS Increment 2' Project 2011/0IS03076

	2015 EUR	1.000 Man-Days	2016 EUR	1.020 Man-Days	2017 EUR	1.040 Man-Days	2018 EUR	1.061 Man-Days	2019 EUR	1.082 Man-Days	2020 EUR	1.104 Man-Days
Civilian Manpower	55,715	44.4	77,809	65.3	428,024	447.4	671,761	673.6	552,269	543.2	474,351	459.2
F1 (Senior Expert)		33.0		60.8		200.0		300.0		243.4		203.6
F2 (Expert)		8.5		4.5		195.6		272.8		216.2		177.8
F3 (Senior Technician)						51.8		100.9		83.6		77.8
F4 (Technician)												
F5 (Military Expert)		2.9										
Consultancy	1,484		24,015									
Travel					41,812		3,829		97,709		48,480	
Other Expenses					88,335		47,548		66,435		53,211	
Total Project Cost	57,200		101,824		558,171		723,137		716,413		576,042	

	2021 EUR	1.126 Man-Days	2022 EUR	1.149 Man-Days	2023 EUR	1.172 Man-Days	2024 EUR	1.195 Man-Days	2025 EUR	- Man-Days	TOTAL EUR	Man-Days
Civilian Manpower	557,508	532.2	36,131	30.8		0.0		0.0		0.0	2,853,569	2,796.1
F1 (Senior Expert)		228.2		24.1							-	1,293.0
F2 (Expert)		205.3		6.7							-	1,087.3
F3 (Senior Technician)		98.8									-	412.9
F4 (Technician)											-	0.0
F5 (Military Expert)											-	2.9
											-	
Consultancy											25,499	
Travel	450		80,550								272,829	
Other Expenses	5,588		76,921								338,038	
											-	
Total Project Cost	563,547		193,602		-		-		-		3,489,935	

VII. Work Breakdown Structure for Project Service Costs (-9) for 'Develop and deliver LC2IS Increment 2' Project 2011/0IS03076

Task Name	F1	F2	F3	F4	F5	Total (MD)
Project Scope (WBS)	1,243.3	1,045.5	397.0		2.8	2,688.5
Project Management	1,243.3	1,045.5	397.0		2.8	2,688.5
Initiating a Project	98.3	12.5			2.8	113.5
Develop PID / Project Plan / TBCE / Fund Request	63.3	12.5			2.8	78.5
Support Fund Request screening / Achieve Authorised Cust	30.0					30.0
Information and Quality Assurance (IA) Evaluation	5.0					5.0
Project Execution Stage-A	161.0	167.0	42.0			370.0
RFQ/IFB Release	40.0	37.0				77.0
Project related meetings and conferences	14.0	14.0				28.0
Planning, Monitoring and Control	97.0					97.0
Project Support	8.0	65.0	32.0			105.0
Contract Management		19.0				19.0
Quality Management		25.0				25.0
Configuration Management			10.0			10.0
ILS Management		5.0				5.0
Security Accreditation / Information Assurance	2.0	2.0				4.0
Project Execution Stage-B	452.0	411.0	152.0			1,015.0
Bid Evaluation	149.0	159.0	10.0			318.0
Project related meetings and conferences	28.0	28.0				56.0
Planning, Monitoring and Control	229.0					229.0
Project Support	19.0	153.0	76.0			248.0
Contract Management	5.0	63.0	10.0			78.0
Quality Management		1.0	36.0			37.0
Configuration Management			20.0			20.0
ILS Management		5.0				5.0
Security Accreditation / Information Assurance	2.0	2.0				4.0
Develop/Release partial JFAI Request	15.0					15.0
Support partial JFAI Screening	5.0					5.0
Project Execution Stage-C (PSA)	223.0	191.0	79.0			493.0
Project related meetings and conferences	28.0	28.0				56.0
Planning, Monitoring and Control	178.0					178.0
Project Support	15.0	119.0	59.0			193.0
Contract Management		15.0				15.0
Quality Management		12.0				12.0
Configuration Management			15.0			15.0
ILS Management		5.0	5.0			10.0
Security Accreditation / Information Assurance	2.0	2.0				4.0
Achieve PSA		10.0				10.0
Project Closure	309.0	264.0	124.0			697.0
Project related meetings and conferences	42.0	42.0				84.0
Planning, Monitoring and Control	222.0					222.0
Project Support	18.0	148.0	74.0			240.0
Contract Management		47.0	13.0			60.0
Quality Management		3.0	12.0			15.0
Configuration Management			20.0			20.0
ILS Management		5.0	5.0			10.0
Security Accreditation / Information Assurance	2.0	2.0				4.0
Achieve FSA/Physical Scope Completed		10.0				10.0
Develop/Release JFAI Request	15.0					15.0
Support JFAI Screening	10.0					10.0
Develop Lessons Learned Report		2.0				2.0
Complete and Close Project		5.0				5.0

VIII. Price Proposal for Internal Engineering Services (-8) for 'Develop and deliver LC2IS Increment 2' Project 2011/0IS03076

	2016	1.020	2017	1.040	2018	1.061	2019	1.082
	EUR	Man-Days	EUR	Man-Days	EUR	Man-Days	EUR	Man-Days
Total Manpower		0.0	9,177	10.4	56,123	62.0	126,830	140.9
F1 (Senior Expert)				1.6		8.3		17.5
F2 (Expert)				6.0		32.3		60.7
F3 (Senior Technician)				2.7		21.4		62.7
F4 (Technician)								
F5 (Military Expert)								
Consultancy								
Travel			40,000					
Other Expenses			2,000					
Total Project Cost	-		51,177		56,123		126,830	

	2020	1.104	2021	1.126	2022	1.149	TOTAL	
	EUR	Man-Days	EUR	Man-Days	EUR	Man-Days	EUR	Man-Days
Total Manpower	143,853	156.7	131,046	140.0		0.0	467,030	510.0
F1 (Senior Expert)		19.9		17.7				65.0
F2 (Expert)		66.5		59.4				225.0
F3 (Senior Technician)		70.3		62.8				220.0
F4 (Technician)								0.0
F5 (Military Expert)								0.0
Consultancy							-	
Travel			4,200				44,200	
Other Expenses			46,800				48,800	
Total Project Cost	143,853		182,046		-		560,030	

IX. Work Breakdown Structure for Internal Engineering Service (-8) for 'Develop and deliver LC2IS Increment 2' Project 2011/0IS03076

Task Name	F1	F2	F3	F4	F5	Total (MD)
Project Scope (WBS)	65.0	225.0	220.0			510.0
Project Execution (One Technical Stage)	65.0	225.0	220.0			510.0
Knowledge Transfer	10.0	50.0	25.0			85.0
System Engineering/Scientific Support	20.0	60.0	25.0			105.0
System Integration, Test Planning and Support	25.0	60.0	80.0			165.0
Technical Support to Transition Activities	5.0	40.0	80.0			125.0
Security Testing Technical Support	5.0	15.0	10.0			30.0
Milestone Chart		0.0				0.0
Contingencies	0.0	0.0	0.0	0.0	0.0	0.0

Type "B" Cost Estimate for Land Command & Control Information Services – Increment 2

Short Title: LC2IS INC-2

CP NUMBER 9C0107

PROJECT 2011/0IS03076

Author	Roberto Porta
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Revision History

Revision date	Summary of Changes	Changes marked
15/05/2015	Initial Version (V0.1)	
20/05/2015	V 0.5 (QG-30-01)	Ch: 1, 2(part)
30/07/2015	V 0.6 (QG-30-02)	Ch: 1, 2 + Apx
08/12/2015	V 0.7 (QG-60)	Ch: 3, 4, 5 + Apx
12/05/2016	V 0.8 (QG-90)	Ch: 6, 7 + Apx
13/06/2016	V 0.9 – Final Draft for internal coordination	Overall
14/07/2016	V 1.0 – Final version, approved for submission	Overall

Responsible Authors

Name	Responsibility	e-Mail	Phone
Mr. Guy Feat	Directorate of Application Services	Guy.Feat@nr.ncia.nato.int	+31703743070
Mr. Paul Howland	C2 Service Line Chief	Paul.Howland@nr.ncia.nato.int	+31703743752
Mr. Roberto Porta	Project Manager	Roberto.Porta@nr.ncia.nato.int	+31703743576

Executive Summary

This document provides the Type B Cost Estimate (TBCE) for CP 9C0107 Project 0IS03076, Land Command and Control information Service – Increment-2 (LC2IS INC-2). This project will develop LC2IS INC-2 and deliver the capability to the applicable Commands in the NATO Command Structure and to the required education, training, exercise and support organizations in NATO.

The new capability will replace the existing (LC2IS Increment 1) capability and enhance the Functional Services support for Land Command and Control including enhancements in the Operational Planning Support, Operational Execution Support and Operational Assessment support functionality.

LC2IS INC-2 will also improve the usability, the integration with other Functional and Core services being planned and implemented and the interoperability with National Systems and Services. An improvement in its maintainability also will enable an optimization of the O&M cost across the Bi-SC AIS.

Business need

LC2IS is the primary Functional Service (FS) supporting Command and Control in NATO-led Land Operations and the primary source for the Recognized ground Picture. LC2IS is deployed and used in the NATO Command Structure (NCS), in specific elements of the NATO Force Structure (NFS, 1st Ge-Nld Corps, RRC-France) and planned to be deployed to NFIU-HQ's and Operational Theatre (KFOR) in 2016-2017.

LC2IS Increment 2 (INC-2) Functional Service is needed to enhance the existing (LC2IS INC-1.1) capability and fill some gaps by supporting additional operational requirements as specified by the Operational Stakeholders in 2015. Interest in the enhanced Increment 2 capability has been expressed also by NFS Commands and Nations which don't have LC2IS now.

The main new requirements in INC-2 with respect to INC-1.1. include enhanced planning, tasking and battlespace management support. LC2IS INC-2 is also required to interoperate with new FS, to support new interoperability profiles/standards coming into effect in the next years and utilize a new IT infrastructure and core services.

LC2IS INC-2 will be used in peacetime, exercises, and time of crisis (operations) throughout the static and deployed environments in the NCS to provide commanders with the required level of land information in order to make informed operational decisions. LC2IS INC-2 will support the same Commands as LC2IS INC-1 (NCS and supporting commands/agencies).

An upgrade of LC2IS INC-1.1. – included in this TBCE - is required to provide operational support continuity with LC2IS INC-1.1. until LC2IS INC-2 is activated.

Proposed Solution

LC2IS INC-2 will be based on a modern, service oriented solution, deployed on the centralized IT infrastructure for the static sites and on the Deployable CIS capability (DCIS) for the deployable components. It will make use of available Reusable Software Components (RSC) and provide also to other FS a new RSC supporting standard interoperability profiles with National Systems and Services.

The re-use of software components among Bi-SC AIS functional and core services is expected to improve maintainability and supportability and optimize the overall service life-cycle costs.

Due to obsolescent components and old technology of the current LC2IS Increment 1 software (some already older than ten years), the technical solution for Increment 2 cannot be simply an enhancement of the functionality and a technology refresh of the existing software. A new design is required.

The basic assumption done in CP 9C0107 Project Implementation Plan in programming Increment 2 (as a relatively simple enhancement of Increment 1) is therefore considered as not applicable.

Alternative Implementation Options

- With the Do-nothing option (Option 0), the available LC2IS capability will become very difficult and expensive to maintain and would have a progressive degradation of quality and interoperability with other NATO FS and National Systems.

- Improving and extending the LC2IS INC-1 capability (Option 1) would allow an easier and more accurate requirement specification, have limited implementation risks and likely be shorter to implement. However,

it would be constrained by the current vendor solution technology and be expensive to implement and maintain due to lack of competitive alternatives.

- A complete re-implementation and re-competition of the capability (Option 2, the recommended option) is expected to provide the most benefits in terms of flexibility and modernity of the technology and a lower life cycle cost respect to Options 1 and 3, mainly due to a positive competition effect.
- A mixed option (Option 3) extending the "core" part of INC-2 and re-implementing/re-competing other components is assessed to offer a worse cost/benefit ratio than Option 2.

Project Implementation approach and main milestones

The implementation is split into four phases:

- Phase-0, initiated after an initial sole-source contract award, includes a major upgrade of the LC2IS INC-1.1 functionality required to extend its life until the planned transition to INC-2. The scope includes the upgrade to MS Office 2013, the alignment to most recent version of the Thales visualization component) and the replacement of the obsolete MIP BL-2 with a MIP BL3.1. Gateway. Delivery is planned in 2017-Q4.
- Phase-1, initiated after the major contract award (ICB) aims at revising and refining the LC2IS INC-2 requirements based on the new INC-2 technology. The deliverable PBL-1, including minimal software development, is a 'Conceptual Prototype Software' that will be used for requirement capture and specification.
- Phase-2, aims at the implementation of a baseline (PBL-2), a "Functional Prototype Software" covering a comprehensive subset of the complete LC2IS INC-2 functionality. Delivery is planned in order to perform a validation in an Operational Test and Validation event in 2019.
- Phase-3, includes the development and transition of the LC2IS INC-2 Operational Software. The first baseline of the final operational software (PBL 3A) is planned to be delivered and validated in an Operational Test and Validation event in 2020. The final project deliverable (PBL 3B) is planned for delivery in 2021. This phase also includes the final system transition activities.

On the assumption that 1st Stage authorization is achieved by February 2017, PSA is planned by September 2020 and FSA and Project Completion by December2021.

Risk Management

- The revision and increase of the requirements during the project acquisition and implementation is the most critical risk (R01). Mitigation measures include an incremental delivery and validation approach (multiple baselines) the inclusion of a "requirement creep" in the cost estimation.
- The dependencies from IT infrastructure, Core Enterprise Services and Re-usable components which are being specified and procured in parallel with this Project is the source of the other critical delay and cost overrun risks (R02 and R03). Mitigation measures include: program/cross-project level coordination and information sharing, development of alternative procurement options (internal implementation as fall-back).

Procurement approach

A Market Survey related to the C4ISR-IOP Reusable Component was conducted in Q2-2015 and used for defining the procurement approach and the cost estimate

The work is decomposed into eight mandatory work packages (WP1 to WP8), two optional (WP9 and WP10), and the Project Support (PSC) and Internal Engineering Service (IES) packages. Each work package has a specific procurement approach.

- WP2 ("Core LC2IS") and WP3 ("C4ISR-IOP Reusable Component") are recommended for International Competitive Bidding (ICB) using a "best value" approach, expected to reduce the technical, schedule and cost risks
- WP4 (COTS Equipment) will be procured through lowest compliant bid selection between WP2 and WP3 (evaluated options) and BOA contractors.
- The other work-packages (WP1, WP5 to WP10) are recommended as Sole Source to existing contractors or to companies winning other Bi-SC AIS ICB.
- PSC and IES are recommended for Sole Source to NCI Agency.

Cost estimate

The total implementation cost is estimated - with contingencies - at 24,278,099 € of investment (-0), 242,221 € of IES (-8) and 3,278,546 € of PSC (-9), over an eight year period.

The Operations and Maintenance for the first full LC2IS O&M year (2022) has been estimated at 2,254,174 €, including estimated NCI Agency Manpower cost.

1 Background

This document describes the Type B Cost Estimate (TBCE) for the Project "LC2IS Increment 2" (in short LC2IS INC-2) included in the Capability Package 9C0107 "Functional Services for Command and Control of Operations".

1.1 Business Driver

1.1.1   The current capability - LC2IS Increment 1.1 (INC-1.1 in short) provides the basic functionality required to support the planning, execution and assessment of land based operations. This increment has been stratified as Capability Level 1 (very high risk to not implement) in Reference 8.5.3.

LC2IS INC-1.1 is deployed and used in the NATO Command Structure (NCS), in specific elements of the NATO Force Structure (NFS, 1st Ge-Nld Corps, RRC-France) and planned to be deployed to NFIU-HQ's and Operational Theatre (KFOR) in 2016-2017.

1.1.2   LC2IS Increment 2 (INC-2) will support all the functional requirements of INC-1.1 and new User Operational Requirements (UOR). It includes the upgrade of interfaces to other components/systems and the revision of the System Architecture required to align with the evolution of services, infrastructure and technology. LC2IS INC-2 has been stratified as Capability Level 2 (high risk to not implement) in Reference 8.5.3.

1.1.2.1   New and enhanced UOR to support Operational (execution) Planning, targeting, and battlespace, ORBAT and land track management. The UOR have been submitted, and prioritized, by the Operational Stakeholders.

1.1.2.2   Required support for new interfaces is essential to maintain, and enhance, interoperability with BiSC AIS and National Systems and Services.

1.1.2.3   Revised System Architecture to align LC2IS with recent technologies and the Bi-SC AIS (Functional and Core Service) evolution. This requirement avoids technical obsolescence and ensures the integration of LC2IS within the BiSC AIS.

1.1.2.4   Revised Bi-SC AIS guidance to prioritize the delivery of re-usable Common Software Components. These re-usable Common Software Components generate savings in the development and support cost as described in reference 8.5.2.

1.1.3   The revised operational and system requirements of LC2IS INC-2 are essential to sustain the current capability and ensure interoperability with BiSC AIS and National Systems.

Interest in the enhanced LC2IS INC-2 capability has been expressed also by NFS Commands and Nations which don't have LC2IS INC-1.1 now.

Failure to support the revised operational and system requirements would seriously impacted the NATO Land C2 Services capability and its sustainment.

1.2 Project context

1.2.1   In the Capability Package (CP) 9C0107 "Functional Services for Command and Control of Operations", nations have agreed on the final scope for LC2IS as incremental, adding two increments to the existing one (LC2IS Increment 1). LC2IS Increments 2 and 3 are products of Project 2011/0IS03076 "Provide Land C2 Information Services, Phase 2", as from the CP 9C0107 Implementation Plan (PIP, Reference 8.1.1).

1.2.2   This document describes the Type B Cost Estimate (TBCE) for the Project "Provide Land C2 Information Services (LC2IS), Phase 2 – Increment 2" (serial number 2011/0IS03076), in short "LC2IS Increment 2". The development of this TBCE has been performed after the authorization by the Investment Committee on the Advanced Planning Funds for the project (Reference 8.3.1).

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1.2.3   LC2IS INC-2 aims is to enhance the functionality provided by the existing application software in support of Command and Control (C2) of Land Operations (LC2IS Increment 1). The implementation of LC2IS Increment 1 (serial 1999/5HQ00592 CP 5A0007) was authorized in 2007 - with a major scope extension (Increment 1.1) authorized in 2011 - and has been completed in Q1 2015.

1.2.4   The enhancement of the LC2IS Increment 1 capability is according to the requirement and constraints described by ACT in the Project Baseline Document (PBD, Reference8.2.3) and the Implementation Perspective Document (IPD) (Reference 8.2.4).

1.2.5   The specification of the User Operational Requirements (UOR) for LC2IS INC-2 has been performed by the Operational Users community - including NCS and NFS representatives - through Land User Requirement Workshops (LURW) from 2013 to 2015. The NCI Agency - under the ACT Program of Work (POW) – has facilitated the capture and documented the requirement specification. The latest requirement specification (version 3) is documented in a NCI AGENCY Technical Note (Reference 8.2.4) and is the subject of the ACT IPD.

1.2.6   The LC2IS INC-2 capability will be delivered on the static infrastructure delivered through CP 9C0150 Projects (reference 8.1.12) and the deployable infrastructure delivered through CP0A0149 (Reference 8.1.8), the Deployable Communication and Information System (DCIS).

1.3 Enterprise Context

1.3.1   The main elements of the C3 Taxonomy (C3T, ref.8.4.1) are the Business Processes, User Applications, Information Products and Technical Services.

1.3.2   LC2IS provides the Communication and Information System (CIS) Capability of the Bi-SC AIS (Reference 8.5.1) – User Applications and Technical Services - supporting Land Operations, mapped to the C3T as described below.

1.3.3   The high level view of the business solution implemented in LC2IS – as described in Reference 8.2.4 and 8.2.1 - is depicted in Figure 1 and described below.
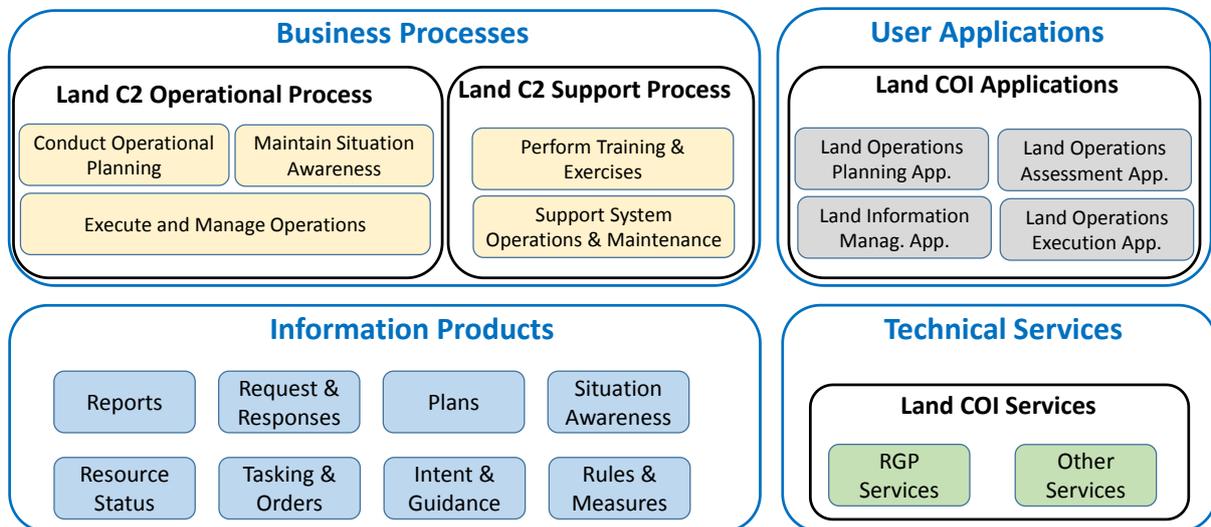

Figure 1 – Target Capability – High Level Business Solution (NSV-4)

1.3.4   The Land User Applications comprise the Capabilities required to support Land C2 Operational Processes and the Land C2 Enabling Services. We focus here on the former.

1.3.4.1   The Land Operations Planning Applications enable users to support both conceptual and detailed Land Operations Planning. For conceptual planning, this functionality enables structured application of the military decision making process and supports development of staff and commander understanding of the operational environment, framing of the problem, definition of a desired end state, and development of an operational approach to achieve the desired end state.

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1.3.4.2   The Land Operations Execution Applications enable users to support the effective execution of the command and control activities required to achieve the operational objectives set in the operational plans by commanders and staff. The applications provide functionality to monitor the process of putting a plan into action while delivering appropriate situational understanding through a Land Ground Common Operating Picture to assess progress and adjust operations as the situation changes.

1.3.4.3   The Land Information Management Application enables users to manage information throughout land operations planning and execution.

1.3.4.4   The Land Operations Assessment Applications enable users to support commanders and staffs monitoring and assessing the current situation and the progress of an operation. Functionality is provided to support commanders and staffs collection of relevant information and assessment the current situation in order to develop measures of effectiveness and measures of performance of operations.

1.3.5   The Land (Community of Interest, COI) Services are COI-Specific services providing unique computing and information services in support of Land Operations. Land Operations are the set of military activities that are conducted by Land Forces to attain and maintain a desired degree of control within the Area of Responsibility (AOR) on land, and, as required, support maritime, air and space operations.

1.3.5.1   One of the Land Services is the Recognized Ground Picture (RGP) Service, which provides the means to produce, manage and disseminate the RGP. The RGP is the compilation of validated data relating to a defined area of responsibility that is disseminated to enable situational awareness and support decision making at all levels. The RGP Services will support the development of the RGP through the collection, aggregation, correlation and fusion of information from multiple sources.

1.3.5.2   Other Land Services include e.g. the support for comparing forces, planning manoeuvres and perform task-time-location management.

1.4 Existing Capabilities

1.4.1   LC2IS Increment 1.0 (Project 5HQ0592 of CP 5A0007, "Obtain and Integrate Land OPS Sub-FASS - Phase 2") was authorized in 2005 (Reference 8.1.3) and achieved its Final Operation Capability in November 2009. Due to the dismantling of the main operational HQ's (LANDCOMs Heidelberg and Madrid), its operational use has been very limited.

1.4.2   LC2IS Increment 1.1 was authorized in 2011 to extend the functional scope of Increment 1.0 and to tailor it to the ISAF Mission (Reference 8.1.5). Subsequently (2013 and 2014) the Strategic Commands accepted the ISAF implementation and requested its further employment within the NATO Command Structure (NCS) (authorization references 8.1.6 and 8.1.7).

1.4.2.1   Implementation stage one updated and tailored the LC2IS Increment 1.1 software to support the ISAF Mission, with a focus on the support of ISAF Crisis Response Urgent Requirements (CUR 1021), including the enhancement of the Battlespace Object Management (BSOM) functionality and deployment of a gateway for the Multi-lateral Interoperability Programme (MIP) in the ISAF theatre. The deployment scope included ISAF (IJC) and the NATO Support and Training sites: Joint Warfare Centre (JWC), Joint Forces Training Centre (JFTC), NATO CIS School (NCISS) and NCI Agency (Reference and test systems).

1.4.2.2   During implementation stage two, further enhancement of the ISAF implementation was curtailed while the deployment scope was extended to all applicable Commands of the NCS, including: HQ JFC Brunssum, HQ JFC Naples, HQ LANDCOM, HQ AIRCOM, HQ MARCOM and two interim deployable systems at the NCI Support Group. IOC was achieved in Q1-2014 and the FOC in Q1-2015.

1.4.3   The existing capability (LC2IS INC-1.1) supports – with some limitations and constraints – the Business Processes and Information Products depicted in Figure 1. An overview of how LC2IS INC-1.1 covers the target capability as depicted in Figure 2.

1.4.4   LC2IS Increment 1.1 supports for the following main functionality:

1.4.4.1   Order of Battle (ORBAT) Management, Battlespace Object and Battlespace Control Measure (BSO, BCM) Management, Situation Awareness and NATO standard Interoperability.

1.4.4.2   Operational planning, operations monitoring, engineering, intelligence, medical, CIMIC, CBRN, targeting, airspace management (from a Land J3/G3 User perspective).

1.4.5   The capability includes the following main components:

1.4.5.1   a Web Portal, providing the end user (role-based) access to LC2IS and information management functionality.

1.4.5.2   a Desktop Application (DA), providing the end-user access to the complete set of supported functionality.

1.4.5.3   a Web Application (WA), providing the end-user access to a subset of the functionality (situation awareness and limited BSO Management) supported by the Desktop Application.

1.4.6   The deployment scope of INC-1.1. includes:

1.4.6.1   Three fixed-site installations in the NATO Command Structure (NCS): JFCBS, JFCNP, LANDCOM.

1.4.6.2   Remote access for two Command HQ's: AIRCOM and MARCOM

1.4.6.3   Two deployable installations: interim deployable systems, managed by NCISG.

1.4.6.4   An approximate number of 300 operational users of the full client application (DA) and an equivalent number of users of the light-weight client application (WA) for all previously identified sites.

1.4.6.5   Five more installations in NATO Commands and Agencies for training, exercise and system support: JFTC, JWC, NCISS, NCIA (2 sites)

1.4.6.6   The physical scope of LC2IS INC-1.1 is summarized in Table 1.

	Operational Node	Site	Location	Phys Nodes	Sec.
1	JFCBS HQ	JFC Brunssum HQ	The Netherlands	1 fix	NS
2	JFCNP HQ	JFC Naples HQ	Italy	1 fix	NS
3	LANDCOM HQ	Land Forces Command HQ	Turkey	1 fix	NS
4	AIRCOM HQ	Air Forces Command HQ	Germany	0	NS
5	MARCOM HQ	Maritime Forces Command HQ	United Kingdom	0	NS
6	JFTC HQ	Joint Forces Training Command HQ	Poland	2 fix	MS
7	JWC HQ	Joint Warfare Center HQ	Norway	1 fix	MS
8	LCC HQ	Land Component Command HQ	Deployable (static location at NCISG, Belgium)	1 depl	MS
9	JFT HQ	Joint Task Force HQ	Deployable (static location at NCISG, Belgium)	1 depl	MS
10	NCISS HQ	NATO CIS School	Italy	1 depl	NU
11	NCIA HQ	NATO CI Agency	The Netherlands / Belgium	2 fix	NU

Table 1 - LC2IS INC-1.1 Sites and Locations

1.4.7   LC2IS Increment 1.1 has been operationally employed by the NCS and utilized within exercises since its IOC. The NCS support is provided in accordance to the Service Level Agreement (SLA) between NCI Agency and ACO, and consists of three levels: first, second and third level support.

1.4.7.1   The first level support is provided by the NCI Agency Command Support Units (static sites) and the Central Support (exercises).

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1.4.7.2   The second level support is provided by NCI Agency in accordance with the Centralized Service Level Agreement (Reference 8.5.5).

1.4.7.3   The third level support (software maintenance) is provided through the LC2IS Contractor.

1.5 Weaknesses of Existing Capabilities

1.5.1   LC2IS Increment 1.1 weakness and limitations relate to several elements of the business model depicted in Figure 1, and in particular to:

1.5.1.1   Limited support to Business Processes related to the on-going definition of Standard Operating Procedures (SOP) and Operational Roles.

1.5.1.2   Limited or no support for some Information Products, mainly for Planning, Tasking and Orders.

1.5.1.3   Limited Functional support in the Land Applications especially for Operational Planning, but also Operational Assessment and Operational Execution.

1.5.1.4   Limited sharing of the COI-Specific Land Services with other Functional Services.

1.5.2   From a User perspective

1.5.2.1   Inadequate support for operational requirements related to: Planning, (J3/G3) Engineering Support, Land Track Management, Preparation and development of staff products such as fragmented orders, Dynamic Battlespace Management, Order of Battle (ORBAT) Management. These limitations are addressed by the new User Operational Requirements (UOR) (Reference 8.2.5).

1.5.2.2   Significant training and experience is required to master the full end-user functionality (through the Desktop Application, DA) compared to other C2IS tools of similar complexity.

1.5.2.3   Inconsistent implementation of functionality between the Desktop (DA) and Web (WA) Human Machine Interfaces (HMI).

1.5.2.4   The functional coverage of LC2IS INC-1.1 is depicted in Figure 2 where in GREEN are indicated the functional areas fully addressed and in RED those that are not covered.
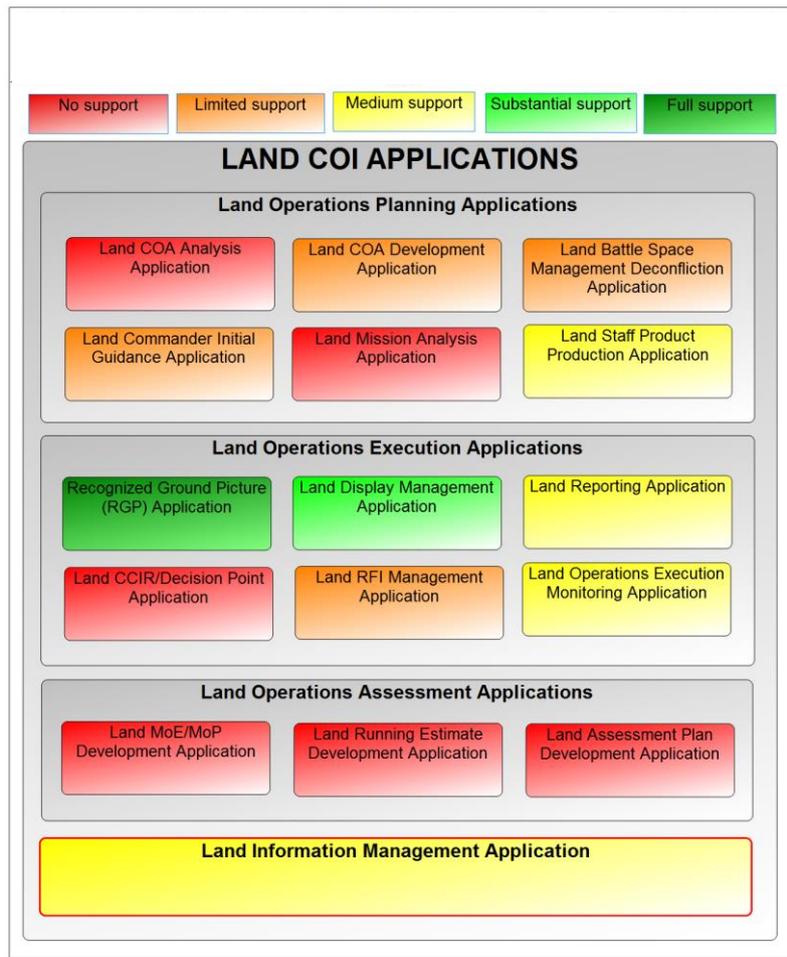
Figure 2 – Functional coverage of existing capability (baseline)

1.5.3   From a <u>System perspective</u>, the current capability has several weaknesses, including:

1.5.3.1   the limited ability to integrate with current and emerging versions of Functional Services (such as LOGFAS and TOPFAS) and Core services.

1.5.3.2   the inability to support interoperability standards, at the current version, for MIP BL 3.1 and ADatP-3 v12 and v13 and others included in the NISP (reference 8.4.2). The MIP weakness is of particular importance as it provides interoperability with many National (Land) Systems.

1.5.4   From a <u>Technical perspective</u> the main weaknesses include:

1.5.4.1   not optimized to fully utilize the emerging ITM infrastructure services.

1.5.4.2   limited re-use and sharing of Commercial, Government and NATO Off The Shelf (COTS, GOTS, NOTS) Software components with other Functional or Core Services.

1.5.4.3   dependency on legacy COTS (Microsoft) software components, of which some will become obsolete, and unsupported, in the next few years.

1.6 Operational Scenarios

1.6.1   The operational concept for LC2IS is currently described in SHAPE's document 'Land Command and Control Information Service Concept of Operation' (Reference 8.2.1). This concept - initially developed for LC2IS Increment 1 and maintained by the Operational Stakeholders through the Land User Working Group (LUWG) - is also applicable to LC2IS Increment 2.

1.6.2   LC2IS will be used by Allied Headquarters at the operational, and tactical levels established in the NATO Command Structure (NCS), NATO Force Structure (NFS) and possibly NATO Nations. Allied Command Transformation (ACT) training and war-gaming centres will also operate LC2IS as part of their Operational Functional Services Infrastructure.

The concept of operation for LC2IS, and the different employment scenarios for Joint NATO-led Operations, is in accordance with MC 0593 (Reference 8.2.2).

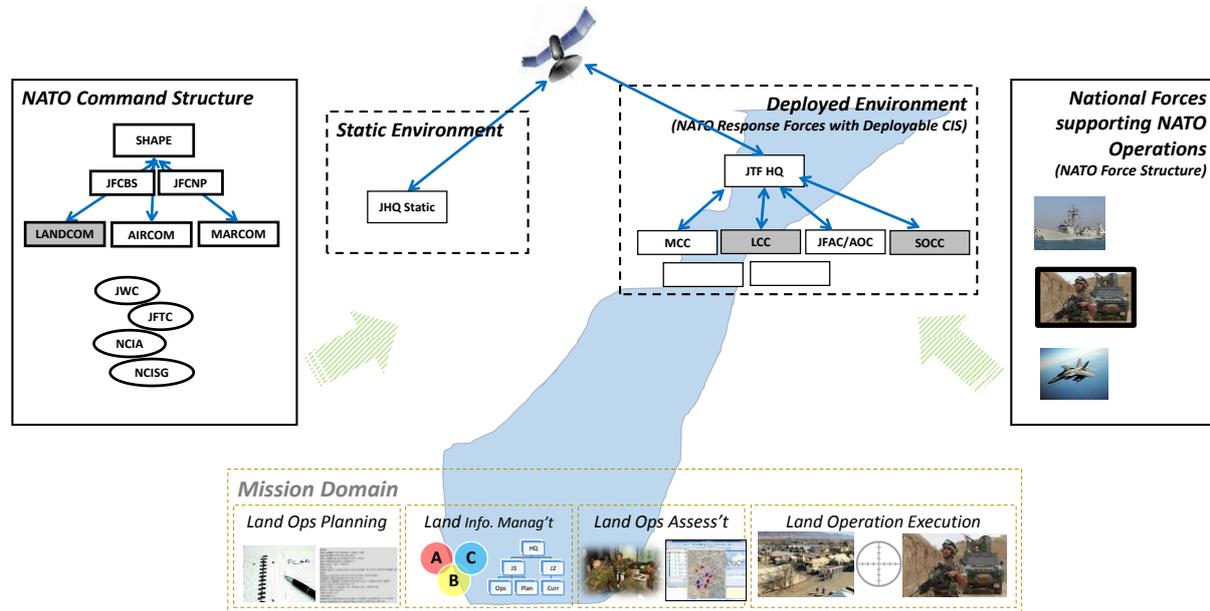1.6.3   Figure 3 provides a graphical representation of the operational scenario.

Figure 3 - LC2IS High Level Operational Concept Diagram (NOV-1)

1.6.4   LC2IS will be employed in three main Command and Control (C2) operational environments:

1.6.4.1   The NCS Static Environment, mainly in the NATO SECRET security domain, supporting peace-time preparedness activities and mission preparation and early planning stages.

1.6.4.2   The Operational Theatre Environment, mainly in the MISSION SECRET security domain, supporting mission execution with three types of Commands:

- Joint Task Force (JTF), a NATO multinational operational-level command formed of all services designed to plan, direct, conduct and sustain military campaigns. The information flow between the JFHQ and the other commands is described in Appendix B.

- Land Component Command (LCC), the tactical level component command provided by the NCS or NFS able to command a land force of a Corps-, Division-, or Brigade-size. LC2IS will be the main NATO Functional Service supporting the LCC in NATO led operations. The information flow between the LCC and the other commands is described in Appendix B.

- Special Operations Component Command (SOCC), the tactical level component command provided by the NCS or NFS able to command a Special Operations force. The information flow between the SOCC and the other commands is described in Appendix B.

1.6.4.3   The NATO Force Structure (NFS) Commands supporting NATO operations may also utilize LC2IS when performing a NATO role.

1.6.4.4   Coalition operations will be conducted using the Future Mission Network (FMN) concepts and profiles.

1.6.5   LC2IS supports the execution of operational functions and provisioning of C2 products in a timely manner between deployed and static elements, including:

1.6.5.1   Mission preparation and early planning performed in the static environment.

1.6.5.2   The main mission execution activities performed in the deployed environment.

1.6.5.3   reach-back support during operations into the static environment facilitating efficient and effective use of scarce C2 resources while minimising the C2 footprint, and thus vulnerability, in-theatre.

1.6.6   LC2IS will be employed in the supporting Commands and Agencies in the C2 Enabling operational environment in support of training, exercise and system support. This environment is normally at a lower level of security classification.

1.6.7   LC2IS supports includes automated C2IS capabilities to plan, execute and monitor operations in a responsive and timely manner. Land business processes and user roles performed at the strategic, operational and tactical levels are supported by LC2IS as described in Reference 8.2.1. The High Level Process Hierarchy is depicted in Figure 4.
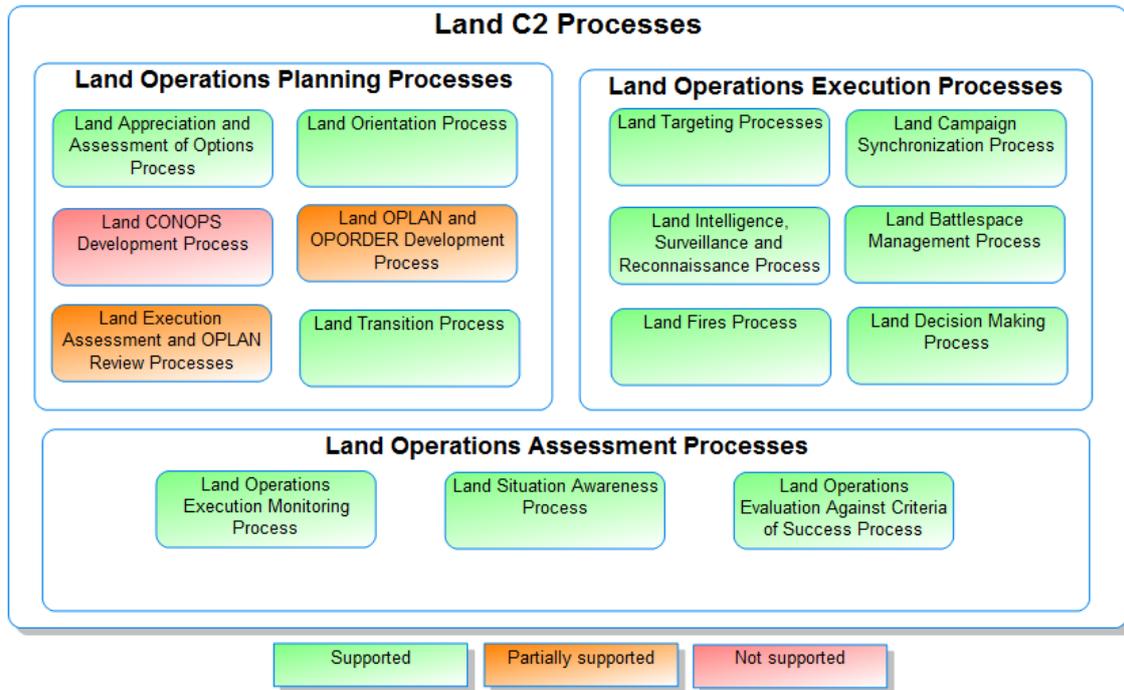

Figure 4 - LC2IS High Level C2 Operational Business Process Hierarchy

1.7 Operational Requirements

1.7.1   Overview

1.7.1.1   LC2IS INC-2 is required to address the weakness and unsupported requirements of INC-1, while providing a modern capability with a lifespan through 2025-2030.

- The initial set of the Operational Requirements for LC2IS INC-2 (Capability Package 9C0107) – were defined by ACT in the Project Baseline Document for LC2IS INC-2 (ref. 8.2.3).

- User Operational Requirements (UOR) have been defined and recorded in the Land C2 Reference Architecture and in the ACT IPD (reference 8.2.4), following a top-down approach, i.e. starting from the process hierarchy and C2 Taxonomy. These requirements are called here "Top-Down" UOR

- UOR have also been specified by the Operational Community through a series of Land User Requirements Workshops (LURW) (references 8.2.5). The approach followed for the requirement capturing was "bottom-up" i.e. expressed as difference respect to the currently available capability (LC2IS INC-1.1). These requirements are called here "Bottom-Up" UOR

- The two views of the UOR are complementary and harmonized. A detailed description is reported in Appendix A and the references included there.

1.7.1.2 The scope of the requirements cover the NCS and the joint/common NCS-NFS needs in both static and deployed mode. Specific National requirements for LC2IS are out of scope.

1.7.2 Functional Requirements (FR)

1.7.2.1 As shown in Figure 5, Functional Requirements for LC2IS can be grouped as follows:

- Common Application Support, including common functionality such as: the Tactical Editor(s), the Information Portal and the applications supporting the production of operational documents.

- Information Management Support, including the management of workspaces, metadata, customization of battlespace object types, configuration and administration support.

- Mission Application Support, including application support for some tasks in the following functional areas: Operational Planning, Operations, Engineer, Intelligence, Administration and Logistics, medical, CIS, CIMIC, Battlespace management, Airspace Management, Targeting, CBRN, and Movement. This functional group will primarily use and interface with readily available services and – in the case where no suitable service exists – will include the minimum required functionality.

1.7.2.2 LC2IS INC-2 FR are distinguished as follows:

- Baseline Functional Requirements', re-validated FR, by the Operational Stakeholders, of existing and supported LC2IS INC-1/INC-1.1 functionality (Reference 8.1.17 and 8.1.18).

- 'New Functional Requirements', extensions and enhancements FR to LC2IS INC-1, required by the Operational Stakeholders, for implementation in LC2IS INC-2 (reference 8.2.5).

1.7.2.3 The 'New Functional Requirements' (Bottom-up UOR) comprise the following functional areas:

- Enhance Operational Planning Support, improve support to the development of the Land Contribution to Joint Operational Planning, including:
  - o Enhanced Planning Support (OR-6)

- Improve Operation Execution Support, including improvements to Battlespace Management, Land track management and representation, Engineering and Land Targeting Support.
  - o Support for Land Tracking Information Management and Representation (OR-2)
  - o (Improved) Support for Track Representation (OR-3)
  - o Enhanced Support for Land Targeting (OR-4)
  - o Engineering Support (OR-5)
  - o Enhanced support for ORBAT Management (OR-9)

- Enhance Operational Assessment Support, including an improvement of the Battle Damage Assessment and an extension of the integration with the NATO Operational planning tools.
  - o Enhanced Battlespace Management (BSM) / Support for Dynamic BSM (OR-8)
  - o Improvement of the information management support
  - o Enhanced support for Operational Staff Work (OR-1)
  - o LCC/JTFHQ Support (OR-7)
  - o Support other Requirements (OR-10, OR-11 and OR-12)

1.7.2.4 The scope of the 'New Functional Requirements' are depicted in orange in Figure 5.

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Figure 5 –Scope of new LC2IS INC-2 UOR

1.7.2.5   The new Functional Requirements for INC-2 have been translated into logical application requirements and represented in the Land Reference Architecture and the LC2IS INC-2 Implementation Perspective Document (IPD, reference 8.2.4). The description of LC2IS INC-2 FR as from the IPD is included in Appendix A.

1.7.3   Non Functional Requirements (NFR)

1.7.3.1   A preliminary list of NFR - developed by NCI Agency - is reported in Appendix D.

1.7.3.2   NFR will be completed and validated by the Operational and Technical Stakeholders before the next stages in the acquisition.

1.7.4   Requirement by Nations

1.7.4.1   There is high interest for using LC2IS INC-2 in all Graduated Forces Land (GRF-L) for NATO-led operations either as interface to other NATO tools and entities or as main Command and Control Service for Land.

1.7.4.2   LC2IS (INC-1 and INC-2) could also be used for Nationals purposes, which is however outside the scope of this TBCE).

1.7.4.3   The Functional requirements included in this document have been developed in requirement workshops including also National (GRF-L) representatives.

1.7.5   Maturity, stability and completeness of the operational requirements

1.7.5.1   The operational requirements as currently defined are considered adequate to capture the scope of LC2IS INC-2 for the purpose of this TBCE.

1.7.5.2   They are expected to evolve until the User and System Requirement Specification is finalized, and possibly also after. Recording and maintaining a requirement database will help managing this evolution.

1.7.5.3   The Implementation approach needs to include some degree of revision of the requirements at later acquisition stages and - in parallel - the provision of a corresponding budget reserve for risk mitigation.

1.8 Operational Context

1.8.1   According to the LC2IS CONOPS (reference 8.2.1), LC2IS will be used at the operational and tactical level in military operations, exercises and training. Reference 8.2.1 provides the details of the Concept of Operation of LC2IS.

1.8.2   The employment during operations is described in the LC2IS CONOPS (Reference 8.2.1) and the MC 593 (Reference 8.2.2) with the interoperability profiles defined in the NISP (reference 8.4.2).

1.8.2.1   LC2IS will be employed by operational or tactical level HQ's in any kind of NATO led operations including Non-Article 5 Crisis Response Operations.

1.8.2.2   LC2IS will be employed in the NATO SECRET and MISSION SECRET security domains; be employed at the NATO static sites and in the deployed sites; inter-operate both in the static and the deployed configurations with National Systems and Services.

1.8.2.3   Operational, system and technical Interoperability with National Systems (in MISSION and National SECRET domains) will be based on FMN concepts and profiles.

1.8.3   At the operational level, the process of executing operational functions and obtaining C2 products, services and applications in a timely manner between deployed and static elements is essential. Reach-back allows the efficient and effective use of scarce C2 resources while minimising the C2 footprint, and thus vulnerability, in-theatre. Operations staffs require automated C2IS capabilities to effectively plan, execute and monitor operations in a responsive and timely manner.

1.8.4   LC2IS will be employed in various types of Exercises in order to provide, maintain and certify NATO Commands and Forces preparedness for operations. The LC2IS capability will be used in static and deployed configurations in operations mode.

1.8.5   The employment of LC2IS during peacetime will mainly be for training and exercise purposes. According to the 'train-as-you-fight' concept, training will also be performed in the operations and exercise modes.

1.8.6   The operational concept for the employment is depicted in Figure 3. The principal target Community of Interest is at the Operational Joint and Component and Tactical; Command and control level, as shown in the following figure.

Figure 6 – Principal target COI

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1.9Actors, Roles and Locations

1.9.1   LC2IS will not be directly used at the Strategic Level in the NATO Command Structure (NCS, SHAPE). Information Products created with LC2IS (e.g. RGP) will be used at the Strategic level.

1.9.2   LC2IS will be used at the Operational level by staff of the Joint Force Commands of the NCS both in static and in deployed HQ's:

1.9.2.1   Joint Force Command, Brunssum (JFCBS)

1.9.2.2   Joint Force Command, Naples (JFCNP)

1.9.3   At the Operational/Tactical level LC2IS will be used by staff of the Component Commands of the NCS both in static and in deployed HQ's:

1.9.3.1   Land Force Command, Izmir (LANDCOM)

1.9.3.2   Air Force Command, Ramstein (AIRCOM)

1.9.3.3   Maritime Force Command Northwood (MARCOM)

1.9.4   For Training, Exercise and System support function LC2IS will be used by staff of the following Commands and Agencies:

1.9.4.1   Joint Warfare Centre Stavanger (JWC)

1.9.4.2   Joint Forces Training Centre Bydgoszcz (JFTC)

1.9.4.3   NATO Communication and Information Agency, Mons, The Hague and other locations (NCIA)

1.9.4.4   NATO Communication and Information Systems Support Group, at garrison and deployed locations (NCISG)

1.9.4.5   NATO Communication and Information Systems School, Lisbon (NCISS)

1.9.5   Note. The use of LC2IS at the NATO School Oberammergau (NSO) and the Joint Analysis and Lessons Learned Centre (JALLC) – which was stated as required in the ACT PBD (at reference 8.2.3) - has been subsequently stated as not required by ACT (reference 8.2.7).

1.9.6   For the employment of LC2IS in deployed HQ's (JTF, LCC and SOCC - as described in section 1.6), LC2IS will be provided on Deployed Communication and Information System (DCIS), managed and supported by the NATO Communication and Information System Support Group (NCISG).

1.9.7   When fulfilling NATO employment roles, NATO Force Structure (NFS) staff could also use LC2IS at NCS fixed or deployed sites. However, National and NFS HQ's are not in the deployment scope of LC2IS INC-2.

1.9.8   The main operational roles played by LC2IS Users will be:

1.9.8.1   User Profile Roles: End User, Information Manager, LC2IS Super User/Mentor.

1.9.8.2   Functional Roles: (Land) Battlespace Manager, G3/J3 Ops, G35/J35 Planning, G32/J32 Intel, Engineer, Targeting.

1.9.9   The main support (training, exercise, system support) roles played by LC2IS Users will be:

1.9.9.1   Training and Evaluation: Trainer, Exercise Controller (End User), Exercise Training Audience (End User), (Operational) Mentor.

1.9.9.2   Operation and Maintenance Support: System and Functional support staff, Data Administrator.

1.9.10   The operational nodes and their locations are summarized in Table 2.

	Operational Node	Site	Location
1	JFCBS HQ	Joint Force Command Brunssum HQ	The Netherlands
2	JFCNP HQ	Joint Force Command Naples HQ	Italy

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3	LANDCOM HQ	Land Forces Command HQ	Turkey
4	AIRCOM HQ	Air Forces Command HQ	Germany
5	MARCOM HQ	Maritime Forces Command HQ	United Kingdom
6	JFTC HQ	Joint Forces Training Command HQ	Poland
7	JWC HQ	Joint Warfare Center HQ	Norway
8	LCC	Land Component Command	(deployable)
9	JTF HQ	Joint Task Force HQ	(deployable)
10	SOCC	Special Ops Component Command	(deployable)
11	NCISS HQ	NATO CIS School	Portugal
12	NCIA HQ	NATO CI Agency	The Netherlands / Belgium

Table 2 - LC2IS INC-2 Sites and Locations

1.10   Service Level requirements

1.10.1   Service Level Requirements and Targets (SLR, SLT) for LC2IS will be aligned with the Service Level Agreement (SLA) for NATO Centralised CIS Services between NCI Agency and ACO, which is revised on a yearly basis.

1.10.2   SLR and SLT for LC2IS INC-2 have not yet been specified by the Operational Authority. For the purpose of the TBCE, the existing SLR for LC2IS INC-1 (as in the existing Centralized SLA, Ref. 8.5.5], are used as baseline.

1.10.3   SLT for LC2IS INC-2 are in general anticipated in general not be worse than those for INC-1. The specific SLR for LC2IS INC-2 will be revised and completed in the following procurement phases. SLT might differ between one Command to another, and especially between operational to supporting commands.

1.10.4   At least three main Level Of Service are anticipated for LC2IS INC-2

- SL-1, for employment during operations and exercises
- SL-2, for the operational environment outside operations and exercises
- SL-3, for the training and support employment outside operations and exercises

1.10.5   A preliminary specification of the SLT for the static capability is described in the table below

Parameter	SL-1	SL-2	SL-3
Agreed Service time (AST)	24 hr / 7d	7.6 hr / 5d	7.6 hr / 5d
End-User availability (AV)	99.5%	99.0%	98.0%
Response Target Time (RTT)	1 hr	16 work-hr / 2 work-days	24 work-hr / 3 work-days
Restore Target Time (MTTR)	4 hr	4 hr	TBD
Transaction Response Time (TRT)	10 sec	10 sec	10 sec

Table 3 - LC2IS INC-2 Service Level Targets

1.10.5.1   Appendix D includes a more extensive definition of these and other Non-Functional Requirements and includes NCI Agency assumptions on targets (not yet validated by operational stakeholders), including:

- Operational use of the service (or Agreed Service Time, AST)
- Approved Service Interruption (ASI),
- Intrinsic application reliability
- Intrinsic application availability

- Average response time (ATTR)
- Client readiness to user commands
- User application response time
- Maximum number of simultaneous users.

1.11   Information Products

1.11.1   The "Information Products" (IP) taxonomy layer in the C3T represents the collections of information that are regarded as the formal output of a business process and/or can be used as an input to other business processes. Information Products consist of several information elements. They can be seen as any communication or representation of knowledge such as facts, data, or opinions in any medium or form.

1.11.2   LC2IS IP are grouped as listed below. A comprehensive list of IP is included in Appendix B.
   - Intent and Guidance, including e.g.: Commander Planning Guidance, Targeting Guidance.
   - Plans, including e.g.: Ground based air defence plan, Synchronization Matrix, Resupply Plan
   - Reports, including e.g. : CBRN Messages, Own Situation Report
   - Requests and Responses. including e.g. : Airspace Control Request, Logistic Assistance Request
   - Resource Status, including e.g. : Logistic Update Report
   - Rules and Measures, including e.g. : Crisis Response Measures, Rules of Engagements (ROE)
   - Situation Awareness Products, including e.g. : Battle Damage Assessment (BDA), Common Operational Picture (COP)
   - Tasking and Orders, including e.g. : Air Tasking Orders (ATO), Fragmentary Order (FRAGO)

1.11.3   To be noted that this list cannot be considered as complete: a significant number of IP's have been recorded in the Land Reference architecture but have not been sufficiently verified and validated and therefore not included in the list. Risk R01 (section 5.8, Table 12) includes this as project risk.

1.11.4   LC2IS will be the Authoritative Data Source (ADS) for some of the Information Products as reported in Table 4 below. To be noticed that for some IP's – mainly those that are built collaboratively – more than one ADS might exist

GROUP	NAME	COMMENTS
INTENT and GUIDANCE		
	Commander's Assessment Report (ASSESSREP)	
	Course of Action (COA)	
	Decision Matrix	Land-related
	Target Nomination List (TNL)	Land-related
PLANS		
	COA Decision Brief	
	Concept of Operations (CONOPS)	Land-related
	Operational Plan (OPLAN)	Land-related
	Synchronisation Matrix (Sync Matrix)	Land-related
	Task Organization / Order of Battle	Land-related
REPORTS		
	Own Situation Report (OWNSITREP)	Land-related
REQUESTS and RESPONSES		
	Air Support Request (AIRSUPREQ)	Land-related
	COA Statements and Sketches	
	Logistics Assistance Request (LOGASREQ)	
	Mission Statement	Land-related
	Request for Additional Fire Support Assets	Land-related
RULES and MEASURES		
	Fire Support Coordination Measures (FSCM)	

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	Rules of Engagement (ROE)	Land-related
SITUATIONAL AWARENESS		
	Air Landing Zone Report (ALZREP)	Land-related
	Battle Space Area Evaluation	Land-related
	Battlespace Objects (BSO)	
	Common Operational Picture (COP)	
	Effects Assessment	
	Geo-spatial Overlay	
	Order of Battle - Land (ORBATLAND)	
	Recognized Ground Picture (RGP)	Land-related
	Situation Report (SITREP)	Land-related
TASKING and ORDERS		
	Bridge Demolition Order	Land-related
	Fragmentary Order (FRAGO)	
	Order of Battle Transfer of Authority - Land and Air (ORBATTOA LAND-AIR)	
	Operational Order (OPORD)	Land-related

Table 4 – Information Products of which LC2IS is ADS

1.12 Interoperability

1.12.1 LC2IS will support the Land C2 process enabling a seamless and timely flow of information from/to other functional areas - supported by other Community of Interest (COI) specific capabilities (Functional Services, FS) – and from/to National C2IS capabilities.

1.12.2 The logical information flow between the Land COI Services, the other NATO COI Services and the National Capabilities is summarized in Figure 7.
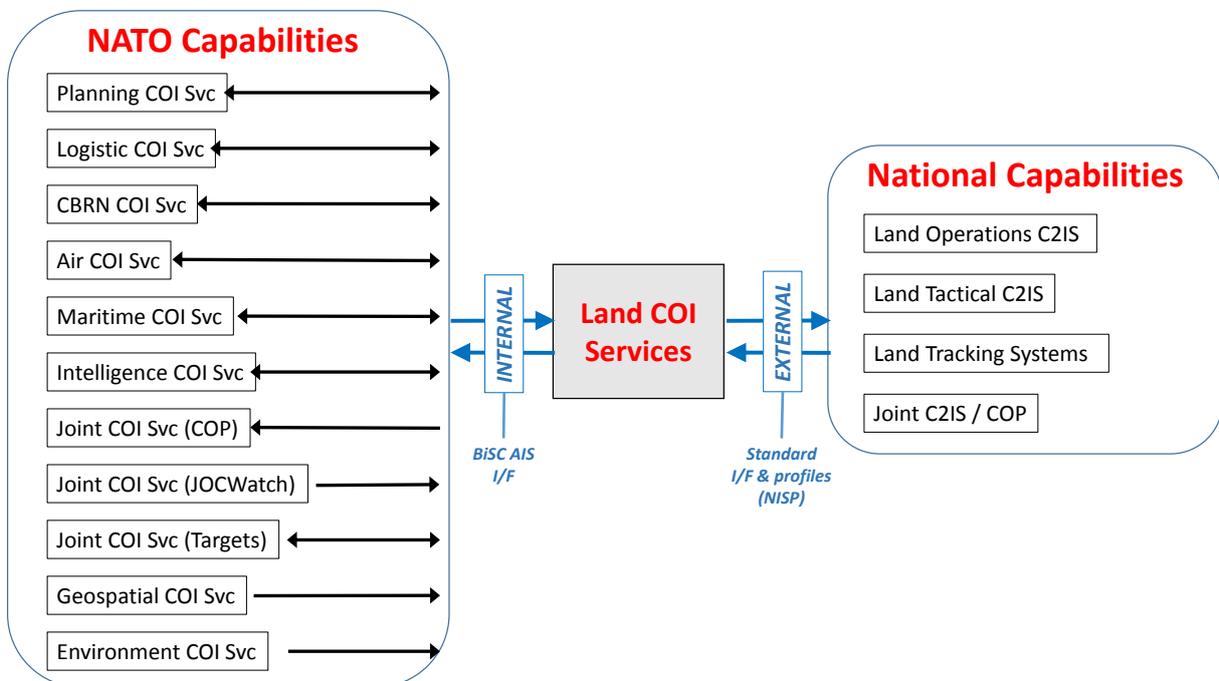

Figure 7 – Interoperability of Land COI Services

1.12.3 The 'internal' interoperability - between LC2IS and the other BiSC-AIS COI Services - is described in detail in Appendix C.

1.12.4   The 'external' interoperability between LC2IS and National capabilities will be based on NATO and multinational interoperability standards and profiles as defined in ADatP-34, the NATO Interoperability Standards and Profiles (NISP, reference 8.4.2).

1.12.5   The specific external information flows to be implemented will be tailored to the Mission requirements and by the employment scope of LC2IS in support of that mission. The exchange of Information Products for a JTF, LCC and SOCC are described in MC 593 (Reference 8.2.2) and detailed in Appendix B.

1.13   User Acceptance criteria

1.13.1   The User Acceptance Criteria defines the key performance metrics defined by the Users / Customers and agreed with the Implementation Authority (NCI Agency) according to which the product (LC2IS) is declared "Fit for Use', i.e. User Accepted. The User Acceptance Testing (UAT) is the qualification activity to establish User Acceptance.

1.13.2   Key Performance Metrics need to be specific, measurable, achievable, relevant and time-bound and need to be formally documented and subject to change management. 'Use Stories' (or Vignette) may be used in UAT as a way to reduce ambiguity and increase measurability of the criteria.

1.13.3   Such criteria will be defined and formally agreed with the Operational Stakeholders in the subsequent acquisition phases. It will then be reviewed and confirmed during the project requirement analysis activities and used as reference for the User Acceptance and validation milestones.

1.14   Transition requirements

1.14.1   User Transition requirements focus on ensuring that the operational use of LC2IS is transferred smoothly from LC2IS INC-1.1. to INC-2 services, with continuity of the service and no negative operational impact.

1.14.2   This transition refers to the period between the introduction into operation of the new capability (LC2IS INC-2 - Initial Operational Capability, IOC) and its final operational activation (Final Operational Capability, FOC) which coincides with the decommission of the legacy capability (LC2IS INC-1.1).

1.14.3   The transition requirements include:

1.14.3.1   The definition of the pre-requisites to be met to achieve the Initial Operational Capability (IOC). E.g. the site(s), the systems, the training and the support.

1.14.3.2   The pre-conditions for terminating the current services and decommissioning the legacy capability.

1.14.3.3   The pre-requisites for the Final Operational Capability (FOC).

1.14.4   The main operational risks associated with the transition that need to be minimized are:

1.14.4.1   Failure of the new capability to pass the operational activation tests. Requirements should be identified prior to the operational activation tests.

1.14.4.2   Non-readiness of operational staff to use the new capability.

1.14.4.3   Lack of availability of the legacy system as back-up if there are issues with new capability.

1.14.5   These requirements will be reflected in the Operational Transition Plan (OTP), coordinated and agreed between the Operational, Implementation and Support authorities.

1.14.6   The maximum operationally acceptable duration of the transition period (IOC to FOC) is assumed as 12 months (value to be reviewed and confirmed in later stages by the Operational Stakeholders).

2 Solution Alternatives

2.1 Options Considered

2.1.1   The four implementation options that have been considered and analysed are summarized in Table 5

#	Option	Description
0	Do nothing	The existing LC2IS INC-1.1. capability will be maintained and enhanced through the O&M activities in order to support to the maximum extent possible new requirements. No new INC-2 acquisition will be performed.
1	Improve and Extend	The design LC2IS INC-1.1 Software will be extended and enhanced in order to support the new user operational and system requirements and the new NATO interfaces and profiles. The implementation will replace components becoming obsolete with newer technology. Centralization and software reuse are expected to be addressed as new architectural requirements. The most appropriate acquisition approach is Sole-Source to INC-1 Contractor.
2	Re-design	The LC2IS capability will be completely replaced with respect to INC-1.1 in order to support new operational and system requirements on the basis of a more suitable and modern baseline. LC2IS INC-1.1 will only be used as functional reference. Centralization and software reuse are expected to be addressed as new architectural requirements. The most appropriate acquisition approach is ICB on the full scope of INC-2.
3	Mixed approach	LC2IS INC-1.1. will be re-designed and re-developed in order to provide the 'core' capability of INC-2, supporting new operational and system requirements. Specific software components will be acquired separately and integrated into the 'core'. New Components are intended to reusable for multiple FS's and possibly implemented by tailoring available COTS/GOTS Components. Centralization and software reuse are expected to be addressed as new architectural requirements. The most appropriate acquisition approach is ICB/BOA for the new components and Sole Source to the INC-1 Contractor for the 'core' functionality.

Table 5 – Implementation Options

2.1.2   The options are compared based on a set of weighted evaluation criteria, as described below.

   a)   Requirement fulfilment: Extent to which the solution is expected to support the operational and system requirements.

   b)   Duration: Estimated duration of the implementation.

   c)   Solution flexibility: Expected degree of flexibility to changed requirements and design constraints.

   d)   Technology: Support for old, current or advanced technology, including service orientation and 'cloud' support.

   e)   Implementation Risks: Estimated technical risk for the implementation.

   f)   Migration Effort: Estimated effort for the migration from the current system.

   g)   Acquisition Cost: Comparative Acquisition cost for the implementation.

   h)   Operation and Maintenance (O&M) Cost: Comparative O&M cost.

   i)   Project Service Cost (PSC): Estimated Cost for the management and support of the project by the Host Nation.

   j)   Other: Other factors that might play a positive or negative weight in the evaluation.

2.1.3   Table 6 provides an overview of the comparative evaluation results. The detailed description of the criteria, the weights, the estimation assumptions are reported in Appendix E.

EVALUATION CRITERIA		OPTIONS			
Criteria	**Weight**	**0. Do Nothing**	**1. Improve & Extend**	**2. Re-design**	**3. Mixed Approach**
Requirement Fulfilment	High	Not Compliant	High	Medium	Medium
Duration	Low	N.A.	36 months	48 months	42 months
Solution Flexibility	Medium	N.A.	Low	High	Medium
Technology	High	N.A.	Current	Advanced	Current / Advanced
Implementation Risks	Medium	N.A.	Low	High	Medium
Migration effort	Low	N.A.	Low	High	Medium
Acquisition Cost	High	N.A.	K1*113%	K1	K1*123%
O&M Cost	Medium	N.A.	K2*150%	K2	K2*140%
PSC	Low	N.A.	Low	High	Medium
Other					

Table 6 - Business Case Comparative Analysis

Table Legend:

- Criteria Weight:
  - High = very important
  - Low = less important
  - Medium = average importance
- Evaluation values: dependent from criterion (see Appendix E)
- Meaning of colours
  - Green: best option
  - Orange: worst option
  - No colour: intermediate option

2.2 Recommendation

2.2.1 Option 0 – which includes only corrective maintenance of the current LC2IS version - is discarded mainly because it does not support and cannot accommodate the LC2IS INC-2 Operational Requirements. Additionally it would soon become not interoperable with other evolving NATO Functional Services and National Systems. LC2IS INC-1.1 maintainability will worsen in the target timeframe due to feasibility and cost of software maintenance

2.2.2 The other three options have been compared according to the assumptions and the evaluation model described in Appendix E. The details of the comparison and assessment are reported in that Appendix. The final score is summarized in Table 7.

EV. CRITERIA		OPTIONS SCORES			
Criteria	**Weight**	**0. Do Nothing**	**1. Improve & Extend**	**2. Re-design**	**3. Mixed**
Requirements	3	N.A	9	6	6

Duration	1	N.A	3	1	2
Flexibility	2	N.A	2	6	4
Technology	3	N.A	3	9	6
Implem. Risks	2	N.A	6	2	4
Migration effort	1	N.A	3	1	2
Acquisition Cost	3	N.A	6	9	3
O&M Cost	2	N.A	2	6	4
PSC	1	N.A	3	1	2
TOTAL		N.A	**37**	**41**	**33**

Table 7 - Business Case Comparative Analysis Results

2.2.3 Option 2 has been evaluated as the best option for the following main reasons:

- It is expected to provide the best technical solution with the highest flexibility.
- it is expected to have the lowest acquisition cost, primarily thanks to a lower unit labour cost.
- It is expected to have the lowest O&M cost, also thanks to lower unit labour cost.

2.2.4 The main advantages of Option 1 (better support for operational requirements, lower implementation risk and less development effort, shorter schedule) are outweighed by the disadvantages

- Less flexible and less 'advanced' technology due to dependency from architectural choices of one company (LC2IS INC-1 manufacturer).
- Higher acquisition and O&M cost due to lack of competition.

2.2.5 Option 3 is a compromise between Option 1 and 2, but much closer to Option 1 (the 'core' capability is an extension of LC2IS INC-1.1). The disadvantages of Option 3 outweighs the advantages.

2.2.6 A potential benefit of Option 2 is that 'Sole Sourcing' of the entire project, to the LC2IS INC-1 manufacturer, is not strongly justified when physical re-use of LC2IS INC-1/INC-1.1 software code is not possible or not required (as explained in Appendix E for Option 0).

3 Technical Solution

3.1 Solution Overview

3.1.1   LC2IS INC-2 will ehance the functionality of INC-1 and implement a new service oriented architecture, deployed on the centralized IT infrastructure for the static sites and on the Deployable CIS capability (DCIS) for the deployable components.

3.1.1.1   Due to obsolescent components and old technology of the current LC2IS INC-1 software (some already older than ten years), the technical solution for INC-2 cannot be simply an enhancement and technology refresh of the existing software. A new design is required, as detailed in this section.

3.1.2   The proposed implementation of LC2IS INC-2 pursues the following architectural goals (see also Architectural Guidance in para.3.5).

3.1.2.1   Re-using of (and/or interfacing with) available capabilities including:

- (static and deployed) hardware, system software and communications infrastructure
- core software services and COI enabling services
- all available and relevant services provided by other Functional Services (FS)
- all available and relevant re-usable software components

3.1.2.2   Providing

- Land Specific Services available for consumption by other FSs
- (at least) one Software component that can be re-used by other FS's.

3.1.2.3   Ensuring

- maximum support - within budget and time constraints - of all the operational requirement
- maximum openness within the enterprise through the implementation of standard SOA profiles and interfaces
- no (or minimal) duplication of functionality among Functional and Core Services
- maximum re-use of functionality, support skills and knowledge gained in the current capability
- maximum usability of the capability with minimum training requirements
- maximum maintainability and flexibility while minimizing O&M costs
- minimum implementation and user acceptance risk
- a smooth transition from the current capability (LC2IS INC-1)

3.1.3   The functional coverage of LC2IS INC-2 is depicted in Figure 8 where GREEN indicates the functional areas fully addressed by this increment and RED indicates those that are not covered. An overview of the additional functionality implemented in INC-2 respect to what is supported in INC-1 can be obtained by comparing Figure 8 with Figure 2.
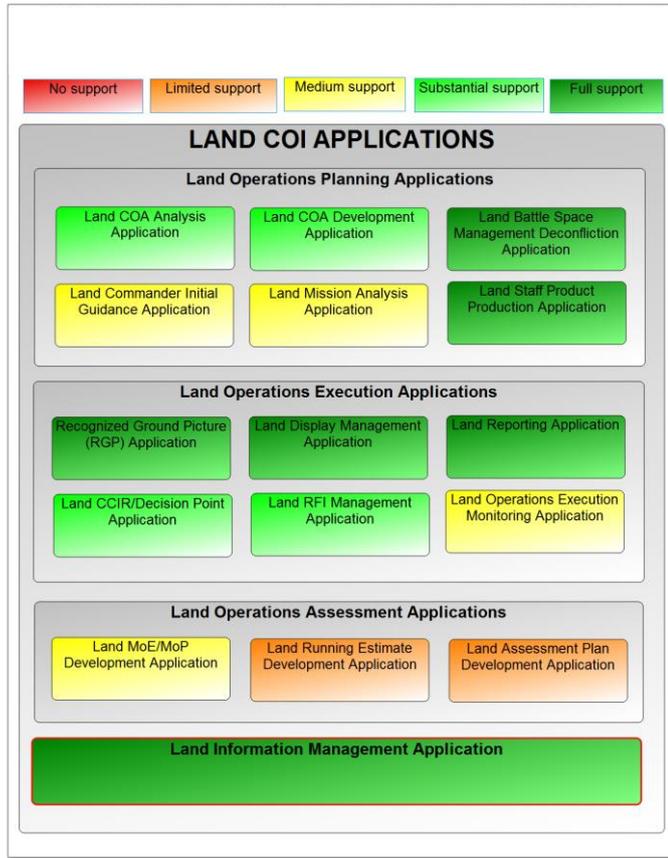
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Figure 8 –Functional coverage of LC2IS INC-2 (target)

3.1.4   LC2IS INC-2 architecture will be service-oriented and will be comprised of the components and services as depicted in Figure 9.
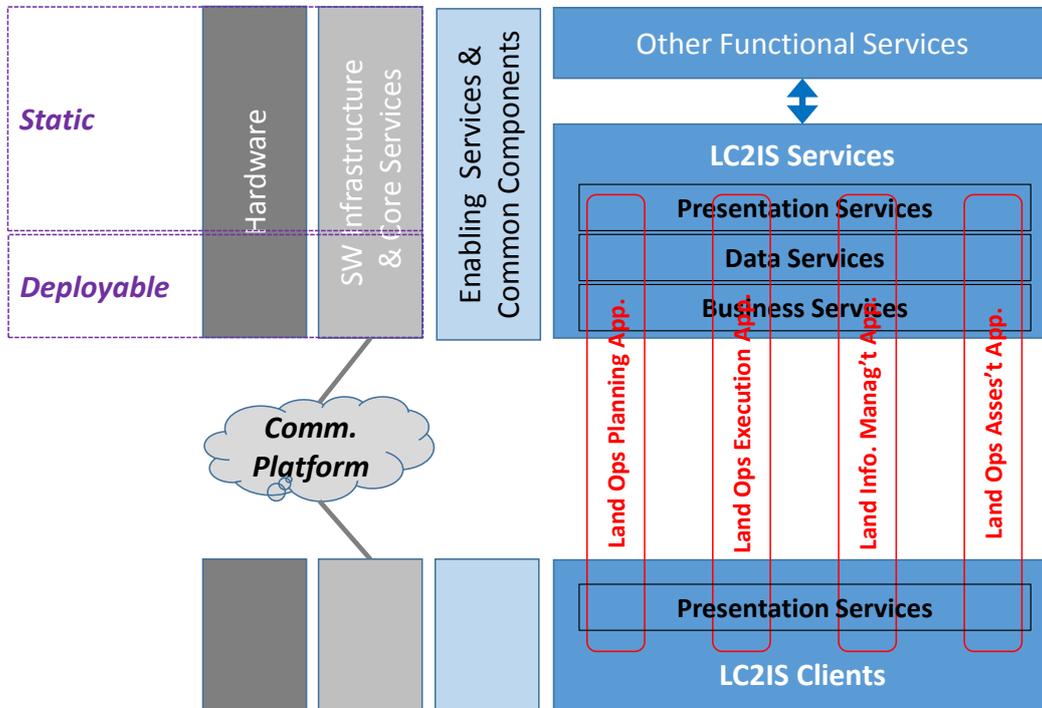

Figure 9 –High Level Technical Solution Overview

3.1.5   The main principles for LC2IS INC-2 Design are the following:

3.1.5.1   As the key FS for Land Operations, LC2IS will ensure that all Land Operational Requirements are supported in a consistent manner. LC2IS will realize all new components and tailoring required.

3.1.5.2   LC2IS will be capable of executing effectively – in distinct operations modes - on the networking and processing infrastructure provided by the ITM project (for static mode) and by the DCIS (for deployed mode).

3.1.5.3   LC2IS will share, to the maximum extent possible, COTS software with the other Functional and Core Services

3.1.5.4   LC2IS will make use of available core services to achieve, in particular:

- A standard platform for Service Oriented Architecture (SOA) (SOA Platform Services)
- Standard Security Labelling and Binding
- Common Message Handling services
- Information Management Services
- Geospatial Services
- Content Management Services
- Business Support Security CIS Services

3.1.5.5   LC2IS will make use of the available Infrastructure Services in particular:

- Infrastructure Storage Services
- Infrastructure CIS Security Services
- Infrastructure System Management and Control (SMC) Services
- Infrastructure Processing Services

3.1.5.6   LC2IS will make use of the available Communication Services:

3.1.5.7   LC2IS will make use of suitable and available software components when such reuse is cost effective. In particular the C4ISR-VIZ component (deliverable of another project), supporting common visualization services, will be reused and the IOP component (deliverable of this project).

3.1.5.8   LC2IS will support the required Land Functionality by using, and leveraging, products and services (either directly or through core services) provided by other FS, including:

- Operational Planning products/services by TOPFAS
- Air capabilities, situation and status (own and opposing) by AirC2IS
- Maritime capabilities, situation and status (own and opposing) by TRITON
- Capabilities, situation and status of opposing forces by INTEL-FS
- Joint Target Information and prioritization products/services by (N-) JTS
- CBRN events, situation and analysis by CBRN FS
- Meteorological and Oceanographic situation and forecast by ENV-FS
- Current incident and event information by JOCWatch
- The overall common operational picture by NCOP
- Logistics and medical information LOG FS,

3.1.5.9   LC2IS will provide its specific product/services (either directly or through core services) to any other FS according to published and – whenever possible – standard interfaces and data schemas, in particular:

- Recognized Ground Picture
- Land contribution to the Common Operational Picture (COP)

3.1.5.10   LC2IS will provide a Software component (C4ISR-IOP), for reuse by other FS, in support of:

- Military messaging (ADatP-3) interoperability
- Multilateral Interoperability Programme Data Exchange Mechanism (MIP-DEM interoperability

3.1.5.11   The C4ISR-IOP can also be utilized through core services.

3.2 Context

3.2.1   LC2IS will interact (utilize capabilities, exchange data and services) with other systems and services, and be used at HQ's and sites as depicted in Figure 10 (referring to an Operation/Exercise mode).
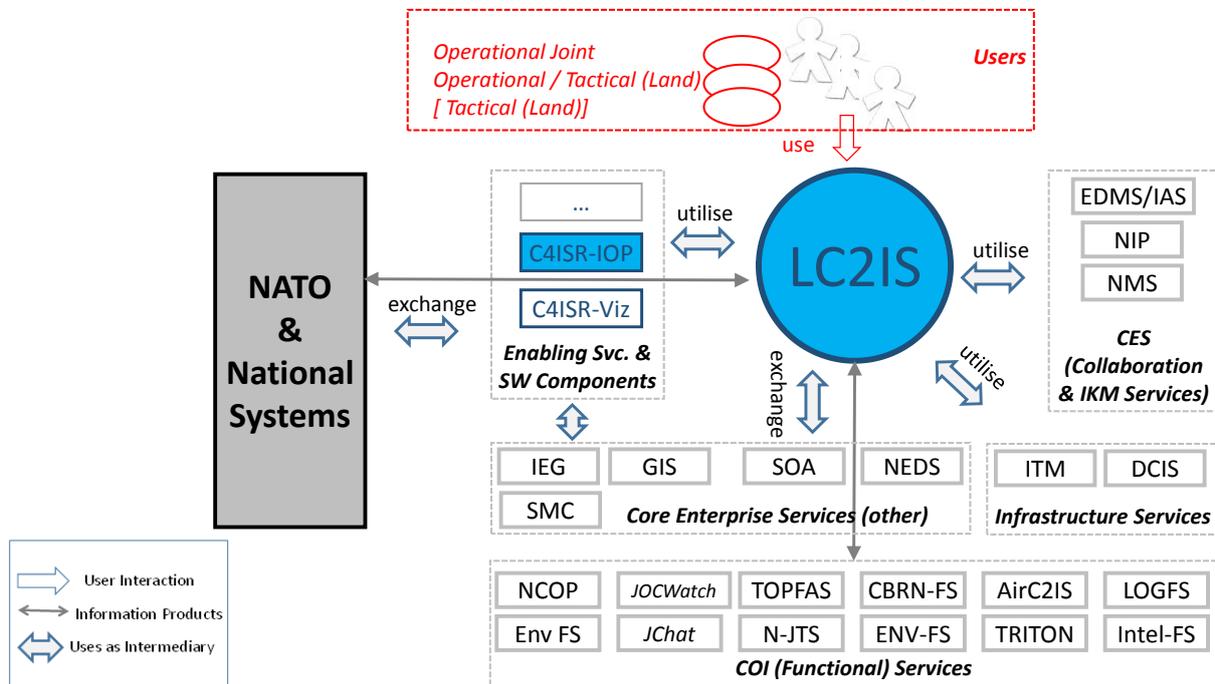

Figure 10 –LC2IS Context – Interaction with Users, Systems and Services

3.2.2   The component in the diagrams coloured in blue identify the acquisition scope for this TBCE.

3.2.3   LC2IS Users

3.2.3.1   Within each supported HQ/Site LC2IS will be used collaboratively in different Functional Areas / Cells and in particular in J3/G3 and the JOC.

3.2.3.2   LC2IS will be utilized at different command echelons.

3.2.3.3   Operational Joint: Joint Force Commands, Joint Task Forces HQ in an NRF.

3.2.3.4   Tactical Commands (Land) reporting to a Joint Command: NCS LANDCOM, Land Component Command in an NRF.

3.2.3.5   Tactical Commands (Land): use by GRF (Land) Users, complementing or replacing National Capabilities or by Liaison Cells, are not in the scope of this TBCE.

3.2.4   Services

3.2.4.1   Core Infrastructure services: static-networked (Information Technology Modernization, ITM) and deployable Communication and Information System (DCIS)

3.2.4.2   Core Unified Communication & Collaboration and Information & Knowledge (IKM) Management Services: end-user applications providing common, core functionality to all Users, including workflow, content management (EDMS/IAS), and NATO Messaging Services (NMS).

3.2.4.3   Core Enterprise Services: supporting the LC2IS capability with services such as Geo-spatial information support (GIS), Information Exchange Gateway (IEG), Service Management and Control (SMC) support.

3.2.4.4   COI Specific Functional Services: supporting the LC2IS capability with the automated information exchange and services, that are provided and managed by other Communities of Interest (COI).

3.2.4.5   COI Enabling services and Common Software Components: provide a set of supporting services for multiple consuming FS's and COI's. Examples include: C4ISR-VIZ and C2ISR-IOP.

3.2.5   Systems

3.2.5.1 LC2IS will interact with National capabilities during NATO Missions and Exercises, including Joint Operational, Land Operational and Tactical Systems.

3.2.5.2 LC2IS will interact with specialized NATO Capabilities such as Force Tracking Systems and Ground Surveillance Systems.

3.2.6 Human Actors

3.2.6.1 The human actors involved (using or supporting) LC2IS in the Operational Command and Control Processes (as shown in Figure 4) cover the following generic roles with respect to the usage of LC2IS:

- End User: any user of LC2IS
- Super User / Mentor: an expert End User, provided with the access to more advanced functionality
- Information Manager, role able to perform management functions of LC2IS data and information.
- System (service) Administrator, responsible for administering and configuring the service and all the roles

3.2.6.2 Each operational user will also cover a functional role within the HQ establishment. Typical functional roles using LC2IS are:

- (Land) Battlespace Manager
- G3/J3 Ops specialist
- G3/J3 Planner
- G3 Engineer
- G3 Targeteer

3.2.6.3 The human actors involved with LC2IS in the Command and Control Enabling Processes at C2 Supporting HQ and Sites cover the following roles:

- Trainer
- Exercise Controller
- Exercise Training Audience
- Operational Mentor
- System Functional and Data Administrator
- System Support Engineer

3.2.7 Interactions with other systems

3.2.8 LC2IS will interact (exchange data and services) uni or bi-directionally with NATO services and National System, as depicted in Figure 7.

3.2.8.1 The interaction will be based - to maximum extent possible - on NATO Interoperability Standard and Profiles (NISP, reference 8.4.2). When this is not possible, bi-laterally agreed, and published, specifications will be used.

3.2.8.2 The interaction will not normally be directly between LC2IS and the external system. In addition to boundary protection services (such as IEG), mediation services such as C4ISR-IOP will sit between LC2IS and external systems.

3.2.9 The key interfaces and profiles that will be supported are:

3.2.9.1 Data exchanges based on the Data Exchange Mechanism (DEM) of the Multilateral Interoperability Programme (MIP) Baseline 3.1 (BL3.1). Support for earlier versions (e.g. MIP Block 2, BL2) is included as part of the Transition Strategy. Support for new emerging versions, identified in the NATO Interoperability Standard and Profiles (NISP, reference 8.4.2), applicable to the lifespan of LC2IS INC-2, will also be considered.

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3.2.9.2   Formatted Text Message exchange (or equivalent XML formats and web-service protocol) based on ADatP-3 rel. 12 and 13. Support for earlier versions (rel. 11) might be considered as part of the Transition Strategy

3.2.9.3   Data exchange and protocol for graphical products based on the NATO Vector Graphics (NVG) Protocol version 2.0

3.2.9.4   Data exchange for graphical products based on the Open Geospatial Consortium - Keyhole Mark-up Language (OGC KML) version 2.2

3.2.10   Interaction between LC2IS and each external system will be based on a selection of the interfaces and profiles that are required and supported by both participants. Such selection includes, for instance, a.

3.2.11   In operations with national systems, interactions will be based on specific FMN profiles and interfaces (such a set of ADatP-3 Messages and MIP contracts) and enabled by cross-domain protection and labelling devices

3.2.12   In order to maximize system interoperability, while optimizing development effort, the Software Component C4ISR-IOP will be implemented within the authorization scope and be utilized by additional FS such as AirC2IS, LOG-FS, TRITON and Intel-FS.

3.2.12.1   C4ISR-IOP will support the data formats and protocols of MIP and ADatP-3. The functionality of C4ISR-IOP is described in Appendix F.

3.2.12.2   An internal interface with the LC2IS Data Model will be implemented. The realization of this interface for specific other FS's is not included in the scope of this TBCE.

3.3 Information Model

3.3.1   A logical model of the information to be supported in LC2IS INC-2 is depicted in Figure 11 with the aim of outlining the main information objects in the scope of LC2IS INC-2 and the main differences with INC-1.
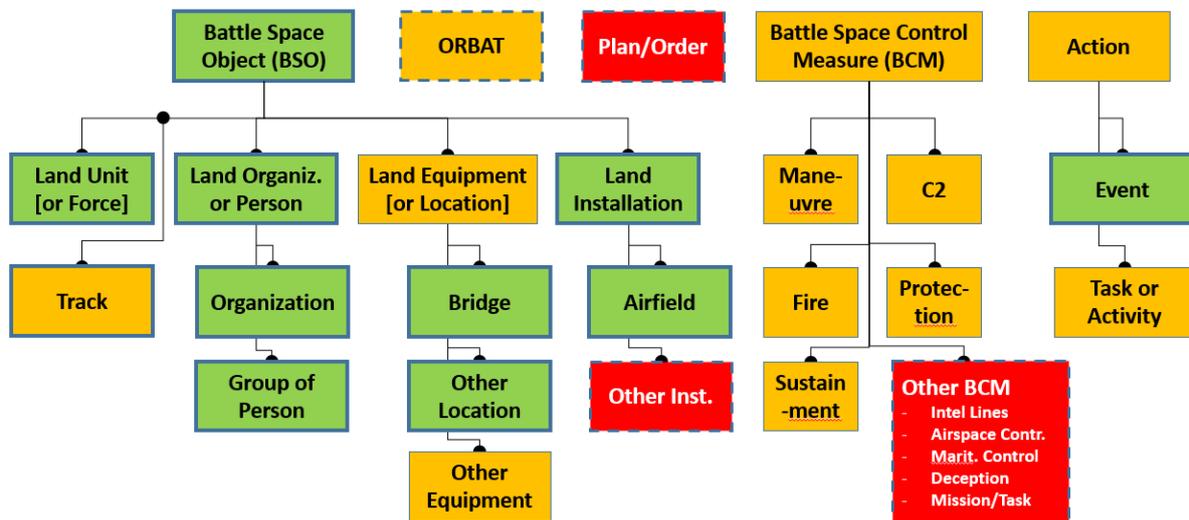
Figure 11 –LC2IS Information Model

3.3.2   The colouring depicts the coverage of LC2IS INC-1 and what is expected to cover in INC-2:

• the entities depicted in green are addressed completely (or to a large extent) in INC-1

• the entities depicted in amber are addressed with limitations in INC-1 (e.g. only as graphical objects)

• the entities depicted in red are not or minimally addressed in INC-1 and need to be addressed in INC-2.

3.3.3   This model is largely based on the taxonomy of the APP-6(C) standard (reference 8.4.3), limited to the part relevant for Land C2. Entities primarily related to Air, Space, Sea Surface and Sub-surface C2 are not included.

3.3.4   The main entities are:

- Battle Space Objects (BSO) representing the main (friendly, neutral or opposing) resources and relevant elements of the situation
- Battle Space Control Measures (BCM), representing controls, constraints and planning elements
- Actions (Task and Events)
- Plans

3.4 Solution Constraints

3.4.1   The main System Design constraints are

3.4.1.1   Software Componentization

- reuse of the C4ISR-Viz Bi-SC AIS Reusable Software Components (RSC)
- construction of the C4ISR-IOP RSC for reuse by other FS.
- reuse of the C4ISR-IOP RSC

3.4.1.2   No use of the COTS Software products that

- are no longer supported, or will become unsupported within the lifespan of LC2IS INC-2.
- failed security testing

3.4.1.3   No use of proprietary software interfaces, unless an adequate open interface does not exists

3.4.1.4   Use (to the maximum extent possible) the same COTS Software products used by other related FS and Core Services, when no product-independent interface is available.

3.4.2   Other Implementation constraints include:

3.4.2.1   Ensure that no LC2IS INC-1 functionality is lost in INC-2, unless explicitly stated as an operational requirement.

3.4.2.2   Ensure that the level of interoperability with National Systems, achieved in LC2IS INC-1, is improved, and not reduced, in INC-2.

3.5 Architectural Guidance

3.5.1   Architectural Principles

3.5.1.1   LC2IS INC-2 will be described by means of the architectural guidance provided by NATO Architecture Framework (NAF) [Ref. 8.4.5] together with the current version of the Bi-SC AIS Target Architecture Methodology [Ref. 8.4.6].

3.5.1.2   The LC2IS INC-2 architectures will comply with the architecture principles described in the NCI Agency's ICT and Architecture Principles (Reference 8.4.7) which are distinguished into Business, Information & Data and Application & Technology principles as summarized in the table below.

Business	Information and Data	Application and Technology
C3 Taxonomy Alignment	Information planning	Service-orientation
Compliance with law and NATO policies	Information and data are assets	Re-use of components
Customer focused	Information and data are authoritative and trusted	Requirements based change
Managed environment	Data and Information is shared	Extensibility, scalability, adaptability and flexibility
Partnering	Data security	Security by design
Ability to Federate	Data is standardized	Applications have a common look-and-feel
Managed Lifecycle	Data independence	Simple solutions
Standardized system, software and service engineering processes	Information assurance	Standardization and technical diversity control
		Maintainability and manageability
		Virtualised infrastructure
		Thin clients, deployability and mobility

Table 8 – Architectural Principles

3.5.2   The complete description of the principles, of the guidance and the strategy to be followed to apply these principles is expected to be issued later in 2016. The strategy will take into account the Bi SC AIS implementation roadmap and the programmatic (scope, time and cost) constraints

3.5.3   Compliance to Architectural principles.

3.5.3.1   The design of LC2IS INC-2 will comply to architectural design principle according to the available guidelines and strategy.

3.5.3.2   This TBCE uses the NAF and alignment to C3 taxonomy regarding the representation of the LC2IS Architecture. Other principles preliminary taken into account at this stage include:

- customer focus: the project implementation approach includes an yearly product baseline released to customers/users for requirement capture, capability evaluation or employment
- service orientation: the high level component model used in the TBCE is based on services
- re-use of components: the re-use of C4ISR-VIZ and realization of C4ISR-IOP are included in the TBCE scope
- requirement based change: the implementation approach includes three main baselines, each corresponding to a major requirement baseline
- application common look and feel: the integration with the C4ISR-VIZ – included in the TBCE scope - pursues the achievement of a Human Computer Interface common with other FS'
- virtualized infrastructure: re-use and deployment on a static virtualized infrastructure is included in the TBCE scope

3.5.3.3   Compliance with other principles cannot yet be stated for the TBCE. It will be pursued in subsequent acquisition phases, namely the IFB.

3.5.3.4   An initial set of architectural goals of the proposed solution in order to meet the Architectural Principles is described in section 3.1.1.

3.6 High Level Component Model

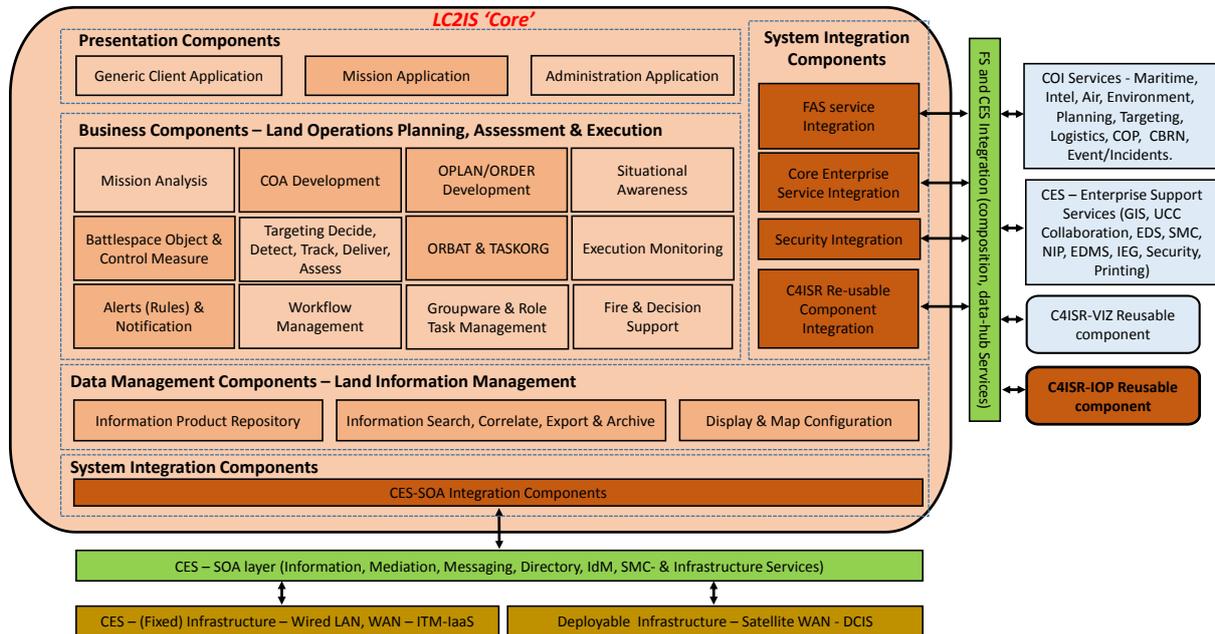3.6.1   The high level system view of the proposed technical solution is depicted in Figure 12.

Figure 12 – High Level Component Model for LC2IS 'Core'

3.6.2   The High Level Component Model describes the proposed high level system architecture, consistent with the technical solution overview (shown in Figure 9) and the C3 taxonomy. It includes the following groups of components:

- LC2IS 'Core'
- The Reusable Software Components (RSC), to be reused by several Functional Services.
- The other Functional Services (FS) of the BiSC-AIS
- The Core Services (CS)
- The Communication and Information System (CIS) infrastructure, fixed and deployable (DCIS)

3.6.3   The scope of this proposal includes the implementation of LC2IS 'Core' and of the C4ISR-IOP RSC (coloured in orange/brown).

3.6.4   LC2IS 'Core' includes the main functional components of LC2IS.

3.6.4.1   The Presentation components, providing the end-user interface of LCIS, including:

- The Generic client application, for the LC2IS end-users
- The Administration application, for the LC2IS system administrators and information managers
- The interface to the Mission Application (Business components).

These components use the functionality provided by the C4ISR-VIZ RSC.

3.6.4.2   The business components support the main Land Command and Control processes, and in particular:

- The analysis and the planning of Land Missions, including the development of different Courses of Action ("Mission Analysis", "COA Development")")
- the support to the development of (Land portions of) the Operational Plan and Operational Order ("OPLAN/ORDER Development")
- the monitoring of the mission execution and more generally providing awareness on the current land situation ("Situation Awareness", "Execution Monitoring")")

- The management of the 'operational' Order of Battle and Task Order, of all the Land relevant (enemy, friendly and neutral) Battlespace Objects and Control Measures ("Battlespace Object & Control Measure", "ORBAT & TASKORG").

- The support for the Land C2 - relevant targeting, fire and decision support tasks ("Targeting", "Fire & Decision Support")

- For Land C2 purposes, subscription to, or tailoring of, generic alerting, workflow management, groupware/collaboration and task management services and tools ("Alert Notification", "Workflow Management", "Groupware").

3.6.4.3   The Data Management components, supporting the management (access, storage, retrieve, presentation) of all Information Product Repositories, the information search and retrieval, and the geo-spatial display. These components are based on the functionality provided by Core Services, such as GIS.

3.6.4.4   The System Integration Components provide the modules required for the integration of LC2IS Core with the other components: other FS's, the CES and the RSC's.

3.6.5   The C4ISR-IOP RSC supports NATO, Multinational and Coalition interoperability standards, protocols and profiles. A High Level Component Model is depicted in the following Figure. The functionality is detailed in Appendix F.
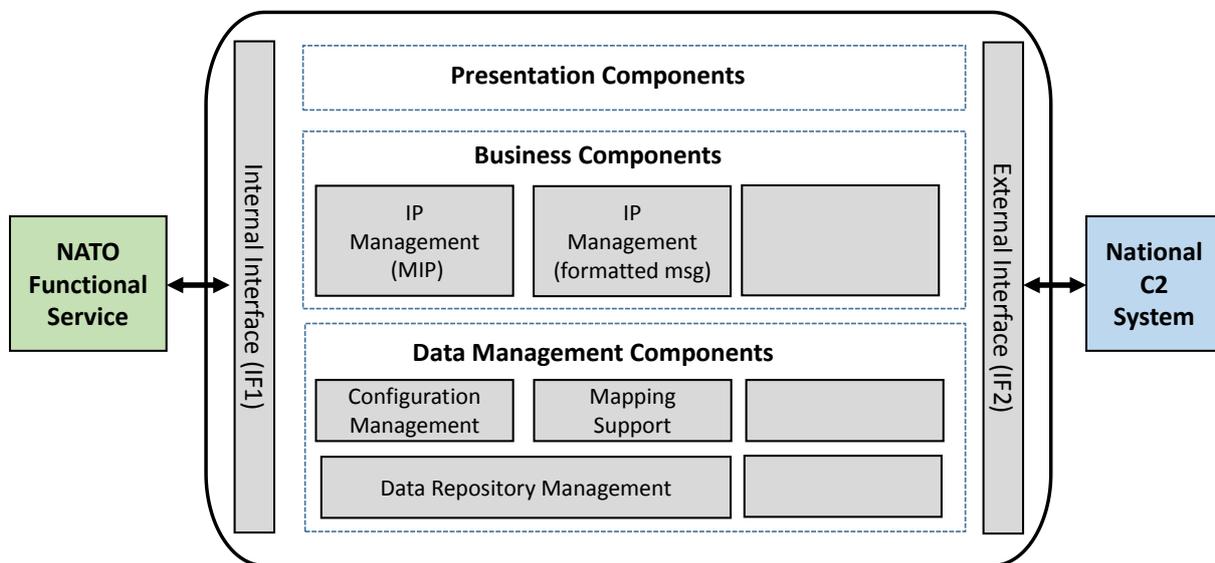
Figure 13 –High Level Component Model for C4ISR-IOP

3.6.6   The main sub-components of C4ISR-IOP are:

- An Information Product Management component, handling the interoperability information exchange contracts and procedures

- A Configuration Management component, supporting the configuration of C4ISR-IOP

- An Internal Interface (IF1), to be used by NATO Functional Service (such as LC2IS 'Core') to employ the C4ISR-IOP Services.

- An External Interface (IF2), to interoperate with National Systems or Services, according to standard and profiles

- A Mapping functionality, supporting the mapping from the Internal Interface to a specific Client Interface (such as LC2IS).

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3.7 Re-use of existing Component and Services

3.7.1   In order to reduce the 're-use' risk (see section 5.8) Reusable Software Component (RSC) need to meet minimum quality and manageability requirements such as.: have stable and documented interfaces placed under configuration management; be qualified and available on time; include an authorized maintenance plan. Besides, their re-use needs to be cost effective from a Total Cost of Ownership perspective.

3.7.2   The reuse of LC2IS INC-1 physical components within INC-2 is expected to be limited to the functionality, as described in section 5.1.

3.7.2.1   The functional re-use of LC2IS INC-1 is indicated in Figure 12 through colour density: a darker colour indicates less re-use (new functionality); a lighter colour more re-use.

3.7.3   LC2IS INC-2 will also reuse the following Software Components:

3.7.3.1   The C4ISR BiSC-AIS RSC called 'C4ISR-VIZ', supporting the visualization of C4ISR and geospatial information objects for all FS.

3.7.3.2   Other 'suitable' software packages (i.e. meeting the re-use requirements) are not identified at this stage. However, If new are identified later they will be included in the subsequent acquisition stages.

3.7.4   LC2IS INC-2 will implement the following RSC to be re-used by other BiSC-AIS FS:

3.7.4.1   The 'C4ISR-IOP' RSC, supporting standard interoperability services (MIP and ADatP-3) with external Systems

3.7.5   LC2IS INC-2 will interact (exchange data and use services) with other Functional Services as described in section 1.12 and detailed in Appendix C. The service provision/consumption might be mediated through Core Services SOA Platform Message-Oriented Middleware Services.

3.7.6   LC2IS INC-2 will use specific Core Services, as depicted in Figure 12, including:

3.7.6.1   Collaboration and Information Knowledge Management Services.

3.7.6.2   Service Oriented Architecture (SOA) Platform Services and Identity Management Services. This group of re-usable services will be utilized in the process of applying data labels and bindings.

3.7.6.3   Service Management and Control Services.

3.7.6.4   Other Core Services such as Information Exchange Gateway (type-C) and Geographical Information Services.

3.7.7   LC2IS INC-2 will also use the following CIS infrastructure:

3.7.7.1   Fixed Information Technology infrastructure (i.e. Data Centres providing centralized data processing and storage services), provided by the Information Technology Modernization (ITM) Project.

3.7.7.2   Deployable processing and data storage services provided though the Deployable CIS Project (DCIS).

3.8 Security accreditation

3.8.1   LC2IS will:

3.8.1.1   operate at the NS or, for coalition operations or Future Mission Network (FMN), at the MS network. There are currently no requirements to operate at data classifications above NS level.

3.8.1.2   provide its services to the consumers within the same security domain.

3.8.1.3   deliver its information products through the existing boundary protection devices (e.g. IEG or Data Diodes).

3.8.2   The Security accreditation consists of the following steps:

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3.8.2.1 Categorization of a new systems / new capability regarding its accreditation needs. The appropriate Security Accreditation Authority (SAA) will review the initial system description and establish if (and to what extend) an accreditation is needed.

3.8.2.2 Development of the required Security Accreditation Plan for this system, as well as the security requirements based on the Security Risk Assessment.

3.8.2.3 Specification of the security testing requirements and validation testing (if required). An interim security accreditation might also be required.

3.8.2.4 Specification, verification and validation of the administrative and physical aspects of this systems, and ensure, among other things, that the required Site Security Compliance are in place.

3.8.2.5 Completion of all Security Accreditation package and request for accreditation.

3.8.3 In order to achieve the Security accreditation the following activities are required:

3.8.3.1 Detailed CIS description of the Communication and Information Systems (CIS) components and interconnection.

3.8.3.2 Development (by NCI Agency) of a Security Accreditation Plan (SAP), to be submitted to the NSAB – defining the security accreditation activities to be conducted during the project implementation.

3.8.3.3 Development of a Security Risk Assessment (SRA), identifying all threats, vulnerabilities, and resulting risks to LC2IS. The SRA will describe the security documentation and security measures required to achieve the desired CIS Security accreditation.

3.8.3.4 Specification of the System-specific Security Requirements Statement (SSRS), based on the results of the SRA.

3.8.3.5 Specification of the Security Operating Procedures (SecOPs) for General User and/or System and CIS Security staffs.

3.8.3.6 Definition of the Security Test and Verification Plan (STVP) based on the SSRS.

3.8.3.7 Performance – if required – of a Vulnerability Assessment (VA).

3.8.3.8 Establishment of the conformance of the Global Security Environment (GSE) and the Local Security Environment (LSE), where a CIS is (to be) operated in, with the NATO security policy/directives requirements or their NATO Nations' equivalent(s). This conformance is established through the generation of Site Security Compliance (SSCs) Statements.

3.8.3.9 Performance of the Security accreditation of the system interconnections. This activity is based on the completed System Interconnection Security Requirement Statement (SISRS). LC2IS data exchange interconnection solution between NS and MS network domains must be accredited. This will be supported only as a re-accreditation of an existing cross-domain interconnection between the NS and MS domains based on XML Guard solutions. The Implementation Contractor will make sure that the capabilities delivered will meet the security requirements of these networks.

3.8.3.10 LC2IS must comply with the Community Security Requirement Statement (CSRS) for Secure Automated Information System (AIS) [Reference 8.4.4] and will operate at system high level. It requires only Discretionary Access Control (DAC) for data protection.

3.8.3.11 Based on LC2IS INC-1.1. security assessment it is expected that also for LC2IS INC-2 only the Configuration Change Proposal (CCP) process resulting in the software being added to the Approved Fielded Software List (AFPL) will be required.

4 High Level Deployment Model

4.1 Deployment configuration

LC2IS will operate in three modes as shown in

4.1.1   Figure 14: <u>static</u> (fully connected), <u>deployed</u> (autonomous or with limited / intermittent connectivity) and <u>stand-alone</u> mode.
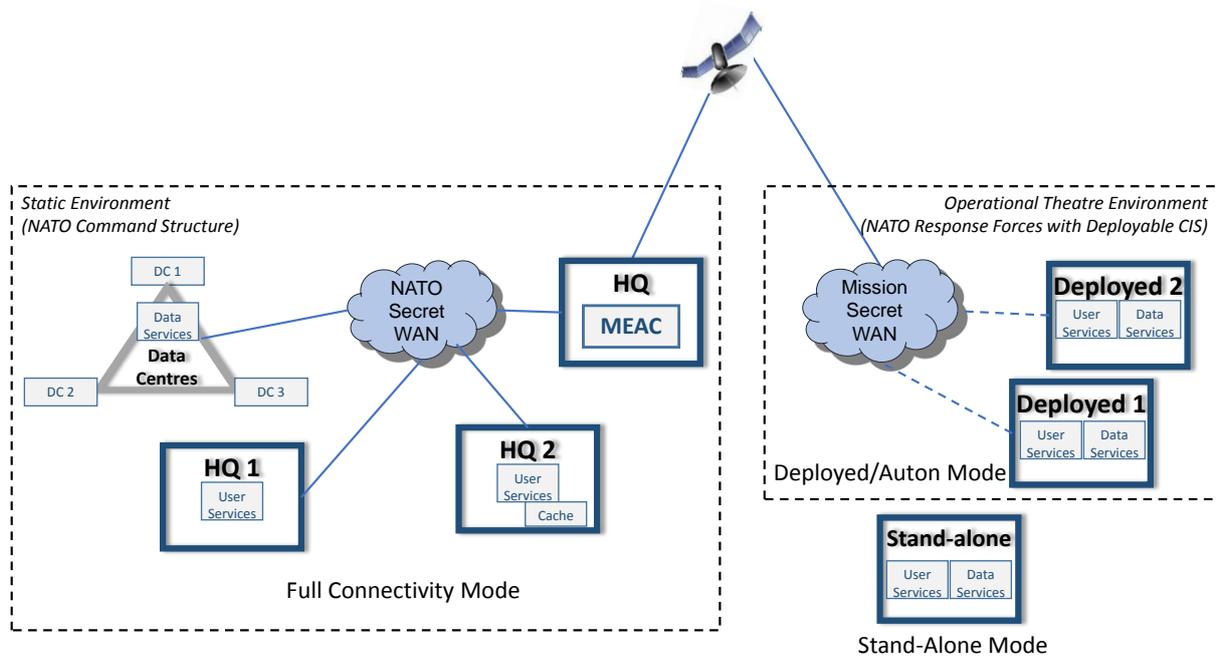
Figure 14 –LC2IS Modes of Operation (NSV-2)

4.1.1.1   In the static (fully connected) mode all users are connected to services hosted in the datacentres (located in another physical location) through the WAN.

4.1.1.2   In the deployed mode, the LC2IS capability is hosted on the Deployable CIS (DCIS) platform and will operate with a disadvantaged connection (possibly low bandwidth and high latency connectivity and limited, intermittent or no connectivity) with the static infrastructure.

- Reach-back to the static environment is mainly provided through the Mission Execution Anchor Capability (MEAC, as at reference 8.1.15).

- A deployed LC2IS configuration will need to operate also in an autonomous mode if the DCIS connectivity is broken, interrupted or is significantly reduced.

4.1.1.3   The stand-alone mode might be required for operational employment and possibly also for training, testing and support purposes. LC2IS will be disconnected from any WANs.

4.1.1.4   Interim systems are required during the project implementation (e.g. for interim Interoperability capabilities and for Operational Test and Validation – OT&V). They will be normally be connected to the OT&V network.

4.1.2   The LC2IS system configuration will depend from the deployment environment:

4.1.2.1   In the static environment, LC2IS instances will be available – as described in Table 9 - in the Datacentres on virtualised server platforms.

- LC2IS Standard Nodes will be centralised, allowing the configuration of task-specific users groups. LC2IS Enhanced Nodes will be complementary physical installation required to increase system availability and resiliency.

- Mission preparation and early planning may be done in this environment (on the LC2IS NATO SECRET capability).

- Mission specific functions can also be performed during mission execution in the static environment through the MEAC (e.g. as initially implemented for the FMN Spiral 1 (NRF 2016)) with the Mission Information Room (MIR) (references 8.5.11 and 8.5.12).

4.1.2.2 In the deployed environment LC2IS will be implemented in one or more Deployable CIS Modules (DCM) of the DCIS.

- Data replication will be implemented to initialize and synchronize the deployed environment and later maintain consistency between the static and deployed environment, if required.

- Through the DCIS Mission Execution Anchor Capability (MEAC – as described above), cross-domain access and information exchange from the static (NATO SECRET) will be supported for possibly multiple Missions.

4.1.2.3 In the stand-alone mode, LC2IS could be self-standing and could operate without network connectivity.

4.1.3 Table 9 summarizes the physical scope of LC2IS INC-2, i.e. the sites where LC2IS will be physically deployed in order to support the 'logical' nodes (Commands and Agencies) listed in Table 2.

Abbrev.	Name	Location	Size (1)	Avail (2)	Est. Usr	DC-1 BEL NS	DC-1 BEL MS	DC-1 BEL NU	DC-2 ITA NS	DC-2 ITA MS	DC-2 ITA NU	DC-3 (>2019) BEL NS	DC-3 MS	DC-3 NU	EN LANDC ENH TUR NS	MEAC JFCBS BEL MS	MEAC JFCNP ITA MS	DCIM LCC MS	DCIM JTF MS	DCIM SOCC MS	DCIM RS MS	MB MS	OTV MS	Tot
JFCBS HQ	Joint Force Command Brunssum HQ	NLD	L	H	65	1			1			1				1						1		5
JFCNP HQ	Joint Force Command Naples HQ	ITA	L	H	65	1			1			1					1					1		5
LANDCOM HQ	Land Forces Command HQ	TUR	L	H	120	1			1			1			1							1		5
AIRCOM HQ	Air Forces Command HQ	DEU	S	H	15	1			1			1												3
MARCOM HQ	Maritime Forces Command HQ	GBR	S	H	15	1			1			1												3
JFTC HQ	Joint Forces Training Command HQ	POL	M	H	20		2			2			-											4
JWC HQ	Joint Warfare Center HQ	NOR	M	H	20		3			3			-											6
LCC	Land Component Command	depl	M	H	50													2				2		4
JTF HQ	Joint Task Force HQ	depl	S	H	15														2			2		4
SOCC	Special Ops Component Command	depl	S	H	15															2				2
NCISS HQ	NATO CIS School	POR	S	L	15			1			1													2
NCIA-SRS	NCIA Support Reference System	NLD/BEL	S	L	5			1			1										2			4
NCIA-ITS	NCIA Integr. Test & Develop. System	NLD/BEL	M	M	20			1			1													2
NCIA-CTS	NCIA CIAV Test System	NLD/BEL	M	H	20		1			1														2
OT&V	Operational Test & Validation	various	S	L	15																		5	
	TOTAL (logical instances)				475	5	6	3	5	6	3	5	-	-	1	1	1	2	2	2	2	7	5	51
	TOTAL (multi-tenant instances)					1	6	3	1	6	3	1	-	-	1	1	1	2	2	2	2	7	5	44

Table 9 – LC2IS INC-2 Physical Scope

Legend for Table 9

- DC: Data centre
- MB: MIP Bridge
- EN : Enhanced Node
- MEAC : Mission Enhanced Anchor Capability
- DCIM: Deployable CIS Module
- MB : MIP Bridge
- OTV: Operational Test and Validation

4.1.3.1 Different configurations will be required mainly driven by the number of users and availability requirements. Both parameters are an estimate based on LC2IS INC-1 and will be revised in later acquisition stages.

4.1.3.2 The main system configurations used for deployment are the following:

- SL – Small Size / Low Availability, used typically for individual training and test systems (5-15 Users).
- SH – Small Size / High Availability, used for small DCIS configurations.

- MH – Medium Size / High Availability, used for larger DCIS configurations systems, exercise preparation, collective training and larger test systems (up to 50 users).

- LH – Large Size / High Availability, used typically for static operational systems supporting more commands (more than 50 users).

4.1.3.3   As shown in Table 9 all the static configurations will be supported by one, two or three Datacentre's and by one Enhanced Node.

- Each instance of LC2IS will be multi-tenant, i.e. able to support simultaneously more than one command (in the same security domain)

- Up to two LC2IS copies (at datacentre DC-1 and DC-2) are required to achieve the service availability as described in para 1.10. One copy at DC-3 is included for disaster recover purposes.

- LANDCOM HQ will also include a local 'Enhanced Node' to increase availability and resilience.

4.1.3.4   The deployed configuration will be supported through DCM (Deployable CIS Modules). Two additional DCM's are included in the configuration as reference system (DCM-RS) and spare.

4.1.3.5   In summary, that physical footprint of LC2IS supports 15 logical nodes and 44 fixed and deployable system installations 12 of which are interim, i.e. only necessary during the implementation project timeframe). This is only an initial estimate for the purpose of the development of this request, which will need to be revised and refined in the later stages of the acquisition.

4.2 Deployment approach

4.2.1   The new capabilities will be deployed using a phased approach as described in section 5.1. which involves both the legacy (LC2IS INC-1) and the new (LC2IS INC-2) capability. The LC2IS INC-2 capability will consist of three main Product Baselines (PBL-2, PBL-3A and PBL-3B) and one prototype (PBL-1) for initial requirement capture and refinement.

4.2.2   The LC2IS INC-1-related capability includes the development a new major software upgrade of the increment 1 software (Version 5.1, also called "Mid-Life Update", MLU) supporting new functionality that are required to guarantee the maintainability and utility of Increment 1 and therefore extend its operational life until the transition to Increment 2.

The transition of the MLU (qualification, validation and deployment) will be part of the LC2IS INC-1 O&M.

4.2.3   The LC2IS INC-2 deployment activities will result in the deployment of PBL-3B (the final version of LC2IS) to the target sites as in Table 2 and Table 9.

4.2.3.1   PBL-1 ('Conceptual Prototype Software ') will be deployed only in the context of User requirement workshops

4.2.3.2   The deployment activities (which will be detailed in the System Transition Plan, SyTrP) comprises the following activities:

1) The installation of PBL-2 (Functional Prototype Software) in the NCIA Integration Test System (NCIA-ITS) in order to support the qualification followed by the deployment to the OT&V-1 sites in order to support the first Operational Validation Test.

2) After its development PBL-3A (initial version of the Operational Software) will be installed at NCIA-ITS for its qualification, followed by the deployment to the designated sites per OT&V-2 or pilot testing. In parallel PBL-3A will also be installed in the NCIA Test System (NCIA-CTS) for the Coalition Interoperability and Validation (CIAV) testing. CIAV is the main validation event for FMN interfaces and profiles.

3) After the completion of OT&V-2 and CIAV, the final baseline (PBL-3B, final version of the Operational Software) will be developed, installed in the NCIS-ITS for qualification and – after the successful qualification - deployed to the target sites as in Table 9). The deployment sequence will follow the agreed SyTrP.

- o At each site the new capability is deployed, tested (in a staged environment if required), data migration, site acceptance and activation tests are performed. If the tests are successful the site is accepted and can be technically activated.
- o The deployment order is performed according to the Operational Transition Plan – coordinated with the OA - identifying in particular the IOC site (likely LANDCOM HQ).
- o After the IOC implementation – and any possible revision of the PBL - the deployment will proceed with all other operational and support sites.

4.2.3.3 The deployment of LC2IS INC-2 is completed when all sites have been accepted and all activities included in the SyTrP have been performed by the Contractors and the Final System Acceptance milestone is achieved.

4.2.4 The responsibility for the support of LC2IC INC-2 during the implementation and O&M phases are described in Table 14.

4.3 Termination of existing services

4.3.1 The approach for terminating the existing services will be performed in accordance with the User Transition Requirements and Operational Transition Plan (see section 1.14).

4.3.2 Before the achievement of the Final System Acceptance (FSA), the following other activities are required before terminating the legacy services.

4.3.2.1 Provision (and completion) of functional knowledge transfer to end users and support staff.

4.3.2.2 Provision of mentoring to end users and support staff.

4.3.2.3 Support to operational and technical staff for the definition of the new SLA.

4.3.2.4 Support to operational staff for the definition/revision of the new SOP/SOI.

4.3.3 Operational transition activities could still be required after FSA and before achieving the FOC. These activities are under the responsibility of the OA and lie outside the scope of the project. The FOC is not therefore a project milestone.

4.3.4 Operation and Maintenance (O&M) during the transition period (see also Table 14).

4.3.4.1 Until FSA the existing capability will remain operational and supported according to the existing SLA.

4.3.4.2 The migration of data from the legacy to the new services and the knowledge transfer will be performed within the project scope throughout the whole system transition.

4.3.4.3 The termination of the existing services will be performed at FOC. Simultaneously, LC2IS INC-2 will be activated as the new Operational Baseline (OBL).

4.3.4.4 The O&M support for LC2IS INC-2 will start immediately after the FSA according to the new SLA.

5 Project Implementation Approach

5.1 Project Model

5.1.1   The Land C2 IS Implementation is incremental, offering the possibility to accommodate evolving operational requirements with following increments. Three increments have been programmed for LC2IS. This TBCE deals with Increment-2 (INC-2).

5.1.2   The tenets of the LC2IS INC-2 <u>implementation strategy</u> are the following:

5.1.2.1   Implementation through and incremental approach (consisting of four phases) allowing a refinement and validation of the operational and system requirements and providing frequent visibility opportunities to the stakeholders on the project progress and performance.

5.1.2.2   Provision of maximum transparency on the procurement approach, achieving a compromise between competition and efficiency aiming at realizing the best and most maintainable solution supporting the requirements at the lowest cost for NATO.

5.1.2.3   Application of the Lessons Learned in implementation and support of LC2IS INC-1.1 and of other Functional Services in NATO. Within each of the phases the implementation can follow a more agile approach respect to what done in the past.

5.1.2.4   Definition of a clear LC2IS software licencing schemes and Intellectual Property Rights ownership allowing NATO, NATO Nations and Mission Federated Nations to make use of LC2IS at the lowest cost and with minimal constraints

5.1.3   The LC2IS INC-2 Implementation Model is based on the following <u>approach</u>:

5.1.3.1   LC2IS INC-1 product life is extended until the planned transition to LC2IS INC-2 in order to guarantee operational support continuity.

- In order to ensure efficient maintainability of the LC2IS INC-1 software one major software upgrade (MLU) is required before 2018. The LC2IS INC-1 O&M cannot cover a significant functional enhancement such as this. A request in this direction has been submitted but not accepted by the NOR/Budget Committee for the NCCB 2016 (reference 8.1.10).

- The MLU also includes the replacement in LC2IS INC-1 of the MIP BL-2 with a new MIP-BL3.1 Gateway, required in order to support the recommendation and operational requirement by SHAPE (as in ref. 8.2.9).

5.1.3.2   The acquisition of the reusable software component C4ISR-IOP needs to be separated from the main LC2IS procurement in order to increase competition and reusability for other Functional Services

5.1.3.3   Early validation of the operational and system requirements and the design concept is required in order to reduce the risk of mis-match between the final capability and the stakeholder's requirements and expectations. This is mainly achieved through:

- An initial test and validation of the capability (some 80% of the functionality) from an operational perspective ("Operational Test and Validation', OT&V) for a preliminary evaluation of its fitness for purpose (OT&V-1).

- A second and final OT&V (OT&V-2) to evaluate the fitness for purpose of the complete functionality, including also an assessment on its quality ("fitness for use"). After taking into account the results of OT&V-2 final product version will complete the tests and validation and be released and deployed.

5.1.4   The LC2IS INC-2 <u>Project Implementation Model</u> - outlined in Figure 15— is split into four phases:

5.1.4.1   <u>Phase-0 (INC-1 Upgrade):</u> Major upgrade (Mid-Life Upgrade or MLU) of the LC2IS INC-1 Software required to extend its life until the planned transition to INC-2. This new version of the INC-1 operational software will be qualified and included in the next planned LC2IS INC-1 maintenance release and deployed as part of the O&M activities.

5.1.4.2   <u>Phase-1 (INC-2 Initial delivery):</u> Development of an initial version of the LC2IS Core and C4ISR-IOP Software packages**,** largely based on existing product (i.e. not requiring any significant software constructions activities). The deliverable **is** a 'Conceptual Prototype Software ' (according to ref. 8.5.13) covering selected LC2IS INC-2 functionality and used to perform to refine and validate LC2IS INC-2 requirements and critical design concepts with NATO stakeholders (Product Baseline 1).

5.1.4.3   <u>Phase-2 (INC-2 Functional Evaluation)</u>: Implementation of a 'Functional Prototype Software '', including a comprehensive subset of the complete LC2IS INC-2 functionality with the sufficient degree of assurance required to support OT&V-2 in a realistic operational/exercise environment (Product Baseline-2, PBL-2).

5.1.4.4   <u>Phase-3 (INC-2 Final Delivery)</u>: Implementation of the complete functionality (including also the C4ISR-IOP component) to be deployed and validated in a OT&V-2 event (Product Baseline 3A, PBL-3A) and then deployed and accepted (FSA) and moved into operations after completing the transition from LC2IS INC-1 (Product Baseline 3B, PBL-3B, "initial version of "Operational Software").

5.1.5   System Acceptance, is split into provisional and final acceptance.

5.1.5.1   <u>Provisional System Acceptance (PSA)</u> is achieved after the construction and qualification of the Baseline PBL-3A Operational Software and its successful deployment to the identified sites for validation purposes. The sites/systems – to be agreed with the Operational Authority – could include the JFC's, LANDCOM HQ's and at one or more of the DCIS Modules. The PSA milestone marks the readiness for the second Operational Test and Validation (OT&V-2).

5.1.5.2   <u>Final System Acceptance (FSA)</u> is achieved after the completion of the second OT&V, the required correction of the Operational Software (Product Baseline 3B) and the completion of the final system transition and support activities. At FSA all sites have been accepted and the post installation support has been provided. The FSA milestone marks the readiness of the system for the Final Operational use of the Capability (FOC).

5.1.6   Delivery of "LC2IS Core" and "C4ISR-IOP" components

The final version of the "LC2IS Core" component is delivered at FSA (part of PBL-3B). The – less complex - component "C4ISR-IOP" is finally delivered at PSA (part of PBL-3A). C4ISR-IOP is involved in the qualification of LC2IS Core (PBL-3B and FSA)..
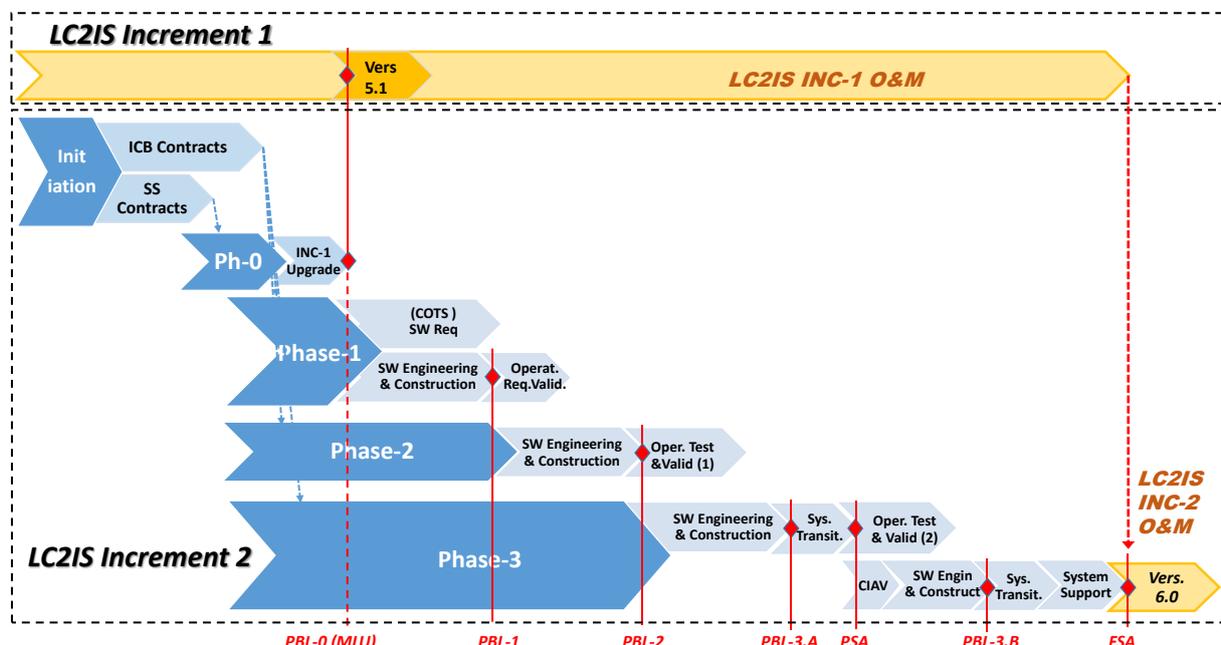

Figure 15 –Project Implementation Model

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5.2 Work Breakdown Structure

5.2.1   The project scope is decomposed into the twelve Work Packages as described below and depicted in the Work Breakdown Structure (WBS) in Figure 16. A detailed description of the work packages is included in Appendix I.
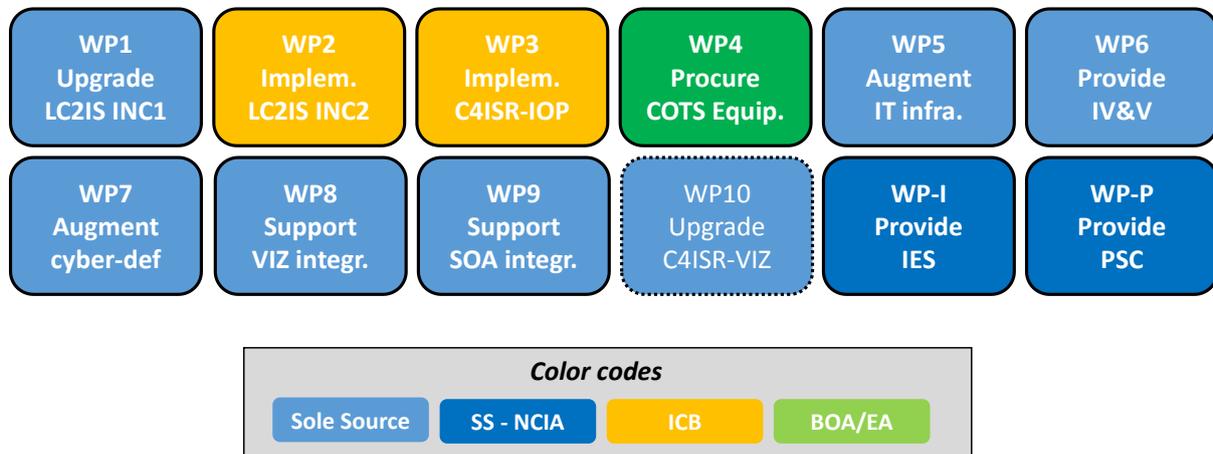

WP1 Upgrade LC2IS INC1	WP2 Implem. LC2IS INC2	WP3 Implem. C4ISR-IOP	WP4 Procure COTS Equip.	WP5 Augment IT infra.	WP6 Provide IV&V
WP7 Augment cyber-def	WP8 Support VIZ integr.	WP9 Support SOA integr.	WP10 Upgrade C4ISR-VIZ	WP-I Provide IES	WP-P Provide PSC

Color codes

Sole Source	SS - NCIA	ICB	BOA/EA

Figure 16 –Work Breakdown Structure

5.2.1.1   <u>Work Package 1:</u> Upgrade LC2IS INC-1.1 Software. This work package comprises software development and test activities required to upgrade the LC2IS INC-1.1 software in order to replace obsolescent COTS and proprietary components and extend INC-1.1 life until the transition to INC-2.

5.2.1.2   <u>Work Package 2: Implement LC2IS INC-2.</u> This is the main work package comprising the activities required to construct the LC2IS INC-2 "core" Software, integrate it with the other components and perform the transition into operations. The final acceptance is at FSA.

5.2.1.3   <u>Work Package 3: Implement C4ISR-IOP Component for LC2IS INC-2.</u> This work package comprises the activities required to construct the C4ISR-IOP RSC, to integrate it with the LC2IS "core" Software and support its transition into operations. The final acceptance is at PSA.

5.2.1.4   <u>Work Package 4: Procure COTS Equipment.</u> This work package comprises the procurement of all the hardware and software components required for the implementation of LC2IS INC-2 and which are not in the scope of WP5. It also includes, its delivery and warranty. The required software and hardware installation activities are not part of this work package, but are included in WP2 and WP3.

5.2.1.5   <u>Work Package 5: Augment the IT infrastructure.</u> This work package comprises the augmentation of the hardware capacity of the fixed IT infrastructure in order to support the LC2IS INC-2 requirements. This is achieved through the Information Technology Modernization (ITM) Project.

5.2.1.6   <u>Work Package 6: Provide Independent Verification and Validation (IV&V).</u> This work package provides the Independent Verification and Validation support to the Project.

5.2.1.7   <u>Work Package 7: Augment the cyber-defence capability.</u> This work package covers the implementation of the mandatory set of NCIRC sensors, thus facilitating centralised prevention, detection and mitigation of cyber defence incidents. This is achieved through the NCIRC Project.

5.2.1.8   <u>Work Package 8: Support the Integration of C4ISR-VIZ Component.</u> This work package comprises the engineering support for the integration of LC2IS with the C4ISR-VIZ Component and the implementation of a standard Human Machine Interface (HMI) for LC2IS.

5.2.1.9   <u>Work Package 9: Support the Integration of SOA Services</u> This optional work package comprises the engineering support by the SOA/IDM Contractor required for the integration of LC2IS with SOA Services. This work package is required if the same scope is not covered under the SOA-IDM Project (WP5).

5.2.1.10 Work Package 10: Upgrade C4ISR-VIZ Component for LC2IS. This optional work package comprises the enhancement of the C4ISR-VIZ Component Software, as required to support the specific LC2IS requirements (e.g. for land symbology and terrain visualization).

5.2.1.11 Work Package IES: Provide Internal Engineering Services (IES). This work package comprises the (NCI Agency) Internal engineering support for the Project. Support includes knowledge transfer, support for test, integration and engineering support for analysis and design.

5.2.1.12 Work Package PSC: Provide Project Service Support (PSC). This work package comprises the activities performed by NCI Agency to manage and support the Project. The WP is split into four stages, corresponding to four major project authorization and acceptance milestones.

5.2.2 The following table shows the allocation of work packages to implementation phases and the recommended procurement strategy as described in section 0.

Project Work Breakdown		Implementation phases					Procurement Strategy		
wbs	Work packages	Prep	0	1	2	3	Opt	Approach	Contractor
WP01	Upgrade LC2IS INC-1 Software		▓				No	SS	LC2IS INC-1 Contractor
WP02	Implement LC2IS INC-2			▓			No	ICB	
WP03	Implement C4ISR-IOP Component for LC2IS			▓			No	ICB	
WP04	Procure COTS Equipment			▓			No	ICB [1]	WP2 & WP3 or BOA Contractors
WP05	Augment IT infrastructure				▓		No	SS	ITM Contractor
WP06	Provide Independent Verification and Validation (IV&V)			▓			No	SS	PMIC Contractor
WP07	Augment cyber-defense capability				▓		No	SS	NCIRC Contractor
WP08	Support the Integration of C4ISR-VIZ Component			▓			No	SS	TRITON (sub) Contractor [2]
WP09	Support the Integration of SOA Services			▓			Yes	SS	SOA/IDM Contractor [2]
WP10	Upgrade C4ISR-VIZ Component for LC2IS			▓			Yes	SS	TRITON (sub) Contractor
WP-I	Provide Internal Engineering Services (IES)		▓				No	SS	NCIA
WP-P	Provide Project Management and Support (PSC)	▓					No	SS	NCIA

Table 10 - Project Breakdown and Implementation Approach

Notes on Table

[1.] Cheapest between WP2 & WP3 and BOA/EA Contractors

[2.] With option to WP2 contractor as risk mitigation

5.2.3 Some specific dependencies between Work packages are the following:

5.2.3.1 WP2 and WP3 are closely inter-dependent. The WP2 Contractors has the main integration leading role, although not formally a "system integrator".

5.2.3.2 NCI Agency – through the WP-I (IES) work-package - will facilitate and coordinate the system integration by information exchange among the various contractors and by coordinating and supporting the system integration planning and execution activities.

5.2.3.3 The IV&V (WP6) Contractor will provide the assurance for all other work packages.

5.3 Procurement approach

5.3.1 General

5.3.1.1 LC2IS is programmed to be acquired in three increments: Increment 1 (implemented), Increment 2 (the subject of this TBCE) and Increment 3, programmed in Capability Package CP9C0107.

5.3.1.2 The overall strategy recommended for this Project consists of:

- An International Competitive Bidding (ICB) using the "Best Value" bid evaluation procedures for selecting the (Main) Contractor of the LC2IS Implementation package (WP2);
- An International Competitive Bidding (ICB) using the "Best Value" bid evaluation procedures for selecting implementing the C4ISR-IOP Re-usable Component (WP3);
- Evaluated options for WP2, WP3 and WP5 or Basic Order Agreement (BOA) / Enterprise Agreement for the procurement of COTS Hardware and Software (WP4)
- Sole Source to the PMIC Contractor for IV&V (WP6)
- Sole Source to NCI Agency for the PSC (WP-P) and IES (WP-I) work packages
- Sole Source to industry (Contractors already or to be selected through other competitions) for the implementation of the other Work packages (WP1, WP5, WP6, WP7, WP8, WP9 and WP10);
- Option to WP2 Contractor for WP8 as risk mitigation measure for the late or inadequate delivery of the C4ISR-VIZ component
- Options to WP2 Contractor for WP9 as risk mitigation measure for the late or inadequate delivery of the SOA/IDM Services.

5.3.1.3 The advantage for having two ICB's for WP2 and WP3 is two-fold

- ensuring that the software component C4ISR-IOP (WP3) does not include explicit or implicit dependencies with the LC2IS 'Core' functionality (WP2), therefore enabling its re-use by FS other than LC2IS.
- achieving a more cost-effective acquisition and maintenance of C4ISR-IOP by offering the opportunity to specialized industry to compete on this bid.

5.3.1.4 The main disadvantage of this approach is the additional complexity in the acquisition and integration of the two components. The role of by NCI Agency in the contractor coordination and system integration (in the PSC and IES) becomes more critical.

5.3.1.5 Assuming that Increment 3 will be acquired before 2025, it is envisaged that the Main Contractor for Increment 3 would be recommended as sole-source to the LC2IS INC-2 WP2 Contractor.

5.3.2 WP1: Upgrade LC2IS INC-1.1 Software

5.3.2.1 Thales Communications and Security (France) is the LC2IS INC-1.1 Manufacturer (references 8.1.3 and 8.1.4) and the company providing the maintenance on the LC2IS INC-1. Software.

5.3.2.2 Thales is the only company that can perform significant software modification in the LC2IS INC-1 software code due to the deep knowledge of it and the presence of libraries covered by Thales Intellectual Property Rights (IPR).

5.3.2.3 This work package is therefore recommended to be procured Sole Source by the LC2IS INC-1.1. Contractor.

5.3.2.4 Due to the urgency of the implementation of this work package, the plan is to proceed with a combined first and second stage authorization.

5.3.3   WP2: Implement LC2IS INC-2

5.3.3.1   According to the Solution Option Analysis described in section 2 and the recommended Option 2, this work package is recommended to be procured through International Competitive Bidding (ICB). In the ICB it is recommended to select the implementation contractor using the "Best Value" bid evaluation procedures, [References 8.5.8 and 8.5.9].

5.3.3.2   NCI Agency assessment is that this procurement approach (Option 2 in section 2) - by maximizing the competition - allows acquiring a more flexible technical solution and reducing the acquisition and O&M costs with respect to the other two options (Option 1 and Option 3) which are totally or partially based on an extension of the LC2IS INC-1 baseline.

5.3.3.3   Best Value procedure is recommended for WP2 due to the critical need to ensure the contractor will have all the required skills and the proven abilities to deliver an LC2IS capability that meets the requirements. The Best Value approach is a significant risk mitigation measure that will reduce the technical, schedule, and cost risks, as detailed in Section 5.8. The specification of the recommended 'Best Value' parameters are described in Annex G.

5.3.4   WP3: Implement C4ISR-IOP Component

5.3.4.1   NCI Agency submitted a Market Survey Questionnaire on the realization of the C4ISR-IOP component (LC2IS MSQ_01, reference 8.5.6). Based on the response received (Appendix F). NCI Agency assessment is that a limited number of companies are able to realize this component and that a large part of the required functionality is available as COTS product.

5.3.4.2   The recommendation is to procure it through International Competitive Bidding (ICB), using 'Best Value" evaluation procedure.

5.3.4.3   Best Value procedure is recommended for WP3 due to the critical need to ensure the contractor will have all the required skills and the proven abilities to deliver a C4ISR-IOP capability that meets the requirements. The Best Value approach is a significant risk mitigation measure that will reduce the technical, schedule, and cost risks, as detailed in Section 5.8. The specification of the recommended 'Best Value' parameters are described in Annex G

5.3.5   WP4: Procure COTS Equipment

5.3.5.1   COTS Equipment is assessed to be required to enable the implementation of LC2IS (WP2) and C4ISR-IOP (WP3).

5.3.5.2   To ensure that NATO is able to obtain the best possible purchase conditions for the necessary COTS hardware and software, NCI Agency will reserve the right to purchase COTS software items using existing NCI Agency Enterprise License Agreements, Standard Ordering Agreements (SOA) or other competitively awarded Indefinite Delivery Indefinite Quantity (IDIQ) contractual tools in place.

5.3.5.3   NCI Agency proposes to optimize cost and schedule by awarding COTS equipment to the cheapest compliant bidder between

- existing Enterprise Agreements, SOA or IDIQ as applicable
- evaluated options to the WP2, WP3 or WP5 Contractor for the all other procurement items: the WP3 contractor for any COTS required for the C4ISR-IOP component; the WP2 contractor for those required to LC2IS Core; WP5 for COTS Software Middleware.

5.3.5.4   This work package does not include any required hardware and software installation, which are included in WP3 for the COTS software related required for C4ISR-IOP, WP2 for those related to LC2IS Core and WP5 for the COTS Software Middleware.

5.3.6   WP5: Augment IT infrastructure capacity

5.3.6.1   NCI Agency assesses that specific knowledge is required on the Information Technology Modernization (ITM) infrastructure (reference 8.1.11) in order to efficiently realize this Work package.

5.3.6.2   NCI Agency recommends to procure WP5 as Sole Source by the ITM Project Contractor, which will provide all the rest of the IT Infrastructure.

5.3.7   WP6: Provide Independent Verification and Validation

5.3.7.1   Critical risks that need to be mitigated through the IV&V (see section 5.8) are related to the interdependencies between LC2IS INC-2 and the many Functional and Core Service Projects, which is one the main functions performed so far by the NSIP PMIC Contractor.

5.3.7.2   NCI Agency therefore recommends to procure this work package Sole Source by the PMIC Contractor (reference 8.1.13), which is providing the same services to all other Functional Services.

5.3.8   WP7: Augment the cyber-defence capability

5.3.8.1   This work package is recommended to be assigned sole-source to the contractor of the NCIRC Project, providing the same services for the IT infrastructure and other Functional Services. The NCIRC contractor is assessed the contractor that can perform this work package most efficiently.

5.3.8.2   LC2IS-side and overall integration and coordination are provided by the WP2 and WP-I contractors.

5.3.9   WP8: Support the integration of C4ISR-VIZ Component

5.3.9.1   This work package is recommended to be assigned sole-source to the contractor of the TRITON Project, responsible for the provision of the C4ISR-VIZ Component and the only contractor capable to deliver this Work package efficiently.

5.3.9.2   A contract option for the WP2 Contractor will be evaluated and included as risk mitigation measure for the risk of late or low quality delivery of the C4ISR-VIZ Component by the TRITON Project.

5.3.9.3   LC2IS-side and overall integration and coordination are provided by the WP2 and WP-I contractors.

5.3.10 WP9: Support the Integration of SOA Services

5.3.10.1   This optional work package is recommended to be assigned sole-source to the contractor of the SOA/IDM Project, which is the only contractor capable to perform this integration efficiently.

5.3.10.2   The work package is required only if the integration with LC2IS is not covered within the scope of the SOA/IDM Project, which includes an option for the integration with two Functional Services.

5.3.10.3   If required, a contract option for the WP2 Contractor will be evaluated and included as risk mitigation measure for the risk of late or low quality delivery of the SOA/IDM Services by the SOA/IDM Contractor.

5.3.10.4   LC2IS-side and overall integration and coordination are provided by the WP2 and WP-I contractors.

5.3.11 WP10: Upgrade C4ISR-VIZ Component for LC2IS

5.3.11.1 This optional work package is recommended to be assigned sole-source to the contractor of the TRITON Project, responsible for the provision of the C4ISR-VIZ Component and the only contractor capable to perform this task efficiently.

5.3.11.2 This work package is only required if the functionality of the C4ISR-VIZ Component delivered in the TRITON Project does not match the LC2IS requirements.

5.3.11.3 In case that the WP8 is assigned to the WP2 Contractor (risk mitigation action) this WP would also need to be assigned to the WP2 Contractor in order to implement a standard HMI in the absence of C4ISR-Viz.

5.3.11.4 LC2IS-side and overall integration and coordination are provided by the WP2 and WP-I contractors.

5.3.12 WP-I: Provide Internal Engineering Services (IES)

5.3.12.1 Due to its experience and role as Implementation Authority, NCI Agency is considered the best candidate, from a cost effectiveness point of view, for providing subject matter expertise and technical support on Land Functional Services as in the scope of the IES Work package.

5.3.12.2 This work package is recommended to be assigned Sole Source to NCI Agency.

5.3.13 WP-P: Provide Project Management and Support (PSC)

5.3.13.1 This work package is recommended to be performed by NCI Agency as the nominated Host Nation for this project.

5.4 Management of contractor performance

5.4.1 The Host Nation will take several measures to monitor Contractor performance so as to detect risks and issues early, and react as appropriate at the right management level in a timely manner.

5.4.2 Several measures will be "standard" e.g. monthly project review meetings at Project Managers' level, monthly Project Master Schedule (PMS) updates, establishment of risk and issue logs, design test and implementation milestones.

5.4.3 Several measures will be more "specific", such as:

5.4.3.1 the delivery scope split into three main product baselines: PBL-2, PBL-3A and PBL-3B (the final baseline). Each baseline includes one verification and validation event, appropriate to the purpose of the PBL. This approach enables the intermediate verification of contractor performance through one or two intermediate gates (corresponding to PBL-2 and PBL-3A) prior to the verification and validation of the final capability.

5.4.3.2 if required, the establishment of a project Steering Committee at Project Executive level, with representatives from Contractor senior management;

5.4.3.3 the activation of the support work package will be subject to Contractor performance.

5.5 Schedule & Milestones

5.5.1 The major milestones of the project are defined in Table 11.

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5.5.2   First stage authorisation of this TBCE is assumed in the 1st quarter of 2017. Subsequent milestones are shown relative to this first milestone (T1).

Milestone	Milestone Description	PIP	1st stage	Duration (mo)	Date
T1	1st Stage Authorization				Feb 2017
T2	2nd Stage Authorization			8	Oct 2017
T3	IFB Submission (ICB)			2	Dec 2017
T4	(Main) Contract Award			9	Sep 2018
T5	Provisional System Acceptance			24	Sep 2020
T6	Final System Acceptance			15	Dec 2021
T7	Project Completed			0	Dec 2021
T8	JFAI Request Submission			3	Jun 2022

Table 11 – Major Milestones

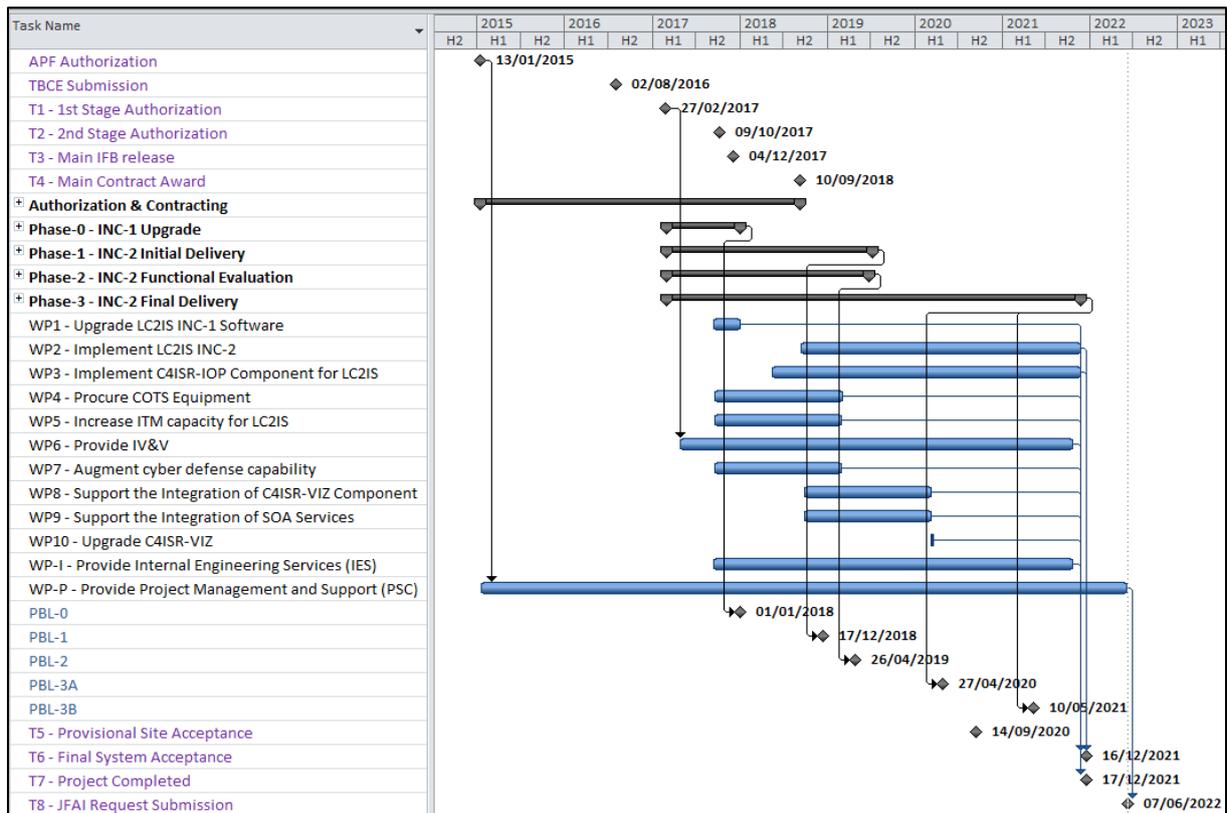5.5.3   The following GANNT chart shows the (simplified) Project Schedule and main milestones

Figure 17 –Project Schedule (simplified)

5.6 Dependencies

5.6.1 External dependencies

5.6.1.1 Operational stakeholders Involvement in Project activities

- Involvement by Users and other Operational Stakeholders in all key review, validation and acceptance events is essential to capture and manage requirements and expectations. The Land User Working Group (LUWG) will be used as the focal point for user involvement activities.

- Availability of users for the project training and mentoring activities according to plans is required to avoid schedule delays and to deliver the full project scope.

5.6.1.2 Revision of the existing DOTMLPFI (Doctrine, Organisation, Training, Materiel, Logistics, Personnel, Facilities, Interoperability) by Operational Stakeholders

- The revision of the DOTMLPFI and in particular the LC2IS Concept of Operation (CONOPS) and Standard Operational Procedures and Instructions (SOP, SOI) for LC2IS INC-2 is an essential prerequisite for the operational implementation and achievement of the FOC, which is a key outcome (but not an output) of this project.

5.6.2 Technical dependencies

5.6.2.1 The NATO SECRET Communication infrastructure - as provided by NATO General Communication Services (NGCS) will provide the communication between the fixed LC2IS sites.

5.6.2.2 Fixed Information System (CIS) infrastructure is required to implement LC2IS. Project 0IS03091 (Information Technology Modernisation, ITM), under CP9C0150 (ref. 8.1.11) is expected to deliver the fixed infrastructure (Datacentre's).

5.6.2.3 Deployable Communication and Information System (CIS) infrastructure is required to implement LC2IS. Project DCIS, under CP0A0149 (ref. 8.1.14 and 8.1.15) is expected to deliver the deployable CIS infrastructure.

5.6.2.4 Core Enterprise (software) Services and tools (under CPC0150) on the fixed infrastructure is required to implement LC2IS and to fully support the Land C2 Process (as described in section 3.2.4).

   1) Project 0IS03094 (Web enabling/Service Oriented Architecture services, SOA).

   2) Project 0IS03099 (Identity Management platform, IDM)

   3) Project IS03090 (NATO Messaging Service, NMS) (to be reviewed and confirmed)

   4) Project IS03095 (Enterprise Directory Services, EDMS)

   5) Project IS03098 (Geographical Information Service, GIS)

   6) Project IS03100 (NATO Information Portal Service, NIP)

   7) Project IS03101 (Service Management & Control, SMC)

   8) Project IS03102 (Information Exchange Services, IEG).

5.6.2.5 The following Bi-SC AIS Functional Service Project are required to fully support the Land C2 Process, complementing the LC2IS functionality, as described in section 1.12.

   1) Project TOPFAS

   2) Project LOGFS

   3) Project CBRN FS

   4) Project AirC2IS

   5) Project Triton (superseding MCCIS and MSA)

   6) Project INTEL-FS

   7) Project NCOP

8)   Project N-JTS (superseding JTS)

9)   Project Environment FS

5.6.2.6   The following COI Enabling Components are required to fully support the Land C2 Process, complementing the LC2IS functionality, as described in sections 1.12. and Figure 10

1)   Track Services (e.g. NIRIS)

2)   JOCWatch

5.6.2.7   The Bi-SC AIS reusable software component C4ISR-Viz (provided under the Project Triton (ref.8.1.16) is required to implement LC2IS.

5.6.2.8   The Bi-SC reusable software component C4ISR-IOP (as provided under this Project) will be reused by other Bi-SC AIS Functional Services such as AirC2IS and Intel-FS.

5.6.2.9   A roadmap, showing the time-based dependency of LC2IS INC-2 and the main projects identified above is depicted in the following figure.
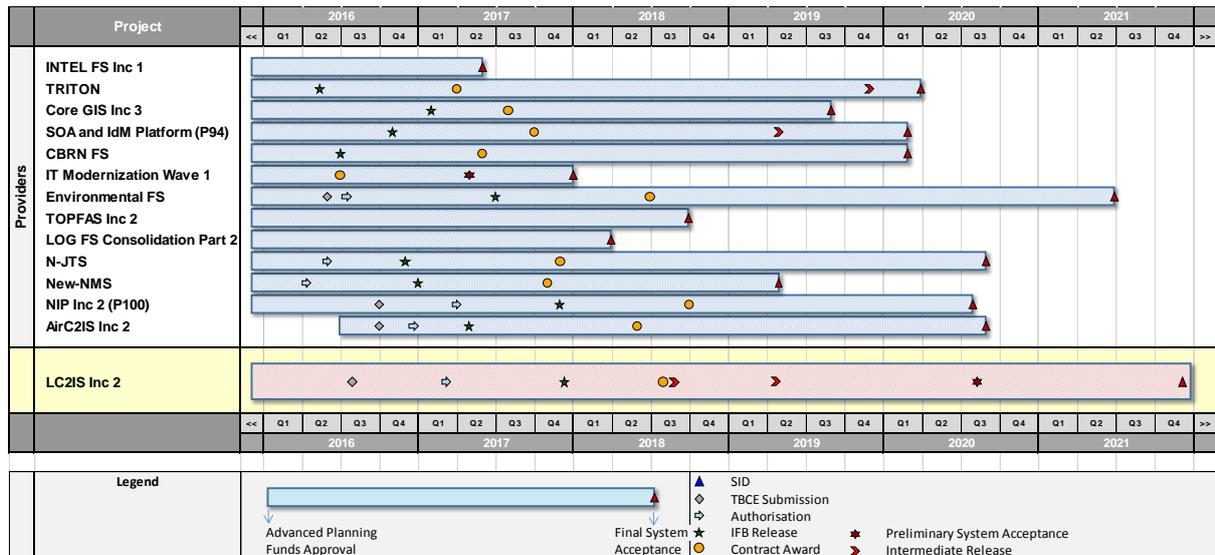
Figure 18 – Schedule Dependencies

5.7 Assumptions

5.7.1   Operational Stakeholder involvement

5.7.1.1   The required operational staff will be available in the LC2IS INC-2 training, mentoring and test evaluation events.

5.7.1.2   The operational requirements will be channelled and confirmed by the Requirement Owner, role that will be staffed and present in all relevant project events.

5.7.1.3   CONOPS, SOP and SOI definition and revision will be the responsibility of the OA (supported on request by Subject Matter Experts of the NCI Agency staff or Contractors).

5.7.2   Fixed CIS Infrastructure

5.7.2.1   The communication infrastructure provided by the NGCS will have adequate capacity to support the Quality of Service (QoS) required for LC2IS (based of the joint analysis done).

5.7.2.2   The fixed infrastructure (Datacentre's) will be provided timely with the LC2IS Implementation Plan.

5.7.2.3   The fixed infrastructure ('Datacentre's delivered by the ITM Project) will require to be augmented with regards to processing and storage capacity in order to support LC2IS QoS

5.7.3   Deployable systems

5.7.3.1   The deployable infrastructure (DCIS) will be provided timely with the LC2IS Implementation Plan.

5.7.3.2   The DCIS processing and storage capacity will be adequate to support LC2IS QoS (based of the joint analysis done).

5.7.4   Core Enterprise Services

5.7.4.1   The required Core Enterprise Services (as in section 5.6.2.4) will be provided also on the DCIS (project not identified).

5.7.4.2   The required Core Enterprise Services will be provided with adequate quality and timely with the LC2IS Implementation Plan.

5.7.4.3   For each of the required core services an alternative is identified before the final LC2IS Implementation Plan if such service is not available on time.

5.7.5   Bi-SC AIS Functional Services and reusable software components

5.7.5.1   The required Bi-SC AIS reusable software component C4ISR-Viz will be provided with adequate quality timely with the LC2IS Implementation timeline.

5.7.5.2   The reusable component C4ISR-Viz will support the HMI visualization (including the geospatial visualization) required by LC2IS. Its integration with LC2IS is part of the project scope.

5.7.5.3   The reusable component C4ISR-IOP should possibly need to be tailored to support the functionality and interoperability standards required by other Functional Services. Such tailoring is outside the project scope.

5.7.5.4   The required Bi-SC AIS Functional Services and reusable components will be provided with adequate implementation maturity.

5.7.5.5   The required Functional Services and reusable components will be provided timely with the LC2IS Implementation Plan.

5.7.5.6   For each of the required Functional Services and Reusable Software components an alternative is identified before the final LC2IS Implementation Plan if such service or component is not available on time.

5.7.6   Project Assurance

5.7.6.1   IV&V support will be provided through the existing Bi-SC AIS Programme Management and Integration Capability (PMIC) Project (ref. 8.1.13). Its cost is included in the cost estimate for WP6.

5.7.6.2   The PMIC facilities at NCI Agency will be available and used for integration, testing, and certification. The IV&V PMIC services will be provided by the PMIC Project under WP6.

5.7.7   Operation and Maintenance (O&M) of LC2IS Increment 1.1

5.7.7.1   The capability enhancement of LC2IS INC-1 (Mid-Life Software Upgrade, WP1) will be released, qualified, deployed and supported within the LC2IS INC-1.1. O&M Budget (Central ACO SLA). The MLU also includes the new MIP-BL3.1 Gateway.

5.7.7.2   An increase in LC2IS INC-1.1. O&M Budget is necessary to support the new MIP-BL3.1 Gateway.

5.8 Risk Overview

5.8.1   Approach

5.8.1.1   Risks encountered in the project will be addressed using the principles of Risk Management in Projects in Controlled Environments (PRINCE2) methodology. The Project Manager is responsible for establishing and maintaining the Risk Log and collecting new risks.

5.8.1.2   The Integrated Project Management Team (IPMT) reviews new risks and agrees to their impact, probability and mitigation measures. Significant new or changed risks will be elevated to the appropriate cross-stakeholder management group for assignment or direction.

5.8.1.3   A section of the detailed Project Management Plan is dedicated to risks and explains in detail how the IPMT will handle them.

5.8.2   Major Risks

5.8.2.1   The major risks identified and analysed at this stage (with probably "possible" or higher and impact "Major" or higher – red category) are summarized in Table 12. The complete risk log and the description of the response actions is reported in Appendix H.

ID	Description	Category	Prob	Impact	Response
R01	Requirement specification is modified or completed during the project life-time causing project delays and additional cost. This applies also to requirements or information products which have not been validated or approved.	Technical (Ext)	Very likely	Extreme	Reduce impact
R02	The two OT&V events – on the critical path - are required to be performed during yearly exercises. Any delay in the critical path (e.g. authorizations) may cause one year delay	Management	Likely	Major	Contingency Plan
R03	The C4ISR-Viz Component will be released late and/or with an incomplete/inadequate functionality for LC2IS causing delays and additional cost	Management (Ext)	Possible	Major	Reduce impact
R04	The required core services will be released late or with an incomplete/immature documentation or implementation causing delays and additional cost.	Management (Ext)	Possible	Major	Reduce impact
R04	The complex acquisition approach (involving more than 8 acquisition packages and companies) causes project delays due to stressed NCIA (PSC) capacity and synchronization issues	Management	Possible	Major	Reduce probability
R05	The lack of knowledge or of experience of the main Contractor causes project delays and/or additional cost	Management	Possible	Major	Reduce probability
R06	The unavailability of operational staff in the training, mentoring and test evaluation events causes project delays and/or prevents operational acceptance.	External (stakeholders)	Possible	Major	Reduce probability
R07	Core Enterprise Services are not available also on the DCIS platform causing delays and extra work (not a CP-149 programmed activity)	Management (Ext)	Possible	Major	Reduce impact

Table 12 –Main Project Risks

5.8.2.2   The 'Response' column indicates the type of response that is considered feasible within the project scope and is included in this TBCE request.

5.9 Project Governance

5.9.1   The project will be managed according to NCI Agency project management procedures, based on Projects in Controlled Environments (PRINCE2) methodology. A Project Board has been formed with NCI Agency staff representing, among others, the users and suppliers.

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5.9.2 The project structure has been established, including the associated Risk, Issue, and Quality Logs. Project tolerances have been established.

5.9.3 The LC2IS INC-2 Integrated Project Management Team (IPMT) will be set up, including NCI Agency Project Manager and System Manager, SHAPE J3 and J6 representatives, ACT C2DS representatives and any other as required. The IPMT will be the mechanism to regularly (or ad-hoc) review status, risk and issues for the project and coordinate solution options.

5.9.4 The NCIA Agency Project Board is composed of:

- Senior User: Representing the users, SHAPE J3 is the Senior User for this project. NCI Agency internal representation of the users is provided by Demand Management.
- Senior Supplier: The Implementation Contractor is the Senior Supplier for this project and responsible for delivering the required capability. NCI Agency internal representation of the supplier is provided by the Command and Control Service Line (C2SL).
- Executive: The NCI Agency will provide the Project Board Executive which will be the C2SL Chief.
- NCI Agency Service Strategy will be part of the Project Board to ensure technical conformity of the implementation and architecture to the relevant NATO standards.
- NCUI Agency C2SL (System Manager) representatives will ensure that O&M aspects are taken properly into account under a comprehensive life-cycle approach of the deployed capability.
- This project will be managed by a NCI Agency Project Manager with support from the IPMT. The Project Manager is responsible for management of this project through Final System Acceptance and Project Closure.

5.9.5 The key stakeholders for the project are provided in Table 13:

Role	Name	Title
ACT CAPCO	Jacobs STEVEN	Cdr, SACT
ACT MISPO	Keen NICHOLAS	Ltc, SACT SEE
ACO Senior User	Krysztof Grzeskowiak	Ltc. (POL-AR), J3, co-chair LUWG
NCIA Project Executive	Paul Howland	C2 Service Line (C2SL) Chief
NCIA Project Manager	Roberto Porta	C2SL, Principal Scientist
NCIA Senior Supplier	Ufuk Dirim	C2SL, Deputy Chief
NOR Expert	Marty Rudy	NOR expert

Table 13 – Key Stakeholders

5.10   Project Success Criteria

5.10.1 The success criteria for this project are defined in terms of the ability to deliver the integrated LC2IS capability in scope of time and cost, meeting the stakeholder requirements and managing any changes and exceptions that will occur during the project execution.

5.10.2 A checklist for declaring the project successful is the following:

a) The operational requirements have been met.

b) The scope is kept within the tolerances. Changes and exceptions are managed.

c) LC2IS is capable of exchanging information with other Functional Services.

d) The capability is ready to integrate seamlessly with existing Core Enterprise Services.

e) LC2IS is ready to successfully interoperate with National (Land C2) Systems according to the identified protocols and profiles.

f) LC2IS Inc. 2 replaced the current LC2IS system are declared operational after validation by users.

g) LC2IS achieves the Final System Acceptance.

6 Life Cycle Management

6.1 Life cycle plan

6.1.1   The scope of this TBCE includes and early deliverable (PBL-0 or MLU) that need to be supported before the Final System Acceptance (FSA) of LC2IS INC-2

- Additional maintenance and support is required for the new MIP BL-3.1. Gateway, part of the MLU.
- The maintenance and support of the other MLU component is estimated that can be covered within the "normal" INC-1 O&M activities.

6.1.2   The final Product Baseline of LC2IS INC-2 (PBL-3B) – which will replace LC2IS INC-1 – will be maintained and supported through the LC2IS INC-2 O&M. The existing services are planned to be decommissioned 3 months after the activation of the new capability.

6.1.3   LC2IS Increment 2 has an anticipated lifetime of ten years, which is the basis for the life cycle plan.

- A major technology upgrade is anticipated after five years to cope with technological obsolescence and maintainability. Such an upgrade is expected to be part of the LC2IS INC-3, part of the programmed scope of Capability Package CP9C0107.

6.2 Support Authority

6.2.1   Support is provided by NCI Agency as Service Provision Authority (SPA) after completion of the transition from the Implementation Authority (IA) and contractor and throughout the whole system lifecycle.

6.3 Concept of Support and Maintenance

6.3.1   The Support Concept is arranged around three distinct levels.

- The First Level of Support is the local, organizational unit operating the system, supported by local support staff.
- The Second Level of Support is formed by the Network Operations Centre, which implements the remote and Central Service Desks and employs the Purchaser's network and system operators and administrators.
- The Third Level of Support is formed by the Service Lines and their Subject Matter Experts (SME), Service Owners and System Managers, located at The Hague, Casteau/Mons, CSSC, NCISS and NPC.
- Technically, there is also a Support Level Zero. This is the end-user level and includes user self-help, interaction with the local Service Desk and user-level preventive maintenance tasks, such as simple cleaning of hardware and local data management.

6.3.2   The Maintenance Concept is arranged around four distinct levels.

- The First Level of Maintenance (non-specialized) is provided by the local support staff.
- The Second Level of Maintenance (specialized) is provided by specialized local support staff
- The Third Level of Maintenance (specialized) is provided at centralized locations by the Service Lines (Service Owners, System Managers, Subject Matter Experts) and vendor's Contractors.
- The Fourth Level of Maintenance is the OEM vendor or supplier level.

6.3.3   Details for the software support and maintenance concept are provided in Appendix J. These concepts will enable the implementation of the service operations processes (Incident Management, Problem and Event Management, Request and Access Management).

6.3.4 Regarding Software Maintenance during the O&M, LC2IS INC-2 regular (pre-planned) maintenance releases will be provided , if possible at fixed calendar dates according to current LC2IS INC-1 O&M and applicable NCI Agency directives

- At least one (major) software release, approved for deployment in February each year
- Possibly another (minor) software release, approved for deployment in June each year

6.3.5 The responsibilities for the support and maintenance functions are summarized in Table 14.

Support Component	During implementation	During warranty	After acceptance
1st level support (static env.)	Implem. Contractor(s)	NCIA Service Desk, NCIA CSU	NCIA Service Desk, NCIA CSU
1st level support (deployed env.)	Implem. Contractor(s)	NCIA Service Desk, NCISG	NCIA Service Desk, NCISG
2nd level support	Implem. Contractor(s)	NCIA Central Support	NCIA Central Support
3rd level and 4th level support	Implem. Contractor(s)	NCIA Central Support, Implem. Contractor(s)	NCIA Central Support [1]
Corrective and preventive maintenance	Implem. Contractor(s)	Implem. Contractor(s)	NCIA Central Support [1]
Adaptive and perfective maintenance	Implem. Contractor(s)	NCIA Central Support[1] [2]	NCIA Central Support[1] [2]
Mentoring Support	Implem. Contractor(s)	NCIA Central Support [1]	NCIA Central Support [1]
System Administrator training	Implem. Contractor(s)	NCIA Central Support[1] [2] NCIA/NCISS[3]	NCIA Central Support [1] [2] NCIA/NCISS[3]
User training	Implem. Contractor(s)	NCIA/NCISS [3], Command Trainers[4]	NCIA/NCISS [3], Command Trainers[4]
Trainer's training	Implem. Contractor(s)	NCIA/NCISS [5] Implem. Contractor(s) [5]	NCIA/NCISS [5], Implem. Contractor(s) [5]

Table 14- Support responsibilities

Table Notes

[1.]   With the support by the Implementation Contractor according to the existing LC2IS O&M Contract

[2.]   Depending from the scope of the Centralized Service Level Agreement

[3.]   Individual user training at NATO School or NCI Agency sites

[4.]   For ad-hoc user training at Command sites

[5.]   According to LC2IS SLA (training)

6.4 Warranty

6.4.1 All new or modified software (delivered in Work package 2 and Work package 3) will be covered by a warranty by the supplier for a period of 1 year after FSA. The warranty includes at least corrective maintenance of the software which will be delivered according to release and the deployment plan applicable NCI Agency directives.

6.4.2 All COTS software procured and delivered will be covered by a warranty by the supplier for a period of 1 year after delivery date. The warranty includes at least corrective maintenance as provided by its vendor.

6.4.3   All COTS hardware procured and delivered will be covered by a warranty by the supplier for a period of 2 years after the delivery date. The warranty includes the correction or replacement of malfunctioning hardware items.

6.5 Support Manpower

6.5.1   The table below describes the required support manpower, expressed in Full-Time-Equivalent (FTE) per year (where 1 FTE corresponds to 186 person-days, 7.6 hours per day).

Category			LC2IS INC-1 O&M (FTE)				LC2IS INC-2 O&M (FTE)									
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
LC2IS Core O&M																
SERVICE DELIVERY (NCIA Manpower)	**4.87**	**4.87**	**4.87**	**4.87**	**4.87**	**4.87**	**4.00**	**4.00**	**4.00**	**4.00**	**4.00**	**4.00**	**4.00**	**4.00**	**4.00**	**4.00**
Support Services (Level 2 and 3)	4.40	4.40	4.40	4.40	4.40	4.40	3.40	3.40	3.60	3.60	3.60	3.60	3.60	3.60	3.60	3.60
Training and Mentoring	0.47	0.47	0.47	0.47	0.47	0.47	0.60	0.60	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40
C4ISR IOP																
SERVICE DELIVERY (NCIA Manpower)	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**1.50**	**1.50**	**1.50**	**1.50**	**1.50**	**1.50**	**1.50**	**1.50**	**1.50**	**1.50**
Support Services (Level 2 and 3) - FTE	0.00	0.00	0.00	0.00	0.00	0.00	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30
Training and Mentoring	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Total	**4.87**	**4.87**	**4.87**	**4.87**	**4.87**	**4.87**	**5.50**	**5.50**	**5.50**	**5.50**	**5.50**	**5.50**	**5.50**	**5.50**	**5.50**	**5.50**

Table 15- Support manpower requirement

6.5.2   Three periods are identified in the table:

- LC2IS INC-1.1: current situation (2016-2017)
- LC2IS INC-1.1. O&M with MLU support (2018-2021)
- Full LC2IS INC-2 O&M (2022-2031)

6.5.3   Manpower support for each year consist of the following mix of skill categories (grades):

- Senior Expert (F1), for coordination and direction: 2 %
- Expert (F2), for system management and 3rd level support: 75 %
- Technician (F4), for 2nd and 3rd level support: 20 %
- Military Expert (F5), mainly for training/mentoring: 3 %

7 Project life cycle cost overview

7.1 Project cost table

7.1.1 Investment Cost

The summary of the investment cost estimated for the project is reported in the following Table. The cost breakdown for each work package is described in Appendix K.

Investment Cost (-0) - All Work Packages		
Work Packages	**Total Price Euro (€)**	**Procurement Strategy**
Work Package 1 - Upgrade LC2IS Increment 1 Software		
Project Management	€ 236,416	
Engineering and Design	€ 1,040,239	
Implementation	€ 341,324	Sole Source
Initial Support	€ 10,056	LC2IS INC-1 Contractor
Initial Support	€ 166,464	
Total Work Package 1	**€ 1,794,500**	
Work Package 2 - Implement LC2IS INC-2		
Project Management	€ 1,987,406	
Engineering and Design	€ 3,857,506	
Implementation	€ 5,094,281	IFB
Initial Support	€ 970,429	
Warranty	€ 238,249	
Total Work Package 2	**€ 12,147,871**	
Work Package 3 - Implement C4ISR-IOP Component for LC2IS		
Project Management	€ 318,534	
Engineering and Design	€ 341,770	
Implementation	€ 1,500,409	
Software	€ 3,075,930	IFB
Initial Support	€ 235,891	
Warranty	€ 491,662	
Total Work Package 3	**€ 5,964,196**	
Work Package 4 - Equipment		
Hardware	€ 130,974	
Software	€ 419,344	
Warranty	€ 52,759	BOA
Transportation	€ 16,510	
Total Work Package 4	**€ 619,586**	
Work Package 5 - ITM Increase IT Capacity for LC2IS		
Project Management	€ 11,249	
Equipment	€ 760,061	Sole Source
Warranty	€ 329,288	ITM Contractor
Total Work Package 5	**€ 1,100,598**	
Work Package 6 - IV&V		
Project Initiation Support	€ 15,388	
Engineering Support	€ 153,881	
Construction Support	€ 89,764	Sole Source
Transition Support	€ 36,675	
Other Support Activities	€ 169,506	
Total Work Package 3	**€ 465,215**	
Work Package 7 - Augment Cyber Defense Capability		
Project Management	€ 34,570	
Implementation	€ 82,204	Sole Source
Software	€ 27,833	NCIRC Contractor
Total Work Package 7	**€ 144,607**	
Work Package 8 - Support the Integration of C4ISR-VIZ Component		
Program Management	€ 27,302	Sole Source
Installation	€ 150,259	TRITON Contractor
Total Work Package 8	**€ 177,561**	
Work Package 9 - Support the Integration of SOA Services		
Program Management	€ 28,998	Sole Source
Installation	€ 177,328	SOA/IDM Contractor
Total Work Package 8	**€ 206,326**	
Work Package 10 - Upgrade the C4ISR-VIZ Component for LC2IS		
Consultancy to WP2 Contractor	€ 505,384	Sole Source
Total Work Package 10	**€ 505,384**	WP3 Contractor
Subtotal	**€ 23,125,845**	
Contingency 10%	€ 2,312,584	
Total - All Work Packages	**€ 25,438,429**	

Table 16- Investment Cost, All Work packages

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7.1.2 Internal Engineering Support (IES) Cost

7.1.2.1 The total cost is 242,221 € as detailed in the IES Cost Sheets and described in Appendix K.

7.1.3 Project Support Cost (PSC)

7.1.3.1 The scope and cost is split into five stages:

- Initiation, until 1st stage authorization
- Stage-A, until submission of IFB
- Stage-B, until validation of Functional Prototype Software (PBL 2)
- Stage-C, until Provisional System Acceptance
- Project Closure, until Final System Acceptance and completion of all required activities.

7.1.3.2 The total PSC is broken down into the five stages as summarized in Table 17, detailed in the PSC Cost Sheets and described in Appendix K.

WBS #	Work Package 8 - Provide Project Support Services	
	Name	Total €
1.1	**Project Initiation**	**164,640**
1.2	**Project Execution Stage-A (IFB)**	**496,945**
1.3	**Project Execution Stage-B (BL2)**	**1,242,483**
1.4	**Project Execution Stage-C (PSA)**	**662,568**
1.5	**Project Completion**	**923,299**
	TOTAL	**3,489,935**

Table 17- Project Support Cost (PSC)

7.2 Project expenditure profile

7.2.1 The project expenditure profile, including all project costs is reported in the following table.

Exp Profile (€) Timeframe	(-0) Investment	(-8) IES	(-9) PSC	Total
To Date	-	-	115,000	115,000
3Q 2016	-	-	22,012	22,012
4Q 2016	-	-	22,012	22,012
1Q 2017	-	-	139,543	5,616
2Q 2017	-	25,589	139,543	25,589
3Q 2017	-	12,794	139,543	12,794
4Q 2017	-	12,794	139,543	12,794
2018	3,403,925	56,123	723,137	6,863,974
2019	4,578,082	126,830	716,413	9,282,994
2020	9,360,975	143,853	576,042	18,865,803
2021	6,490,711	182,046	563,547	13,163,468
2022	1,604,736	-	193,602	3,209,472
Total	**25,438,429**	**560,030**	**3,489,936**	**29,488,395**

Table 18- Project Expenditure Profile

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7.3 Operation and Maintenance (O&M) costs

7.3.1   The following table shows the cost estimate for Operations and Maintenance of the capability affected by this project. The more detailed breakdown is reported in Appendix K.

WBS	Description	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	Total
1	LC2IS Increment 1.1 O&M	€ 1,461,555	€ 1,440,726	€ 1,537,648	€ 1,580,446	€ 1,488,481	€ 1,444,638											€ 8,953,494
1.1	Contractor	€ 689,028	€ 668,199	€ 749,670	€ 776,709	€ 668,669	€ 608,430											€ 4,160,705
1.2	Agency Costs Increment 1.1	€ 772,527	€ 772,527	€ 787,978	€ 803,737	€ 819,812	€ 836,208											€ 4,792,789
2	LC2IS Increment 2 O&M							€ 1,755,695	€ 2,328,312	€ 2,374,878	€ 2,464,325	€ 2,664,060	€ 2,563,884	€ 2,570,644	€ 2,622,057	€ 2,628,183	€ 2,846,854	€ 24,818,891
2.1	Contractor							€ 656,838	€ 1,167,157	€ 1,190,500	€ 1,214,310	€ 1,389,045	€ 1,263,368	€ 1,288,636	€ 1,314,408	€ 1,340,696	€ 1,533,617	€ 12,358,575
2.1.1	LC2IS Core O&M							€ 594,423	€ 627,231	€ 639,776	€ 652,571	€ 816,071	€ 678,935	€ 692,514	€ 706,364	€ 720,491	€ 901,008	€ 7,029,385
2.1.2	C4ISR IOP							€ 62,415	€ 539,926	€ 550,724	€ 561,739	€ 572,974	€ 584,433	€ 596,122	€ 608,044	€ 620,205	€ 632,609	€ 5,329,190
2.2	Agency Costs Increment 2							€ 1,098,857	€ 1,161,155	€ 1,184,378	€ 1,250,015	€ 1,275,015	€ 1,300,515	€ 1,282,009	€ 1,307,649	€ 1,287,486	€ 1,313,236	€ 12,460,316
2.2.1	NCI Agency Manpower							€ 1,098,857	€ 1,161,155	€ 1,184,378	€ 1,250,015	€ 1,275,015	€ 1,300,515	€ 1,282,009	€ 1,307,649	€ 1,287,486	€ 1,313,236	€ 12,460,316
2.2.2	C4ISR IOP							€ 288,668	€ 303,746	€ 309,821	€ 325,698	€ 332,212	€ 338,856	€ 335,360	€ 342,068	€ 338,221	€ 344,985	€ 3,259,636
	Total	€ 1,461,555	€ 1,440,726	€ 1,537,648	€ 1,580,446	€ 1,488,481	€ 1,444,638	€ 1,755,695	€ 2,328,312	€ 2,374,878	€ 2,464,325	€ 2,664,060	€ 2,563,884	€ 2,570,644	€ 2,622,057	€ 2,628,183	€ 2,846,854	€ 33,772,385

Table 19- O&M Costs

7.3.2   The following should be noted

- O&M for LC2IS INC-1.1.is planned to be continued until 2021.
- The additional O&M cost in the 2018-2019 period is related to the maintenance and support of the new MIP BL3.1 Gateway (included in PBL-0, MLU).
- The full O&M for LC2IS INC-2 will start in 2022, after FSA and short (max three months) transition from INC-1.1..
- A Mid-Life Update of LC2IS INC-2 for a technology refresh is estimated as required in 2027

7.4 Life cycle costs

7.4.1   The following table and chart show the 15-year life cycle costs for the capability affected by this project.

| LifeCycle Costs (€ K)	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	Total
O&M for Existing LC2IS Services	€ 689	€ 668	€ 750	€ 777	€ 669	€ 608											€ 4,161
O&M for New LC2IS Services							€ 594	€ 627	€ 640	€ 653	€ 816	€ 679	€ 693	€ 706	€ 720	€ 901	€ 7,029
O&M C4ISR IOP				€ -	€ -	€ -	€ 62	€ 540	€ 551	€ 562	€ 573	€ 584	€ 596	€ 608	€ 620	€ 633	€ 5,329
Tech Refresh											€ 150					€ 166	€ 317
PSC	€ 159	€ 558	€ 723	€ 716	€ 576	€ 564	€ 194										€ 3,490
LC2IS Increment 2 NSIP Project	€ -	€ -	€ 3,404	€ 4,578	€ 9,361	€ 6,491	€ 1,605										€ 25,438
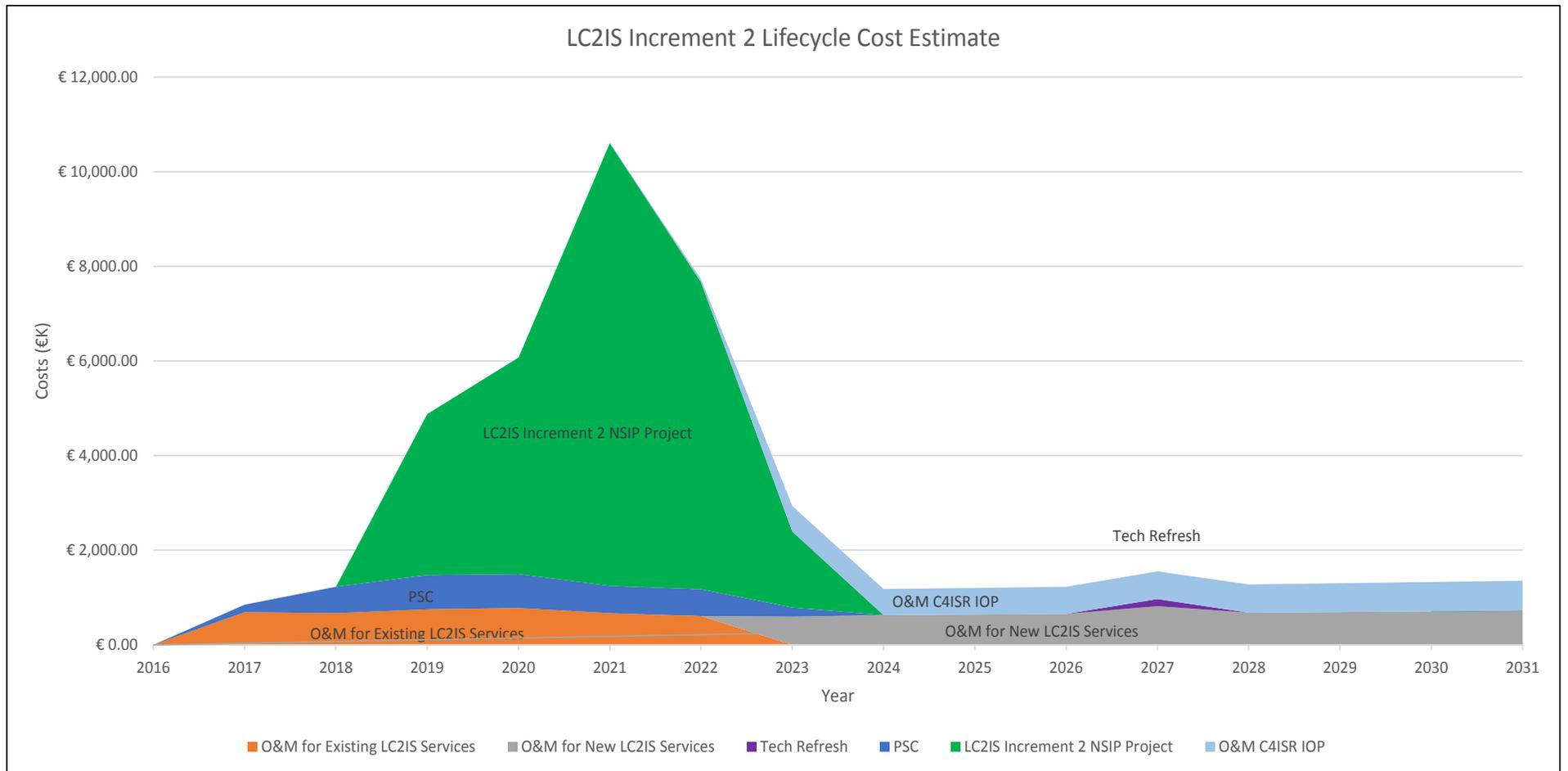
Table 20- 15-years Life Cycle Cost

7.4.2   Legend for graph:

- Investment cost for the Implementation the new capability (LC2IS INC.2, including also C4ISR-IOP): green colour

- Project Support Cost for the Implementation the new capability (LC2IS INC.2, including also C4ISR-IOP): dark blue colour

- O&M Cost for the existing capability (LC2IS INC.1.1), including only contractor cost: orange colour

- O&M Cost for the new capability (LC2IS INC.2, including only contractor cost, not including C4ISR-IOP): grey colour

- O&M Cost for the new C4ISR-IOP Component, including only contractor cost: light blue colour

- Additional O&M cost for a Mid-Life-Update (Tech refresh) of LC2IS INC-2: purple colour

8 References

8.1 CP Related

8.1.1 AC/4(PP) N (2012)0020 "Capability Package 9C0107 – Functional Services for Command and Control of Operations - Capability Package Implementation Plan (PIP)", dated 21 February 2012.

8.1.2 Bi-SC letter "Delivery of Land Command and Control Information Services Increment. 1.1 to cover NATO Command Structure sites", dated 04 June 2013.

8.1.3 AC/4-DS (2005)0018 – First stage authorization of project "Land C2 Functional System" (serial. 1999/5HQ00592), dated 22 June 2005.

8.1.4 AC/4-DS (2011)0023 – First stage authorization of project "Provide LC2IS to ISAF and applicable NATO Commands" (serial. 1999/5HQ00592), dated 12 September 2011.

8.1.5 AC/4-DS (2011)0023 - Authorization of funds for project "Provide LC2IS to ISAF and applicable NATO Commands" (serial. 1999/5HQ00592), dated 12 September 2011.

8.1.6 AC/4-DS (2013)0027 - Authorization of additional scope for project "Provide LC2IS to ISAF and applicable NATO Commands" (serial. 1999/5HQ00592, NCS Phase-1), dated 6 May 2014.

8.1.7 AC/4-DS (2014)0010 - Authorization of additional scope for project "Provide LC2IS to ISAF and applicable NATO Commands" (serial. 1999/5HQ005920, NCS Phase-2), dated 26 November 2013.

8.1.8 AC/322-N(2011)0154 "Capability Package 9C0150 Core Information Services for Command and Control", dated 7 September 2011

8.1.9 ACT 5000/TSC MFX-0280/TT-140412/Ser:NR0096 "Capability Package 0A0149R01, Rev-1', dated 19 December 2014

8.1.10 NCCB Budget 2016 - Centralized Service Level Agreement (CSLA) – 2.2 LC2IS

8.1.11 CP 0A0104 NATO General Communication Services (NGCS)

8.1.12 CP9C0150, Projects 0IS03091, 0IS03092 and 0IS03101, Information Technology Modernization Project (ITM)

8.1.13 CP 9C0150 – Programme Management and Integration Capability (PMIC) Project 5IS03027

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8.4 Architectural References

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Appendices

NATO UNCLASSIFIED

A. User Operational Requirements

(See separate document)

B. Information Products

(See separate document)

C. Interoperability with other FS's

(See separate document)

D. Non-Functional Requirements

(See separate document)

E. Analysis of Implementation Options

(See separate document)

F. C4ISR-IOP Component

(See separate document)

G. ICB Best Value Calculation

(See separate document)

H. Risk Analysis

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NATO UNCLASSIFIED

I. Project Work Breakdown

(See separate document)

J. Software Maintenance and Support

(See separate document)

K. Implementation Cost Estimate

(See separate document)

L. Life Cycle Cost Estimate

(See separate document)

M. Acronyms

(See separate document)