Serial	Requirement	Scope
1	Project Management Review (PMR)	Project (initial)
2	Project Checkpoint Review (PCR)	Project (monthly)
3	System Requirements Review (SRR)	System level
4	Preliminary Design Review (PDR)	System level
5	Critical Design Review (CDR)	System level
6	Software Requirements Review (SwRR)	Each SW Build Process
7	Software Design Review (SwDR)	Each SW Build Process
8	Hardware Requirements Review (HwRR)	HW Build Process
9	Hardware Design Review (HwDR)	HW Build Process
10	Hardware Production Readiness Review (PRR)	HW Build Process
11	Test Readiness Review (TRR)	Prior to each test event
12	Sustainment Qualification Review (SQR)	For each Build Process
13	Training Readiness Review (TrRR)	Prior to each training course
14	Site Acceptance Review (SiAR)	At each Site Installation
15	Organizational Node Activation Review (ONAR)	At each Node Activation
16	Provisional System Acceptance Review (PSAR)	After BL3 and 4 delivery.
17	Operational Test Readiness Review (OTRR)	Build Process 2, 3, 4
18	Transition Readiness Review (TrRR)	Build Process 2 and 3
19	In-Service Review (ISR)	During OT&E, system level
20	Monthly Maintenance Review (MMR)	During OT&E
21	Component Acceptance Review (CAR)	At the end of WP4
22	System Verification Review (SVerR)	For each Build Process
23	System Validation Review (SVR)	During OT&E, system level
24	COTS Products Review (COTSPR)	Optional WP

3.16.4.2. The Contractor shall define the Entry and Exit Criteria (see Paragraph 3.3.8) in the related plans in which the reviews are defined. The Purchaser has the right to redefine the proposed criteria.

3.16.4.3. At least two (2) weeks before each Formal Review, the Contractor shall send an invitation to the participants and an organization paper, including as a minimum the following:

- Purpose
- Agenda
- List of participants
- Date, time, location of the Formal Review

3.16.4.4. Upon Purchaser's approval, Formal Reviews can be combined with other meetings or reviews to increase time efficiency. The Contractor may propose optimal dates and schedule considering official holidays and availability of staff.

3.16.4.5. Attendance in person is preferred but video or telephone conferences may be accepted by the Purchaser if a review meeting is deemed to be too short to justify travel.

3.16.5. User Assessment Reviews

3.16.5.1. User involvement in early stages of the development is highly beneficial to correctly understand the user needs and design the software accordingly, especially the user interface. User reviews play a crucial role in providing feedback to designers. The Purchaser will therefore organise User Assessment Reviews (UAR) during each phase of software implementation to assess an implementation product or part of the system under development.

3.16.5.2. During the UAR, participants will review a specification document or a mock-up, or work on a pilot system to provide initial feedback.

3.16.5.3. The Contractor shall support UARs by:

- Preparing a demonstration using the available system capabilities,
- Preparing a scenario to demonstrate the system functions,
- Preparing document reviews,
- Collecting feedback and user comments on the assessed parts of the system or the reviewed product.

3.16.5.4. UAR will be conducted at the Purchaser's PMIC facilities for a duration of three (3) days.

3.17. Project Highlight Report

3.17.1. The Contractor shall provide, no later than the third working day of each month, a Project Highlight Report (PHR). This report shall summarise the activities stated in Table 3-4.

Table 3-4 – PHR Content

Serial	Requirement
1	Summary of contract activities during the preceding month, including the status of current and pending Work Packages
2	Progress of work and schedule status, highlighting any changes since the preceding report
3	Status of action items and decisions
4	Description of any identified problems, anomalies and high risk areas with proposed solutions and corrective actions
5	Test(s) conducted and their results
6	Provisional financial status and predicted invoices
7	Changes in key Contractor personnel, as approved by the Purchaser
8	Summary of Change Requests requested, recommended or approved
9	Summary of any Site Surveys or other analysis conducted
10	Report on maintenance calls by number, type, and actions taken
11	Plans for activities during the following reporting period

3.17.2. Progress of work and schedule status shall include application of Earned Value Management and provide information to measure progress and performance, including the actual cost incurred by the Contractor under this Contract. Following elements shall be provided based on the data delivered in the WBS:

- Budgeted Cost of Work Scheduled (BCWS)

- Budgeted Cost of Work Performed (BCWP)
- Actual Cost of Work Performed (ACWP)
- Forecast of Remaining Work (FCST)
- Budget at Completion (BAC)
- Estimate to Complete (ETC)
- Schedule Variance (SV)
- Cost Variance (CV)
- Schedule Performance Index (SPI)
- Cost Performance Index (CPI)

3.17.3. The Contractor shall prepare the PHRs as documents and maintain an archive of PHRs on the Project Website.

3.18. Project Status Assessment

3.18.1. The project will be continuously assessed by the Purchaser through a series of control points. These control points are certain events like Milestones in addition to monthly Project Checkpoint Reviews.

3.18.2. Milestones

3.18.2.1. Milestones are the certain events that are held at the end of each development phase to provide visibility to system-wide issues, synchronise the management and engineering perspectives and verify that the goals of the phases have been achieved. SRR, PDR, CDR, TRR, FAT, OTRR, SVT are examples to Milestones. Some Milestones are system-wide (SRR, PDR, CDR, SVR) while some are at Work Package level.

3.18.2.2. Build Process Milestones such as SwRR, SwDR, FAT, SiAR focus the detailed content for a defined scope.

3.18.2.3. The Contractor shall clearly identify in the Project Master Schedule all Milestones identified in this SOW and the Work Packages.

3.18.3. Checkpoints

3.18.3.1. Checkpoints are the selected Milestones or events in the Project Master Schedule used to ensure that the project status is on agreed track. They have clear expectations and tangible results.

3.18.3.2. The Contractor shall clearly identify the Checkpoints and the associated Milestones stated in this SOW in the Project Master Schedule.

3.18.4. Checkpoint Assessment

3.18.4.1. The project will be assessed at each Checkpoint by the Purchaser based on the associated Milestones.

3.18.4.2. “Status Indicators” as traffic lights, Red-Amber-Green colours, will be used to visually indicate the status of the associated Milestones at the time of assessment. A Status Indicator will be assigned to each Milestone according to the amount of schedule deviation as defined in Table 3-5:

Table 3-5 – Status Indicators for Milestones

Milestone Deviation	Description	Status
0 - 15 days	The Milestone is achieved earlier than the scheduled date or within fifteen (15) days behind the schedule.	Green
15 - 30 days	The Milestone is achieved between fifteen (15) and thirty (30) days behind the schedule.	Yellow
More than 30 days	The Milestone has not been achieved yet although it is more than thirty (30) days behind the schedule.	Red

3.18.4.3. The Purchaser will decide which Status Indicator will be assigned to the Milestones at the time of the Checkpoint assessment.

3.18.4.4. A Checkpoint will be assessed by the Purchaser. The result of the assessment shall be one of the following:

- Success: All associated Milestones are achieved on time.
- Provisional Success: One or more Milestones are not fully achieved. They are recognised as in progress and will be completed within an agreed schedule. The pending items will be reassessed during other PCRs and the status of the Checkpoint can be set to Success.
- Fail: The status of one or more Milestones are not acceptable for the Purchaser. The assessment have to be repeated according to a revised plan. Contractual leverages shall apply.

3.18.4.5. A Checkpoint Assessment may also include warnings to the Contractor, describing the risk areas and subjects to be improved. Warnings can be issued by the Purchaser within a Formal Notification (see Paragraph 3.18.7).

3.18.4.6. Checkpoint Assessments will be in the form a review meeting of the Purchaser and the Contractor. The first PCR after the associated Milestone can be used for Checkpoint Assessment.

3.18.4.7. The Purchaser will use the result of the Checkpoint Assessment to activate other Work Packages.

3.18.5. Contract Phases

3.18.5.1. The Contract Schedule is divided into logical phases called “Contract Phases” in order to assess the performance of the Contract.

3.18.5.2. The Contract Phases are identified in Work Package 1, Project Management.

3.18.5.3. The Purchaser will commit the Contract phase by phase (not as a whole). As such, each Contract Phase is bound to certain Milestones, a Checkpoint and a payment plan.

3.18.5.4. The transition between the Contract Phases are achieved by means of “Decision Gates”.

3.18.6. Decision Gates

3.18.6.1. Decision Gates are used to transition between stages of a project as defined in AAP-20, Section 3. The decisions made at each of the gates may be to (see Figure 6):

- execute the next stage,

- continue this stage,
- go to a preceding stage,
- terminate the programme/project (life cycle),
- hold programme/project (life cycle) activity.

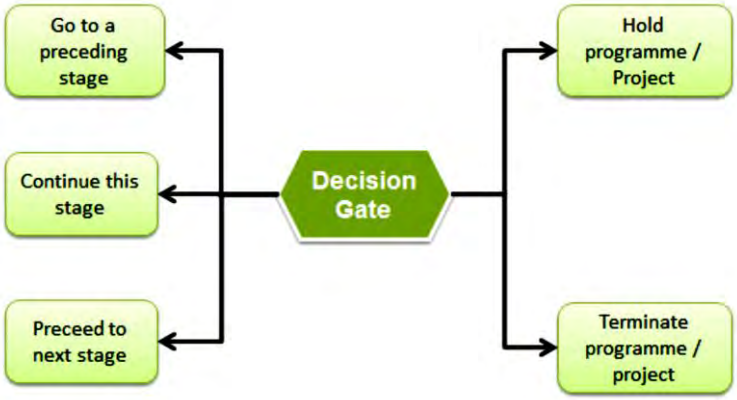


Figure 6 – Decision Gate (AAP-20)

3.18.6.2. Decision Gates mark the milestones and the steps from one Contract Phase into the next. They are mapped to Checkpoints where past work is mature and validated, future work is agreed upon and lessons learned are captured in the Lessons Log and Lessons Report is prepared.

3.18.6.3. Decision Gates may be in the form of review meeting of the Purchaser and the Contractor. The first PCR after the associated Milestone can be used for Decision Gate assessment.

3.18.6.4. The Decision Gates for the TRITON Contract are identified in Work Package 1, Project Management.

3.18.6.5. The Purchaser will define the Entry, Success and Fail Criteria for each Decision Gate and provide them to the Contractor at the last PCR prior to the Decision Gate. The default criteria are defined in the Work Package 1.

3.18.6.6. The Purchaser can use the Decision Gates as break-points at which there will be administrative decision about whether or not continuing the project by executing the next phase. The Purchaser has the right to re-assess if the Contract and the capability it implements is still in NATO's best interest. If not, the Contract will be terminated and Premature Close-out procedure (see 3.19.2) will be activated.

3.18.6.7. A Decision Gate will be assessed by the Purchaser using the Success and Fail Criteria. The result of the assessment shall be one of the following:

- Success: All items in the Success Criteria are met. The Purchaser will commit for the next Contract Phase.
- Provisional Success: One or more items of the Success Criteria are not fully achieved. They are recognised as in progress and will be completed within an agreed schedule. The Purchaser will commit for the next Contract Phase or wait until completion of all identified items. The pending items will be reassessed during other Checkpoints and the status of the Decision Gate can be set to Success.

- Fail: One or more items of the Fail Criteria are met. This Decision Gate can be a break-point for the Contract. The Purchaser may choose not to commit the next Contract Phase. A Cure Plan may be applicable, or the Contract may be terminated.

3.18.6.8. The result of the Decision gate assessment will be a written document signed by the Purchaser formalising the decisions made, or any other form that is deemed appropriate for the project.

3.18.7. Formal Notification

3.18.7.1. The Purchaser may inform the Contractor about certain subjects which are deemed to be not compliant to the contractual requirements and cannot be acceptable. Continuous delays, inefficient plans, unacceptable quality of services, inappropriate project organization are examples to reasons that lead to Formal Notification.

3.18.7.2. A Formal Notification may include one or more warnings to the Contractor, which may have indication levels as “Minor”, “Medium” or “Major”.

3.18.7.3. The Purchaser may use the “Formal Notification” to inform the Contractor in writing about the unacceptable conditions of the Contract based on the status assessment at Checkpoints prior to a Decision Gate.

3.18.7.4. Formal Notifications may have impact on the decision taken by the Purchaser at the Decision Gate.

3.19. Contract Close-out

3.19.1. Planned Closure

3.19.1.1. Planned Contract Close-out occurs after all products and services provided by the Contractor have been accepted by the Purchaser.

3.19.1.2. The Contractor shall finalise all plans such as PMP, CMP, QP, STrP, ISP and ISSP, and all records such as Risk, Issue Register and Lessons Log.

3.19.1.3. The Contractor shall apply the project closure practices as defined in PRINCE2.

3.19.1.4. The Contractor shall plan a Contract Close-out Meeting (CCM) to review all products and services are delivered, and all activities are successfully completed.

3.19.1.5. Contract Close-out Meeting (CCM) and its report shall mark the End of Contract.

3.19.2. Premature Closure

3.19.2.1. Premature Close-out occurs when the Purchaser decides to close the Contract at an earlier phase than the FSA. It does not mean that the work in progress is not simply abandoned, but that the project salvages anything of value created to date and checks that any gaps left by the cancellation of the project are clearly defined.

3.19.2.2. Upon the decision on premature close-out, the Contractor shall:

- Update the Project Plan with actuals from the final phase.
- Identify the status of the Developmental Items under development.
- Identify the work that has not started yet.
- Identify the products already developed.

- Agree the means for recovering products that have been completed or are in progress (if appropriate).
- Develop an Exception Plan to include additional work to create, make safe or complete products that needs to be delivered to the Purchaser.

3.20. Other Project Management Work

3.20.1. Other work that the Contractor shall perform as specified under appropriate Work Packages under the Project Management Task Area includes:

3.20.1.1. Project and security risk analysis.

3.20.1.2. Adapting the Requirements Management.

3.20.1.3. Attending to Purchaser meetings or conferences and giving briefs.

3.20.1.4. Preparation of Project Information Materials such as brochures, white papers, posters and a video presentation.

3.20.1.5. Preparation and maintenance, in coordination with the Purchaser, of a project Lessons Log, project Risk Register and Issue Register.

SECTION 4: TECHNICAL

4.1. General

4.1.1. This section outlines the Technical Task Area of the TRITON Contract.

4.1.2. The Contractor shall design, implement, integrate, test, and deliver the TRITON capability including software and hardware. Furthermore, the Contractor shall provide engineering and operational support for the TRITON capability.

4.1.2.1. The Contractor shall refine the system requirements based on an analysis and a fine-tuning of the Purchaser's functional and non-functional requirements provided in the Contractual SRS; design and develop system elements, adapt and integrate the system elements and components to establish the TRITON Product Baseline; and plan and execute a series of tests to confirm that this baseline meets the functional and non-functional requirements.

4.1.2.2. The Contractor shall provide continuing engineering for the TRITON capability, which shall include analysing the cost and performance impacts on the TRITON Product Baseline of changes in OTS components or system requirements, integrating approved changes, and planning and conducting follow-on tests.

4.1.2.3. The Contractor shall integrate the TRITON capability with existing NATO systems and interfaces, deploy and prepare it for operation as part of the NATO Communications and Information Systems (CIS).

4.1.2.4. The Contractor shall install the TRITON software to Purchaser-designated facilities in close coordination with the Purchaser’s staff.

4.1.2.5. The Contractor shall install a Deployable Kit on board a selected ship in close coordination with the Purchaser’s staff.

4.1.2.6. The TRITON capability shall be made available to its users as a Web-based application running on the existing NATO SECRT Wide Area Network and (NSWAN) and NATO UNCLASSIFIED Network. Stand-alone operation with limited capabilities shall be provided to support Afloat Command Platforms (ACP) in case network connectivity fails during operation at sea.

4.1.2.7. TRITON shall consist of a combination of custom-developed, off-the-shelf (whether commercially available or developed for other customers), and potentially, adaptations of Purchaser-provided prototypes and systems.

4.1.2.8. TRITON shall be built following a Component-Based Framework (CBF) approach for reusability of components and a Service Oriented Architecture (SOA) to provide for flexibility, scalability and agility, to minimise the impacts of future modifications to accommodate changes in other NATO systems and interfaces, as well as changes in the products and technologies employed in the TRITON capability.

4.1.3. As authorised by the Work Packages, the Contractor shall be responsible for the overall design, implementation, integration, and system engineering of the TRITON capability throughout all Product Baselines delivered under this Contract.

4.1.4. The Contractor shall be responsible for delivering the items and services described in this SOW and its Annexes. Any conflict shall be resolved with the Order of Precedence defined below:

4.1.4.1. Precedence 1 - SOW Work Package Requirements: Describe what the deliverables are, when they will be delivered.

4.1.4.2. Precedence 2 - SOW Requirements: Describe how the deliverable item will be prepared and delivered.

4.1.4.3. Precedence 3 - SRS Requirements: Describe the system element functions.

4.1.4.4. Precedence 4 - SRS Descriptions: Define and clarify the system element functions.

4.1.5. The Final System Acceptance (FSA) shall be achieved when all system and project requirements are met, all services are delivered.

4.2. System Life Cycle Processes

4.2.1. The Contractor shall apply the system life cycle processes as defined in AAP-48 referencing to ISO/IEC 15288 under [STANAG 4728].

4.2.2. The AAP-20 defines, based on the ISO/IEC 15288 system definition and its general life cycle model, the customer (NATO, Agencies, Nation or Groups of Nations) system concept and the necessary skeleton (stages) for the life cycle. The appropriate Decision Gates mark milestones and the steps from one stage into the next. The big picture given in Figure 7 shows the relationship and dependencies between the documents and major elements of the system life cycle concept.

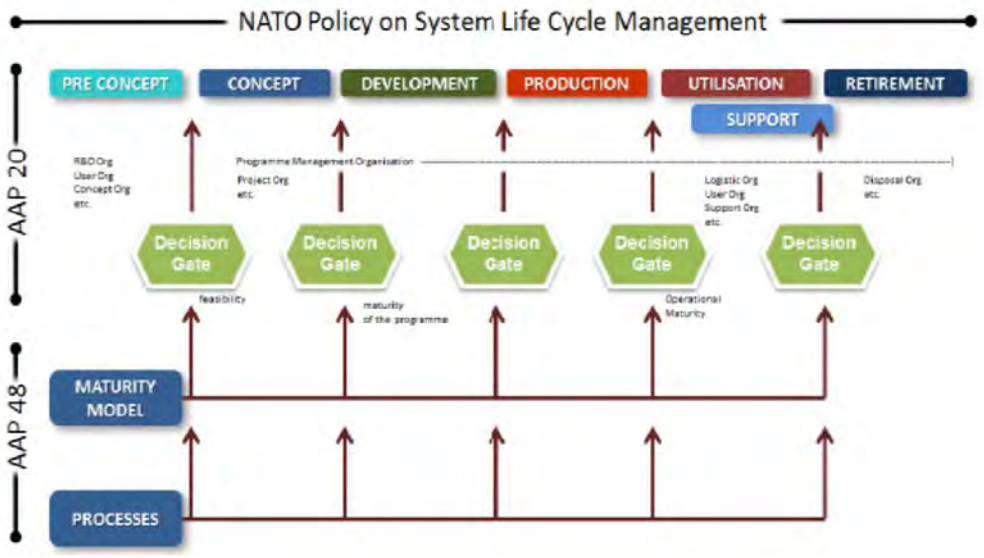


Figure 7 – NATO Policy on System Life Cycle (AAP-20)

4.2.3. The NATO Policy on Life Cycle Management provides the frame for all system life cycle elements and linked these with the industrial life cycle framework described in ISO/IEC 15288. The Development Stage and Production Stage are covered within this Contract with overlaps on Utilisation Stage. The mapping of overall life cycle of AAP-20 onto the TRITON life cycle is depicted in Figure 8.

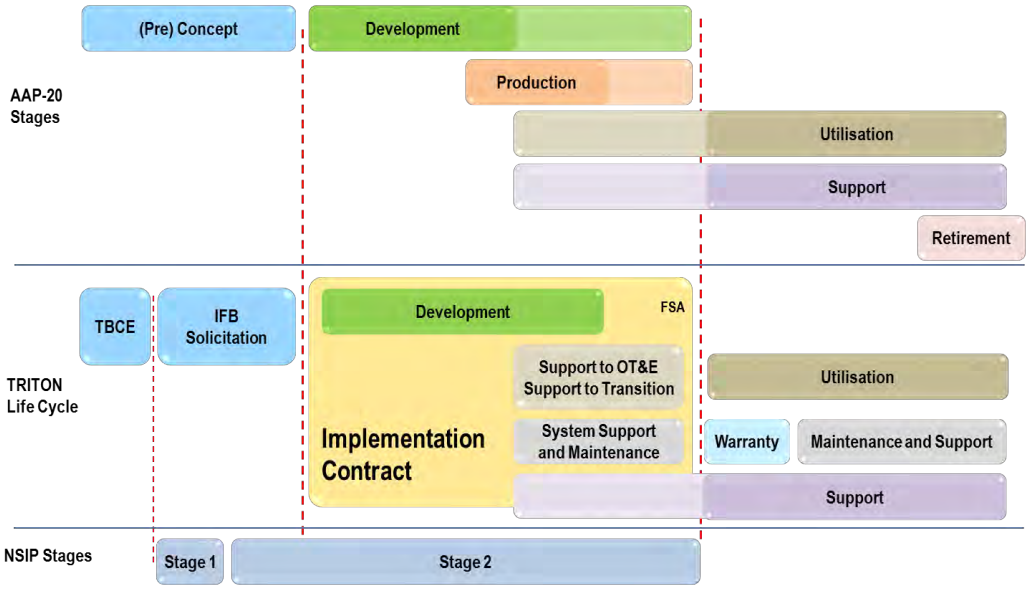


Figure 8 - Life Cycle Mapping

4.2.4. The Contractor shall apply the system life cycle activities defined in this Contract.

4.2.5. The Contractor shall construct software (and produce hardware) at his own or his sub-contractor's premises. After the internal software construction is completed with internal unit tests, the System Verification and Transition Process will start. This process is defined in this SOW and also depicted in Figure 9.

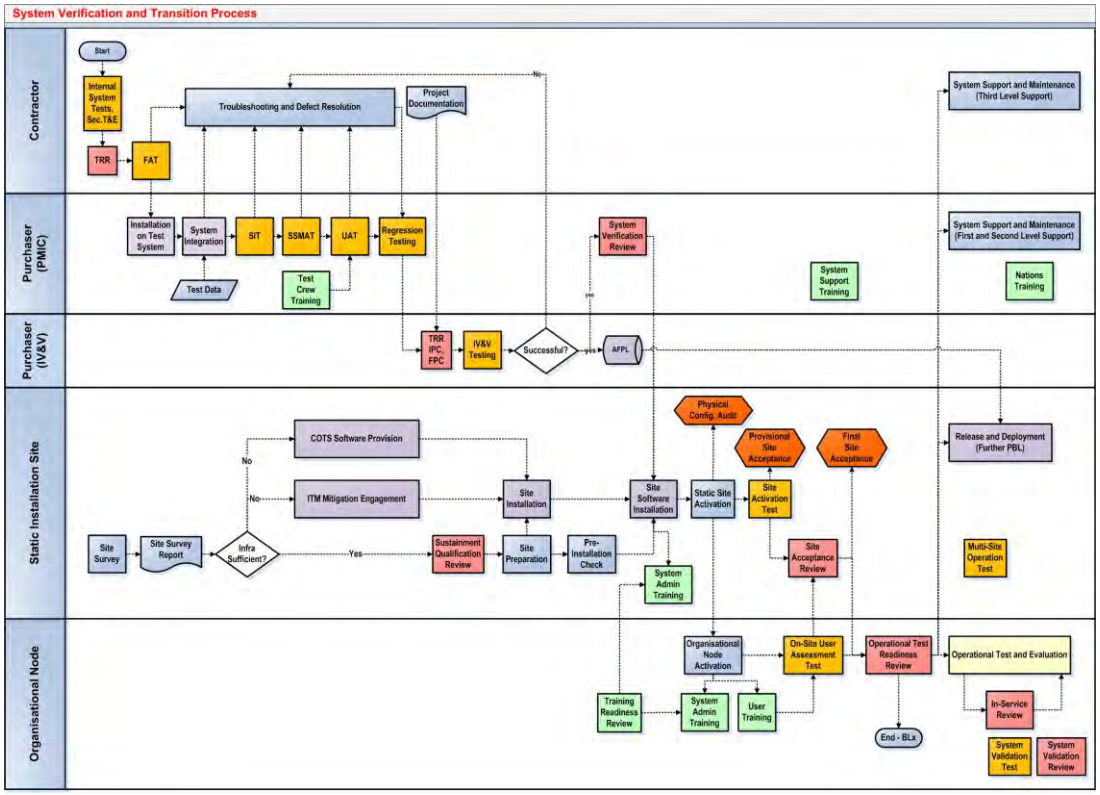


Figure 9 – System Verification and Transition Process

4.3. Incremental Development Methodology

4.3.1. General system life cycle approach and terminology as defined in AAP-48 (referring to ISO/IEC 15288) shall be used during the realisation of TRITON. A summary of the general system life cycle processes to implement TRITON capability is given in Figure 10.

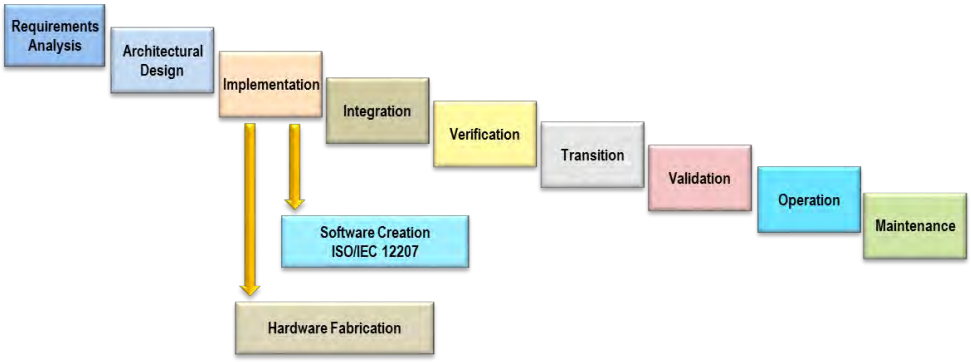


Figure 10 – System Life Cycle Processes

4.3.2. The Contractor shall deliver TRITON using an Incremental Development Methodology. Each increment shall be identified as a "Build Process" which shall be realised using Waterfall Methodology. Software shall be developed using the software life cycle processes as defined in ISO/IEC 12207. A summary of the general software life cycle processes to be used for each Build Process are given in Figure 11.

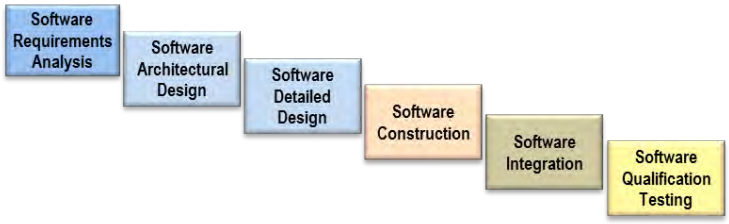


Figure 11 - Software Life Cycle Processes

4.3.3. The Contractor shall group the system requirements and assign the groups to a Baseline to be developed in a Build Process. After developing software through each Build Process, a software product with a baselined version will be delivered and set to operation. There may be parallel or overlapping Build Processes for Baselines, which can reuse previously developed software elements to deliver a new version of the overall system. The overall TRITON System Life Cycle, notionally depicting the Incremental Development with Multiple Deliveries is given in Figure 12.

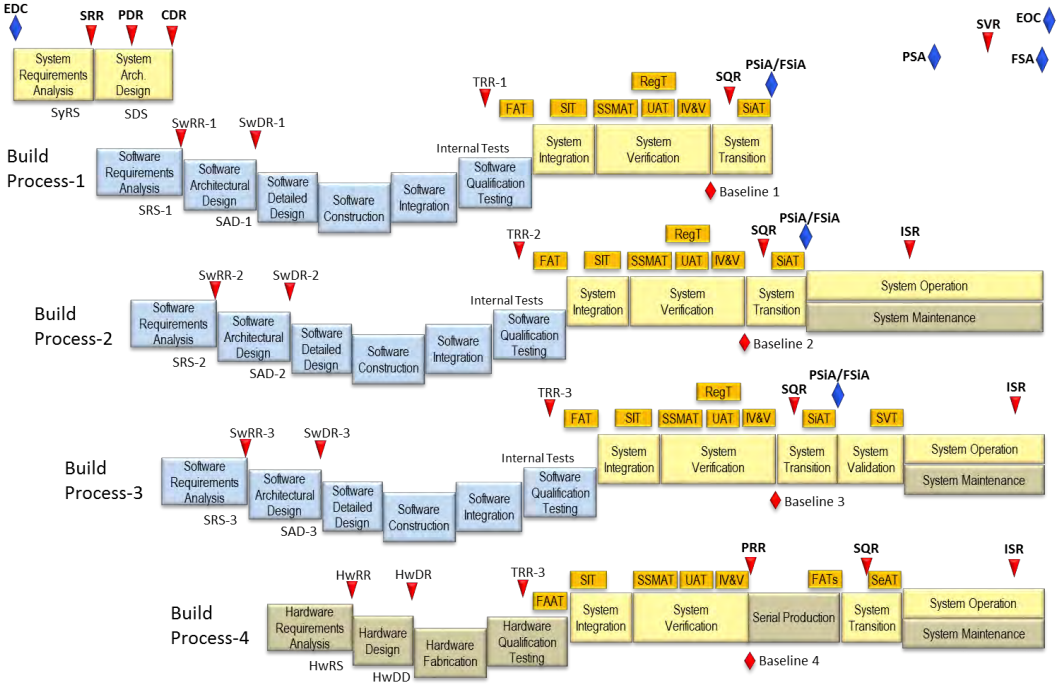


Figure 12 – TRITON System Life Cycle

4.3.4. During the System Requirements Analysis and System Architectural Design, all requirements defined in the SRS shall be allocated to Baselines according to the proposed solution and the RIS shall be updated. Within each Build Process, the functions and requirements shall be prioritised for applying agile management and development approaches (see Requirements Prioritisation).

4.3.5. The Contractor shall apply the software life cycle processes defined in [ISO/IEC 12207] to build a product in each Build Process, to deliver it and set it to operation.

4.3.6. Within each Build Process, the Contractor shall conduct software requirements analysis, software architectural and detailed design following a Waterfall Methodology; and then construct the software, integrate it with hardware, interface it with external systems, test and create a product as a "Baseline". The Contractor may apply iterative or agile techniques for detailed software design and construction within a Build Process, but must follow the milestone schedule. Smaller deliveries can be made at the Test System at the Purchaser's site.

4.3.7. The Contractor shall use Software CM Process to manage CIs and to combine the products of each Build Process into one general built.

4.3.8. The Contractor shall fabricate TRITON Deployable Kits conducted as a Build Process.

4.3.9. At the end of each Build Process, the Contractor shall deliver a PBL and install the PBL at the TRITON Test System and Reference System, and the selected NATO sites.

4.3.10. Within each Build Process life cycle, the Contractor shall organise the following types of meetings using the recent version of the developed products relevant to the aim of the meeting:

- Joint Technical Reviews (JTR)

- Working Group Reviews (WGR)
- Formal Reviews

4.3.11. The formal acceptance of the deliverables from the current stage shall be done using the formula of Formal Review, as described in Paragraph 3.16.4.

4.4. Working Groups

4.4.1. The Contractor shall organise activities involving the Purchaser and the Users (excluding the Contractor internal engineering activities and Formal Reviews with the Purchaser) under a Working Group structure.

4.4.2. The Contractor shall ensure that each Working Group addresses requirements, planned or on-going activities, issues and deliverables in its respective scope by collaboration between Users, Purchaser and the Contractor.

4.4.3. The Working Groups shall meet under formula of JTR and WGR.

4.4.4. The Contractor shall seek approval from the Purchaser to decide in which Working Group a subject (activity or deliverable) should be discussed in case the subject belongs to different groups.

4.4.5. In case a subject is not within the scope of a Working Group, the Contractor shall seek approval from the Purchaser to decide in which Working Group the subject will be refined further.

4.4.6. The Contractor shall support the following Working Groups defined within the TRITON Project:

- Systems Engineering Working Group (SEWG)
- Implementation Working Group (IWG)
- Visualisation Component Working Group (VCWG)
- Verification and Validation Working Group (VVWG)
- System Transition Working Group (STWG)
- Operation and Support Working Group (OSWG)

4.4.7. Systems Engineering Working Group

4.4.7.1. The scope of SEWG is the overall requirements analysis, specification, design, technical architecture, integration and interface aspects of TRITON.

4.4.7.2. SEWG will focus on the architectural-driving requirements and the design of TRITON.

4.4.7.3. SEWG will work on the interoperability aspects, interfaces (ICDs) and information exchange standards as well as adapting to changing environment (e.g. changes in Formatted Messages).

4.4.7.4. The SEWG shall include the following representation:

- User SMEs on Maritime domain
- Purchaser Project Manager, Technical Lead, System Manager, Group Leads and selected SMEs
- Contractor’s Project Manager, Technical Lead, Group Leads and selected experts

- Any other staff required for a particular subject.

4.4.7.5. SEWG will coordinate the security aspects of the capability, preparation of the security and INFOSEC documentation.

4.4.8. Implementation Working Group

4.4.8.1. The Contractor shall organise software and hardware implementation activities involving the Purchaser and the operational users (excluding the Contractor internal engineering activities and Formal Reviews with the Purchaser) under the IWG structure.

4.4.8.2. The IWG shall include the following representation:

- User SMEs on Maritime domain
- Purchaser Project Manager, Technical Lead, System Manager, Group Leads and selected SMEs
- Contractor's Project Manager, Technical Lead, Group Leads and selected experts
- Any other staff required for a particular subject.

4.4.8.3. The composition of the IWG shall be adjusted before each IWG Workshop to meet the goals of the review (e.g. software or hardware).

4.4.8.4. The IWG Meetings/Workshops will be held at the Purchaser's location, the NCI Agency The Hague.

4.4.8.5. The Contractor shall use the IWG Meetings/Workshops to discuss all the engineering deliverables.

4.4.8.6. At the IWG Meeting/Workshops the Contractor shall present to the Purchaser the documentation before sending them for the formal approval of the Purchaser. The quality of the provided documents shall reduce the risk that the documents will be rejected during the Formal Review.

4.4.8.7. At the IWG Meeting/Workshop the Contractor shall discuss users' feedback on the TRITON Operational Software deployed to the TRITON Test System.

4.4.8.8. The Contractor shall send the documentation to be discussed at the IWG Meeting/Workshop and deploy, if necessary, any software to the TRITON Test System at least two (2) weeks prior to the IWG Meeting/Workshop.

4.4.9. Visualisation Component Working Group

4.4.9.1. The scope of VCWG is the overall requirements analysis, specification, design, technical architecture, integration and interface aspects of the C4ISR Visualisation Component.

4.4.9.2. VCWG will focus on the architectural-driving requirements and the design of the Component.

4.4.9.3. VCWG will work on the interoperability aspects, interfaces (ICDs) and information exchange standards as well as adapting the Component to TRITON visualisation requirements.

4.4.9.4. The Contractor shall organise the development activities for the C4ISR Visualisation Component under the VCWG structure.

4.4.9.5. The VCWG shall include the following representation:

- User SMEs on geospatial domain
- Purchaser's Group Lead and selected experts
- Contractor's Group Lead and selected experts.

4.4.9.6. The VCWG will meet at mutually-agreed locations or using VTC facilities.

4.4.9.7. The Contractor shall send the documentation to be discussed at the VCWG Meeting/Workshop and deploy, if necessary, any software to the TRITON Test System at least two (2) weeks prior to the VCWG Meeting/Workshop.

4.4.10. Verification and Validation Working Group

4.4.10.1. The scope of VVWG is the support for qualification testing and acceptance of the capability including both functional and non-functional aspects.

4.4.10.2. VVWG will also support preparation of test procedures, test scenarios and test data.

4.4.10.3. The Purchaser will provide test data related to the NATO systems and services. The Contractor shall prepare the test data necessary for executing the testing other systems or services. The Contractor shall make use of the test data provided by the Purchaser.

4.4.10.4. The Contractor shall organise the testing activities under the VVWG structure.

4.4.10.5. The VVWG shall include the following representation:

- Purchaser's Test Manager responsible for the V&V process
- Purchaser's IV&V staff, TV&V staff and selected experts
- Contractor's Test Manager and selected experts
- Contractor's developers when necessary.

4.4.10.6. The Contractor shall send the documentation to be discussed at the VVWG Meeting/Workshop at least two (2) weeks prior to the VVWG Meeting/Workshop.

4.4.11. System Transition Working Group

4.4.11.1. The scope of STWG is the support for installation of the capability, site-specific aspects, training and transition from legacy systems.

4.4.11.2. STWG will provide support for the following:

- Deployment of the capability on the authorised sites
- Training and mentoring aspects for the end-users
  - Training Need Analysis
  - Preparation of Training Materials (including CBT)
  - Providing training courses and computer-based training.
- Software transition from the Contractor to the Purchaser.

4.4.11.3. The STWG shall include the following representation:

- Purchaser's Transition Manager responsible for the transition process
- Purchaser's Training Group Lead

- Purchaser's support staff
- Contractor's Training Group Lead
- Contractor's support staff and developers.

4.4.12. Operation and Support Working Group

4.4.12.1. The scope of OSWG is to provide support during the operation of TRITON OBL and the final deliverables during the OT&E period.

4.4.12.2. The OSWG will also provide support to the acquisition, development and implementation of the physical support capability (e.g. organise the supply chain, set up logistics data, organise warranty and in-service support, organise CM, codification and labelling, etc.).

4.4.12.3. The OSWG shall include the following representation:

- Purchaser's Test Manager responsible for the OT&E process
- Purchaser's support staff
- Contractor's support staff and experts.

4.5. Technical Reviews

4.5.1. Joint Technical Reviews

4.5.1.1. The aim of the Joint Technical Reviews (JTR) shall be to address issues prior to formal coordination of issues within the current Build Process life cycle.

4.5.1.2. The Contractor shall plan and take part in JTRs at locations and dates proposed by the Contractor and approved by the Purchaser. These reviews shall be attended by persons with technical knowledge of the software products to be reviewed. The reviews shall focus on in-process and final software products, rather than materials generated especially for the review. The reviews shall have the following objectives:

4.5.1.2.1. Review evolving software products, using the software product evaluation criteria in listed below:

- Accurately describes (an item)
- Adequate test cases, procedures, data, results
- Consistent with indicated product(s)
- Contains all applicable information in the related description document
- Covers all requirements
- Feasible
- Follows the development plans
- Internally consistent
- Meets contractual requirements
- Presents a sound approach
- Testable
- Understandable.

4.5.1.2.2. Review and demonstrate proposed technical solutions; provide insight and obtain feedback on the technical effort; surface and resolve technical issues.

4.5.1.2.3. Review project status; surface near- and long-term risks regarding technical, cost, and schedule issues.

4.5.1.2.4. Arrive at agreed-upon mitigation strategies for identified risks, within the authority of those present.

4.5.1.2.5. Identify risks and issues to be raised at joint management reviews.

4.5.1.2.6. Ensure on-going communication between acquirer and developer technical personnel

4.5.1.3. Attendance in the JTR is solely at the discretion of the Purchaser and shall not be limited by the Contractor.

4.5.1.4. The Contractor shall capture and manage all issues raised during JTRs in the project Issue Register with a category corresponding to the Working Group handling the issue.

4.5.1.5. The Contractor shall organize and conduct JTR to address and resolve critical technical issues in advance of the Working Group Reviews, supporting incremental development.

4.5.1.6. The Contractor shall propose the subject and the timing of the JTRs to ensure the most critical technical risks are raised and mitigated as early as possible. The JTRs shall be planned as early as possible but as a minimum four weeks prior to the review to provide sufficient time for the identification of appropriate operational users and arrangements for their participation.

4.5.1.7. The Contractor shall deliver, at least one (1) week prior to each JTR, a meeting agenda and a list of issues to be reviewed with an impact assessment, root cause of the issue (evidence) and possible solutions per issue.

4.5.1.8. Unless agreed by the Purchaser or organised in accordance with 4.5.1.14, all JTRs shall be conducted at a Purchaser Facility (either the NCI Agency Brussels or The Hague). The specific date and location must be agreed between the Contractor and the Purchaser's Project Manager.

4.5.1.9. The Contractor shall provide all relevant resources including personnel, hardware, software, and tools at each review.

4.5.1.10. The Contractor shall propose the detailed scope of the JTRs executed within the Build Process. The JTR’s shall be based on deliverables reviewed at SRR, PDR and CDR, following the Incremental Development approach.

4.5.1.11. The Contractor shall provide, at each review, presentation and discussion of each issue, including relevant technical material such as requirements references, design specifications, views, use cases, mock-ups, screenshots, or prototypes.

4.5.1.12. The Contractor shall deliver, within one week after each JTR, the Minutes of Meeting, updated Issue Register, and any resulting proposed Change Requests.

4.5.1.13. In addition to the JTRs, the Contractor may call additional Working Group meetings, when deemed necessary, to ensure that critical project risks are raised, discussed, and resolved as early as possible throughout the course of the project.

4.5.1.14. The Contractor may organise JTRs using remote meeting technologies (online conferencing tool) over the NATO Unclassified network after approval by the Purchaser.

4.5.1.14.1. The online review meeting shall take place in regular Central European Time (CET) business hours (i.e. 09:00 to 17:00).

4.5.1.14.2. The online review may be planned on a shorter notice than a regular review, but not shorter than a week.

4.5.1.14.3. The Contractor shall ensure that participating in an online review is at no-cost for the participants. Any licences for the online meeting shall be arranged at the beginning of the Contract by the Contractor.

4.5.1.14.4. The Contractor shall allow the online review of material with classification up to NATO Unclassified using appropriate security means.

4.5.2. Working Group Reviews

4.5.2.1. The aim of the Working Group Reviews (WGR) shall be verification of the deliverables produced during the current Build Process and providing recommendation for the next Build Process. The verification shall be carried out using the scope defined for SRR, PDR and CDR, as planned by the Contractor.

4.5.2.2. Attendance in the WGR is solely at the discretion of the Purchaser and shall not be limited by the Contractor.

4.5.2.3. The Contractor shall capture and manage all issues raised during WGRs in the project Issue Register with a category corresponding to the Working Group handling the issue.

4.5.2.4. The Contractor shall organise a WGR at the end of each Build Process.

4.5.2.5. The Contractor shall organise a single WGR not to last more than two hours for a remote meeting. In case the agenda requires more time, more sessions shall be organised in coordination with the Purchaser.

4.5.2.6. The WGRs shall follow the requirements as specified for the JTRs, with the exception that WGRs shall keep the scope separately for each Working Group and shall not join their meetings, unless otherwise agreed by the Purchaser.

4.5.2.7. The Contractor may organise WGRs using remote meeting technologies (online conferencing tool) over the NATO Unclassified network after approval by the Purchaser.

4.5.2.7.1. The online review meeting shall take place in regular CET business hours.

4.5.2.7.2. The online review may be planned on a shorter notice than a regular review, but not shorter than one (1) week.

4.5.2.7.3. The Contractor shall ensure that participation to an online review is at no-cost for the participants. Any licences for the online meeting shall be arranged at the beginning of the Contract by the Contractor.

4.5.2.7.4. The Contractor shall allow the online review of material with classification up to NATO Unclassified using appropriate security means.

4.5.3. IWG Workshops

4.5.3.1. The IWG shall meet under the formula of IWG Workshop.

4.5.3.2. The aim of the IWG Workshop shall be to address issues prior to formal coordination within the current Build Process.

4.5.3.3. Attendance in the IWG Workshop is solely at the discretion of the Purchaser and shall not be limited by the Contractor.

4.5.3.4. The contractor shall organize an IWG Workshop either in a form of a standard meeting on a location selected by the Purchaser, or via a remote meeting. The selection is to be approved by the Purchaser.

4.5.3.5. Remote meeting can be used to increase efficiency for the User Community to participate in the IWG Workshop session.

4.5.3.6. In case of a remote meeting, the Contractor shall make sure the duration of the session not to last more than two hours. In case the agenda requires more time, several sessions shall be organised in coordination with the Purchaser.

4.5.3.7. The Contractor shall capture and manage all issues raised at IWG Workshop in the project Issue Register.

4.5.3.8. The Contractor shall organize IWG Workshop at least twice per Build Process, before the planned Formal Reviews.

4.5.3.9. The IWG Workshop shall aim into recommendation for approval of the deliverables produced during the Build Process. The verification shall be carried out using the scope defined for the related Formal Review.

4.6. System Development Plan

4.6.1. The Contractor shall provide and maintain a System Development Plan (SDP). The SDP shall include all necessary activities for planning, managing and controlling the engineering efforts for specifying, designing, implementing, integrating, testing, installing and supporting TRITON capability.

4.6.2. The SDP shall describe the following:

4.6.2.1. Engineering Work Packages and Work Items defined in the PWBS Dictionary.

4.6.2.2. The system development strategy including the organization, tasks, resources, and methodologies.

4.6.2.3. The technical approach, including the relationship between bespoke (i.e. software specially written to specification) and off-the-shelf (OTS) products (i.e. existing products that can be integrated with little or no customization).

4.6.2.4. The engineering processes (e.g. development technologies, development practices, design methodologies, unit testing and system integration procedures, risks analysis, control and monitoring mechanisms).

4.6.2.5. The computing environment including COTS hardware, operating system and other infrastructure software.

4.6.2.6. The development and test methodologies, standards, tools (including OTS products and programming or scripting languages), engineering environment, equipment, facilities, libraries, interfaces, plug-ins/add-ins, glue code and data.

4.6.2.7. Change Management and Configuration Management of the TRITON SyRS, SDS, and TMP, which shall be described in line with the Incremental Development methodology (described in 4.2).

4.6.2.8. System development schedule, which shall be prepared in line with the Incremental Delivery methodology (described in 4.2).

4.6.2.9. Purchaser/user participation, which shall be achieved using a Working Group structure (described in 4.4).

4.6.2.10. Requirements management, which shall be performed to ensure traceability and alignment with requirements from other NCI Agency projects, and to Baseline requirements within the Work Packages (described in 4.8.2).

4.6.2.11. Following annexes:

- Requirements Implementation Schedule (RIS)
- Usability Engineering Plan (UEP)
- Security Accreditation Plan (SAP)

4.6.3. Requirements Implementation Schedule

4.6.3.1. The Contractor shall provide (in the Bid) a Requirements Implementation Schedule (RIS), which lists groups of TRITON requirements from the Contractual SRS and assigns in which Baseline the requirement will be implemented (Available at Bidding Time, Available at Baseline 1, 2, 3, 4 or PSA). The requirements for the C4ISR Visualisation Component shall also be allocated to its own Baselines, 1, 2 or 3.

4.6.3.2. The Contractor shall provide, in the RIS, the roadmap for any COTS components used in the technical solution in the Bid. The Roadmap should contain the list of planned updates to the COTS product and the new functionality that will be included in each Baseline.

4.6.3.3. The Contractor will suggest, in the RIS, what will be implemented in each Build Process based on the proposed concept, technical solution envisioned, availability of COTS components and other factors relevant for the Bid.

4.6.3.4. The RIS shall have tabular form as specified in the template given Annex C with at least the following columns:

- Requirement identification
- Requirement short description
- Implementation Baseline and Milestone:
  - Available at EDC
  - Baseline (1, 2, 3, 4)
  - PSA
  - Not implemented (requirements will not or cannot be implemented)

4.6.3.5. Each requirement shall have only one Baseline or Milestone selected.

4.6.4. Usability Engineering Plan

4.6.4.1. Usability Engineering Plan (UEP) which defines how the human-centred activities fit into the overall system development process shall be prepared as an annex to the SDP, in accordance with ISO 9241-210:2010.

4.6.4.2. The UEP shall identify:

4.6.4.2.1. The human-centred design process activities such as:

- Understanding and identifying context of use and supported user tasks,
- Considering recent military and industry Human-Computer Interaction (HCI) innovations,
- Surveying academic usability research,
- Producing prototypes for user assessment and Graphical User Interface (GUI) design refinement,
- Evaluating GUI designs with users including usability testing and HCI evaluation,
- Procedures for integrating these activities with other system development activities (e.g. analysis, design, implementation, testing).

4.6.4.2.2. The individuals and the organization(s) responsible for the human-centred design activities and the range of skills and viewpoints they provide;

4.6.4.2.3. Effective procedures for establishing feedback and communication from users and other Purchaser representatives on human-centred design activities as they affect other design activities, and methods for documenting these activities;

4.6.4.2.4. Appropriate milestones for human-centred activities integrated into the overall design and development process, including events with the users prior to the SRR, PDR, CDR, TRR, FAT, SIT, SiAT, SiAR, SQR and OTRR.

4.6.4.2.5. Suitable timescales to allow feedback and possible design changes to be incorporated into the project schedule.

4.6.5. Security Accreditation Plan

4.6.5.1. The Security Accreditation Plan (SAP) describes the Contractor deliverables and the interaction with the Purchaser in order to achieve timely system INFOSEC accreditation.

4.6.5.2. The Contractor shall prepare the SAP compliant to [AC/35-D/2005-REV3].

4.7. Configuration Management Process

4.7.1. General

4.7.1.1. Configuration Management (CM) is the technical and administrative activity concerned with the creation, maintenance and controlled change of configuration throughout the life of System Elements.

4.7.1.2. The Contractor shall perform CM in accordance with the NATO CM Contractual Requirement document and the applicable additional requirements as selected on NATO Form ACMP-2009. STANAG-4427 which covers [ACMP-2000], [ACMP-2009] and [ACMP-2100] shall be used as the main reference. The industry standard [ISO 10007] shall be used for further guidance.

4.7.1.3. The system is decomposed into building blocks. System Elements are the main building blocks and also considered as a System Component.

4.7.1.4. A Component is a general term that is used to mean one part of something more complex. For example, a computer system may be a component of an IT Service, an Application may be a Component of a Release Unit. Components that need to be managed should be Configuration Items (ITILv3).

4.7.1.5. A Configuration Item (CI) is any Component that needs to be managed in order to deliver a Service. Information about each CI is recorded in a Configuration Record within the Configuration Management System and is maintained throughout its life cycle by CM. CIs are under the control of Change Management. CIs typically include IT Services, hardware, software, and formal documentation such as Process documentation and Service Level Agreements (ref. ITIL v3).

4.7.1.6. The Contractor shall use a structural decomposition of system into System Elements, Components, CIs and further. A notional decomposition is given in Figure 13 (the type of each element/component to be identified as software or hardware).

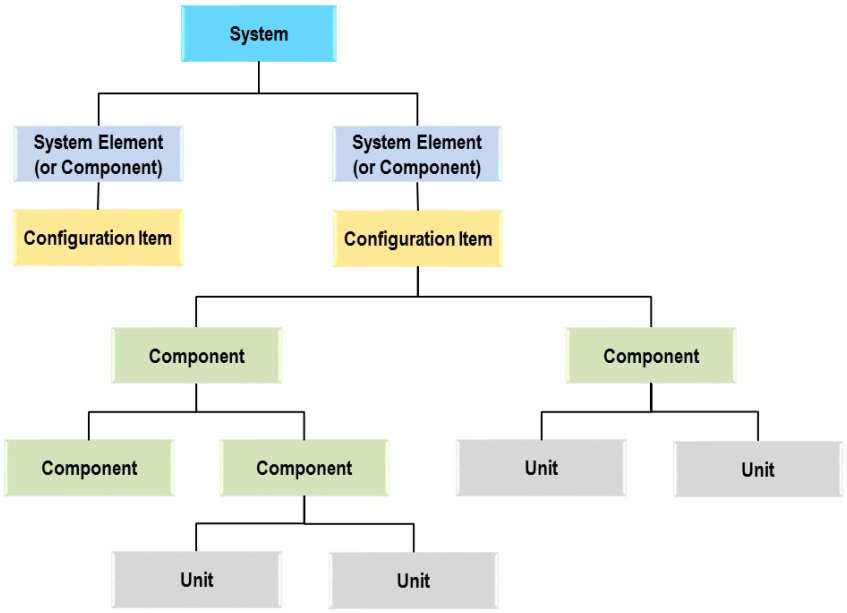


Figure 13 – System Decomposition

4.7.1.7. The Contractor shall implement a CM program in accordance with [STANAG-4427], which covers [ACMP-2000], [ACMP-2009] and [ACMP-2100], to carry out the CM functions as described in this SOW (configuration item identification, configuration control, configuration status accounting, and configuration verification).

4.7.1.8. The CM program shall enable the baselining of CIs into the FBL, ABL and PBL and the maintenance of these baselines throughout the duration of the contract.

4.7.1.9. The Contractor shall ensure that an effective CM organization is established and maintained to implement the CM program and apply all necessary CM procedures, in accordance with the requirements and guidance applicable for this contract throughout the duration of the contract.

4.7.1.10. Under the CM program the Contractor shall maintain and update all project CIs as requested by changes within the project or external to the project throughout the duration of the contract.

4.7.1.11. The Contractor shall establish and maintain a Configuration Management System (CMS) to store all CIs.

4.7.1.12. The Contractor shall describe the CM program and the CM organization in a CMP.

4.7.2. Configuration Item Identification and Documentation

4.7.2.1. A CI is an aggregation of hardware, software, or both that satisfies an end-use function and is designated for separate configuration management.

4.7.2.1.1. Computer Software Configuration Items (CSCI) is an aggregation of software that satisfies an end use function and is designated for separate configuration management. CSCIs are selected based on trade-offs among software function, size, host or target computers, developer, support concept, plans for reuse, criticality, interface considerations, need to be separately documented and controlled, and other factors.

4.7.2.1.2. Hardware Configuration Item (HWCI) is an aggregation of hardware parts that satisfies an end use function and is designated for separate configuration management.

4.7.2.2. The Contractor shall establish, document and maintain a configuration identification system in accordance with [ACMP-2009].

4.7.2.3. The Contractor shall use configuration identification to divide the system into CIs (HWCI and CSCI) for ease of management. Configuration identification shall identify the documents that establish each baseline. The identification process will continue as long as the system is undergoing change.

4.7.2.4. The Contractor shall identify, for each CSCI, its Computer Software Components (CSC) and Computer Software Units (CSU), if any. For each CSCI, CSC and CSU, the Contractor shall issue/obtain a Software Identifier, which shall consist of a name or number, and a version identifier, and shall relate the software to its associated software design documentation, revision, and release date.

4.7.2.5. The Contractor shall identify, for each HWCI, its assembly and parts. For each part the Contractor shall issue/obtain a Hardware Identifier, which shall consist of a name, CAGE number, part number and serial number, and shall relate the hardware part to its associated hardware design documentation, revision, and date of production.

4.7.2.6. An explanation of the rationale and criteria used in the process of selecting CIs shall be provided and be based on the criteria for selection of CIs as detailed in [ACMP-2009].

4.7.2.7. The CIs shall be chosen in accordance with [ACMP-2009] and in a way to assure visibility throughout the development effort and easy support to the operational system after acceptance.

4.7.2.8. All COTS, adapted and developed software shall be designated as CIs.

4.7.2.9. Where COTS can be installed in a modular fashion, the description of the CI shall unambiguously identify the complete list of installed components.

4.7.2.10. The Contractor shall ensure that the configuration baselines and configuration items are persistently stored in a COTS Configuration Management Database (CMDB) and that it shall be kept consistent and updated.

4.7.2.11. The CMDB shall provide the ability to easily trace higher and subordinate CIs using CI identifiers or other CI attributes.

4.7.2.12. The CMDB shall include the Data Information Packets (DIP) specified in [ACMP-2009].

4.7.2.13. The CI identification system shall provide the ability to easily trace higher and subordinate CIs.

4.7.2.14. Each commercial/government/NATO/modified-off-the-shelf (OTS), adapted, and developed software application or module shall be designated as a CI.

4.7.2.15. Each complete hardware element shall be designated as a CI and shall be marked in accordance with [STANAG 2290].

4.7.2.16. The CI structure shall be a tree structure with TRITON being the top level CI and shall show the relationships between the lower level CIs. The Purchaser reserves the right to modify the CI structure prior to its baselining.

4.7.2.17. The level of granularity for the CI selection shall reach at minimum:

- Line Replaceable Units (LRUs) - Hardware CIs,
- Software Assets and/or Firmware - Software CIs,

4.7.2.18. The Hardware CI attributes shall include, but is not limited to, the MDS.

4.7.2.19. Any Documentation CI shall include, but is not limited to, the Contract Schedule of Supplies and Services (SSS) attributes.

4.7.2.20. Each physical deliverable software shall be marked with the Contract number, its associated CI identifier, name, version number, release date, and media copy number.

4.7.2.21. Non-Developmental Items identified as CI, when modified to satisfy project requirements, shall be re-identified as a project modified CI, and documented accordingly.

4.7.3. Configuration Baselines

4.7.3.1. The Contractor shall establish the following Configuration Baselines for each CI:

- Functional Baseline (FBL)
- Allocated Baseline (ABL)
- Development Baseline (DBL)
- Product Baseline (PBL)
- Operational Baseline (OBL)

4.7.3.2. The Contractor shall ensure that the configuration documentation defining the Configuration Baselines is mutually consistent and mutually compatible. Each succeeding level of configuration documentation from the FBL to the ABL to the PBL and OBL shall be traceable to, and be a detailed extension of, its predecessor(s).

4.7.3.3. Functional Baseline

4.7.3.3.1. The Functional Baseline (FBL) is the initial approved functional configuration identification (documentation) for each system element which describes the system functional characteristics.

4.7.3.3.2. The system level FBL shall be derived from the TRITON Contractual SRS and shall be established at the successful completion of the SRR with the approved SyRS.

4.7.3.3.3. Since Incremental Development with Multiple Deliveries Approach is used, there will be separate FBLs for each Build Process during the Contract execution, which are subsets of the system-level FBL.

4.7.3.4. Allocated Baseline

4.7.3.4.1. The Allocated Baseline (ABL) is the allocation of the FBL to (physical) system elements. It is the initial approved allocated configuration identification (documentation) for each system element functional and interface characteristics allocated from those of a higher level CI, and interface requirements with interfacing CIs, additional design constraints and the verification required to demonstrate the achievement of those specified functional and interface characteristics.

4.7.3.4.2. The ABL shall be a product of the Preliminary Design stage (approved at CDR) and provides architecture of the system at the element level.

4.7.3.5. Developmental Baseline

4.7.3.5.1. The Developmental Baseline (DBL) is the status of the TRITON capability during development by the Contractor.

4.7.3.5.2. The system level DBL shall be established after successful completion of the PDR and shall be finally approved at the CDR. Each Build Process shall have its own Design Review to set the DBL for that Build Process.

4.7.3.5.3. The Contractor shall include the TRITON System Design Specification (SDS) (including the Requirements Traceability Matrix), the TMP, and any other documentation deemed appropriate by the Contractor, in accordance with provisions of ISO/IEC/IEEE 15288 and ISO/IEC/IEEE 12207, to ensure TRITON requirements are reflected in the system during development and integration, can be demonstrated through a comprehensive set of tests, and can be delivered in the form of the Product Baseline.

4.7.3.6. Product Baseline

4.7.3.6.1. The Product Baseline (PBL) is the initial approved product configuration identification (documentation) for each CSCI and HWCI. It reflects the “as-built” configuration of the system.

4.7.3.6.2. The PBL documentation shall describe all of the necessary functional and physical characteristics of the CI, any required joint and combined operations, interoperability characteristics of a CI and the selected functional and physical characteristics designated for production acceptance testing and tests necessary for support of the CI.

4.7.3.6.3. The PBL shall be established after successful completion of the CDR.

4.7.3.6.4. The PBL shall contain all delivered HWCI, CSCI and documentation that comprise the TRITON Increment 1 (for both NS and NU) system and any subsequent releases.

4.7.3.6.5. The Contractor shall include in the PBL release package the elements listed in Table 4-1, as a minimum.

Table 4-1 – Product Baseline Contents

Serial	Requirement
1	All required CSCIs and HWCIs.
2	The source code of elements categorised as foreground knowledge, script, and configuration setting baseline, including the documentation for these items.
3	The script and configuration setting baseline, including documentation for these items, for non-development software items (e Microsoft Office).
4	Release notes, which include a description of what is new or changed in each software module.
5	List of open known problems and faults.
6	The SyRS and SDS versions against which the PBL has been developed.
7	ICD for TRITON external interfaces
8	All design artefacts provided as part of the SDS, updated to reflect the Product Baseline.
9	Conversion programs and instructions
10	Plug-ins/add-ins, glue-code and interfaces.
11	Parameter definitions.
12	Initial data sets.
13	Online help files.
14	Test procedures and test cases for any automated tests, along with all source data for the manual and automated tests and including the documentation for these items.
15	Copyright and license information.
16	Instructions for system administration staff to follow to save the previously installed system baseline, to install the new baseline, and to recover the old baseline if the new baseline installation must be interrupted or aborted.
17	Installation scripts.
18	Instructions on how to identify and report problems after acceptance.
19	Instructions for the generation of new Product baselines, distribution and installation of new software versions, and any test procedures and test cases necessary to verify the generated baseline before distribution.
20	Additional documentation artefacts identified in the SyRS.

4.7.3.7. Operational Baseline

4.7.3.7.1. The Operational Baseline (OBL) is the "approved" product configuration identification (documentation) for all delivered CSCI and HWCI and other documentation that comprise the TRITON systems (NS, NU, Deployable Kit) and any subsequent releases. It reflects the "as-deployed" configuration of the system.

4.7.3.7.2. Since Incremental Development with Multiple Deliveries Approach is used, there will be multiple OBLs during the Contract execution until FSA. Each OBL shall be identified with a unique number.

4.7.3.7.3. The final OBL shall be established after successful completion of Validation Process and approved at the FSA.

4.7.4. Versioning and Baselines

4.7.4.1. The Contractor shall apply the guidance provided by the Purchaser for versioning and baselines.

4.7.4.2. Baselines will be given a major release number and a minor release number comprising an "X.X.X" notation. Once a system is approved for Approved Final Product List (AFPL), which is maintained by the NCI Agency, it is given a version number 1.0.

4.7.4.3. TRITON Baselines shall be given version numbers starting with 1.X and followed by a release number (e.g. 1.2.1).

4.7.4.4. Long term Operational Baseline shall be identified as 2.0.

4.7.4.5. Similar numbering scheme shall be used for the C4ISR Visualisation Component.

4.7.4.6. An example list of versions and releases of TRITON Operational Software and C4ISR Visualisation Component is given in Table 4-2:

Table 4-2 – Release Numbers

Build	Name	Baseline	Release Number
Build Process 1	BL1 – TRITON-NS (Pilot)	BL 1	1.1.0
Build Process 2	BL2 – TRITON-NU (full)	BL 2	1.2.0
Build Process 3	BL3 – TRITON-NS (full)	BL 3	1.3.0
Build Process 4	BL4 – TRITON-ACP NS (full)	BL 4	1.4.0
FSA	TRITON Increment 1	OBL	2.0
C4ISR Visualisation Component	Visualisation Component – BL1	VC-BL1	1.1.0
	Visualisation Component – BL2	VC-BL2	1.2.0
	Visualisation Component – BL3	VC-BL3	1.3.0
CAR	C4ISR Visualisation Component	OBL	2.0

4.7.4.7. Intermediate baselines, whether they are Functional or Developmental baselines, shall be labelled logically within this scheme. For example, 1.2.1 is an interim release within Build Process 2.

4.7.4.8. The Contractor shall develop Configuration Control mechanisms to keep one single source tree and generate multiple OBLs out of this tree. The concept is presented in Figure 14.

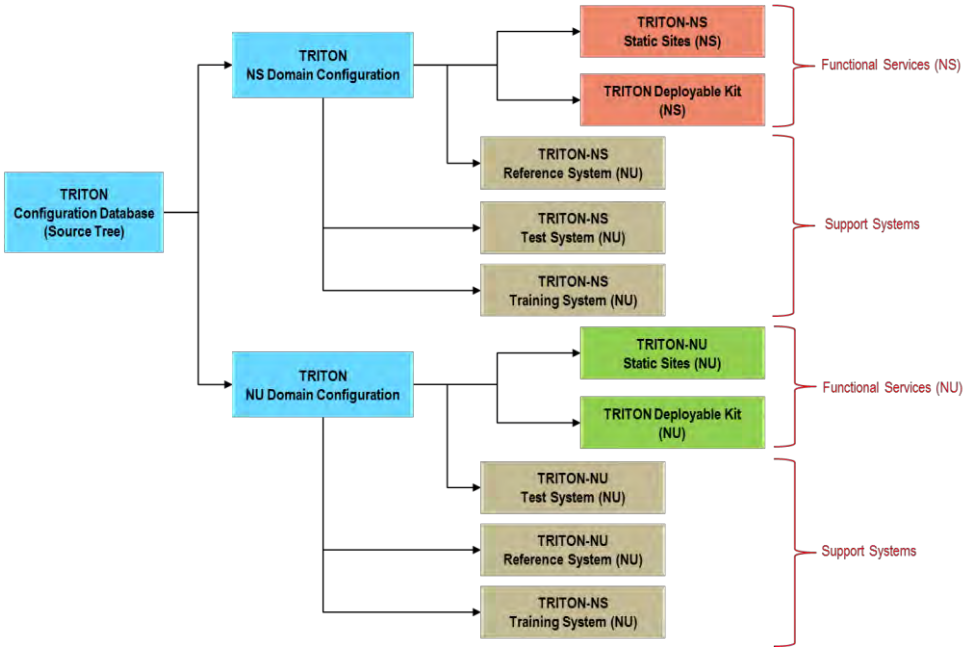


Figure 14 – Configuration Control for OBLs

4.7.4.9. TRITON Deployable Kits shall be identified with Model Numbers like "TDK Model 1".

4.7.5. Configuration Management Plan

4.7.5.1. The Contractor shall prepare a Configuration Management Plan (CMP) in accordance with [STANAG 4427] and deliver it together with the PMP.

4.7.5.2. The Contractor shall define in the CMP the CM organization and the relation to the overall organization.

4.7.5.3. The Contractor shall identify the means by which continuity of effort and understanding is achieved between his subcontractors and himself, and between the PM and himself and internally within his organization, for the allocated CI, integrating, interfacing or otherwise related CI, contractor organizations, test and evaluation activities, and managers.

4.7.5.4. The CMP shall describe the relationship with the SSS.

4.7.5.5. The Contractor shall define CM organization and procedures in place to implement the CM program and manage the CM functions and the role of the CCB.

4.7.5.6. The CMP shall describe relation between the CMS at the Contractor's site and the CMS to be deployed at the Purchaser's site.

4.7.5.7. The CMP shall describe how the CM data will be handed-over to the Purchaser to be further supported as described in Section 5.

4.7.5.8. Procedures and the schedule for updating the CMP shall be included in the CMP itself. The CMP, when approved, shall serve as a working document to plan, guide, and measure the CM process. CM shall be implemented in accordance with the approved CMP.

4.7.6. Configuration Control

4.7.6.1. The Contractor shall apply configuration control measures to each Baseline and CI in accordance with [ACMP-2009].

4.7.6.2. The Contractor shall define the responsibilities and procedures used within the Contractor's organization for configuration control of established CI, and for processing changes to these CI.

4.7.6.3. The Contractor shall define the Configuration Baseline Change Procedures and shall submit Notice of Revision or Request for Deviations and Wavers when required and approved by the Purchaser.

4.7.7. Change Management Process

4.7.7.1. The Contractor shall implement a central Change Management Process that addresses the approval and controls the implementation of changes to the TRITON infrastructure in accordance with [ACMP-2009].

4.7.7.2. The Contractor shall implement the Change Management Process to:

- Assess changes.
- Minimize the impact of changes on the TRITON Baselines.
- Ensure the traceability of changes.

4.7.7.3. The Contractor shall implement a Change Management Process to ensure that standard methods [ACMP-2009] and procedures are used, that changes can be dealt with quickly, with the lowest possible impact on service quality. All changes must be traceable.

4.7.7.4. The Contractor shall organise the Change Management Process such that the following objectives are successfully met:

4.7.7.4.1. Reduced adverse impact of changes on the quality of TRITON Baselines.

4.7.7.4.2. Better estimates of the costs of proposed changes.

4.7.7.4.3. Fewer changes are reversed, and any back-outs that are implemented proceed more smoothly.

4.7.7.4.4. Enhanced management information is obtained about changes, which enables a better diagnosis of problem areas.

4.7.7.4.5. Improved user productivity through more stable and better TRITON Baselines.

4.7.7.4.6. Increased ability to accommodate frequent changes without creating an unstable TRITON operational environment.

4.7.8. Change Requests

4.7.8.1. The Contractor shall establish and maintain a process for identifying, reviewing, approving, and tracking all requests for changes to FBL, ABL and PBL in accordance with [ACMP-2009].

4.7.8.2. Change Requests (CR) identify proposed changes to the FBL, ABL or PBL.

4.7.8.3. The Contractor shall prepare and submit Engineering Change Proposals (ECP), Requests for Deviations (RFD), Requests for Waivers (RFW), and Notices of Revision (NOR) in accordance with [ACMP-2009].

4.7.8.4. Any CR shall contain, at a minimum:

- Identification number per request
- Requestor's identity
- Date of request
- Type of change (e delete, add etc.)
- Requested change description
- Status of request (how it was addressed – e, completed, not addressed etc.)
- Comment/Resolution of the request
- If the requested change impacts the cost, design, implementation, licensing scheme, or any other contractual documentation, then two other areas shall be addressed:
  - Impact on schedule, cost, performance, or any other contractual requirements (based on an analysis)
  - Priority for handling (high/critical/urgent, medium/sensitive/important, low)
- Consequences if the change is not implemented.

4.7.8.5. The Contractor shall foresee a change approval mechanism that consists of the three aspects given below:

- Financial approval - cost/benefit analysis and budget.
- Technical approval - impact, necessity and feasibility.
- Business approval - approval by the customers requiring the change and those functions impacted by the change.

4.7.8.6. The Contractor shall apply internal configuration control measures to the configuration documentation of each CI, prior to the time that each CI is baselined.

4.7.8.7. The Contractor shall prepare and process an ECP for engineering, design, development changes, and shall classify and submit to the Purchaser. The process and classification is defined in [ACMP-2009].

4.7.9. Deficiency Reports

4.7.9.1. The Contractor shall establish and maintain a process for reporting, tracking, and resolving deficiencies in the Developmental and Product Baselines.

4.7.9.2. Deficiency Reports (DRs) are used to document the problems encountered during the design, configuration, implementation and operation of the TRITON capability.

4.7.9.3. DRs shall be closed when the identified problem is resolved through procedure or other action that does not affect the system baselines, or when a corresponding CR is opened to correct the deficiency through a change to a baseline.

4.7.10. Configuration Status Accounting

4.7.10.1. The Contractor shall be fully responsible for the Configuration Status Accounting (CSA) for all CIs in accordance with [ACMP-2009].

4.7.10.2. Under the CSA function the Contractor shall prepare CSA reports in a manner, and format which shall be proposed by the Contractor in his CMP and approved by the Purchaser.

4.7.10.3. The Contractor shall deliver CSA reports to the Purchaser both as part of management and specialist products in this Contract and also as standalone documents at the Purchaser's request.

4.7.10.4. At the end of the Contract, the Contractor shall deliver a set of final CSA reports for each CI or set of CI's in both hard copy and in electronic media.

4.7.10.5. Configuration Status Accounting System

4.7.10.5.1. The Contractor shall maintain a CSA System (CSAS) for all CIs. The CSAS shall be capable of recording and reporting on the status of the configuration baselines and maintaining traceability of all configuration changes to the current baselines.

4.7.10.5.2. The CSAS shall be maintained and provided as a database, spreadsheet, or version control system. It shall provide the following data for each CI:

- Associated baseline
- CI identifier
- CI name
- Version number
- Release date
- Audit date

4.7.10.5.3. The CSAS shall provide the following data for each CR:

- Unique CR identifier
- CR title
- Description
- Justification
- Category
- POC identifying CR
- Priority
- Criticality (high, medium, low)
- Impact on schedule, cost and performance
- Baseline(s) affected
- CIs affected
- Date opened
- Date approved or rejected
- Date closed
- Status

4.7.10.5.4. The CSAS shall provide the following data for each DR:

- Unique DR identifier

- DR title
- Description
- Category
- POC identifying DR
- Priority
- Severity (high, medium, low)
- Impact on schedule, cost and performance
- Baseline(s) affected
- CIs affected
- Date opened
- Date approved or rejected
- Date closed
- Status

4.7.10.5.5. The CSAS shall be maintained in such a manner that it can readily be copied in part or in total.

4.7.10.5.6. The CSAS shall provide a complete historical record of all CIs, CRs, and DRs.

4.7.10.5.7. The CSAS shall be capable of providing the following reports:

- List of CIs associated with a baseline
- List of all CRs and DRs associated with a CI
- List of all audits
- Log of all changes to a baseline

4.7.11. Configuration Verification

4.7.11.1. Upon request from the Purchaser, the Contractor shall support Configuration Audits to demonstrate that the actual status of all CIs matches the authorised state of CIs as registered in the Configuration Status Accounting reports according to [ACMP-2009].

4.7.11.2. The Contractor shall support the Functional Configuration Audit (FCA) and Physical Configuration Audit (PCA) as defined in [ACMP-2009], by providing the required Baseline Documentation and answering questions from the Purchaser's Auditor. The Contractor shall schedule the FCA and PCA in the CMP.

4.7.11.3. The Contractor shall plan the FCA during the TRR, and the PCA during the SiAR of each Build Process.

4.7.11.4. The Contractor shall draft a Configuration Audit Report (CAuR) for the FCA and PCA that summarises the results for the Purchaser's approval.

4.7.11.5. The Contractor shall solve any deficiencies found during the Configuration Management Audits within the agreed timeframe and update the Baseline accordingly.

4.7.11.6. The initial version of the ABL, and PBL shall be provided to the Purchaser for acceptance. Upon Purchaser Acceptance, ABL and PBL shall be placed under the control of the CCB.

4.7.11.7. The Contractor shall be responsible for ensuring that Subcontractors, Vendors, and Suppliers participate in audits, as appropriate.

4.7.11.8. The acceptance of the ABL and PBL by the Purchaser signifies only that the Purchaser agrees to the Contractor's approach in meeting the requirements. This acceptance in no way relieves the Contractor from its responsibilities to meet the requirements stated in this Contract.

4.7.11.9. The Contractor shall keep the contents of the ABL and PBL under Configuration Control and shall keep it current to reflect the progress of the project activities.

4.7.12. Configuration Management and Software Versioning Tool

4.7.12.1. The Contractor shall create and maintain a COTS-based Configuration Management System (CMS), including the CMDB, which persists the CIs attributes, (inter-) relationships.

4.7.12.2. A software source code version control tool shall be used for any custom software development.

4.7.12.3. The version control/configuration management automation tool shall include the capabilities for baseline management, source control versioning (including source code), configuration item identification, change request management, deficiency reporting management, and configuration status accounting.

4.7.12.4. The Contractor shall provide the Purchaser read-only access to the version control/configuration management automated tool via the project Web-site.

4.7.12.5. The Contractor shall provide the ability for the Purchaser to access (read-only) the source code of the baseline via the version control/configuration management automation tool.

4.7.12.6. The Contractor shall provide the information about the COTS tools to the Purchaser. If it is proprietary solution, the Contractor shall provide the necessary licenses to enable life-cycle configuration management.

4.7.12.7. The Contractor shall enable the Purchaser to be able to download the baseline on a weekly basis, including components required to perform a build.

4.8. System Requirements Analysis Process

4.8.1. General

4.8.1.1. The Contractor shall perform system requirements analysis activities in compliance with the processes defined in ISO/IEC 15288, Paragraph 6.4.2 as referred by AAP-48, Paragraph 6.4.2.

4.8.1.2. The Contractor will use ISO/IEC 29148 as a basis for Requirements Engineering.

4.8.1.3. The Contractor shall review the Contractual SRS and all other applicable documents; liaise with NATO subject matter experts as necessary; and prepare its recommendations in terms of proposed changes to the SRS. The Contractor may propose changes to the SRS, in order to resolve inconsistencies and/or make improvements. Such proposals will be considered by the Purchaser through the CCB approval process after the Systems Requirements Review (SRR) Meeting.

4.8.1.4. The Contractor shall conduct an initial System Requirement Analysis phase at system level to support the Incremental Development methodology (described in Subsection 4.2).

4.8.1.5. The Contractor shall use the DOORS (IBM) Requirements Management tool for management of the system and project requirements given in SOW and SRS.

4.8.1.6. The Purchaser will provide the TRITON Requirements Management Database (RMD) to the Contractor.

4.8.1.7. The Contractor shall update the RIS, as Annex to the SDP, to reflect the requirements to be implemented as a Baseline as agreed during the SRR (described in Paragraph 4.8.7).

4.8.1.8. The Contractor shall justify any proposed changes to the requirements by the expected system cost, schedule, performance, and supportability impacts.

4.8.1.9. The Contractor shall also identify any requirements that seem to be in conflict (e.g. with design constraints).

4.8.1.10. The Contractor shall identify the requirements initially satisfied by the proposed solution.

4.8.2. Requirements Identification, Elaboration and Validation

4.8.2.1. The focus and effort for TRITON Increment 1 Project is on analysing and consolidating the TRITON requirements provided as part of this Contract as the basis for establishment of TRITON Increment 1 for both NS and NU Domains.

4.8.2.2. The Contractor shall provide additional support for requirements identification, elaboration and validation as stated below:

4.8.2.2.1. Elicit, analyse, and support validation of stakeholder needs, expectations, constraints, and interfaces to specify requirements that constitute an understanding of what will satisfy stakeholders.

4.8.2.2.2. Develop the lifecycle requirements of the product (e.g. development, transition to operations, maintenance).

4.8.2.2.3. Review operational concepts and scenarios to refine and discover detailed requirements.

4.8.2.2.4. Analyse needs and requirements (for each product lifecycle phase), the operational environment, and factors that reflect overall customer and end-user needs and expectations for attributes such as safety, security, portability, maintainability, performance, interoperability and affordability.

4.8.2.2.5. Define the environment in which the product will operate, including boundaries and constraints.

4.8.2.2.6. Analyse stakeholder needs, expectations, constraints, and external interfaces to remove conflicts and to organize into related subjects.

4.8.2.2.7. Analyse requirements to determine whether they satisfy higher level requirements.

4.8.2.2.8. Analyse requirements to ensure that they are complete, feasible, realizable, and verifiable.

4.8.2.2.9. Identify key requirements that have a strong influence on cost, schedule, functionality, risk, quality, or acceptance.

4.8.2.2.10. Identify technical performance measures to be tracked during the implementation.

4.8.2.2.11. Derive new system-level requirements from the existing ones if further clarification is needed according to the proposed solution.

4.8.2.2.12. Explore the adequacy and completeness of requirements by developing product representations (e.g. prototypes, simulations, models, scenarios, and storyboards) and by obtaining feedback about them from relevant stakeholders.

4.8.2.2.13. Analyse the requirements to determine the risk that the resulting product will not perform appropriately in its intended-use environment.

4.8.2.2.14. Define constraints for verification and validation.

4.8.2.2.15. Establish and maintain relationships among the requirements under consideration during change management and requirements allocation.

4.8.2.2.16. Apply requirements elicitation, documentation, and verification and validation methods based on sound engineering principles.

4.8.2.2.17. Provide impact assessment of new project issues, risks, and changes.

4.8.2.3. Requirements Prioritisation

4.8.2.3.1. The Contractor shall prioritise capabilities, functions and requirements using MoSCoW (Must have, Should have, Could have, Would like but won't get) method, initially trying to deliver all the "Must have", "Should have" and "Could have" requirements, but the "Should" and "Could" requirements will be the first to be deferred if the delivery timescale looks threatened.

4.8.2.3.2. Minimum Usable SubseT (MUST) of functions shall be completely implemented, thoroughly tested and delivered. The functions and requirements defined in SRS are all in MUST status within the Contract duration. Prioritisation is therefore only applicable within the Build Processes and any approved maintenance work.

4.8.2.3.3. The Contractor shall apply at least three-level prioritisation as given below and depicted in Figure 15:

- Level 1: Capability allocation to Baselines (as described in SRS and RIS)
- Level 2: Function allocation within a capability
- Level 3: Requirement allocation within a function (e.g. into sprints).

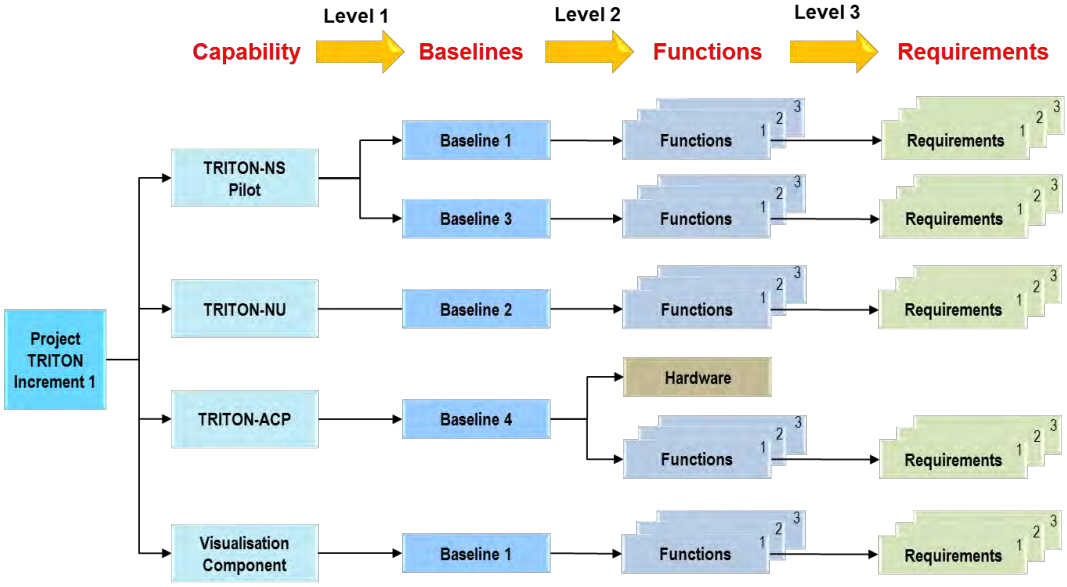


Figure 15 – Requirements Prioritisation

4.8.2.3.4. Within each Build Process, prioritised requirements can be implemented in small increments and interim baselines can be deployed on the Test System at PMIC to allow continuous development, testing and integration process.

4.8.2.3.5. The Contractor shall propose a prioritisation approach such as prioritising functions and requirements as 1, 2, 3, and develop a plan.

4.8.2.3.6. Upon Purchaser's approval, the Contractor shall conduct the development plan supported by an agile management and development practice, and update continuously.

4.8.2.4. The Contractor shall employ the following techniques to elicit system requirements as applicable:

- Questionnaires and interviews with staff officers
- Business Process Analysis
- Operational scenarios obtained from end users
- Operational walkthroughs and end-user task analyses
- Prototypes, storyboards and models
- Observation of existing products, environments, and workflow patterns
- Participation in NATO exercises
- Structured workshops with brainstorming
- Working Group studies
- Market surveys (for any COTS product)
- Extraction from sources such as business process documents, standards, or specifications
- Use Cases and User Stories
- Technical documentation review
- Reverse engineering (for legacy products).

4.8.2.5. The Contractor shall employ the following techniques to elicit project requirements as applicable:

- Organise, facilitate, and document the results of Joint Technical Reviews and other stakeholder workshops (such as the Working Groups) in an agreed requirements database, and architecture product deliverables.
- Develop Use Cases to identify in details, the required functions, supported processes, information exchanges, and operational modes of the system.
- Develop proposed changes to the system requirements, justified and documented by the products mentioned above.
- Re-prioritise functions and requirements according to the progress and test results.

4.8.3. System Requirements Specification

4.8.3.1. The Contractor shall prepare the System Requirements Specification (SyRS) by using the Contractual SRS with approved changes and, as required, extended with additional details supporting the approved scope including the identification of COTS products to be used.

4.8.3.2. The Contractor shall use ISO/IEC 15289, ISO/IEC 29148 as a basis for developing the SyRS.

4.8.3.3. The Contractor shall propose changes to the Contractual SRS during the Incremental Development in order to take into account outcomes of the Working Group reviews or to mitigate identified issues.

4.8.3.4. The Purchaser will propose changes to the contractual SRS during the Incremental Development to take into account outcomes of the Working Group reviews or to mitigate identified issues.

4.8.3.5. The Purchaser will propose a prioritised requirements list to insure that proposed changes can be considered by the TRITON CCB within the same Build Process scope or within another.

4.8.3.6. The Purchaser will propose elaborated contractual requirements consistent with user requirements to a level of detail that is sufficient to be included in the Contract.

4.8.4. User Interface Specification

4.8.4.1. The Contractor shall prepare User Interface Specification (UIS) to capture the details of the Human Machine Interface (HMI) including Graphical User Interface (GUI) and covering all possible actions that an end user may perform.

4.8.4.2. The Contractor shall ensure that the GUI design is compliant to the NCI Agency Style Guide.

4.8.4.3. The UIS shall include the following:

- All user interaction through HMI
- Main Application View design
- Structure and navigation of Web pages
- Individual Application GUI
- Dialog boxes

- Notification windows
- Tooltips
- Description and navigation for each window
- All elements in a window (including the menu/list items)
- Behaviour of control widgets

4.8.4.4. The UIS shall include all use cases for logical flow, description of displays, windows and dialog boxes, full range of information displayed in GUI elements (e.g. items for a pull-down list).

4.8.4.5. The Contractor shall deliver the first UIS with high-level requirements at PDR, a more detailed, preliminary version at CDR. The actual details for individual software elements shall be added during related Build Processes and evaluated at related Software Requirements Reviews and Software Design Reviews.

4.8.4.6. The UIS will be updated during detailed software design and reviewed by operational users as planned during the Build Processes.

4.8.4.7. The Contractor shall provide user interface mock-ups supporting the descriptions included in the UIS better understanding and more effective assessment.

4.8.5. Security Risk Assessment and Requirements Analysis

4.8.5.1. The Contractor shall conduct a Security Risk Assessment (SRA) which identifies all threats, vulnerabilities, and resulting risks to TRITON using the NATO version of the PILAR methodology.

4.8.5.1.1. The SRA shall identify any changes to the contractual SRS required to achieve the desired system accreditation.

4.8.5.1.2. The Contractor shall provide a report documenting the findings of its SRA.

4.8.5.1.3. The SRA Report shall be discussed at the TRITON IWG Workshop and agreed with the Purchaser.

4.8.5.1.4. The SRA Report will be subject to the approval by the respective NATO Security Authority. The Contractor is requested to update the document as requested to obtain security approval.

4.8.6. System-Specific Security Requirement Statement

4.8.6.1. The Contractor shall prepare the System-specific Security Requirement Statement (SSRS) and the Community Security Requirement Statement (CSRS) defining all security measures required to counter the risks identified in the SRA, as a change to the Contractual SRS.

4.8.6.2. The Contractor shall prepare a System Interconnection Security Requirement Statement (SISRS) for each interface between TRITON and any other Purchaser system on NS Domain.

4.8.6.3. The SSRS, CSRS and SISRS shall be based on the documents provided by the Purchaser and shall be discussed at TRITON IWG Workshop

4.8.6.4. The Contractor shall develop and provide system documentation before the IV&V Testing as required by the NCI Agency in order to support the Security Penetration Test and screening activities and to include TRITON in the NATO AFPL. The security settings and related testing documentation will be provided as part of PFE.

4.8.7. Reliability Engineering

4.8.7.1. The Contractor shall perform Reliability Engineering to meet the related non-functional requirements specified in the SyRS. The Reliability Engineering shall include the following:

- System availability and operational readiness analysis and related reliability and maintenance requirement allocation
- System failure analysis
- Design reliability analysis
- System error handling and diagnostic design
- Failure and recovery analysis

4.8.7.2. The Contractor shall document the results of Reliability Engineering in the SyRS, derive requirements for software development, review the system-level and component design and perform specific tests to make sure the product can meet the specifications.

4.8.7.3. The Contractor shall also consider Availability and Maintainability aspects of the product and review the design according to the specification.

4.8.8. System Requirements Review

4.8.8.1. System Requirements Review (SRR) is a multi-disciplined review to ensure that the system under review can proceed into initial systems development, and that all system requirements and performance requirements derived from the SyRS are defined and testable, and are consistent with cost, schedule, risk, technology readiness, and other system constraints.

4.8.8.2. The Contractor shall organise and conduct the SRR at the Purchaser's facility to present the updated SyRS as the Functional Baseline (FBL) for TRITON.

4.8.8.3. Entry Criteria

4.8.8.3.1. The Contractor shall include in planning the SRR Entry Criteria given in Table 4-3 and make them available to the Purchaser at least two (2) weeks prior to the SRR:

Table 4-3 – SRR Entry Criteria

Serial	Activities / Documents
1	A preliminary SRR agenda
2	Success Criteria (enhanced or adapted)
3	System Requirements Specification (SyRS)
4	Traceability of requirements from SyRS to SRS
5	Security Risk Assessment Report (SRA-R)
6	System-Specific Security Requirements Statement (SSRS)
7	Community Security Requirements Statement (CSRS)

8	System Interconnection Security Requirements Statements (SISRS)
9	Preliminary system requirements allocation to the next lower levels.
10	Updated schedule
11	Preliminary software development plan
12	Preliminary verification and validation approach
13	Updated risk assessment and mitigations in the Risk Register
14	Active Change Requests

4.8.8.4. Success Criteria

4.8.8.4.1. The Purchaser concludes that the SRR Success Criteria in Table 4-4 accomplished to complete the objectives of the SRR.

Table 4-4 – SRR Success Criteria

Serial	Requirement
1	The resulting overall concept is reasonable, feasible, complete, responsive to the operational requirements, and is consistent with system requirements and available resources (cost, schedule, staff, etc.).
2	The project utilizes a sound process for the allocation and control of requirements throughout all levels, and a plan has been defined to complete the definition activity within schedule constraints. Preliminary software development plan exists.
3	Requirements definition, SyRS, is complete with respect to the Contractual SRS requirements, and interfaces with external entities and between major internal elements have been defined.
4	Requirements allocation and traceability of key driving requirements have been defined from Contractual SRS, down to SyRS and lower level system elements.
5	System and element design approaches and operational concepts exist and are consistent with the SyRS.
6	The requirements, design approaches, and conceptual design will fulfil the mission needs within the estimated costs.
7	Preliminary approaches have been determined for how requirements will be verified and validated down to the system element level.
8	Requirements Implementation Schedule (Annex to SDP) is updated to reflect the requirements to be implemented at each Build Process.
9	All changes to SyRS, SSRS, CSRS, SISRS are agreed, they are accepted to have sufficient detail to begin or continue with the system design and implementation work.
10	Major risks have been identified, and viable mitigation strategies have been defined. Steps to mitigate risks are identified in the Risk Register.

4.8.8.5. The Contractor shall prepare a SRR Report and deliver within one week after the completion of the SRR.

4.8.9. Requirements Management Database

4.8.9.1. The Contractor shall establish and maintain an effective Requirements Management Database (RMD).

4.8.9.2. A copy of the Purchaser's Preliminary System Requirements will be handed over to the Contractor during the TRITON Project Kick-Off Meeting. The Contractor shall take over the requirements that the Purchaser's RMD contains and maintain it throughout the Contract.

4.8.9.3. The RMD shall indicate for each requirement in which iteration it will be implemented. The RMD should also indicate requirements which are covered by COTS components (by definition these should exist at the time of bidding).

4.8.9.4. The Contractor shall provide Internet access for the Purchaser to this RM tool via the Project Website.

4.8.9.5. The Contractor shall provide the initial version of the system-level RMD Baseline at least two (2) weeks prior to the System Requirements Review (SRR).

4.8.9.6. The Contractor shall deliver the final version of the RMD at FSA.

4.8.10. Requirements Change Requests

4.8.10.1. The Contractor shall identify all proposed changes to the Contractual SRS in the form of one or more Change Requests (CR).

4.8.10.2. The Contractor shall prepare CRs following the guidelines of the Contract Configuration Management requirements stated in Paragraph 4.7.10.

4.8.10.3. The CR impact description shall include a statement of compliance with the authorised scope of the project and any trade-offs that shall be considered.

4.8.10.4. Provided approval of the Purchaser's Contracting Authority, the Contractor shall update the Contractual SRS to reflect the decision of the TRITON CCB on these CRs and also apply the changes to SyRS.

4.8.10.5. The Contractor shall use the approved SyRS as the basis for the TRITON system design and subsequent design changes.

4.9. System Architectural Design Process

4.9.1. General

4.9.1.1. System Architectural Design includes an identification of the hardware items, software items and manual operation items included in the system and an allocation of system requirements to those items. The Contractor shall perform System Architectural Design activities in compliance with the processes defined in ISO/IEC 15288 Paragraph 6.4.3 (s referred by AAP-48) and using the guidance of ISO/IEC 42010 and ISO/IEC 15289.

4.9.1.2. The Contractor shall conduct the System Architectural Design phase in accordance with the Incremental Development approach (described in 4.2).

4.9.1.3. The Contractor shall provide system architecture design to be used by the Build Processes. The design shall describe the structure of the final system as described in the SyRS.

4.9.1.4. The Contractor shall decompose the system into System Elements, allocate the requirements to the elements and verify that all requirements are allocated to elements.

4.9.1.5. The Contractor shall use one of the following requirement assignment types:

- Direct assignment: The requirement from SyRS is directly assigned to a System Element.
- Indirect assignment: The requirement from SyRS is analysed, and the derived parameters are assigned to the appropriate System Elements.
- Derived requirement: The requirements produced as a result of design activities (e use of COTS items, reuse, and adaptation).

4.9.1.6. The Contractor shall specify the selected physical design solution as an architectural design baseline in terms of its functions, performance, behaviour, interfaces and unavoidable implementation constraints.

4.9.1.7. The Contractor shall start software architectural design after system-level requirements are finalised and provide the preliminary versions of Software Architecture Description (SAD) and Database Design Description (DDD) during PDR, and finalise them during CDR. These documents can be updated in Build Processes as necessary.

4.9.1.8. The Contractor shall develop and provide a mock-up or low fidelity prototype of the major user interface features and include the user interface concept in the User Interface Specification (UIS). The UIS shall be updated during the Build Processes.

4.9.1.9. The Contractor shall perform Reliability, Availability, Maintainability and Testability (RAMT) engineering, model the system reliability using Reliability Block Diagrams (RBD) and Failure Modes and Effect Analysis (FMEA) as defined in STANREC 4174.

4.9.1.10. The Contractor shall organize and conduct system-level design reviews to present its design of the TRITON capability and any subsequent maintenance and major releases.

4.9.1.11. The Contractor shall deliver the draft documents prior to the design reviews as agreed with the Purchaser. Informal design reviews using the draft documents may be held at times agreed to by the Purchaser and the Contractor.

4.9.2. System Design Specification

4.9.2.1. The Contractor shall establish, provide, and maintain the System Design Specification (SDS) based on the approved SyRS specifying the FBL.

4.9.2.2. The SDS shall describe the TRITON capability to a level of detail that is sufficient for the Purchaser to be able to understand how the TRITON capability will be implemented and verified.

4.9.2.3. The Contractor shall develop the SDS in accordance with ISO/IEC 12207, ISO/IEC 15289, IEEE 1016 and the specifications given in this SOW.

4.9.2.4. After having an approved initial SDS at PDR, the Contractor shall develop the final SDS in accordance with the processes defined in Paragraph 7.1.4 through 7.1.7 of ISO/IEC 12207 and submit it at CDR.

4.9.2.5. The Contractor shall include in the SDS the ABL which includes all documentation related to verification (i.e. test procedures per CI as defined in ACMP-2009) of requirements per CI identified in the FBL.

4.9.2.6. The SDS shall identify the proposed CIs and their design, functionality, interfaces, and data structures. For each CI, the SDS shall identify the following:

- The functional requirements that are realized by a CI
- Any constraints imposed upon it
- Any COTS and NATO OTS components necessary to build, deploy or execute this CI
- The value of the Adjusted Function Points Count, as the measure of CI's complexity
- Test Procedures (preliminary) to be used for verification and validation

4.9.2.7. The SDS shall identify the Interface Control Descriptions (ICD) required to define the interface between TRITON and external systems, services, or capabilities.

4.9.2.8. The SDS shall identify all necessary customisation (by parameterisation or new software development) of the COTS packages that will be used.

4.9.2.9. The SDS shall include the information as required in the architectural views based on the NATO Architectural Framework (NAF) (currently Version 3.1).

4.9.2.10. The SDS shall provide both the high-level and detailed design information as an integrated set of model files using structured dataset format containing all the required data and relationships according to the SyRS specifications. The Contractor shall propose the most appropriate notation and representation to represent the underlying data in the SDS to be validated by the Purchaser at PDR.

4.9.2.11. TRITON Architecture Models

4.9.2.11.1. The Contractor shall provide the high-level design information in the form of a TRITON Logical Model.

4.9.2.11.2. The TRITON Logical Model shall include the following:

- Use Case Diagrams
- Activity Diagram
- State Machine Diagram
- Sequence Diagram.

4.9.2.11.3. UML or SysML may be used to develop the Logical Model.

4.9.2.11.4. The Contractor shall develop and maintain TRITON System Architecture Model in an architecture repository using Purchaser-approved format (ARIS or System Architect). The Model shall be delivered to the Purchaser at CDR and updated at each SwDR. The Purchaser will provide guidance on preparing the model.

4.9.2.12. System Security Design Specification

4.9.2.12.1. The SDS shall include a System Security Design Specification (SSDS) as an Annex to support accreditation of the TRITON capability for use in NSWAN.

4.9.2.12.2. SSDS shall include at least the following:

- System access control, data protection, and information exchange requirements and design features

- Backup, recovery, availability, and security requirements and design features
- System configuration and administration requirements and design features
- Security impacts, including any required adjustments and configuration changes to workstation baselines and network elements such as firewalls and routers
- The security features of any off-the-shelf products included in the system
- For each security measure included in the SRS, the SDS shall either identify the matching security design feature or operational procedure.

4.9.2.13. The SDS shall identify the minimum hardware and software specifications required to support the proposed system baseline, including the baseline design, maintenance, and test elements to be installed. The required computation resources shall be identified in terms of Service Parameters for static sites.

4.9.2.14. The SDS shall provide a detailed list of the COTS components (hardware and software) proposed to be supplied as part of the Contract. The product name, manufacturer name, and manufacturer's part number, version, or release number shall be stated, as appropriate.

4.9.2.15. The SDS shall provide a detailed specification sheet for each item of COTS equipment and software proposed to be supplied as part of the Contract.

4.9.2.16. Requirements Traceability Matrix

4.9.2.16.1. As an annex to the SDS, the Contractor shall provide and maintain a Requirements Traceability Matrix (RTM) that guarantees the two-way link between requirements (SyRS), technical specifications (SDS), test procedures and tests.

4.9.2.16.2. The Contractor shall extend the RTM to the Developmental Baseline, Product Baseline, and the TMP to ensure the Purchaser can verify compliance throughout the project.

4.9.2.16.3. The Contractor shall update the RTM during the System Architectural Design Process if any Change Proposal is accepted by the CCB.

4.9.2.17. Interface Control Description

4.9.2.17.1. The Contractor shall produce TRITON Interface Control Description (ICD), describing all external TRITON interfaces (for external systems, services, Nations and ACPs) to be developed or updated within this Contract. The ICD shall refer to other ICDs where applicable.

4.9.2.17.2. The TRITON ICD shall include all types of interfaces including the Web-services (e.g. RMP Service) and their Service Interface Profiles (SIP).

4.9.2.17.3. The Contractor shall made the initial TRITON ICD available at CDR. This ICD shall include Nations' interface options as well as known interfaces.

4.9.2.17.4. The Purchaser will release the TRITON ICD to Nations and other Functional Services.

4.9.2.17.5. The Contractor shall update the TRITON ICD for the NS Domain and NU Domain at during the Software Design Reviews for each Build Process.

4.9.2.18. The Contractor shall include an updated set of all the above design artefacts as part of the delivered Product Baseline.

4.9.2.19. Review and acceptance of design documentation provided by the Contractor to the Purchaser shall not imply Purchaser acceptance of the TRITON design. It remains the sole responsibility of the Contractor to prove the design through the regime of testing set forth in the Contract and it shall be the sole responsibility of the Contractor in the event that the system proves deficient in meeting the SRS.

4.9.3. Preliminary Design Review

4.9.3.1. The Preliminary Design Review (PDR) demonstrates that the preliminary design meets all system requirements with acceptable risk and within the cost and schedule constraints and establishes the basis for proceeding with detailed design. It will show that the correct design option has been selected, interfaces have been identified, and verification methods have been described.

4.9.3.2. The Contractor shall plan the PDR near the completion of the preliminary design phase and conduct the PDR at the Purchaser's facility.

4.9.3.3. Entry Criteria

4.9.3.3.1. The Contractor shall include in planning the PDR Entry Criteria given in Table 4-5 and make them available to the Purchaser at least two (2) weeks prior to the PDR:

Table 4-5 – PDR Entry Criteria

Serial	Activities / Documents
1	A preliminary PDR agenda
2	Success Criteria (enhanced or adapted)
3	System Design Specification (SDS) (preliminary)
4	Software Architecture Description (SAD) (preliminary)
5	Database Design Description (DDD) (preliminary)
6	User Interface Specification (UIS) (preliminary)
7	System Security Design Specification (SSDS) (preliminary)
8	Requirements Traceability Matrix (RTM)
9	TRITON Interface Control Description (ICD) (draft)
10	Integrated Support Plan (ISP) (draft)
11	Updated Risk Register
12	Active Change Requests

4.9.3.3.2. The scope of the SDS to be provided for PDR may be limited to high-level design information, and is not required to present implementation details.

4.9.3.4. Success Criteria

4.9.3.4.1. The Purchaser concludes that the PDR Success Criteria in Table 4-6 accomplished to complete the objectives of the PDR.

Table 4-6 – PDR Success Criteria

Serial	Status / Documents
1	Agreement exists for the top-level requirements, including their verification and validation criteria, technical performance measures and any implementation constraints, and that these are finalised, stated clearly, and are consistent with the preliminary design.
2	The traceability of verifiable requirements is complete and proper or, if not, an adequate plan exists for timely resolution of open items. Requirements are traceable to the Contractual SRS.
3	The preliminary design is expected to meet the requirements at an acceptable level of risk.
4	Definition of the technical interfaces is consistent with the overall technical maturity and proves an acceptable level of risk.
5	Adequate technical interfaces are consistent with the overall technical maturity and provide an acceptable level of risk.
6	Adequate technical margins exist with respect to technical performance measures.
7	The project risks are understood; plans, process and resources exist to effectively manage them. Steps to mitigate risks are identified in the Risk Register.
8	Major user interface features are reviewed and concept of interfaces are agreed.
9	Non-functional requirements have been adequately addressed in preliminary designs.
10	The operational concept is technically sound, that it includes (where appropriate) human factors that apply, and that requirements for its execution are traceable.

4.9.3.5. The Purchaser concludes that the Success Criteria was accomplished to complete the objectives of the PDR.

4.9.3.6. The Contractor shall incorporate all design changes approved during the PDR.

4.9.3.7. The Contractor shall prepare PDR Report and submit it within one week after the completion of PDR.

4.9.4. Critical Design Review

4.9.4.1. The purpose of the Critical Design Review (CDR) is to demonstrate that the maturity of the design is appropriate to support proceeding with full scale software and hardware implementation, integration, verification, validation and operation and that the technical effort is on track to complete system development in order to meet the SyRS requirements within the identified cost and schedule constraints.

4.9.4.2. The Contractor shall plan the CDR at the completion of the system design phase and conduct the CDR at the Purchaser's facility.

4.9.4.3. Entry Criteria

4.9.4.3.1. The Contractor shall include in planning the CDR Entry Criteria given in Table 4-7 and make them available to the Purchaser at least two (2) weeks prior to the CDR:

Table 4-7 – CDR Entry Criteria

Serial	Activities / Documents
1	A preliminary CDR agenda
2	Success Criteria (enhanced or adapted)
3	Successful completion of the PDR and responses has been made to all PDR open issues, or a timely closure plan exists for those remaining open.
4	Test Management Plan (TMP) (final)
5	Test Procedures (preliminary)
6	Training Plan (TrP) (initial release)
7	System Validation Plan (draft)
8	System Design Specification (SDS) (final)
9	User Interface Specification (UIS) (initial version)
10	System Security Design Specification (SSDS) (final)
11	Software Architecture Description (SAD) (final)
12	Database Design Description (DDD) (final)
13	Requirements Traceability Matrix (RTM)
14	TRITON Interface Control Description (ICD) (initial version)
15	Integrated Support Plan (ISP) (initial version)
16	Updated Risk Register
17	Active Change Requests

4.9.4.4. Success Criteria

4.9.4.4.1. The Purchaser concludes that the CDR Success Criteria in Table 4-8 accomplished to complete the objectives of the CDR.

Table 4-8 – CDR Success Criteria

Serial	Status / Documents
1	The detailed design is expected to meet the requirements with adequate margins at an acceptable level of risk. System Element-level functionality, design and interfaces are defined.
2	Core Services integration (at Service-level and host environment-level) is defined.
3	System security, including Technical Services access-control mechanisms, data protection, backup and recovery, audit, interconnection, and information exchange security in context of the Services breakdown are defined.
4	High-level design of Maritime Information Entities is completed.
5	ICDs are appropriately matured to proceed with implementation, integration and test, and plans are in place to manage any open items. System-level and Service-level interfaces, including external Services interfaces are defined.
6	High confidence exists in the PDR, and adequate documentation exists and/or will exist in a timely manner to allow proceeding with implementation, integration, and test. For any elements that require development, the development methodology and documentation approach are defined.

7	Overall system design and its interactions, Services, components and Human-Machine Interface and Human Factors justifications are defined.
8	For COTS products, the intended product and version, and note if any modifications, adaptations, or additional elements (such as macros or plug-ins) are required. Open Source Software (OSS) are to be disclosed (for review of OSS conditions by the Purchaser).
9	The verification and validation requirements and plans are complete.
10	The testing approach is comprehensive, and the planning for system integration, test, and operation is sufficient to progress into the next phase. Sequence and scope of system tests of each Baseline and any requirements for Purchaser support and participation are defined.
11	Adequate technical and programmatic margins and resources exist to complete the development within budget, schedule, and risk constraints.
12	Risks are understood, and plans and resources exist to effectively manage them. Steps to mitigate risks are identified in the Risk Register.
13	Non-functional requirements have been adequately addressed in system and operational designs.

4.9.4.5. The Purchaser concludes that the CDR Success Criteria was accomplished to complete the objectives of the CDR.

4.9.4.6. As required, the Contractor shall organise subsequent Design Reviews and shall deliver updated design documents as minor revisions that replaces earlier versions of the documents of the Functional Baseline. The reviews shall be carried out within the framework of the Working Group Reviews.

4.9.4.7. The Contractor shall incorporate all design changes approved during the CDR.

4.9.4.8. The Contractor shall prepare CDR Report and submit it within one week after the completion of CDR.

4.10. System Implementation Process

4.10.1. General

4.10.1.1. The Contractor shall implement the System Elements (hardware and software items) identified in the SDS.

4.10.1.2. The Contractor shall perform system implementation activities in compliance with the processes defined in ISO/IEC 15288, Paragraph 6.4.4 as referred by AAP-48, Paragraph 6.4.4.

4.10.1.3. The Contractor shall conduct Software and Hardware Implementation Processes separately.

4.10.2. Software Implementation Processes

4.10.2.1. General

4.10.2.1.1. The Contractor shall perform Software Implementation Process to produce a specified system element implemented as a software product or service according to ISO/IEC 12207, Paragraph 7.1.

4.10.2.1.2. The Contractor shall apply a formally defined and documented software development methodology.

4.10.2.1.3. The Contractor shall use a Component-Based Architecture for developing the TRITON capability as it is expected that it will be a combination of custom-developed and off-the-shelf (whether commercially available or developed for other customers).

4.10.2.1.4. The Contractor shall design and implement identified components supporting well-defined interfaces and supporting reuse, encapsulation and independent deployment together with its own documentation

4.10.2.1.5. The Contractor shall develop the TRITON capability as a Service-Oriented Architecture (SOA). The Contractor shall identify, document and implement services (primarily as Web services) that can be accessed within TRITON and by other authorised systems or services.

4.10.2.1.6. The Contractor shall utilise the available Bi-SC AIS Core Services which will be provided either as components of the target operating environment or by the other NATO systems/services with which TRITON must co-operate and communicate.

4.10.2.1.7. The Contractor shall provide integration with available Bi-SC AIS Functional Services which will be provided either as components of the target operating environment or by the development of other NATO systems with which TRITON must cooperate and communicate.

4.10.2.1.8. The Purchase will have the right to observe the process.

4.10.2.2. Software Development Environment

4.10.2.2.1. The Contractor shall establish a software development environment at his own premises in accordance with the following requirements:

4.10.2.2.1.1 The Contractor shall establish, control, and maintain a “software engineering environment”, which consists of the facilities, hardware, software, firmware, procedures, and documentation needed to perform software engineering effort. Elements may include but are not limited to computer-aided software engineering tools, compilers, linkers/loaders, operating systems, debuggers, simulators, documentation tools, and database management systems. The Contractor shall ensure that each element of the environment performs its intended functions.

4.10.2.2.1.2 The Contractor shall establish, control, and maintain a “software test environment”, which consists of the facilities, hardware, software, firmware, procedures, and documentation needed to perform qualification, and possibly other, testing of software. Elements may include but are not limited to simulators, code analysers, test case generators, and path analysers, and may also include elements used in the software engineering environment. The Contractor shall ensure that each element of the environment performs its intended functions.

4.10.2.2.1.3 The Contractor shall establish, control, and maintain a Software Development Library (SDL) [ACMP-2009], which is a controlled collection of software, documentation, other intermediate and final software products, and associated tools and procedures used to facilitate

the orderly development and subsequent support of software. The SDL, having procedures for controlling the software residing within the SDL, may be an integral part of the software engineering and test environments.

4.10.2.2.2. The Contractor may use non-deliverable software, which are software products that are not required by the Contract to be delivered to the Purchaser, in the development of deliverable software as long as the operation and support of the deliverable software after delivery to the Purchaser do not depend on the non-deliverable software or provision is made to ensure that the Purchaser has or can obtain the same software. The Contractor shall ensure that all non-deliverable software used on the project performs its intended functions.

4.10.2.3. Incremental Development

4.10.2.3.1. The Contractor shall apply Incremental Development with Multiple Deliveries approach for implementing the TRITON Functional Services in Build Processes. The Contractor shall develop a deliverable product within a Build Process.

4.10.2.3.2. The Contractor shall apply all software implementation processes separately for each Build Process.

4.10.2.3.3. The Contractor shall provide a Product Baseline at the end of each Build Process.

4.10.2.4. Software Requirements Analysis Process

4.10.2.4.1. The Contractor shall conduct Software Requirements Analysis Process to establish the requirements of the software elements of the system allocated to the Build Process.

4.10.2.4.2. The Contractor shall perform the software requirements analysis activities described in ISO/IEC 12207, Paragraph 7.1.2.3.

4.10.2.4.3. The Contractor shall generate requirements for software from the SyRS.

4.10.2.4.4. Software Requirements Specification

4.10.2.4.4.1 The Contractor shall produce and maintain the Software Requirements Specification (SRS) based on the approved SyRS for each Build Process and specify the FBL.

4.10.2.4.4.2 The Contractor shall develop the SRS in accordance with ISO/IEC 12207, ISO/IEC 15289, and the specifications given in this SOW.

4.10.2.4.4.3 The SRS shall include the following:

- Requirements allocated to the software elements which are to be implemented in a Build Process.
- Derived software requirements (functional and non-functional)
- Database requirements

4.10.2.4.5. The Contractor shall perform lower-level software requirements analysis for each defined software item in order to specify construction-level requirements and produce item-level specification documents (e.g. SRS-CI).

4.10.2.4.6. Software Requirements Review

4.10.2.4.6.1 Software Requirements Review (SwRR) is a review to ensure that the software under review can proceed into initial development, and that all software requirements and performance requirements derived from the SyRS are defined and testable, and are consistent with cost, schedule, risk, technology readiness, and other system-level constraints.

4.10.2.4.6.2 The Contractor shall organise and conduct the SwRR at the Purchaser's facility to present the SRS for each Build Process.

4.10.2.4.6.3 The SRS containing the software requirements allocated to that Build Process shall be evaluated, reviewed, approved and baselined during the SwRR.

4.10.2.4.6.4 The Contractor shall prepare a SwRR Report and deliver within one week after the completion of the SwRR.

4.10.2.5. Software Architectural Design Process

4.10.2.5.1. The Contractor shall conduct a Software Architectural Design Process in order to define an architectural solution for all TRITON Software. As a minimum, the architectural solution shall consist of both a functional/logical architecture (expressed as a set of functions, scenarios, and/or operational models) and a physical architecture (expressed as a set of system elements physically connected between them) associated to a set of design properties.

4.10.2.5.2. The Contractor shall perform the software architectural design activities described in ISO/IEC 12207, Paragraph 7.1.3.3 in each Build Process.

4.10.2.5.3. The Contractor shall decompose the TRITON software, for both NS and NU Domains, into components, and then into lower level elements.

4.10.2.5.4. The Contractor shall transform the requirements for the software into an architecture that describes its top-level structure and identifies the software components. It shall be ensured that all the requirements are allocated to software components and lower level elements.

4.10.2.5.5. Software Architecture Description

4.10.2.5.5.1 The purpose of the Software Architecture Description (SAD) is to describe the system-wide design decisions related to software architectural design, including the concept of execution and resource limitations.

4.10.2.5.5.2 The SAD shall include:

- System-wide software design
- Infrastructure software and SOA
- Software Components and their interfaces
- High-level design for the databases (input to Database Design Description)
- Dynamic behaviour of modules, components and services
- Provision of data integrity (synchronisation and replication)
- Recovery from failure.

4.10.2.5.5.3 The SAD shall include architecture drawings compliant with the NATO Architecture Framework (v3) views.

4.10.2.5.5.4 The SAD shall be produced in the first Build Process and updated during other Build Processes.

4.10.2.5.5.5 One system-wide SAD may be used for all Build Processes with indications of classification domains (NS and NU) and installation sites (Static and Afloat).

4.10.2.5.5.6 The SAD shall be evaluated, reviewed, approved and baselined during a Software Design Review (SwDR) for each Build Process.

4.10.2.5.5.7 The Contractor shall provide the detailed GUI information in the UIS at each SwDR and then update during the construction of each software item.

4.10.2.5.6. Database Design Description

4.10.2.5.6.1 The Contractor shall design the databases used in TRITON and prepare a Database Design Description (DDD) as an annex to the SAD.

4.10.2.5.6.2 DDD shall describe database-wide design decisions, that is, decisions about the database's behavioural design (how it will behave, from a user's point of view, in meeting its requirements, ignoring internal implementation) and other decisions affecting further design of the database.

4.10.2.5.6.3 DDD shall describe the detailed design of the database (Data Model). The number of levels of design and the names of those levels shall be based on the design methodology used.

4.10.2.5.6.4 DDD shall identify a database design level and shall describe the data elements and data element assemblies of the database in the terminology of the selected design method.

4.10.2.5.6.5 DDD shall define other database-related functions, management, accessibility and security issues.

4.10.2.6. Software Detailed Design Process

4.10.2.6.1. The Contractor shall perform the software detailed design activities described in ISO/IEC 12207, Paragraph 7.1.4.3 in each Build Process.

4.10.2.6.2. The Contractor shall develop a detailed design for each software item or component. The software components shall be refined into lower levels containing software units that can be coded, compiled, and tested. It shall be ensured that all the software requirements are allocated from the software items to components and to software units.

4.10.2.6.3. The Contractor shall follow the following process as a general design approach for managing the identified information objects:

- Determine information to be managed
- Define a data structure to store the data
- Design the data model
- Provide standard management functions on the stored data (create, modify, delete, export, import etc.)
- Assign access privileges
- Provide a user interface to manage the data

- Provide a user interface to enter data
- Provide a user interface to view data (read-only)
- Provide user interface to link data to other data structures.

4.10.2.6.4. The documents produced during the Software Detailed Design Process shall be discussed during IWG Workshops.

4.10.2.6.5. The Contractor shall provide the detailed design information in the form of a TRITON implementation model.

4.10.2.6.5.1 The TRITON implementation model shall include the following diagrams:

- Activity diagram
- Class diagram
- Object Diagram
- Component diagram
- Deployment diagram
- Sequence diagram
- State Machine diagram
- Communication diagram.

4.10.2.6.5.2 UML class diagrams shall be used to identify and describe the computer software units and their interdependencies. Class diagrams shall portray attributes (data), methods (functions, interface), and dependency relationships (e inheritance, dependencies, associations).

4.10.2.6.6. Software Design Description

4.10.2.6.6.1 The Contractor shall document the detailed design in Software Design Description (SDD) in accordance with ISO/IEC 12207, ISO/IEC 15289, IEEE 1016 and specifications given in this SOW.

4.10.2.6.6.2 The SDD shall include the database schema represented using UML data modelling standards. The SDD shall include Logical and Physical Data Models.

4.10.2.6.6.3 The SDD shall provide a data dictionary describing all data elements within the database, with views and outputs consistent with UML modelling standards. The information in the data dictionary shall be captured in the database design tool.

4.10.2.6.6.4 The Contractor shall perform lower-level Software Design for each defined software item in order to code it efficiently and produce item-level design documents (e.g. SDD-CI).

4.10.2.6.6.5 There may be more than one SDD depending on the level of components and units. The SDD documents will have informative purposes and not subject to Purchaser approval.

4.10.2.6.6.6 The Purchaser shall have the right to ask for the SDD during the development and examine to ensure that the software construction is carried out according to the architecture, detailed design and selected methodology.

4.10.2.6.6.7 The Contractor shall deliver the SDD(s) to the Purchaser for information purposes.

4.10.2.6.7. User Interface Design

4.10.2.6.7.1 The Contractor shall design the GUI for each software item before the construction and update the UIS during the Build Process.

4.10.2.6.7.2 The detailed GUI design shall be discussed during IWG Workshops/Meetings, the UIS shall be reviewed. User Community will also be involved in the GUI design process to the extent possible.

4.10.2.6.7.3 The Contractor shall update the GUI design for each software item in the UIS. The Purchaser will approve the GUI design for each item before its construction.

4.10.2.6.7.4 Both the Contractor and Purchaser can propose changes to the GUI design following the Change Management process. Any change to any part of the UIS will be subjected to the Purchaser's approval.

4.10.2.6.8. Software Design Review

4.10.2.6.8.1 Software Design Review (SwDR) is a review to ensure that the software design is sufficient to proceed into construction, and that all software requirements and performance requirements can be met.

4.10.2.6.8.2 The Contractor shall organise and conduct a SwDR for each Build Process at the Purchaser's facility to present the design documents.

4.10.2.6.8.3 The Purchaser will review, evaluate and approve the design documents to be used in that Build Process during its SwDR, and the Contractor shall baseline them.

4.10.2.6.8.4 The Contractor shall prepare a SwDR Report and deliver within one week after the completion of the SwDR.

4.10.2.7. Software Construction Process

4.10.2.7.1. The Contractor shall perform the software construction activities described in ISO/IEC 12207, Paragraph 7.1.5.3 in each Build Process.

4.10.2.7.2. The Contractor shall apply best practices for software development and documentation, including lower level design documents, development tools, test environment and internal test procedures.

4.10.2.7.3. Coding

4.10.2.7.3.1 The Contractor shall develop the source code together with source code documentation (commenting).

4.10.2.7.3.2 The Contractor shall ensure that the construction follows the design given in related documents. Any diversion shall be justified, and updated design documents shall be presented to the Purchaser for assessment.

4.10.2.7.3.3 The Purchaser has the right to closely monitor the software construction activities at the Contractor premises and examine the source code to ensure that the software construction is carried out according to the design descriptions following the methodology and coding standards defined in the SDP.

4.10.2.7.3.4 The Contractor shall produce executable software units that properly reflect the software design.

4.10.2.7.4. Unit Testing

4.10.2.7.4.1 The Contractor shall perform unit-level internal testing at his own premises, units using internal development and test environment.

4.10.2.7.4.2 The Contractor shall develop the software unit test procedures in accordance with ISO/IEC 12207, ISO/IEC 15289, and IEEE Std 829.

4.10.2.7.4.3 The Contractor shall perform unit testing for any identified software components using applicable test methods (e.g. black-box, white-box).

4.10.2.7.5. Source Code Review

4.10.2.7.5.1 The Contractor shall perform Source Code Review (SCR) during Unit Testing using COTS tools.

4.10.2.7.5.2 The objective of the SCR shall be to demonstrate that the code is maintainable, well-documented and follows sound coding practises.

4.10.2.7.5.3 The Contractor shall prepare a Source Code Review Report (SCR-R) which describes the methodology used, the acceptance criteria, the list of findings, explanations and a resolution plan.

4.10.2.7.5.4 The Contractor shall deliver the SCR-R at the TRR. The SCR-R shall be one of the Entry Criteria for the TRR.

4.10.2.7.5.5 The Contractor shall submit the final (if modified) SCR-R at the SSMAT and the Purchaser will review the Report as part of the SSMAT.

4.10.2.7.5.6 The Purchaser may conduct another Source Code Review, through IV&V Support as part of the SSMAT, using automated tools. The results/findings will be presented. The Contractor shall include the deficiencies found during this process into his resolution plan.

4.10.2.7.5.7 The Contractor shall correct all deficiencies in the resolution plan prepared and updated according to the Source Code Review Reports.

4.10.2.7.6. The documents produced during the Software Construction Process (e.g. SRS-CI, SDD-CI, STD-CI) shall be discussed during IWG Workshops.

4.10.2.8. Software Integration Process

4.10.2.8.1. The Contractor shall perform the Software Integration activities described in ISO/IEC 12207 Paragraph 7.1.6.3, in each Build Process.

4.10.2.8.2. The Contractor shall combine the software units and software components, producing integrated software items, consistent with the software design, and demonstrate that the functional and non-functional software requirements are satisfied on an equivalent or complete operational platform.

4.10.2.8.3. The Contractor shall be responsible for system integration of the TRITON capability. This integration shall include both the integration of the various hardware and software elements that constitute the TRITON capability and the integration of the TRITON capability with the existing NATO systems, capabilities and Core Services specified in the SyRS.

4.10.2.8.4. The Contractor shall perform software integration in its own premises using the Software Development Environment. The Contractor can also use the TRITON Test System at the Purchaser's PMIC facilities for conducting developmental tests and integration.

4.10.2.8.5. The Purchaser will have the right to examine the integration and internal test documents and process to ensure that the software integration is carried out according to the plans and selected methodology.

4.10.2.8.6. The Contractor shall deliver any prepared integration and test document to the Purchaser for information purposes.

4.10.2.9. Software Qualification Testing Process

4.10.2.9.1. The Contractor shall perform the software qualification testing activities described in ISO/IEC 12207, Paragraph 7.1.7.3 within the System Verification Process for each Build Process.

4.10.2.9.2. Software Test Description

4.10.2.9.2.1 The Contractor shall produce Software Test Description (STD) in accordance with ISO/IEC 12207, ISO/IEC 15289, and IEEE Std 829 for each software element.

4.10.2.9.2.2 The STD shall describe the Test Environment, prerequisite conditions that must be established prior to performing the test case.

4.10.2.9.2.3 The STD shall include at least one test case per requirement, per use case and per main flow/extension.

4.10.2.9.2.4 The STD shall describe test inputs, expected results and criteria for evaluating results.

4.10.2.9.2.5 The STD shall describe test procedures for each software element to be tested internally.

4.10.2.9.2.6 The Contractor shall deliver the STD(s) to the Purchaser for information purposes.

4.10.2.9.3. Internal System Test

4.10.2.9.3.1 The Contractor shall perform Internal System Test (IST) as software qualification testing to confirm that the integrated software product meets its defined requirements.

4.10.2.9.3.2 The Contractor shall use the STDs for IST.

4.10.2.9.3.3 The Purchaser shall have the right to witness the internal system integration and testing activities to ensure that the software qualification testing is carried out according to the TMP by following the indicated quality system.

4.10.2.9.3.4 The Contractor shall cover, in IST, all code logic and branches, including the rationale behind the selected test coverage and the accepted risk level. The IST shall include boundary value testing (maximum-minimum values, error values), wild key testing of user interfaces (an extensive error checking testing executed by having a user hit any combination of keys, and trapping errors to redirect he user to correct the entries or key combinations without crashing the software or losing previous work), state

transition testing (rules and conditions to cause state transition), and black-box testing.

4.10.2.9.3.5 The Contractor shall deliver the IST-Report (IST-R) within one week after the IST.

4.10.2.9.3.6 The IST-R shall be one of the Entry Criteria for TRR and contain any defects found during the IST and a Resolution Plan.

4.10.2.9.4. Qualification Methods

4.10.2.9.4.1 The Contractor shall use the software qualification methods defined in Table 4-9 for each requirement in the specification document to ensure that the requirement has been met:

Table 4-9 – Software Qualification Methods

Method	Description
Analysis	The processing of accumulated data obtained from other qualification methods. Examples are reduction, interpretation, or extrapolation of test results; analysing the performance of design by running simulations. This method can be used if a test scenario cannot be created at the Test Environment.
Test	The operation of the software element or component, using instrumentation or other special test equipment to collect data for later analysis. Controlled condition, configurations, and inputs are used in order to observe the response. Results are quantified and analysed. This method can be used where user interaction is involved and when computations with input data are necessary.
Demonstration	The operation of the software element or component, that relies on observable functional operation not requiring the use of instrumentation, special test equipment, or subsequent analysis. This method is used to demonstrate a capability to be provided by the requirement.
Inspection	The visual examination of software code, documentation, etc. This method can be used where testing is not possible (e.g. the maximum number of items used as a limitation inside the code).
Special Case	Any special qualification methods for the software element, such as special tools, techniques, procedures, facilities, and acceptance limits.

4.10.2.10. Software Verification and Validation Processes

4.10.2.10.1. The Contractor shall perform the software verification activities described in ISO/IEC 12207, Paragraph 7.2.4 and 7.2.5 within the System Verification Process and System Validation Process applicable to each Build Process.

4.10.2.10.2. The Contractor shall perform software verification to confirm that each software element properly reflects the specified requirements, design, code, integration and documentation.

4.10.2.10.3. Further software verification and validation shall be performed according to the System Verification Process (Paragraph 4.12) and System Validation Process (Paragraph 4.14).

4.10.2.11. Software Version Description

4.10.2.11.1. The Contractor shall produce a Software Version Description (SVD) for each Baseline and for each new release thereafter.

4.10.2.11.2. The SVD shall list by identifying numbers, titles, abbreviations, dates, version numbers, and release numbers, as applicable, all physical media (for example, listings, disks) and associated documentation that make up the software version being released.

4.10.2.11.3. The SVD shall include applicable security and privacy considerations for the release.

4.10.2.11.4. The SVD shall contain a list of all changes incorporated into the software version since the previous version.

4.10.2.11.5. The SVD shall identify or reference all unique-to-site data contained in the software version.

4.10.2.11.6. The SVD shall identify any possible problems or known errors with the software version at the time of release, any steps being taken to resolve the problems or errors, and instructions (either directly or by reference) for recognizing, avoiding, correcting, or otherwise handling each one. The information presented shall be appropriate for the user who may need advice on avoiding errors.

4.10.3. Hardware Implementation Processes

4.10.3.1. General

4.10.3.1.1. The Contractor shall perform Hardware Implementation Process to produce TRITON Deployable Kits (TDK).

4.10.3.1.2. The Contractor may use ISO 9001:2008 to produce the Hardware Developmental Items (HDI) or use a subcontractor.

4.10.3.1.3. The Contractor shall manufacture the TDKs, install the software and test them as a complete system.

4.10.3.2. Hardware Requirements Analysis Process

4.10.3.2.1. The Contractor shall perform hardware requirements analysis in order to determine detailed requirements for the production.

4.10.3.2.2. The Contractor shall prepare Hardware Requirements Specification (HRS) which maps the system-level requirements to the hardware with additional derived requirements.

4.10.3.2.3. Hardware Requirements Review

4.10.3.2.3.1 The Contractor shall conduct Hardware Requirements Review (HwRR) and prepare HwRR Report.

4.10.3.3. Hardware Design Process

4.10.3.3.1. The Contractor shall design the TDKs, prepare the interface, layout and integration diagrams, cable diagrams, power circuits used in the server and.

4.10.3.3.2. The Contractor shall prepare Hardware Design Description (HDD) to clearly describe what COTS products are used, how they are assembled to build the desired hardware unit, and how they are integrated.

4.10.3.3.3. If any component is manufactured, its design shall also be included.

4.10.3.3.4. Hardware Design Review

4.10.3.3.4.1 The Contractor shall conduct Hardware Design Review (HwDR) and prepare HwDR Report.

4.10.3.4. Hardware Production Process

4.10.3.4.1. The Contractor shall procure the COTS hardware needed for TDKs, as agreed with the Purchaser.

4.10.3.4.2. The Contractor shall integrate the COTS equipment to build one HDI as the First Article.

4.10.3.4.3. The Contractor shall fully document the cabling design to allow the maintenance staff to trace the source and destination of cables and their path. The cable marking shall be by one of the following methods:

- Moulded on the cable or cord
- Stamped on the cable, cord or wire
- Bands securely attached or captivated.

4.10.3.4.4. All cabling shall be installed in a neat and workmanlike manner. It shall allow for easy access to the label, have sufficient slack to prevent undue stress, and provide sufficient access for maintenance. The cables shall be properly supported and secured to avoid undue stress on the connectors.

4.10.3.5. Software Installation

4.10.3.5.1. The Contractor shall install the TRITON Operational Baseline (BL4), specifically developed for ACPs, on each TDK, along with the supporting software and documentation associated with the Baseline.

4.10.3.5.2. The Contractor shall obtain server address and other configuration details from the Purchaser and activate the installed servers, workstations, and ancillary equipment on the TDK.

4.10.3.5.3. The Contractor shall install and configure OTS software applications included as part of the TRITON Baseline for the TDK.

4.10.3.5.4. The Contractor shall configure all software settings to match the Product Baseline and TDK-specific requirements, and load any initial data included with the baseline.

4.10.3.5.5. The Contractor shall import and/or load any specific data.

4.10.3.5.6. The Contractor shall demonstrate to the local Security Accreditation Authority (SAA) that the equipment complies with the SyRS and SOW requirements, and Security Operating Procedures (SecOps).

4.10.3.5.7. The Contractor shall execute the SIVPs for the TDK for verification by the SAA. The Contractor shall obtain a System Statement of Conformance from the SAA.

4.10.3.5.8. Upon completion of TDK software installation, the Contractor shall provide the Purchaser with a copy of the TDK installation and activation checklist. The Contractor shall resolve any discrepancies identified.

4.10.3.5.9. The Contractor shall provide operation of the TRITON software on the TDK as listed in the AFPL.

4.10.3.5.10. The Purchaser will provide the Contractor the images of the latest version of the supported software configuration (Operational Baseline) for TDKs and clients as defined in the AFPL.

4.10.3.5.11. The Purchaser will provide the Contractor the licenses for the activation of the COTS software indicated in the Software Baseline maintained by the NCI Agency unless otherwise specified (e.g. the Contractor purchases the software licenses on behalf of the Purchaser).

4.10.3.6. Hardware Verification Process

4.10.3.6.1. Hardware Test Description

4.10.3.6.1.1 Hardware verification shall be conducted on the basis of test cases. These test cases shall be developed by the Contractor and documented in the Hardware Test Description (HTD).

4.10.3.6.1.2 The Contractor shall deliver the HTD to the Purchaser for information prior to HW-TRR.

4.10.3.6.1.3 The Contractor shall perform internal hardware testing according to the HTD.

4.10.3.6.2. First Article Acceptance Test

4.10.3.6.2.1 The Contractor shall plan the First Article Acceptance Test (FAAT) for the first HDI produced before the serial production.

4.10.3.6.2.2 The Contractor shall conduct the PCA for a new production item on the first article of its kind of the production line [ACMP-2009].

4.10.3.6.2.3 The Contractor's conduct of the PCA shall include a detailed audit of; engineering drawings, specifications, technical data and tests utilized in production of hardware CI. The PCA shall also include an audit of the released engineering documentation and quality control records to make sure the as-built or as-coded configuration is reflected by this documentation [ACMP-2009].

4.10.3.6.2.4 The Contractor shall prepare the FAAT Procedure which includes test cases for the hardware components of the HDI. The FAAT Procedure shall include test cases related to overall HDI functionality as well as the hardware components.

4.10.3.6.2.5 FAAT shall cover at least the following tests:

- Demonstration of components
- Mantling and dismantling

- Power and network cabling
- Operating all components
- Hardware maintainability (such as accessibility and replaceability of components).

4.10.3.6.2.6 The Contractor shall deliver the FAAT Procedure two (2) weeks prior to the Hw-TRR.

4.10.3.6.2.7 The FAAT is not complete until all non-conformances affecting the part are closed and corrective action is implemented. After corrective action is implemented a FAAT for the failed characteristic shall be re-performed and the results recorded that include the details of the corrective action taken.

4.10.3.6.2.8 The Contractor shall perform serial production for the TDKs as an HDI after the successful completion of FAAT.

4.10.3.6.2.9 The Contractor shall prepare FAAT Report for the status of the First Product.

4.10.3.6.3. IV&V Testing

4.10.3.6.3.1 The hardware of the TDK is subject to security screening and approval by the NCI Agency. In particular, the software used in the TDK must be included in the NATO Operational Baseline as described in the AFPL.

4.10.3.6.3.2 The Purchaser will execute Security Test for one produced TDK with its NS and NU Units as a single, stand-alone "system".

4.10.3.6.3.3 The Contractor shall transfer one TDK to the test location indicated by the Purchaser, set to operation, and after the test, the Contractor shall transfer the TDK to its own premises.

4.10.3.6.3.4 The IV&V Testing for TDK is described in Paragraph 4.12.12.7.26.

4.10.3.7. Serial Hardware Production

4.10.3.7.1. Production Readiness Review

4.10.3.7.1.1 Production Readiness Review (PRR) is planned to determine if the hardware design is ready for serial production and if the Contractor (and subcontractors) have accomplished adequate production planning without incurring unacceptable risks that will breach thresholds of schedule, performance, cost, or other established criteria.

4.10.3.7.1.2 The Contractor shall plan and execute a PRR prior to the serial production of the HDIs.

4.10.3.7.1.3 The Contractor shall prepare PRR Report.

4.10.3.7.2. The Contractor shall perform serial production of HDIs according to the authorisation given by the Purchaser.

4.10.3.8. Hardware Acceptance

4.10.3.8.1. Hardware Test Readiness Review

4.10.3.8.1.1 Before scheduling the individual FATs, the Contractor shall host a Hardware Test Readiness Review (Hw-TRR) to review preparations and

readiness for testing of HDIs, including adequate version identification of hardware, software and test procedures.

4.10.3.8.2. Factory Acceptance Test (Hardware)

4.10.3.8.2.1 The Contractor shall plan a Factory Acceptance Test (FAT) for each of the produced HDI. One TDK shall be tested with full test cases, and the others shall be tested using the nominal test cases.

4.10.3.8.2.2 The Contractor shall inform the Purchaser about the date and time of the FATs for each TDK at least thirty (30) days prior the FAT.

4.10.3.8.2.3 The Contractor shall prepare the FAT Procedure which includes test cases for the hardware components of the HDI and TRITON Operational Software Baseline 4.

4.10.3.8.2.4 FAT Procedure shall cover the following tests in addition to the functional tests:

- Mode changes
- Lost and recovered network connectivity
- Lost and regained power
- Bandwidth utilisation under simulated environment
- Performance under simulated environment
- Hardware maintainability (such as accessibility and replaceability of components).
- Nominal test cases (for the remaining HDIs).

4.10.3.8.2.5 The Contractor shall deliver the TDK FAT Procedure two (2) weeks prior to the Hw-TRR.

4.10.3.8.2.6 The Contractor shall prepare each TDK for FAT including the COTS software and TRITON Operational Software installation. TDK Test Environment shall have the simulation capability for the external interfaces (e.g. ship side for the ACP Interface).

4.10.3.8.2.7 The Purchaser has the right to participate in the selected or all FAT activities of TDKs.

4.10.3.8.2.8 The Contractor shall prepare FAT Report for the status of each TDK.

4.10.3.8.3. Sea Acceptance Test

4.10.3.8.3.1 The objective of the Sea Acceptance Test (SeAT) is to ensure that the TDK can be transferred on board a ship, carried to the indicated compartment, fixed on the deck, powered on, set to operation and get connected to the selected static TRITON Server. ACP simulator can be used to simulate the data exchange with ship systems.

4.10.3.8.3.2 SeAT shall cover the following tests in addition to the functional tests:

- Mode changes
- Lost and recovered network connectivity
- Lost and regained power
- Bandwidth utilisation under available ship capabilities

- Performance under ship conditions
- Hardware maintainability.

4.10.3.8.3.3 The Contractor shall prepare SeAT Procedure and deliver it at least two (2) weeks prior to the Hw-TRR.

4.10.3.8.3.4 The Contractor shall transport one TDK to the port where SeAT will be executed, perform the tests and transport the TDK back to its own premises if not any other destination is agreed.

4.10.3.8.3.5 The Contractor shall conduct the SeAT and prepare the SeAT Report.

4.10.3.9. Delivery

4.10.3.9.1. The Contractor shall pack, preserve, ship, transport, document, deliver and handover HDIs (TDK) to the Purchaser after the shipment authorisation is given for an indicated location in Europe.

4.10.3.9.2. The Contractor shall apply the procedure defined in Subsection 5.9 of the SOW.

4.10.3.9.3. The Purchaser will have the right to reject any TDK determined to be defective due to transportation. In this case, the Contractor shall replace any defective unit of the TDKs and demonstrate at the Purchaser's location that the entire TDK is functioning properly.

4.10.3.10. Hardware Maintenance Process

4.10.3.10.1. The Contractor shall provide software and hardware maintenance for TDK until FSA.

4.10.4. Purchaser Access during Implementation

4.10.4.1. The Purchaser, case-by-case represented by the IV&V team, reserves the right to monitor the Contractor's activities, including code inspections, to ensure that sound engineering practices are followed and that the requirements of the SRS are met.

4.10.4.2. During the process of development, the Contractor shall provide the Purchaser with Internet access to a version of the Developmental Baseline. This online accessible version of the application shall be updated to reflect the weekly build.

4.10.4.2.1. The Contractor shall implement an access control mechanism to restrict viewing of the version of the Developmental Baseline to a list of users approved by the Purchaser and administered by the Contractor.

4.10.4.3. The Contractor shall permit Purchaser personnel or designees to inspect the Developmental Baseline.

4.10.4.4. The Purchaser will notify the Contractor at least three (3) working days before an inspection visit.

4.11. System Integration Process

4.11.1. General

4.11.1.1. The Contractor shall perform the System Integration Process to assemble the TRITON capability that is consistent with the architectural design.

4.11.1.2. The Contractor shall perform system integration activities in compliance with the processes defined in ISO/IEC 15288, Paragraph 6.4.5 as referred by AAP-48, Paragraph 6.4.5.

4.11.1.3. The purpose of System Integration shall be:

4.11.1.3.1. Completely assemble the implemented system elements to make sure that the implemented elements are compatible with each other.

4.11.1.3.2. Demonstrate that the aggregates of implemented elements perform the expected functions and performance/effectiveness.

4.11.1.3.3. Detect defects/faults related to design and assembly activities by submitting the aggregates to focused verification and validation actions.

4.11.1.3.4. Demonstrate that the implemented elements form the entire Functional Service.

4.11.1.3.5. Demonstrate that the Functional Service can interact with external systems/services.

4.11.2. System Integration Activity

4.11.2.1. The Contractor shall perform System Integration Activity with the support of SEWG and VVWG at the NCI Agency PMIC facilities using the actual external systems with the test data necessary for each Build Process.

4.11.2.2. The Purchaser will provide working environment for the System Integration Activity and provide support for the external systems.

4.11.2.3. The Contractor shall install the PBL on the TRITON Test System at the PMIC facilities. The Contractor shall work in close coordination with the Purchaser's staff members.

4.11.2.4. The Purchaser will establish TRITON Interoperability Test Centre (TRITON-ITC) at PMIC using the TRITON Test Systems (NS and NU). The ITC will be used during integration and test activities for Nation Interfaces.

4.11.2.5. The Contractor shall perform system integration by checking all interfaces, adapting the software as necessary and performing dry-run of the System Integration Test (SIT).

4.11.2.6. System Integration Activity can last up to two (2) weeks, between the FAT and the SIT.

4.11.2.7. The Contractor shall determine any deficiencies and correct them before the actual SIT.

4.11.2.8. The Contractor shall provide technical support to integration and testing of Nation Interfaces using the TRITON Test Systems.

4.11.3. System Integration Test

4.11.3.1. The Contractor shall perform the System Integration Test (SIT) at the NCI Agency PMIC using the actual external systems with test data for each Build Process. The details of the SIT are given in Paragraph 4.12.12.3.

4.11.3.2. As the prerequisite to start the SIT, the Contractor must pass the FAT.

4.11.3.3. The Contractor shall perform the SIT prior to other acceptance tests.

4.12. System Verification Process

4.12.1. General

4.12.1.1. Verification is the process of providing objective evidence that the system, software, or hardware and its associated products conform to requirements (e.g. for correctness, completeness, consistency, and accuracy) for all life cycle activities during each life cycle process (acquisition, supply, development, operation, and maintenance); satisfy standards, practices, and conventions during life cycle processes; and successfully complete each life cycle activity and satisfy all the criteria for initiating succeeding life cycle activities. Verification of interim work products is essential for proper understanding and assessment of the life cycle phase product(s).

4.12.1.2. The Contractor shall perform system verification activities in compliance with the processes defined in ISO/IEC 15288, Paragraph 6.4.6 as referred by AAP-48, Paragraph 6.4.6.

4.12.1.3. Testing is a set of activities conducted to facilitate discovery and/or evaluation of properties of one or more test items. It is the primary technique intended to evaluate the fulfilment of specifications and requirements to reduce risk and improve quality/user satisfaction. Testing activities could include planning, preparation, execution, reporting, and management activities, insofar as they are directed towards testing.

4.12.1.4. The Contractor shall define and develop test programs, plans, and procedures, conduct testing, and evaluate and document results.

4.12.1.5. The Contractor shall perform sequence of testing on a TRITON Baseline in order to verify its quality and receive necessary approvals required to deploy the system in NATO operational environment.

4.12.1.6. Test Levels

4.12.1.6.1. The Contractor shall include the following types of tests during the Verification Process [IEEE 29119]:

- Smoke Tests (surface level testing to ensure further tests can be performed)
- Functional Tests
  - Positive (verifying outputs with valid inputs)
  - Negative (invalid inputs, unexpected operating conditions, other out-of-bound scenarios)
- Compatibility Tests
- Usability Tests
  - User friendliness tests
  - User interface tests (including wild key testing)
  - Navigation tests
  - Look-and-feel tests
  - Accessibility tests (limited to military users)
- Performance Tests
  - Timing and limitations

- Scalability Tests
  - Load test
  - Volume test
  - Data flow test
  - Storage test
- Reliability Tests
  - Stress tests (for hardware and software)
  - Spike tests (sudden increase in number of users)
- Destructive Tests (attempting to cause the system/component to fail)
- Recovery Tests
  - Exception handling
  - Error recovery
  - Failover
- Security Tests
- Safety Tests
- Exploratory Testing (testers learn the system before testing)
- Ad-hoc Testing (testers already know the system)
- Installation Tests
- Maintenance Tests

4.12.1.6.2. The Contractor shall explain the objectives of these tests in the TMP and allocate them onto each formal Test Activity in the Verification Process.

4.12.1.7. The Contractor shall have the overall responsibility for meeting TRITON testing requirements, and shall provide the man-power required to install the TRITON Baseline under test onto the Purchaser's Test Systems and to perform all tests.

4.12.1.8. The Contractor shall ensure that its hardware, software, test equipment, instrumentation, supplies, facilities, and personnel are available and in place to conduct or support each scheduled test.

4.12.1.9. Test Data and Test Environment

4.12.1.9.1. The Contractor shall establish a Test Environment in its premises using simulators for external data sources. This environment shall be used during Internal System Tests and FAT.

4.12.1.9.2. The Contractor shall establish a Test Environment at the Purchaser's premises using the TRITON Test Systems (see 4.13.10.1). This environment shall be used during SIT, SSMAT and UAT.

4.12.1.9.3. The Test Environment shall include a scenario-based data input capability for the TRITON function under test. The concept of Training Environment described in SRS can be used for test purposes.

4.12.1.9.4. The Contractor shall provide Test Data to support developmental, acceptance, and operational testing activities.

4.12.1.9.5. The Test Data shall provide:

- The quantities,

- The varieties of object types, object sizes and attribute values,
- The exceptional values,
- The update frequency appropriate to the type of testing and sufficient to verify that all system requirements are met.

4.12.1.9.6. For acceptance and operational testing, the Test Data shall also include, as a minimum, the anticipated operational quantities and sizes of Maritime Information Entities identified in the SyRS.

4.12.1.9.7. The Contractor shall also use live data sources to test the system behaviour under real conditions. The necessary live data sources shall be made available by the Contractor during the tests. If commercial sources require licenses or service fees, the Contractor shall provide the appropriate licenses for test purposes (e.g. AIS Data Source license).

4.12.1.9.8. The Contractor shall be able to use recorded data for test purposes.

4.12.1.9.9. The Contractor shall develop tools to capture, store or replay Test Data to perform functional tests without the real systems or services.

4.12.1.9.10. The Contractor shall identify which parts of Test Data will be used as Reference Data to test the correctness of processes.

4.12.1.9.11. The Purchaser will provide Test Data, when feasible, for those NATO Systems and Services that TRITON will have interface with.

4.12.1.10. The Contractor shall perform follow-on Operational Testing activities during the OT&E period in order to evaluate the TRITON capability performance and establish benchmarks for future enhancements, including the changes which are made to meet the requirements.

4.12.1.11. The Contractor shall perform developmental, acceptance, and operational testing for future TRITON enhancements and modifications undertaken as part of this Contract, including the changes which are made to meet the requirements.

4.12.2. Test Management Plan

4.12.2.1. The Contractor shall provide and maintain a Test Management Plan (TMP) outlining the tests and supporting tasks to meet the requirements of this SOW and the Contractual SRS.

4.12.2.2. The Contractor shall use ISO/IEC/IEEE 29119 as a guidance for Test Management and include the sections given in Table 4-10 as a minimum:

Table 4-10 – TMP Content

Section	Description
Test Objectives	The tangible goals of testing. At the TMP level, the test objectives are driven by the solution objectives and describe the overall objectives for testing. These include high level objectives that address the business functions, the technical requirements and those that reduce the risks and costs of failure.
Test Scope	The boundaries of testing. It describes or lists applications and systems within scope of the TMP. The TMP also covers static testing of the development and testing work products or references to document covering this.

	If any of the applications or systems is known to be out-of-scope for testing, the exclusions are mentioned here.
Assumptions	Any underlying assumptions on which this TMP is based. This is very important and key to successful testing because, if any of the assumptions turn out to be untrue, then this TMP and the detailed test plans it drives will require to be adjusted.
Test Strategy	The Functions - this includes functions or use cases from the use case model. The PTP shall identify the relation of all Functions to the [Project Name] Configuration Items (CIs) and shall indicate by which method the items will be evaluated. The Requirements - this lists, refers to, the requirements that are within scope for testing. The Risk Assessment - this comprises a detailed risk assessment, driven by the functions and requirements of the project under development. Set the level of risk for each function. Use a simple rating scale such as (H, M, L): High, Medium and Low.
Planning	The Roles and responsibilities - this describes in generic terms the handoffs and handovers that occur at various points in the test lifecycle as the project evolves from specification to design to implementation. Test Schedule - this defines the overall schedule of, and relationships between the various levels of testing. Major testing milestones - this defines the major milestones at each level of testing. Resource requirements - this provides an overview of the human and infrastructure resources required for each level of testing. Contingencies - this describes any actions taken to minimize the impact, should the testing not proceed as planned. It is based on the Risk Assessment above.
Test Environment Build Strategy	Test Environment Test Data Strategy - this identifies the approach to test data creation and set-up, and describes how test data is shared amongst the different levels of testing.
Requirements Traceability Matrix	Description of terms.
Test Reporting	The status and other periodic test reports for ongoing progress tracking as well as hand off from one level of testing to another. Descriptions of the frequency, format, and distribution of test reports.

4.12.2.3. The TMP shall describe at a high level, the overall plans for test, verification and validation at all stages of the project lifecycle including the following:

- Applicability of the quality characteristics
- Standards to be used
- Risk
- Project activities and IV&V activities at each stage
- Test stages (e.g. unit, system, integration, change evaluation, acceptance)
- Test Environments (including Test/Reference Data) to be used at each stage
- Resource requirements and schedule.

4.12.2.4. The TMP shall describe how the Contractor intends to meet the following objectives:

- How testing deficiencies will be categorized, addressed, rectified and retested;
- Verification that the design produces the required capability;
- Confidence that system defects are detected early and tracked through to correction by using a test management tool and logged in a file;
- Compliance with the requirements of the SRS, including quality attributes and their test case coverage and with external system interfaces as defined in the ICDs, including any plug-ins/add-ins and glue code;
- Compatibility among internal system components (with reference to the TRITON SDS implementation model);
- Regression testing;
- Operational readiness and suitability of all configurations;
- Verification by the operational users that the system is usable and acceptable;
- Verification that the system can be efficiently supported and maintained;
- System characterisation to establish the system's performance benchmarks;
- Documentation and code verification;
- Establishment of the Test and Reference Systems.

4.12.2.5. The TMP shall describe the Contractor's test organization and its relationship with the Contractor's Project Management Office and QA functions.

4.12.2.6. The TMP shall provide a flow diagram that identifies the overall sequence of tests, the location, and Contractor and Purchaser equipment and personnel involved in each test, and the relationship of test events to project milestones.

4.12.2.7. The TMP shall identify the test documentation associated with each test, including the scenario, procedures, test data, test results, and test reports.

4.12.2.8. The TMP shall identify how defects are tracked through to correction by using a Test Management Tool or defect management tool respectively.

4.12.2.9. The TMP shall identify the support to be provided by the Purchaser in terms of manpower, services and material, including Purchaser witnessing and approval activities.

4.12.2.10. The TMP shall identify any specialised or long-lead items required for testing.

4.12.2.11. The TMP shall identify all TRITON system elements and CIs that are subject to test and shall indicate by which method the items will be evaluated.

4.12.2.12. The TMP shall include a description of how the Requirements Traceability Matrix (RTM) shows how test tasks demonstrate that the tested system fulfils specific SRS requirements and implements specific SDS features.

4.12.2.13. The TMP shall provide the allocation of test procedure to each test task supporting the tests.

4.12.2.14. The TMP shall include the following plans as appendices:

- Security Test and Verification Plan (STVP)

- System Validation Plan (SVP)

4.12.2.15. Security Test and Verification Plan

4.12.2.15.1. The Contractor shall provide and maintain, as an annex to the TMP, which can be addressed as a separate document, a Security Test and Verification Plan (STVP) that details the tests by which it will demonstrate compliance with the security requirements of the SyRS. This test should demonstrate that the Contractor has mitigated the security risks that are identified in the Security Risk Assessment. The report of this test shall be delivered to the INFOSEC accreditation authority as a step to achieve INFOSEC accreditation.

4.12.2.15.2. The Contractor shall derive a generic STVP, compliant to [AC/35-D/2005-REV3], from the original STVP which can be used by Organizational Nodes to produce their specific STVP.

4.12.2.15.3. The Contractor shall deliver the draft STVP at the CDR.

4.12.2.16. System Validation Plan

4.12.2.16.1. The Contractor shall prepare a System Validation Plan (SVP), as an annex to the TMP, which describes the detailed activities needed for the validation process.

4.12.2.16.2. The SVP shall include the following:

- Evaluate the stakeholders' requirements
- Determine the proper validation method (i.e. demonstration, inspection, test) and level (i.e. system, component)
- Develop the requirements verification matrix
- Define the approach for validating the system services in a representative operational environment
- Identify resources necessary to perform validation
- Identify and plan for enabling systems
- Define the roles and responsibilities
- Define validation criteria for stakeholders' requirements

4.12.2.16.3. The Contractor shall deliver the draft SVP at the CDR.

4.12.2.16.4. The Purchaser will obtain operational user community's concurrency/ approval on the SVP and approve it.

4.12.3. Test Management Tool

4.12.3.1. The Contractor shall perform Test Quality Management by introducing a Test Management Tool including a Test Automation Tool.

4.12.3.2. The Test Management Tool shall:

4.12.3.2.1. Link requirements in the SyRS to test cases, procedures, and results.

4.12.3.2.2. Support Test Preparation, Test execution, Test evaluation and Test optimisation, as well as the logging of errors.

4.12.3.2.3. Support the establishment of version-controlled test baselines associated with the Functional, Development and Product Baselines.

4.12.3.2.4. Provide all Test Case references to the associated SOW and SyRS requirement(s).

4.12.3.2.5. Provide all Test Case references to the associated functional area(s) in the logical model of TRITON SDS.

4.12.3.2.6. Provide detailed Test Case description, including the following fields:

- Test Case title / Unique identifier
- Test priority (low/medium/high/critical)
- Function to be tested (names of components, modules and sub-modules)
- Objective
- Acceptance criteria
- Input data
- Preconditions
- Execution procedures (test scripts, execution steps)
- Output data
- Expected result
- Post conditions
- Exception handling, including test break-off criteria.

4.12.3.2.7. Provide overall and individual Test Case dependencies.

4.12.3.2.8. Provide overall procedures for sequences of tests, such as those for the Factory Acceptance Test.

4.12.3.2.9. Provide individual and summary test results.

4.12.3.2.10. Provide a Test Log of all tests run, including:

- Test Log Identification (number/name)
- Test Case reference and/or attachment
- Test Level
- Test Environment
- Test Execution Date
- Tester
- Test Witness (the Purchaser or its designee)
- System elements under test
- Software Build Version and Release Number
- Test Inputs (test data, configuration parameters)
- Remarks (steps taken to achieve the test outcome if different than test case)
- Test Outputs (actual results per test step, description of system behaviour after test execution if actual result differs from expected result a test defect)
- Test Result (pass/conditionally pass/fail)

4.12.3.3. Support Change Management, including data on test errors, affected Test Cases, associated Deficiency Reports, and change history.

4.12.3.4. The Contractor shall make the contents of the Test Management Tool information accessible on a read-only basis via the Project Website.

4.12.3.5. Test Automation Tool

4.12.3.5.1. The Contractor shall use a Test Automation Tool which is part of the Test Management Tool to allow automation on repeatable test cases.

4.12.3.5.2. The Contractor shall define automated test cases with automated verification conditions.

4.12.4. Test Procedures

4.12.4.1. The Contractor shall develop and maintain Test Procedures (or test cases) for each formal test activity (as defined in the TMP) according to ISO/IEC/IEEE 29119.

4.12.4.2. The Contractor shall identify any conditions which shall be satisfied prior to application of the test with, if applicable, a block diagram showing the proposed method of meeting the test requirements.

4.12.4.3. The Contractor shall state for each test the following items:

- Test objective
- System elements and facilities and test equipment involved
- Configuration parameter resets (i.e. to allow recording of relevant initial parameter settings)
- Steps to be taken to achieve the test outcome
- Data to be collected
- Expected outcome.

4.12.4.4. The Contractor shall include, in each Test Procedure, the Nominal Test Cases, which can be used to demonstrate that the system elements continue functioning properly after applying maintenance to some elements. The Nominal Test Cases shall cover the basic flows of the system elements and can be used to verify that a selected system element is functioning as specified and tested before.

4.12.4.5. The Contractor shall include a subset of the RTM relevant to the test item to show how test tasks are linked to and demonstrate specific SOW and SyRS requirements.

4.12.4.6. The Contractor shall identify the means of measurement or assessment for each test in the Test Procedure.

4.12.4.7. The Contractor shall forward the Test Procedures for Purchaser review and acceptance at least three (3) weeks prior to test execution, unless specified differently in the Work Package.

4.12.4.8. The Contractor shall generate and deliver automated Test Procedures compatible with the Test Management and Test Automation Tools for all test procedures.

4.12.4.9. The Test Procedures shall also be provided in a structured format (XML) to allow exporting to the Purchaser's Test Management Tool.

4.12.5. Test Readiness Review

4.12.5.1. A Test Readiness Review (TRR) ensures that the test article (hardware/ software), test facility, support personnel, and test procedures are ready for testing and data acquisition, reduction, and control.

4.12.5.2. Before scheduling the Verification Tests (see 4.12.12), the Contractor shall organise and host a TRR to review preparations and readiness for testing of system elements, including adequate version identification of CIs and test procedures.

4.12.5.3. The Contractor shall plan and conduct Physical Configuration Audit (PCA) as defined in [ACMP-2009] in order to clearly identify the PBL as the items to be tested, with their configuration control and version numbers. Each Baseline shall have its own PBL to be considered as the Test Baseline.

4.12.5.4. Entry Criteria

4.12.5.4.1. The Contractor shall include in planning the TRR Entry Criteria given in Table 4-11 and make them available to the Purchaser at least two (2) weeks prior to the TRR:

Table 4-11 – TRR Entry Criteria

Serial	Activities / Documents
1	A preliminary TRR agenda
2	Success Criteria (enhanced or adapted)
3	The objectives of the testing have been clearly defined and documented, and all of the test plans, procedures, environment, and configuration of the test item(s) support those objectives.
4	TRITON Test System is available.
5	Configuration of the system under test has been defined and agreed to. All interfaces have been placed under configuration management or have been defined in accordance with an agreed to plan, and a version description document has been made available to TRR participants prior to the review.
6	All applicable functional, unit-level, element, system, and qualification testing has been conducted successfully; reports are available.
7	All previous design review success criteria and key issues have been satisfied in accordance with an agreed-upon plan.
8	All required test resources people (including a designated test director), facilities, test articles, test instrumentation, and other test enabling products have been identified and are available to support required tests.
9	Roles and responsibilities of all test participants are defined and agreed to.
10	Test contingency planning has been accomplished, and all personnel have been trained.

4.12.5.5. Success Criteria

4.12.5.5.1. The Purchaser concludes that the TRR Success Criteria in Table 4-12 accomplished to complete the objectives of the TRR.

Table 4-12 – TRR Success Criteria

Serial	Requirement
1	Test Management Plan (TMP), Security Test and Verification Plan (STVP) (an Annex in TMP), System Validation Plan (an Annex in TMP) and System Transition Plan (STrP) are completed and approved for the system under test.
2	Adequate identification and coordination of required test resources are completed; the test environment is adequate to execute the test according to its objective.
3	Previous component, element, and system test results form a satisfactory basis for proceeding into planned tests.
4	The objectives of the testing have been clearly defined and documented, and the review of all the test plans, as well as the procedures, environment, and configuration of the test item, provide a reasonable expectation that the objectives will be met.
5	The test procedures and test cases (including Security Implementation Verification Procedures (SIVP) and Security Operating Procedures (SecOps)) have been reviewed and analysed for expected results, and the results are consistent with the test plans and objectives.
6	Operational software (baselined version to be tested) (PBL) is available on the TRITON Test System.
7	Test personnel have received appropriate training in test operation and safety procedures.
8	Test Report form (empty) is available.
9	Test Automation Tool is available.
10	Plans to capture any lessons learned from the test program are documented in the Lessons Log.
11	Major risks have been identified, and viable mitigation strategies have been defined. Steps to mitigate risks are identified in the Risk Register.

4.12.5.6. The Contractor shall prepare a TRR Report and submit it within one week after the completion of the TRR.

4.12.6. Test Crew Training

4.12.6.1. The Contractor shall provide Test Crew Training for the following tests in accordance with the requirements given in Paragraph 5.8.8:

- FAT for each Baseline
- UAT for each Baseline
- SSMAT for each Baseline.

4.12.7. Test Reports

4.12.7.1. The Contractor shall record the results for each testing activity (test levels) in a Test Report, using the test result sheets incorporated in the relevant test procedure and the information collected in the Test Log.

4.12.7.2. The Contractor shall include at least the following items in the Test Report:

- Test Report Identification (level/name of the test activity)
- References (Test Procedures, Test Logs)

- Metrics (number of planned and executed Test Cases, status of Test Cases)
- Test Environment
- Types of tests performed
- Lessons Learned
- Recommendations
- Exit Criteria
- Conclusion

4.12.7.3. Where the Purchaser has witnessed the testing, the witness will annotate each page of the test results. Such annotation will only confirm the accuracy of the test results and shall not be considered as an acceptance of the testing.

4.12.7.4. Any failure to complete a test successfully shall be recorded by the Contractor, logged as a Deficiency Report, and noted in the Test Report.

4.12.7.5. The original Deficiency Report (electronic and hard-copy) shall be delivered to the Purchaser for acceptance within two (2) weeks after the completion of the test, unless specified differently in the Work Package.

4.12.8. Test Failures

4.12.8.1. Classification of Failures

4.12.8.1.1. Should a failure occur during testing, the Contractor shall submit a failure report (individually identified to ensure traceability) and carry out a preliminary investigation to classify the failure as one of the following:

4.12.8.1.1.1 Class “A”: there is evidence that the cause was an external or transient condition;

4.12.8.1.1.2 Class “B”: there is mutual agreement between the Contractor and Purchaser that the cause was an inherent design or manufacturing deficiency in the unit under test; or

4.12.8.1.1.3 Class “C”: When the specific nature of the cause cannot be immediately determined and a more detailed investigation is required before a conclusion can be drawn.

4.12.8.2. Class “A” Failures

4.12.8.2.1. In the event that a preliminary investigation results in the classification of a failure as described above, the Contractor shall repeat the test at least three successive times in order to confirm the failure.

4.12.8.2.2. If the re-test is successful, the Purchaser will close the observation and testing shall be resumed from the point immediately after that where the failure occurred.

4.12.8.2.3. If the re-test fails, the Contractor shall change the failure category to class “B” or “C”, as described above.

4.12.8.3. Class “B” Failures

4.12.8.3.1. If a failure is classified as a Class "B" from above, the Contractor shall suspend all testing until the Contractor determines the specific cause of the failure and proposes appropriate remedial action acceptable to the Purchaser.

4.12.8.3.2. If the Contractor determines that the cause of the failure or the effect of the proposed remedial action will have no influence whatsoever on other areas of scheduled testing, it may propose to the Purchaser to continue testing in the other areas prior to the rectification of the cause of the failure.

4.12.8.3.3. The Purchaser shall have the right to require repetition of any or all tests performed in these circumstances after the rectification of the cause of the failure and the subsequent re-tests, to prove they have been successfully completed.

4.12.8.3.4. The Contractor shall be responsible for all costs related to the rectification of deficiencies or failures and subsequent re-testing caused by the design or production of the deliverables identified during the verification and/or testing cycles.

4.12.8.3.5. The Contractor shall be responsible for any travel, subsistence and other incidental expenses incurred by the Purchaser as a result of the requirement for the re-performance of tests necessitated by test failures.

4.12.8.3.6. The Contractor shall provide full details describing the cause of the failure and the recommended remedial actions to be taken by the Contractor.

4.12.8.3.7. After the Contractor has taken remedial action, the test may be resumed at the step during which the deficiency or failure was identified; however, the Purchaser shall have the right to require that re-testing includes all of the tests related to the verification of that particular specification requirement.

4.12.8.4. Class “C” Failures

4.12.8.4.1. If a failure is classified as a Class "C" from above, the Contractor shall immediately suspend testing and conduct a detailed investigation into its causes.

4.12.8.4.2. The Contractor shall report its findings and recommendations on the cause and remedial action required and advise if the failure should be re-classified as either a Class “A” or “B.” The actions previously described relating to these classifications shall then be commenced.

4.12.8.4.3. If the Contractor determines that the test failure was due to a component failure and not attributable to a deficiency in design, then the defective component may be replaced and the failure re-classified as a Class "A" failure.

4.12.8.5. Tracking of Failures

4.12.8.5.1. If a failure occurs during testing, the Contractor shall record the event and log the subsequent actions taken to resolve the failure.

4.12.8.5.2. The Contractor shall indicate in the Problem Resolution Plan, how these recorded failures will be solved.

4.12.9. Test Waivers

4.12.9.1. If the Contractor has previously successfully completed qualification testing to national or international standards for assemblies, subassemblies, components or parts, the Contractor may submit documentation that substantiates the particular test requirement.

4.12.9.2. The Purchaser reserves the right to review and approve the test documentation for acceptance and waiver of any test requirement.

4.12.9.3. The Contractor shall produce the following to justify a test waiver:

4.12.9.3.1. The nationally or internationally certified test results;

4.12.9.3.2. The test standards, procedures and methods employed on the testing; and

4.12.9.3.3. The Test Environment specifications that show that the previous testing matches the requirements of this Contract.

4.12.9.3.3.1 The Contractor shall certify that the environment to be implemented is identical to that which was originally tested and certified, or advise the Purchaser of design/construction changes which affect form, fit or function.

4.12.9.3.3.2 The Purchaser, after review of such changes and their impact, reserves the right to require test and certification of the modified equipment at no cost.

4.12.9.4. The Contractor shall record and log all waiver requests along with their resolution.

4.12.10. Test Results

4.12.10.1. The result of a Verification Test shall be assigned as one of the results defined in Table 4-13:

Table 4-13 – Verification Test Results

Result	Description
Passed	The results of all test cases are successful.
Conditionally Passed	Some test cases have deficiencies. They are identified, recorded and included in the Problem Resolution Plan.
Failed	The test is not successful due to too many deficiencies. The test has to be repeated.

4.12.10.2. The Contractor shall propose the result of a test event in the relevant Test Report.

4.12.10.3. The final decision about the result of the test will be given by the Purchaser and the decision shall be recorded in the Test Report.

4.12.11. Problem Resolution Plan

4.12.11.1. The Contractor shall prepare a Problem Resolution Plan (PRP) after each test. One PRP may be used for all tests and updated accordingly.

4.12.11.2. The PRP shall include how all the findings, deficiencies and failures will be resolved.

4.12.12. Verification Tests

4.12.12.1. Factory Acceptance Test

4.12.12.1.1. The purpose of the Factory Acceptance Test (FAT) is to demonstrate that the Product Baseline complies with the FBL (as set during the FCA for each Baseline) and that the off-the-shelf and uniquely developed elements of the TRITON capability have been integrated to meet the requirements of the SOW and the SyRS.

4.12.12.1.2. The testing environment for FAT at the Contractor premises shall reflect the target implementation environment including configuration and security settings. The tests shall cover both functional testing and security testing.

4.12.12.1.3. The FAT shall be conducted by the Contractor at the Contractor's premises and observed by the Purchaser. The Contractor shall allow the Purchaser to perform specific tests after demonstration of that test by the Contractor.

4.12.12.1.4. Factory Acceptance Test Procedure

4.12.12.1.4.1 The FAT shall be conducted on the basis of test cases. These test cases shall be developed by the Contractor and documented in the FAT Procedure. The Purchaser will review, amend and approve the FAT Procedure prior to execution.

4.12.12.1.4.2 The Contractor shall prepare the final FAT Procedure and deliver it at the TRR of each Build Process.

4.12.12.1.4.3 The FAT Procedure shall include the GUI test cases according to the UIS.

4.12.12.1.5. The Contractor shall facilitate and support at least five (5) days of ad hoc testing by the Purchaser's staff. The Contractor shall support the ad hoc testing and shall provide space and at least five (5) TRITON capability-enabled workstations for the Purchaser's staff. The Contractor shall record and assess for contract relevance any discrepancies identified during the ad hoc testing.

4.12.12.1.6. The Contractor shall inform the Purchaser about the date and time of the FAT at least thirty (30) days prior the FAT.

4.12.12.1.7. The Purchaser will declare the status of the FAT (Passed / Conditionally Passed / Failed) at the end of the test event.

4.12.12.1.8. The Contractor shall prepare the FAT Report (FAT-R) submit it to the Purchaser within (1) one week after the test event.

4.12.12.2. Security Test and Evaluation

4.12.12.2.1. The purpose of Security Test and Evaluation (ST&E) is to demonstrate that the TRITON capability meets its security requirements and can be accredited for use on the NATO SECRE_T network, MISSION SECRE_T, NATO RESTRICTE_D NATO UNCLASSIFIED network.

4.12.12.2.2. The Contractor shall provide the initial version of the Security Operating Procedures (SecOps) in accordance with [AC/35-D/1014-REV2] and the Security Implementation Verification Procedures (SIVP) no later than the TRR for the FAT.

4.12.12.2.3. The Contractor shall perform an internal ST&E prior to a TRR for Baseline. The results of this test shall be used to contribute to the development of the initial version of the TRITON SecOps.

4.12.12.2.4. The Contractor shall demonstrate compliance of the TRITON capability with security requirements of the SRS, the draft SecOps and the SIVP, including compliance with operating system and security configuration settings.

4.12.12.2.5. Security Operating Procedures

4.12.12.2.5.1 The Security Operating Procedures (SecOps) shall be based on a Purchaser-furnished template in accordance with [AC/35-D/1014-REV2] and cover the following:

- Administration and Organization of Security
- Physical Security
- Personnel Security
- Data Protection
- Information Security (INFOSEC)
- Emergency and Contingency Measures
- Configuration Management
- General Security Guidance to Users.

4.12.12.2.5.2 After approval by the Purchaser, the SecOps shall be provided as part of Product Baseline.

4.12.12.2.6. Security Implementation Verification Procedures

4.12.12.2.6.1 The Contractor shall develop, provide and maintain the initial and any updated Security Implementation Verification Procedures (SIVP) for each TRITON element as part of Security Tests. These procedures shall consist of a set of software scripts and inspection procedures that shall allow a System Security Officer to verify that the installed systems at a site comply with the SRS and SecOps.

4.12.12.2.6.2 After approval by the Purchaser, the SIVP shall be provided as part of Product Baseline.

4.12.12.2.7. The Contractor shall prepare the ST&E Report (ST&E-R) which will be required as part of the submissions for INFOSEC accreditation and submit it at the TRR of each Baseline.

4.12.12.3. System Integration Test

4.12.12.3.1. The purpose of System Integration Test (SIT) is to demonstrate that the Product Baseline complies with the FBL concerning the integration with the Bi-SC AIS Hardware Baseline and the Bi-SC AIS Core Services and other Bi-SC AIS Functional Services.

4.12.12.3.2. The purpose of the SIT is also to demonstrate that the Product Baseline complies with the Interoperability Requirements such as information exchange and interfaces to other systems, standards and protocols.

4.12.12.3.3. The Contractor shall perform SIT by installing the PBL on the TRITON Test System at the PMIC facilities.

4.12.12.3.4. System Integration Test Procedure

4.12.12.3.4.1 The SIT shall be conducted on the basis of test cases. The Contractor shall develop the initial version of the test cases and document them in the SIT Procedure.

4.12.12.3.4.2 The Purchaser will review, amend and approve the SIT Procedure prior to execution.

4.12.12.3.4.3 The Contractor shall prepare the final SIT Procedure and deliver it at the TRR of each Build Process.

4.12.12.3.5. The SIT shall include testing of all supporting capabilities, including:

- Data migration capabilities
- Data migration verification and validation
- Collaboration capabilities
- Data display and validation.

4.12.12.3.6. The SIT shall be executed using Test Data that is realistic in terms of structure, content and size.

4.12.12.3.7. The Purchaser reserves the right to observe the tests and to have the Contractor perform selected testing tasks on the TRITON Reference System to confirm compliance.

4.12.12.3.8. The Purchaser reserves the right to perform ten (10) days of ad hoc testing by the Purchaser personnel with support from the Contractor personnel. The Contractor shall record and assess for Contract relevance any discrepancies identified during the ad hoc testing.

4.12.12.3.9. The Purchaser will declare the status of the SIT (Passed / Conditionally Passed / Failed) at the end of the test event.

4.12.12.3.10. The Contractor shall prepare the SIT Report and submit it to the Purchaser within one (1) week after the test event.

4.12.12.4. System Support and Maintenance Acceptance Test

4.12.12.4.1. The purpose of System Support and Maintenance Acceptance Test (SSMAT) is to demonstrate that the PBL complies with the FBL with respect to support and maintenance, and provides Purchaser support staff with the capability to support, test and maintain after handover to the Purchaser.

4.12.12.4.2. The Contractor shall perform SSMAT by installing the PBL using the Software Installation Guide on the TRITON Test System at the PMIC facilities.

4.12.12.4.3. Software Installation Guide

4.12.12.4.3.1 Software Installation Guide (SIG) provides information about all actions to take in order to install and configure the TRITON Operational Software, including COTS components.

4.12.12.4.3.2 The SIG shall include the following:

- Prerequisites for installing TRITON (e.g. the necessary operating system access right to perform installation)
- The necessary supplementary software, drivers, etc. to install TRITON
- The required disk space
- Configuration file information (location, content, available settings of the items and their meaning)
- How to modify the configuration file

- How to configure the database management systems (including both the data model and access mechanisms)
- How to modify the system backbone to run TRITON
- Any additional information specific to the system.
- Text and/or screenshots of the system feedback which will be displayed after each action
- Detailed installation procedures for all services installed or migrated on new or existing platforms, allowing system administrators to rebuild services from scratch.

4.12.12.4.3.3 The Contractor shall deliver the SIG at least three (3) weeks prior to the SSMAT.

4.12.12.4.4. "Read Me" Files

4.12.12.4.4.1 There may be additional "Read Me" files to explain specific information related to installation and configuration of certain components.

4.12.12.4.4.2 The TRITON "Read Me" files shall have at least the following information:

- The version number of the component to which the "Read Me" file applies
- Minimal system requirements necessary to run the specific component
- The functional changes since the latest release
- The solved problems
- Known errors
- Contact information for problem reporting.

4.12.12.4.4.3 The Contractor shall provide "Read Me" files in the installation package.

4.12.12.4.5. The SSMAT shall include at least the following:

- COTS software installation
- Application software installation
- Configuration
- Running and setting to operation with appropriate mode changes
- Operation monitoring
- Error detection and fault isolation (System Technical Status Management and Error Reporting functions)
- De-installation
- Back-up and restore
- Data migration (with realistic structure, content and size)
- Maintainability (including replaceability, quick releases, direct accessibility, no obstruction by other items, no harm or disturbance during maintenance)
- Source code quality (submission and review of the Source Code Review Report – SCR-R)

4.12.12.4.6. SSMAT Procedure

4.12.12.4.6.1 The SSMAT shall be conducted on the basis of test cases for software elements.

4.12.12.4.6.2 The Contractor shall develop the test cases and document them in the SSMAT Procedure.

4.12.12.4.6.3 The SSMAT Procedure shall refer to the Software Installation Guide.

4.12.12.4.6.4 The Purchaser will review, amend and approve the SSMAT Procedure prior to execution.

4.12.12.4.7. The Purchaser reserves the right to observe the tests and to have the Contractor perform selected testing tasks on the TRITON Test System to confirm compliance.

4.12.12.4.8. The Purchaser reserves the right to perform five (5) days of ad hoc testing by Purchaser personnel with support from the Contractor personnel. The Contractor shall record and assess for Contract relevance any discrepancies identified during the ad hoc testing.

4.12.12.4.9. The Purchaser will evaluate the source code quality using the SCR-R as part of the SSMAT. The Purchaser has right to conduct another Source Code Review through IV&V Support.

4.12.12.4.10. The Purchaser will declare the status of the SSMAT (Passed / Conditionally Passed / Failed) at the end of the test event.

4.12.12.4.11. The Contractor shall prepare the SSMAT Report and submit it within one (1) week after the SSMAT.

4.12.12.5. User Assessment Test

4.12.12.5.1. The Contractor shall perform functional testing for the TRITON capability to demonstrate that user requirements are met. As representatives of operational users participates this activity, it shall be referred to as User Assessment Test (UAT).

4.12.12.5.2. The UAT will be conducted by the representatives of the User Community (Maritime Community of Interest) at the Purchaser's PMIC facility using the TRITON Test Systems. The Contractor shall provide support to the activity.

4.12.12.5.3. The Operational Users from the User Community will assess and identify that the product is available for testing, and meets the operational needs ("fit for purpose"). The UAT shall be based on the requirements defined in the Stakeholder Requirements Specification (StRS) document provided by the Purchaser.

4.12.12.5.4. UAT is a key event that must be passed for the Baseline to go to IV&V Testing and AFPL posting.

4.12.12.5.5. UAT Procedure

4.12.12.5.5.1 UAT shall be conducted on the basis of tests cases (scenarios or vignettes).

4.12.12.5.5.2 The Contractor shall develop an initial version of the UAT Procedure using the User Requirements provided by the Purchaser, test scenario, test data,

the Acceptance Criteria and description of tests already developed or produced by the Operational Users if available.

4.12.12.5.5.3 The Purchaser will review, amend with the Operational Users and approve the UAT Procedure and the Acceptance Criteria prior to execution.

4.12.12.5.5.4 The UAT shall also be conducted on the basis of an operational context (vignettes) in addition to the UAT execution plan. The Purchaser and the User Community will determine which events will provide the context for the additional UAT scope.

4.12.12.5.5.5 The UAT Acceptance Criteria shall describe the conditions that a particular test case/vignette is considered as Passed or Failed according the associated User Requirement in the StRS.

4.12.12.5.6. The Contractor shall provide Test Crew Training (as defined in Paragraph 5.8.8) to the representatives of the User Community at the beginning of the UAT.

4.12.12.5.7. The Contractor shall record any recommendations or comments related to Training Material (including the CBT) by the participants of the UAT.

4.12.12.5.8. The Purchaser reserves the right to observe the UAT and to have the Contractor perform selected testing tasks to confirm compliance.

4.12.12.5.9. The Purchaser reserves the right to perform two (2) days of ad hoc testing by the Purchaser's staff and the User Community with support from the Contractor personnel.

4.12.12.5.10. The duration of the UAT shall be no less than three (3) working days for a Baseline.

4.12.12.5.11. The Contractor shall record and assess for contract relevance any discrepancies identified during testing.

4.12.12.5.12. The Contractor shall identify any discrepancies and provide a schedule for resolving.

4.12.12.5.13. The Contractor shall prepare the UAT Report which includes the deficiencies found during the test. The participating Operational Users will provide their own report to the Purchaser.

4.12.12.5.14. The Purchaser will declare the status of the UAT (Passed / Conditionally Passed / Failed) at the end of the test event.

4.12.12.6. Regression Test

4.12.12.6.1. Regression Test (RegT) is a quality control measure to ensure that the newly modified code still complies with its specified requirements and that unmodified code has not been affected by the maintenance activity. The intent of regression testing is to provide confidence that corrective actions have not introduced or exposed anomalies in unchanged parts of the test item.

4.12.12.6.2. The Contractor shall plan and execute RegT to uncover new software problems or regressions in the system after changes or bug fixes are applied.

4.12.12.6.3. The Contractor shall demonstrate in the RegT that the defects found in the previous test events are solved and the rest of the system is not affected.

4.12.12.6.4. The Contractor shall perform a RegT on the whole system (or some components) if a formal test activity is deemed to be "Conditionally Passed". The test status shall be changed to "Passed" if the RegT is agreed to be successful.

4.12.12.6.5. The Contractor shall provide Regression Test Procedure to the Purchaser prior to the test, execute the test, update the Test Log and provide the Regression Test Report (RegT-R) within two (2) weeks after the test.

4.12.12.7. Independent Verification and Validation Testing

4.12.12.7.1. The Contractor shall provide support to the Purchaser to conduct Independent Verification and Validation (IV&V) Testing including the Independent Security Testing (IST).

4.12.12.7.2. The Contractor is responsible for successfully obtaining security accreditations of TRITON Operational Software for both NS and NU Domains.

4.12.12.7.3. The purpose of Software Accreditation is to demonstrate that TRITON meets its security requirements and can be accredited for use on NATO networks within the NCI Agency jurisdiction.

4.12.12.7.4. Any software to be used in NATO networks and operational environments is subject to security screening and approval by the NCI Agency. In particular, this software must be included in the NATO Operational Baseline as described in the AFPL. The process of software accreditation is divided in two phases:

- Configuration Change Proposal – the software to be accredited is presented to a Configuration Control Board;
- Software Accreditation Test – the Software itself and the software documentation are subjected to in-deep technical assessment by the NCI Agency.

4.12.12.7.5. The Contractor-provided software shall operate within the environment of NATO Operational Baseline (defining software deployed at NATO computers) as listed in the AFPL.

4.12.12.7.6. The Purchaser will provide the Contractor the images of the latest version of the supported software configuration (Operational Baseline) for servers and clients as defined in the AFPL.

4.12.12.7.7. The Purchaser will provide the Contractor with the licenses for the activation of the COTS software indicated in the software that is covered by Enterprise Agreements the Purchaser has signed, unless otherwise specified (e.g. the Contractor purchases the software licenses on behalf of the Purchaser).

4.12.12.7.8. In case third party software is used, the Contractor shall provide the software warranty and licensing documentation to the Purchaser at least three (3) weeks before the IV&V Security Testing or when otherwise specified to ensure that Security Test planning can be carried out at the Purchaser's facility.

4.12.12.7.9. The Contractor shall develop and provide system documentation as required by the IV&V and NCI Agency CCB in order to support the security

penetration test and screening activities (to be conducted using the NCI Agency IV&V Testbed) and to include TRITON in the AFPL. The list of documents required to conduct such activities will be provided as part of PFE on Contract Award.

4.12.12.7.10. The Contractor shall deliver the IV&V test documentation for reviewing at least thirty (30) days prior to the IV&V testing activity. This delivery shall be indicated in the TMP.

4.12.12.7.11. The Contractor is responsible for successfully obtaining listing on the necessary AFPL. This includes the provision of the required product documentation and actively supporting the product testing.

4.12.12.7.12. Two test sessions for software accreditation are foreseen, whose duration is five (5) working days each. Test session schedule will be planned in advance by the NCI Agency and in coordination with the Purchaser. The Contractor will be communicated in due time the test schedule.

4.12.12.7.13. IV&V Test sessions will be repeated until completion with a Pass or Conditional Pass.

4.12.12.7.14. Upon successful completion of the test, the software product is added to the AFPL and then it can be installed on a NATO site.

4.12.12.7.15. The NCI Agency will provide the Contractor with a Test Report at the end of each test session, where the reason for failure and remedial actions will be indicated.

4.12.12.7.16. The Purchaser will perform IV&V Testing in support of the approval process for changes to the operational Bi-SC AIS configuration. The IV&V Testing will be performed at the Purchaser's IV&V Test Facility at Casteau, unless mutually agreed by the Contractor and the Purchaser. Standard Bi-SC AIS components (e.g. operating systems, e-mail servers) will be provided at the IV&V Test Facility.

4.12.12.7.17. The Contractor shall develop and provide system documentation as required by the IV&V and the NCI Agency CCB in order to support the security penetration test and screening activities. The list of documents required to conduct such activities will be provided as part of PFE on Contract Award.

4.12.12.7.18. The Contractor shall support the Purchaser for Initial Planning Conference (IPC) and Final Planning Conference (FPC) prior to the IV&V Testing.

4.12.12.7.19. The Contractor shall support the installation and configuration of the TRITON capability (as delivered in the Product Baseline) in support of IV&V Testing. The Contractor shall install all required elements of the TRITON PBL including Purchaser- and Contractor-provided COTS components on the equipment in the IV&V Test Facility using the Site Installation and Activation Procedures. The Contractor shall install test databases to support Acceptance Testing.

4.12.12.7.20. The Contractor shall provide support to the IV&V Testing activity performed by the Purchaser. The Contractor shall provide on-site support for the testing, including supporting the identification and resolution of issues, performance of test procedures to demonstrate system functionality, and participation in

pre- and post-test reviews. The Contractor shall record and assess for Contract relevance any discrepancies identified during IV&V Testing.

4.12.12.7.21. The Contractor shall support interoperability testing performed between TRITON and other applications as requested by the user. These applications will be defined in correspondence of the Contractor's submission of the Test Management Plan.

4.12.12.7.22. The Contractor shall resolve any discrepancies relevant under the Contract and support additional IV&V Testing required to verify these fixes. If the resolution of discrepancies requires changes to the PBL, the Contractor shall deliver a revised version of the PBL prior to site installation and additional testing.

4.12.12.7.23. The IV&V Testing will be repeated for those Baselines indicated in the relevant Work Package and major release thereafter.

4.12.12.7.24. The Purchaser reserves the right to perform the user-produced test scenarios during this test.

4.12.12.7.25. The Purchaser's test authority will prepare the IV&V Report.

4.12.12.7.26. TDK IV&V Testing

4.12.12.7.26.1 The TDK IV&V Testing covers System Security Test for one TDK.

4.12.12.7.26.2 The Purchaser or its designees (e.g. IV&V Contractor) will review/approve the Contractor's TMP and procedures for correctness and completeness for the TDK IV&V Testing, and will monitor and inspect the Contractor's test activities to ensure compliance.

4.12.12.7.26.3 The TDK IV&V Testing for one TDK is similar to the system IV&V Tests for Baselines and expected to last 5 (five) days.

4.12.12.7.26.4 The Contractor shall provide technical support to the TDK IV&V testing activity.

4.12.12.7.26.5 The Purchaser's test authority will prepare the TDK IV&V Report.

4.12.12.7.26.6 The Contractor shall resolve any discrepancies relevant under the Contract and support additional IV&V Testing required to verify these fixes. If the resolution of discrepancies requires changes to the PBL, the Contractor shall deliver a revised version of the PBL prior to serial production or fix apply the changes after the production.

4.12.13. System Verification Review

4.12.13.1. The Contractor shall execute a System Verification Review (SVerR) after each IV&V Testing as indicated in AAP-20 Development Stage.

4.12.13.2. The SVerR shall include reviewing at least the following:

- IV&V Test reports
- Problem Resolution Plan

4.12.13.3. The Contractor shall prepare a SVerR Report and submit it after the SVerR.

4.12.13.4. The Contractor shall perform the system deployment and installation activities after the successful verification of the software by IV&V.

4.12.14. Key Performance Indicators

4.12.14.1. The Contractor, in conjunction with the Purchaser, shall measure the success of each Verification Test by measuring and monitoring the following KPIs:

- Total number of critical defects and non-conformities found during verification activities
- Number of defects (according to their severity)
- Number of emergency changes reported by the user community following deployment
- Number of customer waivers required to field the product, service or system.
- Labour spent for verification activities.

4.12.14.2. The Contractor shall provide KPI and any other statistical data in the result report.

4.12.14.3. The Contractor shall use the KPIs to identify opportunities for quality improvement, provide solutions and update the plans.

4.13. System Transition Process

4.13.1. General

4.13.1.1. The Contractor shall perform system transition activities in compliance with the processes defined in ISO/IEC 15288, Paragraph 6.4.7 as referred by AAP-48, Paragraph 6.4.7 and AAP-20.

4.13.1.2. The Contractor shall conduct a System Transition Process in order to facilitate the transfer, as appropriate, of the responsibility for the system and system support to the Purchaser.

4.13.1.3. The Contractor shall install and activate the verified TRITON capability, together with the Support Systems (Reference Systems, Test Systems, and Training Systems) and provide the related Initial Operational Support.

4.13.1.4. The Contractor shall coordinate the deployment activities with the Purchaser's site CIS Support Units (CSUs).

4.13.1.5. Since the TRITON Infrastructure will be based on deployment on Data Centres, not all sites will be having or updating infrastructure to host TRITON Servers and Storage. Therefore, the Transition Process will be conducted in two parallel activities:

- Static Site Installation and Activation (Data Centre or Enhanced Node)
- Organizational Node Activation

4.13.1.6. The Transition Process shall cover the following activities:

- Surveying the installation site
- Preparations at the installation
- Software installation
- Activation on operational sites
- Training.

4.13.1.7. Although the Purchaser will provide the facilities in which the TRITON capability will be installed and the external systems to which it will be interfaced, the Contractor shall be responsible for timely and complete delivery and installation of all relevant supplies provided under this Contract.

4.13.1.8. The Contractor shall solve all integration and interface problems that may occur during the installation. The responsibility for the system's operation, support, and performance rests solely with the Contractor until reaching FSA.

4.13.1.9. The Purchaser reserves the right to suspend the Contractor's installation or activation work for up to two (2) working days to avoid interfering with or disrupting a critical operational event. If this suspension exceeds two (2) working days, an adjustment of the Work Package price can be submitted for consideration in connection with rescheduling efforts required. During the installation activities, if the Contractor receives any indication of a possible requirement for a suspension, this shall be made known immediately to the Purchaser’s Project Manager.

4.13.1.10. System Transition for a site shall be completed with a Site Acceptance Process as defined in STrP. Each Site Acceptance shall be conducted in two phases. Provisional Site Acceptance (PSiA) and Final Site Acceptance (FSiA).

4.13.1.11. The overall transition process is given in Figure 9.

4.13.2. System Transition Plan

4.13.2.1. The Contractor shall prepare a System Transition Plan (STrP) as defined in AAP-48 (para. 6.4.7.2).

4.13.2.2. The STR shall define the hand-over of TRITON Product Baseline hardware (for TDKs), software and documentation from the Contractor to the Purchaser Implementation Authority (IA), the Service Provision Authority (SPA) and the Operation Authority (OA).

4.13.2.3. The STrP shall detail the overall schedule for transition activities, including site preparation, site activation, data migration, initial on-site training, the Contractor's approach to all transition tasks, the Contractor organization and Key Personnel involved in transition, a sample of its Site Survey checklist, initial site inventory, site engineering drawing(s), installation and activation checklist(s).

4.13.2.4. The specific procedures to be executed at each site shall be described in Site Installation and Activation Procedures, being a part of the STrP.

4.13.2.5. The STrP shall include an agreed process for site transition from the use of MCCIS and MSA/BRITE to the use of the TRITON capability. This may require running the capabilities in parallel for a period of time.

4.13.2.6. The STrP shall contain a list of Site Points of Contact (POCs) and their associated contact data.

4.13.2.7. Site Survey Workbook

4.13.2.7.1. The STrP shall include a generic Site Survey Workbook and checklists, fill-in forms, installation sketches, contact information, installation specifications, and any other documentation required to perform the Site Survey.

4.13.2.7.2. The Site Survey Workbook shall be available for Purchaser review and shall be maintained and updated as necessary to support site surveys throughout the period of performance of this Contract.

4.13.2.8. The STrP shall include transition planning, describing the procedures, mechanisms and responsibilities to be used in transitioning the TRITON capability into operation. These transition plans and procedures shall be of sufficient quality and detail to enable the successful transition of the TRITON capability at a particular site without adverse impact on the operational mission, but also the continued maritime operations of those sites not yet transitioned. The transition plans and procedures shall include:

4.13.2.8.1. Technical transition (e.g. parallel operation with the legacy systems, phased transition, timing of transition to lower risk periods)

4.13.2.8.2. Organizational transition (e.g. communication planning, just-in-time training, issue reporting)

4.13.2.8.3. Site Acceptance Process (Provisional and Final Site Acceptance)

4.13.2.9. The STrP shall include “back-out” procedures for deactivating and removing installed TRITON components and restoring existing services if any part of the TRITON capability is found to be interfering with the operation of other Purchaser systems.

4.13.2.10. The STrP shall be structured so that general implementation information is maintained in the body of the plan and site-specific details are kept as annexes.

4.13.2.11. The Contractor shall maintain the STrP on the Project Website and update it to reflect changes in the SRS and SOW.

4.13.2.12. The site installation sequence and installation dates shall be coordinated with the Site POCs to accommodate site-specific requirements, exercises, holiday periods, and other considerations and shall be approved by the Purchaser.

4.13.2.13. The Contractor shall be able to conduct parallel installations in different locations at the same time, as required to meet the project milestones.

4.13.2.14. The Contractor shall deliver the STR for Purchaser approval not later than the CDR milestone. It shall be updated at each TRR if necessary.

4.13.3. Site Survey

4.13.3.1. The Contractor shall visit the Purchaser facilities, according to the agreed STrP, at which it is required to install elements of the TRITON Baseline; survey physical, logistical, and system configuration requirements to support TRITON installation; and interview site personnel involved in TRITON installation, training, activation, and use.

4.13.3.2. The Contractor shall use the Site Survey Workbook from the STrP to conduct the Site Survey.

4.13.3.3. Site Survey will be used to determine the site’s infrastructural capabilities including the status of the NATO Communication Infrastructure at the time of deployment.

4.13.3.4. The Site Survey shall verify the provided Detailed Design and identify if there are any design or implementation issues which have not been documented or described.

4.13.3.5. The Site Survey may be conducted with the NCI Agency representatives, and the duration is estimated at two (2) calendar days (without travel time) for each of the sites.

4.13.3.6. Site Survey Preparation

4.13.3.6.1. The Contractor shall give notice in well in advance to coordinate with the Purchaser access to any classified spaces which require an escort.

4.13.3.6.2. The Contractor shall convey initial information about the site configuration from Purchaser's representation at the Implementation Working Group.

4.13.3.7. Site Survey Execution

4.13.3.7.1. As a minimum the Site Survey shall be conducted to resolve the following issues:

- Coordination of site installation periods
- Survey of the physical infrastructure (server rooms, site layout etc.) and identification of missing infrastructure elements.
- Coordination of the installation with the Installation Site, identifying all responsibilities, tasks, their sequence and required resources (e.g. space, personnel, and data).
- Identification of the exact shipment addresses and NATO Points of Contact (POCs) for subsequent equipment delivery.
- Identification and documentation of any minor elements not addressed in other project documentation.
- Coordination of a proposed work schedule and migration strategy with the site, including identification of unique technical and design issues to be considered during implementation.
- Identification of availability of hardware / software capacity (meeting the TRITON requirements) to be used for TRITON and determination of whether additional server capacity for TRITON is needed.
- Identification of site specific policies for requirements to server hardware that apply to the TRITON installation.
- Identification of data provider systems that need to exchange information with the TRITON services.

4.13.3.8. Site Survey Report

4.13.3.8.1. The Contractor shall provide a Site Survey Report (SS-R), separately for each site, detailing its findings from the Site Survey, identifying all required Purchaser and Contractor actions to prepare for, conduct, or support TRITON installation and activation, and identifying the type of training courses required and the number of Purchaser staff to be trained for each course.

4.13.3.8.2. At minimum, the SS-R shall include the following subjects:

- Infrastructure

- Available computing environment (physical and virtualised)
- Network infrastructure
- NATO Communication Infrastructure
- System location, space and ventilation
- Details for possible delivery

- Installation and activation
  - Stakeholders communication
  - System installation requirements
  - Schedule of installation activities
- Training requirements (initial and follow-on)
- Local Security Accreditation Authority documentation
  - Contact details of security responsibilities
  - Interconnection details
  - Network diagrams

4.13.3.8.3. The SS-R shall include a site diagram that shall be used as the basis for the As-Built Documentation and used in the installation of the site.

4.13.3.8.4. The SS-R shall register all findings that require modification of the site infrastructure or change of the agreed implementation scope. For each of the changes the Contractor shall produce a formal change proposal.

4.13.3.8.5. In SS-R the Contractor shall include a proposal for the infrastructure to be deployed at the site, to comply with the existing site's infrastructure. The Contractor's solution shall strive to achieve required performance by upgrading the existing hardware rather than deploying new components.

4.13.3.8.6. The SS-R shall provide an annex with a list of all preparations required to support the installation and activation of the TRITON capability at the site, as specified in Section 4 of the SOW.

4.13.4. Sustainment Qualification Review

4.13.4.1. Sustainment Qualification Review (SQR) is used to check if the Installation Site resources including facilities and support personnel are sufficient for system sustainment.

4.13.4.2. The Contractor shall provide the documents given in Table 4-14 for the SQR:

Table 4-14 – Input for the SQR

Serial	Requirement
1	Integrated Support Plan (ISP)
2	Software Distribution List (SWDL)
3	Pre-Installation Check Procedure (PIC-P)
4	Site Activation Test Procedure (SiAT-P)

4.13.4.3. The Contractor shall plan and conduct a SQR at each Installation Site.

4.13.4.4. The Contractor shall prepare the SQR Report (SQR-R) and submit it to the Purchaser within three (3) days after the review.

4.13.5. Site Preparation

4.13.5.1. The Contractor shall identify all facilities support issues, including modifications or additions required, within one (1) week after the Site Survey.

4.13.5.1.1. This notification shall be in the form of an attachment to the Site Survey Report, accompanied by engineering drawings, checklists, or any other supporting information.

4.13.5.1.2. Facilities support issues that represent Medium or High risk items shall be highlighted in the Project Highlight Report for the month in which they are identified.

4.13.5.2. In case the Site Infrastructure has to be augmented instead of TRITON equipment acquired, the Contractor shall inform the Purchaser of the necessary changes and the Purchaser will make necessary arrangements with the Site POC to reflect the infrastructure upgrade.

4.13.5.3. For each out-of-scope item that requires either technical support or procurement activity, the Contractor shall offer a proposal to the Purchaser with his recommended solution.

4.13.5.4. The Contractor shall provide the Purchaser and each respective Site POC with a list of software to be shipped (if necessary) and a list of Contractor personnel who will be involved in site installation and activation at least two (2) weeks prior to the installation date.

4.13.5.5. The Contractor shall monitor the progress of any required Purchaser facilities preparations and ensure that anything that may delay installation is brought to the attention of the Purchaser promptly.

4.13.6. Site Installation

4.13.6.1. Pre-Installation Check

4.13.6.1.1. The Contractor shall check the site infrastructure using the Pre-Installation Check Procedure (PIC-P) in order to make sure all the necessary infrastructure is ready to perform the installation.

4.13.6.1.2. The Contractor shall prepare and submit the PIC-P at least two (2) weeks prior to the SQR.

4.13.6.2. Site Software Installation

4.13.6.2.1. The Contractor shall apply the Roll-Back Plan (e.g. taking snapshots of the Virtual Machines of the affected servers) to restore the previous service in case the new deployment causes serious business impact.

4.13.6.2.2. The Contractor shall provide support to the Purchaser to ensure the integrity of the installed baseline is maintained and be prepared to execute the Roll-Back/Contingency Plan in the event of a major incident or problem.

4.13.6.2.3. The Contractor shall install the baselined TRITON operational software, along with any supporting/COTS software and documentation associated with the baseline, on the designated Purchaser environment.

4.13.6.2.4. During installation and migration, the service interruption shall be kept to minimum. Precautions shall be taken for not losing any data, as any loss of data is unacceptable. Any system downtime occurring during normal business

hours shall be coordinated and agreed with the Site POC. Using details provided by the Site, the Contractor shall prepare a migration plan to achieve this. This plan shall be included in the STrP.

4.13.6.2.5. The Contractor shall obtain server address and other site configuration details from the Site POC and activate all installed servers, workstation, and ancillary equipment on the Site's Local Area Network.

4.13.6.2.6. The Contractor shall install and configure COTS software applications included as part of the TRITON PBL for the site.

4.13.6.2.7. The Contractor shall configure all software settings to match the Product Baseline and site-specific requirements, and load any initial data included with the PBL.

4.13.6.2.8. The Contractor shall import and/or load any site-specific data (e.g. Group Policy Objects).

4.13.6.2.9. The Contractor shall demonstrate that the TRITON capability is accessible by the authorised users at the Authorised Locations.

4.13.6.2.10. The Contractor shall demonstrate that:

- The installed TRITON capability is integrated with the Bi-SC AIS Core Enterprise Services;
- The installed TRITON capability is correctly interfaced with the required Bi-SC AIS Functional Services;
- The installed TRITON capability has correctly-configured interfaces with Nations;
- The installed TRITON capability has correctly-configured interfaces with external systems and services (e.g. Commercial Data Services over Internet).

4.13.6.2.11. The Contractor shall demonstrate to the local Security Accreditation Authority (SAA) that the equipment complies with the SRS and SOW requirements, and Security Operating Procedures (SecOps).

4.13.6.2.12. The Contractor shall execute the Security Implementation Verification Procedures (SIVP) for the TRITON elements installed for verification by the local SAA. The Contractor shall obtain a System Statement of Conformance from the local SAA prior to proceeding with site activation.

4.13.6.2.13. Upon completion of site installation work, the Contractor shall provide the Purchaser Site POC with a copy of the site installation and activation checklist. The Contractor shall resolve any discrepancies identified.

4.13.6.2.14. The Contractor shall provide operation of the TRITON software within the environment of NATO Operational Baseline (defining software deployed at NATO computers) as listed in the AFPL.

4.13.6.2.15. The Purchaser will provide the Contractor the images of the latest version of the supported software configuration (Operational Baseline) for servers and clients as defined in the AFPL.

4.13.6.2.16. The Purchaser will provide the Contractor with the licenses for the activation of the COTS software indicated in the software baseline maintained by the

NCI Agency unless otherwise specified (e.g. the Contractor purchases the software licenses on behalf of the Purchaser).

4.13.6.2.17. If a site has already been installed, further installations can be performed remotely.

4.13.6.2.18. All required System Maintenance Documentation (SMD) and training aids shall be delivered.

4.13.6.3. Ship Installation

4.13.6.3.1. The Contractor shall perform one installation on board a selected NATO Command Ship for Sea Acceptance Test of the TRITON Deployable Kit (TDK).

4.13.6.3.2. The Contractor shall transfer one set of TDK to the port indicated by the Purchaser. The port will be assumed to be in Europe.

4.13.6.3.3. The Purchaser will provide access to a NATO Command Ship to install the TDK.

4.13.6.3.4. The Contractor shall install one set of TDK on board the ship, at the designated compartment, connect it to the networks on board, integrate with the allowed ship systems (e.g. AIS Data Source) and operate it.

4.13.6.3.5. The Contractor shall perform the installation and testing together with the NCI Agency Support Personnel and ship crew.

4.13.6.3.6. The Contractor shall perform the Sea Acceptance Test (SeAT) as described in Paragraph 4.10.3.8 after the installation.

4.13.6.3.7. The Contractor shall de-install the TDK and transfer it to his own premises.

4.13.6.4. Physical Configuration Audit

4.13.6.4.1. The Contractor shall plan and conduct the Physical Configuration Audit (PCA) for each TRITON Installation Site as described in Paragraph 4.7.11. The objective of the PCA is to verify that the delivered CIs correspond with the TRITON PBL documentation.

4.13.6.4.2. The PCA shall include visual inspection of all physical CIs (if delivered) and visual verification of the presence and correct configuration of all software CIs.

4.13.6.4.3. Successful completion of PCA establishes the Site Baseline.

4.13.6.4.4. The Contractor shall document the PCA in Configuration Audit Report (CAuR) that shall be provided to the Purchaser no later than two (2) weeks after the PCA.

4.13.6.5. Static Site Activation

4.13.6.5.1. Static Site Activation includes checking the accessibility of Organizational Nodes to the just-installed TRITON Instance, configuring the system to adapt the TRITON capability according to organizational needs.

4.13.6.5.2. Organizational adaptation is not intended to include changes to the Product Baseline, but shall include, as necessary:

- Establishment of local system interfaces

- Creation of initial user accounts and privileges
- Adaptation of workflows
- Changes to mapping values to support data migration.

4.13.6.5.3. Upon authorisation by the Purchaser's Installation Site POC, the Contractor shall establish live connections with other TRITON Instances and perform synchronisation tests.

4.13.6.6. Site Activation Test

4.13.6.6.1. The Contractor shall perform Site Activation Test (SiAT) at the Installation Site to demonstrate that:

- The software installed for an individual site is ready for operational use.
- All supporting capabilities (e.g. configuration, operational data, user management) for operation have been successfully performed.
- The Site Activation is verified.

4.13.6.6.2. The Contractor shall execute SiAT using the Site Activation Test Procedures (SiAT-P) that the software installed and configured for an individual site is ready for operational use.

4.13.6.6.3. The SiAT shall demonstrate that:

4.13.6.6.3.1 All supplied equipment (if there is any) meets, or exceeds, the Purchaser's stated specifications.

4.13.6.6.3.2 All supplied equipment is in full working order.

4.13.6.6.3.3 All supplied equipment has been configured by the Contractor and is fully integrated within the existing site Bi-SC AIS infrastructure and has been implemented to meet:

- Information exchange
- Software configuration
- Security configuration
- Network and communications configuration
- Systems and services configuration
- System administration and management

4.13.6.6.3.4 All user data and accounts have been successfully migrated to the new environment.

4.13.6.6.3.5 All legacy server equipment has been migrated to the new environment using the new software baseline configuration (if necessary).

4.13.6.6.3.6 All interfaces with relevant other systems within the site has been established.

4.13.6.6.3.7 All interfaces with Nations and external systems have been established.

4.13.6.6.3.8 All training pertaining to deployment, configuration and operation of TRITON has been completed.

4.13.6.6.4. The Contractor shall prepare SiAT Report and submit it within three (3) days after the test.

4.13.6.7. Organizational Node Activation

4.13.6.7.1. Organizational Node Activation includes checking the accessibility of Organizational Node to the TRITON Instances and configuring the system according to the Standard Operating Procedures (SOP) of the Maritime Community.

4.13.6.7.2. The Contractor shall execute selected test cases (nominal tests) from On-site User Assessment Test Procedure to ensure that the Organizational Node is activated successfully.

4.13.6.7.3. The Contractor shall provide support to the Organizational Node to configure TRITON, including functional and technical user account settings.

4.13.6.7.4. The Contractor shall provide support to migrate local data and configuration data from the legacy systems (MCCIS and MSA/BRITE configuration data will be made available by the Purchaser).

4.13.6.7.5. The Contractor shall establish data import and export mechanisms, establish information exchange with information sources, adapt business rules to the local environment, prepare automated supervision reports, workflows, and defined roles as required and assign TRITON Users to Roles.

4.13.6.7.6. The Contractor shall plan and conduct Organizational Node Activation Review (ONAR) for each Organizational Node at which activation is performed.

4.13.6.7.7. The Contractor shall prepare ONAR Report and submit it within three (3) days after the review.

4.13.6.7.8. On-Site User Assessment Test

4.13.6.7.8.1 The objective of the On-Site User Assessment Test (UAT) is to establish that the system is fit-for-purpose for the end-users and the support staff, to establish benchmarks on the capabilities of TRITON on the Organizational Node and to establish that the operational staff can conduct their tasks with no disruption of loss of productivity than any previous system that TRITON is replacing.

4.13.6.7.8.2 The Contractor will plan an On-Site UAT at each activated Organizational Node and provide support to the user to execute the test. MARCOM On-site UAT shall be conducted for each delivered Baseline.

4.13.6.7.9. On-Site UAT Procedure

4.13.6.7.9.1 The On-site UAT shall be conducted on the basis of On-Site UAT Procedure.

4.13.6.7.9.2 The Contractor shall develop an initial version of the On-site UAT Procedure using test data and description of test already developed/produced by the Operational Users if available.

4.13.6.7.9.3 The On-site UAT shall include nominal test cases to cover technical issues and used during Organizational Node Activation.

4.13.6.7.9.4 The Contractor shall deliver the On-site UAT Procedure at SQR.

4.13.6.7.9.5 The Purchaser will review, amend with the Operational Users and approve the On-site UAT Procedure prior to execution.

4.13.6.7.10. The Contractor shall configure TRITON and enable the required functionalities as required by the On-site UAT Procedure and as requested by the On-site UAT audience while performing the tests and ad-hoc testing.

4.13.6.7.11. The On-site UAT shall be conducted by the representatives of the Operational Community, with support from the Contractor personnel. The representatives will perform procure-driven and ad-hoc testing during this On-Site UAT.

4.13.6.7.12. The Purchaser's on-site representative will declare the result of the On-site UAT.

4.13.6.7.13. The Contractor shall record and assess for Contract relevance any discrepancies identified during testing.

4.13.6.7.14. The Contractor shall provide On-the-Job Training (OJT) to the operational users on the selected locations as described in Paragraph 5.8.9.

4.13.6.7.15. The Contractor shall prepare On-Site UAT Report and submit it within three (3) days after the test.

4.13.6.8. Key Performance Indicators

4.13.6.8.1. The Contractor, in conjunction with the Purchaser, shall measure the success of each deployment by measuring and monitoring the following KPIs:

- Number of emergency releases or deployments in response to problems with each respective deployment
- Number of operational user complaints related this each respective deployment
- Amount of deployment delays (measured in days)
- Cost over-runs related to each respective deployment
- Complaints received from Purchaser's support staff regarding their ability to support the deployment.

4.13.6.9. Software Distribution List

4.13.6.9.1. The Contractor shall provide and maintain a Software Distribution List (SWDL) for each site.

4.13.6.9.2. The SWDL shall contain all applications that are comprised in the system's package and thus including COTS, glue-code and software developed for exclusive use of the Purchaser.

4.13.6.9.3. The SWDL shall contain the following information:

- Site (location and server ID where the CI is installed)
- Software Application
- Version
- Release
- Manufacturer
- License Code and Expiry Date
- NATO Ownership (i.e. COTS or PFE).

4.13.6.9.4. The Contractor shall provide the SWDL at least two (2) weeks prior to SQR for each Baseline.

4.13.7. Training

4.13.7.1. The Contractor shall perform the training activities as defined in Subsection 5.7 and provide the initial training for users and the system support staff as defined in the Training Plan.

4.13.8. Site Acceptance

4.13.8.1. Provisional Site Acceptance

4.13.8.1.1. Provisional Site Acceptance (PSiA) will take place on completion and Purchaser's acceptance of all work at the site. The PSiA should last no longer than three (3) calendar days per site.

4.13.8.1.2. As part of the PSiA, the Contractor shall present the Purchaser with witnessed and approved Site Activation Test (SiAT) and On-Site User Assessment Test (UAT) Reports and all documentation including verified inventory, Software Distribution List (SWDL), and site delivery to the Purchaser or his representative. The deliverables include all software configurations, any software licences supplied plus all documentation, maintenance, training, and support included in this Contract. The Purchaser reserves the right to request draft configuration details prior to PSiA.

4.13.8.1.3. Any discrepancies discovered during the PSiA shall be recorded on Observation Sheet(s) with a statement on their required resolution. Depending on the severity and priority of the discrepancy discovered, PSiA may be withheld until satisfactory resolution.

4.13.8.1.4. The Contractor shall plan a formal Technical Transfer Meeting to record formal acceptance of the deliverables, including training, as meeting the contractual requirements for PSiA.

4.13.8.2. Site Acceptance Review

4.13.8.2.1. After successful resolution of any discrepancies and completion of the PSiA, the Purchaser, together with the Contractor, will organise a Site Acceptance Review (SiAR) meeting to record formal acceptance of the deliverables as meeting the contractual requirements.

4.13.8.2.2. The Contractor shall conduct SiAR for each site installation and site updates.

4.13.8.2.3. The Contractor shall update the Software Installation Guide and Site Activation Test Procedures based on the lessons learned and provide the updated documents not later than two (2) weeks after the SiAR.

4.13.8.2.4. The Contractor shall prepare a SiAR Report (SiAR-R) within one (1) week after the SiAR.

4.13.8.3. Final Site Acceptance

4.13.8.3.1. The Contractor shall perform an analysis of the Site Installation and present the Entry-Exit Criteria with all the achievements performed, their results and remaining items if there are any.

4.13.8.3.2. If all the site acceptance criteria are deemed to be met during the SiAR, the Final Site Acceptance (FSiA) will be achieved and both Contractor and Purchaser will sign the Site Acceptance documentation.

4.13.8.3.3. A copy of the System Statement of Conformance (SSC) signed by the local SAA, separately for each installation site.

4.13.8.3.4. FSiA shall be repeated for each site installation and major upgrade (e.g. Baseline-3 installation).

4.13.8.3.5. After the FSiA, the Contractor shall start performing the activities of the Operational Testing and Evaluation and System Support and Maintenance for the installed Baseline at the installed site.

4.13.9. Operational Test Readiness Review

4.13.9.1. Operational Test Readiness Review (OTRR) is a multi-disciplined product and process assessment to ensure that the system can proceed into OT&E with a high probability of success, and that the delivered Baseline is effective and suitable for service introduction. The OTRR examines the actual system characteristics and the procedures used in the system's operation and ensures that all system software, personnel, procedures, and user documentation accurately reflect the deployed state of the system.

4.13.9.2. The Contractor shall plan OTRR at the location where the Purchaser will indicate.

4.13.9.3. Entry Criteria

4.13.9.3.1. The Contractor shall include in planning the OTRR Entry Criteria given in Table 4-15 and make them available to the Purchaser at least two (2) weeks prior to the OTRR:

Table 4-15 – OTRR Entry Criteria

Serial	Activities / Documents
1	A preliminary OTRR agenda
2	Success Criteria (enhanced or adapted)
3	All verification tests are completed.
4	Test failures and anomalies from verification testing have been resolved and the results incorporated into OBL.
5	All OBL of the product that are necessary for operations has been tested, delivered and installed at the site necessary to for operations.
6	All user documentation have been provided.
7	Training has been provided to the users and operators on the correct operational procedures for the system.
8	Operational contingency planning has been accomplished, and all personnel have been trained.

4.13.9.4. Success Criteria

4.13.9.4.1. The Purchaser concludes that the OTRR Success Criteria given in Table 4-16 accomplished to complete the objectives of the OTRR.

Table 4-16 – OTRR Success Criteria

Serial	Requirement
1	The system, including any enabling products, is determined to be ready to be placed in an operational status.
2	All applicable lessons learned for organizational improvement and systems operations have been captured in the Lessons Log.
3	All waivers and anomalies have been closed.
4	System software, personnel, and procedures are in place to support operations.
5	All levels of support are planned and ready to be provided.

4.13.9.5. The OTRR shall be used as a milestone to end the System Transition Process and start the OT&E Process for a Baseline.

4.13.9.6. The Contractor shall prepare the OTRR Report and submit it within one week after the completion of OTRR.

4.13.10. Support Systems Installations

4.13.10.1. TRITON Test System

4.13.10.1.1. TRITON Test System is a test environment configured to provide a representation of the target network/security domain. It will include all the necessary configurations and interfacing systems and services to represent the live environment for test purposes. It will also include test harnesses and test data.

4.13.10.1.2. All hardware (server, storage, network elements and workstations) and Virtualisation Environment for the Test Systems will be provided by the Purchaser.

4.13.10.1.3. The Purchaser will prepare the Virtual Environment for the TRITON Test Systems (for both NS and NU Domains) at the PMIC facilities.

4.13.10.1.4. The Contractor shall provide the operating systems and any other COTS software needed by TRITON Infrastructure and Operational Software with the necessary Original Equipment Manufacturer's manuals and licenses.

4.13.10.1.5. The Contractor shall install the COTS software on the Virtualised Environment and apply the necessary configuration.

4.13.10.1.6. The Contractor shall provide the necessary licenses or service fee for the commercial data services (e.g. IHS Fairplay) to be used during the development. The licenses shall cover the use of live data services in TRITON Test Systems during system integration and acceptance tests.

4.13.10.1.7. The Contractor shall establish the "TRITON Test System – NS" on the NU Domain after SwDR-1. The Concept Demonstration System (CDS) can be installed on the Test System prepared for BL1.

4.13.10.1.8. The Contractor shall establish the "TRITON Test System – NU" on the NU Domain after SwDR-2.

4.13.10.1.9. The Contractor shall update, if necessary, the TRITON Test System – NS during Build Process-3 and 4.

4.13.10.1.10. The Contractor shall update the Test Systems at each new release until FSA.

4.13.10.2. TRITON Reference System

4.13.10.2.1. TRITON Reference System is a test environment configured to provide a certified representation of the target network/security domain, (e.g. NS). It will include all the necessary security settings, patches, network configurations and interfacing systems and services to represent the live environment as viewed from the perspective of the product, system or service being tested. It will also include representative data. Some tests, focused on a specific aspect, will require the Reference Environment to provide only a partial representation of the live environment.

4.13.10.2.2. The TRITON Reference Systems shall provide a Reference Environment for both NS and NU Domains to support test events and subsequently on-line and off-line diagnosis, integration and generation of subsequent changes to the PBL, and testing of TRITON Operational Software and its performance.

4.13.10.2.3. The TRITON Reference Systems shall comprise a representative configuration, which includes all functionality of the TRITON installation and operational sites.

4.13.10.2.4. All hardware (server, storage, network elements and workstations) and Virtualisation Environment for the Reference Systems will be provided by the Purchaser.

4.13.10.2.5. The Purchaser will prepare the Virtualised Environment for the TRITON Reference Systems (for both NS and NU Domains) at the PMIC facilities or Mons.

4.13.10.2.6. The Purchaser will provide the operating system if MS Windows is used. Any other operating system shall be provided by the Contractor.

4.13.10.2.7. The Contractor shall provide the any other COTS software needed by TRITON Infrastructure and Operational Software with the necessary Original Equipment Manufacturer’s manuals and licenses.

4.13.10.2.8. The Contractor shall install COTS software on the reserved Virtualised Environment and apply the necessary configuration for the Reference Systems.

4.13.10.2.9. The Contractor shall establish the TRITON Reference System - NU on the NU Domain at least two (2) weeks prior to the TRR (IV&V-2) for BL2.

4.13.10.2.10. The Contractor shall update, if necessary, the TRITON Reference System - NS on the NU Domain at least two (2) weeks prior to the TRR (IV&V-3) for BL3.

4.13.10.2.11. The Contractor shall update the Reference Systems at each new release until FSA.

4.13.10.3. TRITON Training System

4.13.10.3.1. TRITON Training System is a training environment similar to the TRITON Test System. There will be two separate Training Systems, one for the TRITON-NS Functional Services and one for the TRITON-NU Functional Services. Trainers and trainees will be able to access both of the TRITON Training Systems for Individual Training deployed at the Training Node Location on the NU Domain. Collective Training users will access the deployment at the Training Node on the designated training network.

4.13.10.3.2. All hardware (server, storage, network elements and workstations) and Virtualisation Environment for the Training Systems will be provided by the Purchaser.

4.13.10.3.3. The Purchaser will prepare Virtual Environment for the TRITON Training Systems (for both NS and NU Domains) at the Training Node Locations.

4.13.10.3.4. The Purchaser will provide the operating system if MS Windows is used. Any other operating system shall be provided by the Contractor.

4.13.10.3.5. The Contractor shall provide the any other COTS software needed by TRITON Infrastructure and Operational Software with the necessary Original Equipment Manufacturer's manuals and licenses.

4.13.10.3.6. The Contractor shall install COTS software on the reserved virtualised environment and apply the necessary configuration for the Training Systems.

4.13.10.3.7. The Contractor shall establish the TRITON Training System – NU on the NU Domain at least two (2) weeks prior to the TRR (FAT-2) for BL2.

4.13.10.3.8. The Contractor shall establish the TRITON Training System – NS on the NU Domain at least two (2) weeks prior to the TRR (FAT-3) for BL3.

4.13.11. Multi-Site Operation Test

4.13.11.1. The Contractor conduct a Multi-Site Operation Test (MSOT) in order to demonstrate that more than one instance of TRITON operates concurrently as designed.

4.13.11.2. The Contractor shall prepare the draft MSOT Procedure, provide it to the Purchaser at the last Site Acceptance.

4.13.11.3. The Purchaser will contribute to the MSOT Procedure according to possible operational scenarios and existing SOPs.

4.13.11.4. The Contractor shall plan, in coordination with the Purchaser, the MSOT after installation and activation of all sites are completed, and at least one TDK is operational and in use at sea.

4.13.11.5. The Purchaser will plan participation of Nations to MSOT in order to test the eligibility and flexibility of TRITON for supporting any emergency conditions.

4.13.11.6. The Contractor shall use the MSOT Procedure to conduct the test.

4.13.11.7. The Contractor shall prepare a MSOT Report to include the result of the test and the resolution plan for any problem found.

4.13.12. Support to Federated Mission Network Testing

4.13.12.1. The purpose of the Federated Mission Network (FMN) Tests is to validate that the introduction of new systems or changes to existing systems are interoperable with the FMN implementation.

4.13.12.2. The FMN Test Procedures will be developed by the Purchaser. These tests will be performed by the NCI Agency under the direction FMN secretariat. The tests will be performed at the NCI Agency The Hague or Mons, typically in two weeks.

4.13.12.3. The Contractor shall provide technical support to the FMN Testing process in accordance with the approved FMN Test Procedures.

4.13.12.4. The Purchaser will install and configure the PBL on the NCI Agency FMN Test Bed. The Contractor shall provide technical support to the installation and configuration if needed.

4.13.12.5. The Contractor shall fix and correct any discrepancies if they are related to the installed PBL.

4.13.12.6. FMN Testing shall be executed in two steps:

4.13.12.6.1. Initial Testing: The tests will be conducted and the results will be recorded. The Contractor will be given time to correct any errors or incompatibilities.

4.13.12.6.2. Final Testing: The tests will be repeated to get the accreditation.

4.13.13. Software Transition

4.13.13.1. The Contractor shall provide Software Transition for the software component defined in the relevant Work Package.

4.13.13.2. The Software Transition Process is defined in detail in Paragraph 4.17.

4.14. System Validation Process

4.14.1. General

4.14.1.1. Validation is the process of providing evidence that the system, software, or hardware and its associated products satisfy requirements allocated to it at the end of each life cycle activity, solve the right problem (e.g. correctly model physical laws, implement business rules, and use the proper system assumptions), and satisfy intended use and user needs.

4.14.1.2. System Validation Process performs a comparative assessment and confirms that the system meets the stakeholders' requirements and measures of effectiveness. Validation confirms, through assessment of the services presented to the stakeholders, that the "right" system entity has been created, i.e. is fit for its purpose and satisfies the customer.

4.14.1.3. The Contractor shall perform system validation activities in compliance with the processes defined in ISO/IEC 15288, Paragraph 6.4.8 as referred by AAP-48, Paragraph 6.4.8.

4.14.1.4. The Purchaser will perform an Operational Testing and Evaluation (OT&E) during the operational period for each delivered OBL with support from the Contractor. Although part of the validation is performed through user involvement during the development (e.g. user interface design), the final validation process will be executed during the OT&E period.

4.14.2. Operational Test and Evaluation

4.14.2.1. Operational Test and Evaluation (OT&E) is a period which consists of a test series designed to estimate the operational effectiveness of the system.

4.14.2.2. OT&E period shall start after a Baseline is set to operation (OTRR) and continue until the FSA.

4.14.2.3. The Contractor shall perform operational analysis, track system performance and account for operational availability.

4.14.2.4. The Contractor shall record and assess for the Contract relevance any discrepancies identified during the ad hoc testing and system operation.

4.14.2.5. The Contractor shall produce a report summarising the results of the operation which shall include a summary of Deficiency Reports (DRs) along with a description of those DRs that will be fixed.

4.14.2.6. The Contractor shall ensure that the users can execute their tasks using TRITON and configure the system to allow users to perform their tasks using TRITON, including configuration of permissions, of TRITON data and interfaces with other systems and information flows.

4.14.2.7. The Contractor shall record and assess for Contract relevance any discrepancies identified during the ad hoc testing and system operation.

4.14.2.8. The Purchaser will perform an OT&E with support from the Contractor personnel immediately following the installation and activation of each Baseline.

4.14.2.9. The Contractor shall provide Second and Third Level Support during the OT&E period.

4.14.3. System Validation Test Procedure

4.14.3.1. The Contractor shall develop System Validation Test Procedure (SVT-P) and deliver an initial version together with the SVP (preliminary at CDR, final at PSA).

4.14.3.2. The SVT-P shall include the following:

- Definition of the validation steps to address various operational states, scenarios and Maritime Operations that progressively build confidence in conformance of the installed capability.
- Specification of the methods, tools and techniques needed to conduct validation
- Definition of the purpose, conditions and conformance criteria for each validation test.

4.14.3.3. The Purchaser will obtain operational user community's concurrency/approval on the SVT-P and approve it.

4.14.4. System Validation Test

4.14.4.1. The Contractor shall plan and execute System Validation Test (SVT) covering both TRITON-NS and NU as defined in the SVP.

4.14.4.2. The Contractor shall ensure that any operators, enabling system for validation and associated facilities are ready in order to conduct SVT.

4.14.4.3. The Contractor shall conduct SVT to attest conformance to stakeholder requirements as documented in the SVT-P.

4.14.4.4. The Contractor shall collect and analyse data in accordance with the SVT-P.

4.14.4.5. The Contractor shall prepare a SVT Report, including the following:

- Results and tests configuration are recorded.
- Results obtained are compared with those expected.
- Validation matrix is updated with data from tests.

- Variances are identified and reported.

4.14.5. Operational Stakeholder Acceptance

4.14.5.1. Initial Operational Capability

4.14.5.1.1. Declaration of Initial Operational Capability (IOC) for TRITON Increment 1 shall occur when the Purchaser Operational Stakeholder has tested and evaluated the TRITON Increment 1 delivery on both NS and NU Domains as an assessment of operational readiness.

4.14.5.1.2. It is expected that the operational evaluation will include the use of both TRITON-NS and NU in an operational exercise during the OT&E period and will include the assessment of TRITON functional fit-for-purpose and performance while interoperating with external systems and services.

4.14.5.1.3. The Purchaser will declare the IOC based on the test reports prepared by the Contractor. The criteria to declare IOC are:

- SiAT-3 for Baseline-3 is successfully completed.
- OT&E period is executed and SOT reports delivered.
- Key operational requirements are met (e Recognised Maritime Picture is available to NATO Commands and Nations).
- One week of operation without any failure ("failure" as defined in the SRS).
- All deliverables due at the time of IOC are accepted in writing by the Purchaser.

4.14.5.2. Final Operational Capability

4.14.5.2.1. Operational Stakeholder Acceptance and declaration of Final Operational Capability (FOC) for TRITON will be achieved when all capabilities defined in the Capability Package (including future increments) are implemented and delivered. Therefore, FOC is not in the Increment 1 scope.

4.14.6. System Validation Review

4.14.6.1. The Contractor shall execute System Validation Review (SVR) as defined in AAP-20 Development Stage.

4.14.6.2. The Contractor shall plan SVR at the location where the Purchaser will indicate.

4.14.6.3. Entry Criteria

4.14.6.3.1. The Contractor shall include in planning the SVR Entry Criteria given in Table 4-17 and make them available to the Purchaser at least two (2) weeks prior to the SVR:

Table 4-17 – SVR Entry Criteria

Serial	Activities / Documents
1	A preliminary SVR agenda
2	Success Criteria (enhanced or adapted)
3	Stakeholders' validation requirements are up to date.
4	SyRS Baselines are up to date.

5	Requirement Traceability Matrix between Stakeholders' requirements and SyRS is up to date, in accordance with the baselines.
6	IV&V Test Reports are available.
7	Identified variances have been corrected.
8	Configuration baselines have been updated (if necessary). System configuration documentation is available.

4.14.6.4. Success Criteria

4.14.6.4.1. The Purchaser concludes that the SVR Success Criteria in Table 4-18 accomplished to complete the objectives of the SVR.

Table 4-18 – SVR Success Criteria

Serial	Requirement
1	SVT Report is reviewed.
2	All capabilities of the system are available as specified in SyRS.
3	All performance levels are met.
4	All levels of support are planned and ready to be provided.

4.14.6.5. The SVR shall be used as Provisional System Acceptance as the first milestone for the System Acceptance Process. The Purchaser will obtain certificate of validation from the appropriate Stakeholders.

4.14.6.6. The Contractor shall prepare the SVR Report and submit it within three (3) days after the SVR.

4.14.7. Provisional System Acceptance

4.14.7.1. Provisional System Acceptance (PSA) occurs when all capability and services are provided to MARCOM. Rolling-out the system for other Authorised Locations shall be performed after PSA.

4.14.7.2. The Purchaser concludes that the PSA Criteria in Table 4-19 accomplished to complete the objectives of the System Acceptance.

Table 4-19 – PSA Criteria

Serial	Requirement
1	All acceptance tests for all Baselines are completed successfully.
2	At least one week of operation without major failure ("failure" as defined in the SyRS) can be achieved.
3	On-site training of NATO personnel involved in operations and maintenance of the capability is completed.
4	All required documentation and support tools are delivered.

4.14.7.3. The Contractor shall plan and conduct Provisional System Acceptance Review (PSAR) to check the PSA Criteria, and provide PSAR Report within three (3) days after the review.

4.14.8. Final System Acceptance

4.14.8.1. Final System Acceptance (FSA) occurs when the Purchaser has evaluated the whole system and has determined that it meets the requirements of this Contract including all deliveries and services.

4.14.8.2. The Purchaser concludes that the FSA Criteria in Table 4-19 is accomplished to complete the objectives of the System Acceptance.

Table 4-20 – FSA Criteria

Serial	Requirement
1	Product Baseline is updated.
2	Reference Systems are updated with the current Product Baseline and activated.
3	Test Systems are available.
4	Training Systems are available
5	System Transition is completed.
6	All SiATs for all authorised locations are completed.
7	All FSiAs for all authorised locations are completed.
8	SVT is completed and the system is validated as indicated in the SVR-R.
9	All due deliverables are accepted in writing by the Purchaser.
10	Status of Deficiency Reports.
11	A copy of the System Statement of Conformance signed by the local SAA, separately for each site.
12	ILS documentation is updated.
13	Warranty Report is provided.

4.14.8.3. The Contractor shall notify the Purchaser in writing when it submits the final delivery for FSA. This notification shall be accompanied by the Final System Acceptance Report (FSA-R).

4.15. System Operation Process

4.15.1. General

4.15.1.1. System Operation Process is to use the system in order to deliver its services. TRITON shall be set to operation after each delivery. When activation of all authorised sites are completed, the system will become fully operational.

4.15.1.2. The Contractor shall perform system operation activities in compliance with the processes defined in ISO/IEC 15288, Paragraph 6.4.9 as referred by AAP-48, Paragraph 6.4.9 and AAP-20.

4.15.1.3. The Contractor shall provide Operational Support as defined in Subsection 5.4.4.6.

4.15.2. Support to Development of Standard Operating Procedures

4.15.2.1. The Contractor shall support the Purchaser with development of Standard Operating Procedures (SOPs) for using TRITON. This includes SOPs for deployment, operation and use of TRITON.

4.15.2.2. The SOP shall include multi-site operation principles.

4.15.2.3. The Contractor shall work with TRITON Operational Trainers, TRITON Administrator Trainers and relevant, appointed staff from NATO HQs in developing and documenting the SOPs.

4.15.2.4. The SOPs shall be documented based on a template for NATO SOPs.

4.15.2.5. One Master SOP document shall be developed. This Master SOP shall be tailored to specific SOPs for all NATO Commands where TRITON is to be installed.

4.15.2.6. The SOPs shall be reviewed and approved by the Purchaser and relevant staff from NATO HQs.

4.15.3. Exercise Support

4.15.3.1. The Contractor shall provide support to operational users during three (3) exercises that MARCOM will participate in. The Purchaser will inform the Contractor which exercise participation is needed one (1) month prior to the exercise.

4.15.3.2. The Contractor shall participate in the exercises and provide support including the following:

- Providing On-the-Job Training
- Helping to configure the system
- Monitoring the processes
- Logging data
- Logging and analysing performance data
- Collecting feedback from operators
- Determining HCI improvements.

4.15.3.3. CWIX

4.15.3.3.1. The Coalition Warrior Interoperability eXploration, eXperimentation and eXamination eXercise (CWIX) programme provides an opportunity for NATO Nations, Partner Nations, Contact Nations, and NATO Agencies to prove, disprove, and improve NATO CIS interoperability.

4.15.3.3.2. The Contractor shall plan and participate in CWIX, as one of the three exercises, to demonstrate the interoperability of TRITON.

4.15.3.3.3. The Contractor shall support the Purchaser for installation and configuration of TRITON for CWIX.

4.15.4. On-Site Support

4.15.4.1. The Contractor shall provide on-site support covering all levels of support at the Purchaser's premises for maintenance of TRITON during its initial operation and implementation of any subsequent modifications until FSA.

4.15.4.2. The Contractor shall provide on-site technical support to the Purchaser as part of its operational support organization. This support shall be focused on software maintenance, software testing and data migration support. The Contractor shall provide the necessary tools to migrate existing MSA/BRITE and MCCIS data into TRITON.

4.15.4.3. The Contractor shall provide designated individuals, who meet or exceed the criteria in Section 7 of the SOW for a System Support Engineer, to provide on-site support services.

4.15.4.4. The Contractor shall ensure that the individual(s) providing this support are familiar with the requirements, design, implementation, verification, transition and support of the TRITON capability.

4.15.4.5. The Contractor shall ensure that the individual(s) providing the support are capable of supporting all of the TRITON roles including Node Administrator. The Contractor shall be responsible for any preparation and training required to bring the individual(s) to the performance level required to fulfil the above roles.

4.15.4.6. The Contractor's designated individuals shall travel as required by the Purchaser's on-site representative.

4.15.5. In-Service Review

4.15.5.1. In-Service Review (ISR) is a multi-disciplined product and process assessment to ensure that the system under review is operationally employed with well-understood and managed risk. As TRITON Baselines are delivered for operational use during the OT&E period, the OBLs will be in service and subject to ISR.

4.15.5.2. The Contractor shall plan and conduct ISRs during the OT&E Period as defined in AAP-20 Utilisation Stage.

4.15.5.3. The ISR shall be quarterly unless otherwise is agreed.

4.15.5.4. The ISR shall include user feedback collection and assessment during OT&E.

4.15.5.5. The Contractor shall propose maintenance requirements according to the user feedback and plan them in the System Maintenance Process.

4.15.5.6. The Contractor shall prepare ISR Report (ISR-R) and submit it within three (3) days after the review.

4.15.6. System Transition

4.15.6.1. The Contractor shall provide support to transitioning from legacy systems to TRITON. This support shall include:

- Providing engineering support
- Developing automatic data migration tools
- Developing TRITON Simulators for Nations' use during interfacing
- Developing process for appropriate use of system functions

4.15.6.2. The Contractor shall provide support to Nations Interoperability Testing to be executed during SITs.

4.15.6.3. The Contractor shall plan and conduct System Transition Readiness Review (STRR) for reviewing the transition process from MSA/BRITE to TRITON-NU and from MCCIS to TRITON-NS.

4.15.6.4. The Contractor shall provide the STRR Report no later than three (3) days after each review.

4.16. System Maintenance Process

4.16.1. General

4.16.1.1. The Contractor shall execute the System Maintenance Process concurrently with the System Operation Process for the OBLs (i.e. BL2, 3, 4) until FSA.

4.16.1.2. The Contractor shall provide Maintenance as defined in Subsection 5.4.4.6 of this SOW.

4.16.1.3. The Contractor shall identify problems or modifications based on feedback from ongoing monitoring of the system, and take corrective, remedial or preventive actions to restore and maintain full capability. The SEWG will provide support to identify the maintenance needs and analyse the impact of changes.

4.16.1.4. The Contractor shall use ISR-Rs as input for any modifications and shall produce Engineering Change Proposal (ECP) before implementing a maintenance request.

4.16.1.5. The Contractor shall perform maintenance activities as planned in the SMP and conduct failure identification action when non-compliance has occurred.

4.16.1.6. The Contractor shall address the obsolescence issues for the COTS products used in software and hardware development in the OMP.

4.16.2. System Maintenance Documentation

4.16.2.1. The Contractor shall develop and maintain the System Maintenance Documentation as defined in Paragraph 5.4.4 based on the FBL, ABL and PBL.

4.16.3. Monthly Maintenance Review

4.16.3.1. The Contractor shall conduct Monthly Maintenance Review (MMR) to plan the maintenance activities within that month.

4.16.3.2. The Contractor shall plan MMR in the first week of each month, starting from the beginning of the Maintenance Process until the end of the Contract.

4.16.3.3. The Contractor shall prepare a MMR Report that summarises all Contractor-performed maintenance tasks and deliverables and introduces suggestions for maintenance performance improvements. The MMR Report related to the previous month shall be delivered to the Purchaser until the fifth of each month. The MMR Report shall be reviewed during the MMR.

4.16.3.4. The Contractor shall provide the Maintenance Records to the Purchaser during the MMR.

4.16.4. Experimentation, Exercise and Prototyping Support

4.16.4.1. The Contractor shall provide technical support to the Purchaser during experiments, demonstrations, and exercises. Such support may include providing technical guidance to operational users for preparing, and executing system demonstrations, or integrating third-party components for experimental purposes. Such support may include preparing demo system for a user conference, setting up the system during an exercise.

4.16.4.2. The Contractor shall also provide requirements analysis, design, implementation, integration, and test support to the Purchaser's prototyping activities associated with the capabilities provided under this Contract.

4.17. Software Transition Process

4.17.1. General

4.17.1.1. Software Transition is the transition of the software support responsibility from the Contractor to the Purchaser.

4.17.1.2. The Contractor shall provide Software Transition with a defined process for the components indicated in the relevant Work Package.

4.17.2. Software Transition Plan

4.17.2.1. Software Transition Plan (SwTrP) identifies the hardware, software, and other resources needed for life cycle support of deliverable software and describes the Contractor's plans for transitioning deliverable items to the Purchaser.

4.17.2.2. The SwTrP shall include at least the following:

- The facilities needed to support the deliverable software
- The hardware and associated documentation, needed to support the deliverable software, including computers, configurations
- Identification and description of the software and associated documentation needed to support the deliverable software
- Any other documentation needed to support the deliverable software
- Personnel and qualifications needed to support the deliverable software
- Training to be provided
- Transition planning, activities, roles and responsibilities
- Procedures for installation and checkout of deliverable items in the support environment.

4.17.2.3. The SwTrP shall be delivered to the Purchaser at least two (2) weeks prior to the Software Transition Readiness Review (SwTrRR).

4.17.3. Software Transition Preparation

4.17.3.1. The Contractor shall prepare the source files to be transitioned to the Purchaser, including any supportive batch files, command files, data files, or other files needed to regenerate the executable software. This will include identification of the necessary compiler/software development tools or database management systems that are commercially available.

4.17.3.2. The Contractor shall identify and record the exact version of software prepared for the transition in the Software Version Description (SVD).

4.17.3.3. The Contractor shall deliver all internal test documentation, test data, and test suites to allow a full or partial retest after maintenance operations by the Purchaser.

4.17.3.4. The Contractor shall update the Software Design Description of each software element (CSCI) to match the "as built" software and shall define and record:

- the methods to be used to verify copies of the software, the measured computer hardware
- resource utilisation for the software element, other information needed to support the software, and
- traceability between the element's source files and software units and between the computer hardware resource utilisation measurements and the requirements concerning them.

4.17.3.5. The Contractor shall prepare and deliver the manuals and guidance which identify and record information needed to program the computers on which the software was developed or on which it will run.

4.17.3.6. Software Source Code

4.17.3.6.1. The Contractor shall deliver all the software source code with all its building blocks (e.g. code files, batch files, configuration files, libraries) required to allow future maintenance by the Purchaser.

4.17.3.6.2. The Contractor shall perform periodic updates on the software source code at the Purchaser's premises during the Software Implementation Process. Any object code or library shall also be included.

4.17.3.6.3. The Contractor shall deliver the configuration tree of the software source code in a portable media initially at the SwTrRR. Any object code or library shall also be included. A final copy, including any changes, shall be provided at FSA.

4.17.3.7. Computer Programming Manual

4.17.3.7.1. The Computer Programming Manual (CPM) provides information needed by a programmer to write the program code in a given computing environment. This manual focuses on how the code is developed using the software development environment and source code configuration (e.g. definition of development environment, special configuration settings, essential libraries).

4.17.3.7.2. The Contractor shall prepare and deliver the CPM two (2) weeks prior to the Software Transition Readiness Review.

4.17.4. Software Transition Readiness Review

4.17.4.1. The Contractor shall plan and execute a Software Transition Readiness Review (SwTrRR).

4.17.4.2. The Contractor shall explain the SwTrP during the SwTrRR and demonstrate that the deliverable software is ready for transition.

4.17.4.3. The details of the transition planning will be agreed with the Purchaser and the software transition activities will start.

4.17.4.4. The Contractor shall prepare SwTrRR Report (SwTrRR-R) and submit it within three (3) days after the review.

4.17.5. Transitioning

4.17.5.1. The Contractor shall provide Software Maintenance Training to the Purchaser's staff as described in Paragraph 5.8.14.

4.17.5.2. The Purchaser will provide the development environment in accordance with SwTrP, on which the transitioned software will be maintained.

4.17.5.3. The Contractor shall install and check out the deliverable software in the Purchaser development environment.

4.17.5.4. The Contractor shall integrate the source code, the requirements, and the links from the requirements to test cases in the automated build environment and the Configuration Management Repository of the Purchaser.

4.17.6. Software Transition Validation Test

4.17.6.1. The Purchaser shall perform Software Transition Validation Test (SwTrVT) to demonstrate that the entire software is delivered correctly to the Purchaser, and the Purchaser has all the capabilities to maintain the software.

4.17.6.2. The Contractor shall demonstrate to the Purchaser that the deliverable software can be regenerated, (compiled/linked/loaded into an executable product) and maintained using commercially available, Purchaser-owned, or contractually deliverable software and hardware.

4.17.6.3. The Purchaser shall ensure that any further software updates (e.g. during Warranty Period) can be successfully transferred to the Purchaser and the Purchaser can re-generate the software at its own environment.

4.17.6.4. The Contractor shall prepare a SwTrVT Report (SwTrVT-R) after the SwTrVT and deliver it to the Purchaser before the Transition Validation Review.

4.17.7. Software Transition Validation Review

4.17.7.1. The Contractor shall plan and execute a Software Transition Validation Review (SwTrVR) to make sure all transition process is completed.

4.17.7.2. The Software Transition will be considered as completed if:

- All remaining items are solved
- All source code, manuals and documents to perform the programming/coding are delivered
- The Purchaser approves the SwTrVT Report.

4.17.7.3. The Contractor shall prepare SwTrVR Report (SwTrVR-R) and submit it within three (3) days after the review.

SECTION 5: INTEGRATED LOGISTIC SUPPORT

5.1. General

5.1.1. The Contractor shall provide Integrated Logistic Support (ILS) by providing the services and delivering the products as described in this Section. The terminology and process definitions are also provided.

5.2. Integrated Support Plan

5.2.1. Integrated Support Plan (ISP) includes support considerations to be incorporated in design and defining the physical support capability and resources required for the in-service organization to operate and maintain the system.

5.2.2. The ISP shall be structured according to the template provided in "NCSA OSLA-14-02 Preparation of NATO CIS Integrated Logistics Support Plans".

5.2.3. The Contractor shall develop and deliver the draft ISP at the PDR in order to define how the integration of supportability engineering is to be included in the design of the system.

5.2.4. The Contractor shall submit the draft release of the ISP to the Purchaser at PMR, an initial version at CDR and a final version at System Qualification Review (SQR) for BL2. The ISP shall be maintained and updated during the transition process and new versions shall be submitted at SQR-3 and 4.

5.2.5. The Contractor shall refer to the TRITON CMP, QP, Training Plan and all documentation (included in SOW Section 7) in the ISP.

5.2.6. The ISP shall include the details related to the support of TRITON throughout its life-cycle.

5.2.7. The ISP shall include a section related to Service Management and Control Concept which includes:

- Service interface: The demarcation of service responsibilities between the TRITON Product Baseline and the Purchaser's operational baseline.
- Security management: The tasks associated with maintaining and using the TRITON capability within the guidelines of the CSRS, SSRS, SISRS, and SecOps.
- Incident management: How the Contractor will deal with service interruptions and application faults.
- Problem management: How the Contractor will support problem/deficiency reporting, isolation, and resolution.
- Release management: How the Contractor will establish the TRITON PBL releases.
- Availability management: How the Contractor will ensure that the TRITON capability can meet its availability requirements.
- Configuration management: How the Contractor will ensure that TRITON components are identified for standardization and status monitoring in a centralised configuration managements process.

- Change management: How the Contractor will support a central change management process for TRITON implementation changes.
- Initial Service Level Agreement: An SLA, based on the NCI Agency SLA Template, identifying the service target and the responsibilities of the Purchaser for achieving this target.
- Service transition: How the Contractor will transition service responsibilities to the Purchaser to ensure that the Purchaser can support TRITON service provisioning, both at System Acceptance and after the end of the initial period of performance of this Contract.
- Warranty support: How the Contractor intends to discharge his responsibilities for system operation and maintenance at each site and describes the Contractor's approach to replacement of faulty hardware and software items.

5.3. In-Service Support Plan

5.3.1. General

5.3.1.1. The Contractor shall prepare the In-Service Support Plan (ISSP), based on a Purchaser-furnished template, defining the responsibilities and procedures for the support and maintenance of TRITON.

5.3.1.2. The ISSP shall cover the all maintenance and support activities starting from the first OTRR until FSA.

5.3.1.3. The ISSP shall be updated at the FSA covering the future support including the Warranty period.

5.3.1.4. The Contractor shall develop System Maintenance Plan (SMP) and Obsolescence Management Plan (OMP) as annexes to ISSP.

5.3.1.5. The Contractor shall deliver the ISSP to the Purchaser at least two (2) weeks prior to the SQR.

5.3.2. System Maintenance Plan

5.3.2.1. System Maintenance Plan (SMP) shall include the following:

- The preventive and corrective maintenance strategy to sustain service in the operational environment in order to achieve customer satisfaction during OT&E period
- The scheduled preventive maintenance actions that reduce the likelihood of system failure without undue loss of services (e.g. suspension or restriction of the services)
- The number and type of replacement hardware elements to be stored, their storage locations and conditions, their anticipated replacement rate, their storage life and renewal frequency (e.g. UPS for the Deployable Kits)
- The skill and personnel levels required to effect hardware repairs and replacements, accounting for maintenance staff requirements and any relevant legislation regarding health and safety, security and the environment. These skills include disassembly strategy, fault diagnosis techniques, re-assembly and testing sequences
- Maintenance constraints on system requirements that result from the maintenance strategy

- Maintenance impact (minor modification (low cost/temporary) or major modification (permanent).

5.3.2.2. The Contractor shall update the SMP according to the maintenance needs raised during the operation of the OBLs.

5.3.3. Obsolescence Management Plan

5.3.3.1. The Obsolescence Management Plan (OMP) shall include the following:

- Identification of appropriate strategies, resources, tools and resolution options
- How to minimise the impact of obsolescence on system support costs and availability
- How to monitor the obsolescence of COTS products, including third party software
- Mitigation plan for each identified product.

5.3.3.2. The Contractor shall update the OMP according to the most recent technological developments and status of COTS products.

5.4. Maintenance Concept

5.4.1. General

5.4.1.1. The Contractor shall develop and maintain the TRITON Maintenance Concept, which defines the maintenance environment, constraints, locations, procedures, artefacts, organization and personnel skills to maintain PBL and the OBL.

5.4.1.2. The Maintenance Concept shall refer to the functional and non-functional Maintenance Requirements of the TRITON FBL.

5.4.1.3. The Maintenance Concept shall define the First, Second and Third Level Maintenance tasks. At each of these Levels, the procedural description shall include objective(s), triggering event(s), input(s), output(s), task(s), roles and Responsibilities, Accountabilities, Consulting, and to Inform (RACI-format), constraints, exceptional case(s), and tool(s) support.

5.4.1.4. The Maintenance Concept shall define the PBL maintenance and supply flow amongst the various NATO and non-NATO locations, organizations, groups, and people.

5.4.1.5. As part of the Maintenance Concept, the System Maintenance Plan (SMP) shall define the Supply Support Requirements and shall describe the procedures for the provisioning, procurement, and acquiring of spare/repair parts, inventories, and consumable material for PBL and the OBL.

5.4.2. Hardware Maintenance

5.4.2.1. The maintenance of delivered hardware shall include the replacement of faulty parts.

5.4.2.2. Due to security regulations, all failed hard disks/drives can only be repaired or replaced on-site and cannot be removed and/or returned to the Contractor for repair. Failed hard disks will be destroyed on site. Failed hard disks shall therefore be replaced by the Contractor, at no extra cost to the Purchaser.

5.4.3. Software Maintenance

5.4.3.1. The Contractor shall perform following types of Software Maintenance in the context of Third Level Maintenance:

- Preventive Maintenance
- Corrective Maintenance
- Adaptive Maintenance
- Perfective Maintenance

5.4.3.2. Preventive Maintenance

5.4.3.2.1. The Contractor shall apply Preventive Maintenance at predetermined intervals or according to prescribed criteria and intended to reduce the probability of failure or the degradation of the functioning of a software unit.

5.4.3.2.2. The Contractor shall provide modification of the software to detect and correct latent faults before they become effective faults. Preventive Maintenance includes scheduled maintenance.

5.4.3.2.3. The Contractor shall perform Preventive Maintenance which includes the following activities:

- Monitor system operation for time schedule or other triggers for each preventive maintenance activity
- Perform scheduled maintenance (e.g. regular updates of third party software, cleaning up system log files)
- Perform safety actions per analysis or upon safety notice
- Record maintenance data.

5.4.3.2.4. The Contractor shall handle the following types of maintenance requests:

- Output of system design as a result of analysis
- Output of system use as a result of corrective action procedure
- User Defect Report - identifying system problems that need to be resolved by the Software Maintenance Process.

5.4.3.3. Corrective Maintenance

5.4.3.3.1. Corrective Maintenance is modification of the software to correct discovered problems or defects (a.k.a. bugs). It is carried out after fault recognition and intended to put a software unit into a state in which it can perform its intended function.

5.4.3.3.2. The Contractor shall perform Corrective Maintenance which includes the following activities:

- Trouble shooting
- Determining the cause
- Correcting the defect
- Generating a patch with versioning
- Testing at the Test and Reference Systems
- Applying the patch
- Testing (including regression and nominal testing)

- Recording maintenance data.

5.4.3.4. Adaptive Maintenance

5.4.3.4.1. The Contractor shall provide modification of the software to keep it usable in a changed or changing environment. This includes environment adaptation, data mapping and addition of new Information Products.

5.4.3.4.2. These adaptations shall be carried out using a disciplined systems engineering methodology following the same approach as described for the design, integration, and test of the initial TRITON Product Baseline.

5.4.3.4.3. Provided authorization from the Purchaser's Contracting Authority, the Contractor shall design, implement, integrate, test, upgrade, and provide life-cycle support for necessary adaptations to TRITON PBL to reflect findings from the OT&E period.

5.4.3.4.4. Environment Adaptation

5.4.3.4.4.1 The Contractor shall apply adaptations which may include moving from one hardware platform to another, updating infrastructure software and insertion of other software components developed by other sources.

5.4.3.4.5. Data Mapping and Addition of New Information Products

5.4.3.4.5.1 The Contractor shall provide mapping and migration of additional data to TRITON, and processing or generation of new Information Products as requested by the Purchaser.

5.4.3.4.5.2 The Contractor shall describe the process to be used to provide data mapping, migration and use of Information Products.

5.4.3.4.5.3 The Contractor shall ensure that data mapping, migration and addition of new Information Products will not interrupt TRITON Functional Services.

5.4.3.4.5.4 The Contractor shall ensure that system data are secured to avoid data loss due to data migration and addition activities

5.4.3.5. Perfective Maintenance

5.4.3.5.1. The Contractor shall apply modification on software and improve performance or maintainability in an agreement with the Purchaser. This includes studies, system enhancement, technology assessment and insertion, experimentation and data adaptation.

5.4.3.5.2. Studies

5.4.3.5.2.1 The Contractor shall research, analyse, and prepare reports, plans, or other documents related to the design, implementation, testing, transition, operation, maintenance and support of the TRITON capability as requested by the Purchaser.

5.4.3.5.3. System Enhancements

5.4.3.5.3.1 Provided authorisation from the Purchaser's Contracting Authority, the Contractor shall design, implement, integrate, test, upgrade, and provide life-cycle support to enhancements to the TRITON capability to reflect any changes in the SyRS or technological upgrade opportunities.

5.4.3.5.3.2 Such changes may include moving from one hardware platform to another, updates of system software and the use of software developed by other sources.

5.4.3.5.3.3 These enhancements shall be carried out using a disciplined systems engineering methodology following the same approach as described for the design, integration, and test of the initial TRITON PBL, also including Regression Tests and IV&V Testing.

5.4.3.5.4. Technology Assessments and Insertion

5.4.3.5.4.1 Technology Insertion is usually known as a viable way to maintain or improve the performance of products already in use through obsolescence management and service life extension, but can also be used to support accelerated fielding, since the time and resources required to integrate a piece of technology into a system should be less than developing the technology from scratch (AAP-20).

5.4.3.5.4.2 The Contractor shall assess new technology applications on TRITON and identify potential risks (integration, unforeseen negative side effects on system performance, supportability, obsolescence) in case they are used.

5.4.3.5.4.3 The Contractor's efforts should employ the latest commercially available technology (or products) in consonance with economic considerations.

5.4.3.5.4.4 The Contractor should maximise opportunities for product improvement through emerging advances in the commercial market place.

5.4.3.5.4.5 The Contractor shall integrate new hardware elements and third party software into the TRITON architecture when it is agreed with the Purchaser that a modification is necessary.

5.4.3.5.4.6 The Contractor should focus on the demonstration of clear and definable improvements in the performance, logistics supportability, reliability and maintainability of the new item.

5.4.4. System Maintenance Documentation

5.4.4.1. The System Maintenance Documentation includes System Maintenance Manual (SMM) and Maintenance Records.

5.4.4.2. The Maintenance Concept and SMM shall, at minimum, cover the maintenance tasks defined in this SOW.

5.4.4.3. For all COTS Configuration Items of the PBL, the SMM shall take maximum advantage of the existing COTS Vendor Original Equipment Manufacturer (OEM) Manuals and documentation, supplemented with the PBL adaptations, and additions.

5.4.4.4. The SMM shall define the required Maintenance Tools and Equipment including the necessary Material Data Sheet (MDS).

5.4.4.5. The Contractor shall use a reporting mechanism as Maintenance Records which shall include:

- Problem/deficiency reporting and resolution procedures – including scheduled replacement of system elements upon failure (reactive maintenance) and prior to failure (preventive maintenance).

- Maintenance Records including history of maintenance actions (reactive/preventive), failures, other trends to inform operations and maintenance personnel, and other projects creating or utilizing similar system elements.
- Key maintenance related metrics such as Mean Time between Failures (MTBF), Mean Time to Failure (MTTF) and Mean Downtime (MDT).
- Monitor and document user satisfaction with maintenance support.

5.4.4.6. Software Support Manual

5.4.4.6.1. Software Support Manual (SSM) describes how to provide First and Second Level Support to the installed TRITON Operational Software.

5.4.4.6.2. The SSM shall provide information sufficient for a technician who has attended the Training Course to be able to operate the system without supervision and to perform fault finding in support of First Level Maintenance.

5.4.4.6.3. The Contractor shall prepare and deliver separate SSMs for the following systems:

- TRITON-NS (static)
- TRITON-NU (static)
- TRITON Deployable Kit (for both NS and NU)

5.4.4.6.4. The SSM shall include at least the following information:

- Configuration settings for the modules, services and components
- How to configure the logging and uses of performance counters
- Interfaces and their settings
- Log file locations
- Logging categories
- Performance counter categories
- Additional notes specific to the systems
- An annex with trouble-shooting information (a break-down on actions to solve a full range of (potential) problems or provide workarounds)
- An annex with database management information describing a break-down from the GUI (fields and actions) down to the effected database tables, triggers and stored procedures, the TRITON Logical Data Model in full detail, the TRITON Physical Data Model, where at least triggers, foreign keys, tables/columns, stored procedures and parameters are described.
- An annex on back-up and restore procedures
- Packing, transporting, unpacking, (dis)mantling the TRITON Deployable Kit on board a ship.

5.4.4.7. Software Transition Manual

5.4.4.7.1. Software Transition Manual (STM) describes how to upgrade software data from one Baseline/Increment to another.

5.4.4.7.2. The STM shall include at least the following:

- How to perform the transition from a TRITON Baseline/Increment to the next in terms of functionality upgrade and migration of data
- How to update a TRITON installation to the next Baseline/Increment
- How to convert the data from a TRITON Baseline/Increment to the next TRITON Baseline/Increment
- How information can be exchanged between different Baselines/Increments of TRITON if necessary
- Updated documentation.

5.5. Provision of Maintenance

5.5.1. The Contractor shall provide all levels of Maintenance for the PBLs as they are delivered until FSA.

5.5.2. The Contractor-furnished proactive and reactive Third Level Maintenance shall be planned, implemented and executed according to the Maintenance Concept.

5.5.3. The Contractor-furnished Third Level Maintenance shall be provided offsite at the Contractor's premises.

5.5.4. The Contractor shall define the Maintenance Process interfaces to other processes such as the Warranty, Incident Management, Problem Management and Release Management.

5.5.5. The Contractor shall solve any deficiencies found during the System Transition Process and System Operation Process prior to the FSA. This period is the applicable Operational Testing and Evaluation period for a Baseline.

5.6. Service Management and Control Concept

5.6.1. General

5.6.1.1. The Contractor shall develop the TRITON Service Management and Control Concept covering how the Customer Support will be implemented and performed in accordance with the Purchaser’s existing Support Concept and submit it for the Purchaser’s approval.

5.6.1.2. The Purchaser’s Support Concept is arranged around four distinct levels and addresses hardware maintenance, software maintenance and service management and control functions (ITIL).

5.6.2. Purchaser’s Support Concept

5.6.2.1. The Purchaser’s First Level of Support is the local, organizational unit operating the system, supported by local support staff.

5.6.2.2. The Purchaser’s 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.

5.6.2.3. The Purchaser’s 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.

5.6.2.4. The Purchaser's Fourth Level of Support is the OEM vendor or supplier level.

5.6.2.5. 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.

5.6.3. Contractor's Support Concept

5.6.3.1. At each support level, the Contractor's Support Concept shall describe the support environment, constraints, locations, procedures, artefacts, organization and personnel.

5.6.3.2. The procedural description shall include objective(s), triggering event(s), input(s), output(s), task(s), roles and responsibilities (RACI-format), constraints, exceptional case(s), and tool(s) support.

5.6.3.3. The Contractor shall define the support process interfaces to the other processes, including the existing Service Desk at the NCI Agency premises. The interface definition shall include the input and output information, its structure, the communication path (POC's), the time constraints for sending and receiving information, and quality criteria to evaluate the integrity of the interface.

5.6.3.4. The Contractor shall define the Support Concept for the TRITON Baselines delivered before the FSA.

5.6.3.5. First Level Support

5.6.3.5.1. The First Level Support tasks shall be defined and designed for military users and operators.

5.6.3.5.2. The First Level Support shall include day-to-day housekeeping tasks, visual inspections, verification of function and performance, and implementation of simple changes to the baseline configuration.

5.6.3.5.3. The First Level Support shall implement the service request and Incident Management Process in accordance with the ISO/IEC 20000 and ITILv3 framework or equivalent.

5.6.3.6. Second Level Support

5.6.3.6.1. The Second Level Support tasks shall be defined and designed for non-specialised military support personnel and shall include detailed baseline inspections and checkouts, limited calibrations, replacement of non-critical LRU's, minor equipment repairs and modifications.

5.6.3.6.2. The Second Level Support shall implement the Problem Management Process in accordance with the ISO/IEC 20000 and ITILv3 framework or equivalent.

5.6.3.6.3. Problem management tasks shall be integrated with the Problem Management Process.

5.6.3.6.4. As part of problem management the following tasks are included:

- (Re-)evaluation of incident category, criticality and priority;
- Identification of the root cause of the issue (e.g. by issue replication testing);
- Identification of workarounds;

- Identification and initial planning of possible short, medium and long-term solutions (e.g. workarounds, patches or new releases);
- Creation of Change Requests;
- Implementation planning and scheduling;
- Synchronisation with the Maintenance Process;
- Monitoring and control of the approved Change Request during implementation.

5.6.3.7. Third Level Support

5.6.3.7.1. The Third Level Support shall be defined and designed for specialised military personnel, and shall include complex repairs or replacements for hardware components, their detailed calibrations, supply support, overhaul and rebuild, implementation of major and/or critical changes to the baseline, baseline restoration, post-maintenance review, monitoring and coordination of transportation.

5.6.3.7.2. The Third Level Support shall cover the four types of software maintenance.

5.6.3.7.3. The Third Level Support shall implement the Release and Deployment Management Process in accordance with the ISO/IEC 20000 and ITILv3 framework or equivalent, assisted by an adequate Configuration Management and Change Management Process, and integrated with the Purchaser's Release and Deployment Process. In this process, solutions to software faults and hardware failures shall be developed, tested and deployed.

5.6.3.8. Fourth Level Support

5.6.3.8.1. The Fourth Level Support tasks shall include repair and replacement of faulty baseline items beyond the capability of Third Level Support.

5.6.3.8.2. If required, this level shall employ and interact with the original equipment manufacturer or item vendors to affect such repair and replacement.

5.6.4. Incident Management Process

5.6.4.1. The Contractor shall implement an Incident Management Process that resolves incidents and restores the provision of services within the terms agreed between the Purchaser and the Contractor.

5.6.4.2. The Contractor shall implement an Incident Assessment Model that categorises incidents according to impact, urgency, risk, required resources to resolve the incident and priority.

5.6.4.3. The Contractor shall comply with the existing NCI Agency business practices which are based on ITIL v3 and will be provided after signing the Contract.

5.6.4.4. The Contractor shall implement an Escalation Process that takes into account the specific site organization and the command structure.

5.6.4.5. The Contractor shall describe the required actions to resolve the incident.

5.6.4.6. The Contractor shall specify the Incident Routing that shall be applied to each site.

5.6.5. Problem Management Process

5.6.5.1. The Contractor shall implement a Problem Management Process that identifies and addresses the underlying cause of an undesirable situation, indicating the root cause of one or more existing or potential incidents.

5.6.5.2. The Contractor shall implement a systematic approach for the investigation of incidents, identification of the root cause and development of appropriate remedies.

5.6.5.3. The Contractor shall ensure the Problem Management Process successfully addresses the following objectives:

- Identification, tracking, resolution of failures.
- Symptoms and permanent or temporary solutions for failures are documented.
- Change Requests are raised to modify the infrastructure.
- Avoidable incidents are prevented.

5.6.5.4. The Contractor shall implement a Problem Classification by area (category) and the Identification shall point to the lowest level CI's that affect the problem. The classification shall be accompanied by an impact analysis, which determines the seriousness of the problem and its effect on the services (urgency and impact).

5.6.5.5. The Contractor shall assign a priority to problems, in the same way as in the Incident Management process. The classification shall include the following:

- Category - identifying the relevant domain, for example hardware or software.
- Impact - on the service.
- Urgency - extent to which deferral of the solution is acceptable.
- Risk - A factor that could result in future negative consequences; expressed as impact and likelihood
- Required resources – level of effort needed to resolve the problem.
- Priority - combination of urgency, impact, risk and required resources.
- Status - e, problem, known error, resolved, closed pending resolution.

5.6.5.6. The Contractor shall determine a combination of impact and urgency factors for incidents to be agreed with each site.

5.6.6. Release Management Process

5.6.6.1. General

5.6.6.1.1. The scope of Release Management includes the processes, systems and functions to package, design, build, test and release the assets and components required to establish or upgrade a service or product as specified in the design package. Release Management ends with the formal hand-over the verified release package to change management, who subsequently deliver a deployment package for use in NATO managed services or for distribution to external customers.

5.6.6.1.2. Release Management ensures that the necessary (software) maintenance activities can be performed to facilitate the effective utilisation of the product as a service asset for Service Operations.

5.6.6.1.3. The Contractor shall apply a Release Management Strategy to build Release Packages, which represents a planned release for Build Processes.

5.6.6.1.4. For the purpose of this Contract, the Contractor shall assume that the Release Management function will be entirely carried out by the Purchaser with its own resources. The Purchaser will provide guidance on Release Management Process including naming, software labelling and marking (Software Identification Tags – SWID Tags), Versioning Specification, Versioning Pattern for Web Services,

5.6.6.1.5. The Contractor, however, shall liaise with the Purchaser's Appointed System Manager and with the Purchaser as far as the delivery of the TRITON additional releases, new versions, patches and bug fixes is concerned.

5.6.6.1.6. The Contractor shall manage all releases during development of each Baseline during its Build Process, during its Maintenance activities defined under this Contract. The Release Management Process will be finalised at FSA.

5.6.6.1.7. The Contractor shall maintain the releases for a fixed period of time, depending on the type of the release. Following release types shall be applicable:

- Emergency Release: An Emergency Release (patch) is only maintained until the next standard release is successfully deployed.
- Routine Release: A Routine Release is maintained for a period of at least twelve (12) months, until FSA or until the end of Warranty.
- Long Term Support Release: For software that is used in support of NATO operations or by external customers Long Term Support Release has to be maintained. This is applicable when the optional Maintenance and Support Package is activated.

5.6.6.2. Baseline Releases

5.6.6.2.1. System enhancements shall be organised and implemented as Maintenance Releases and Major Releases. The Purchaser will accept releases upon verification and validation on a Purchaser-specified Reference Systems.

5.6.6.2.2. Maintenance Release

5.6.6.2.2.1 Maintenance, bug fix or patch releases are version changes designed to fix identified critical problems such as security vulnerabilities and other bug and might also address improvements to usability or performance. It typically excludes new features or changes of the Human Machine Interface (HMI), Application Programming Interface (API), service interfaces or the data structure – unless fixing a defect or security vulnerability requires such changes. Third party systems can most likely use the systems further without modification.

5.6.6.2.2.2 Two categories of Maintenance Release are identified: "Emergency" and "Routine" and they will be processed accordingly.

5.6.6.2.2.3 A Maintenance Release incorporates one or more design changes and/or one or more fault fixes into the TRITON PBL that collectively do not

affect existing ICDs or system security or technical compliance certification.

5.6.6.2.2.4 The Contractor shall plan and perform Regression Testing and IV&V Testing for Maintenance Releases.

5.6.6.2.2.5 The IV&V CCB will decide the level of effort necessary for testing the maintenance release during TRR.

5.6.6.2.2.6 The Contractor shall make the necessary documentation and test results available to the CCB prior to the TRR.

5.6.6.2.3. Major Release

5.6.6.2.3.1 A Major Release is generally a programmatic or life-cycle management decision. It is typically indicated by major enhancements and improvements such as the addition of key features to the functional baseline of a system; including major changes to the HMI concept, API, service interfaces, data structures and templates as well as new interfaces or a modified/enhanced control concept it can also include a change to the underlying platform(s) (i.e. a computer or hardware device and/or associated operating system, or a virtual environment, on which software can be installed or run). It may also refer as to the increment to an initial release.

5.6.6.2.3.2 A Major Release incorporates one or more design changes to the TRITON PBL that collectively affect one or more ICDs or system security or technical compliance certification.

5.6.6.2.3.3 The Contractor shall plan and perform both Regression and Certification Testing for Major Releases.

5.6.6.2.4. Minor Release

5.6.6.2.4.1 A Minor Release includes new features and can include minor changes of the HMI, API, service interfaces, data structure or templates. Fundamental changes such as HMI concept change are not expected. A new minor release should maintain all interfaces introduced since the previous major release.

5.6.6.2.4.2 The Contractor shall plan and perform Regression Testing for Minor Releases.

5.6.6.3. Release and Deployment Plan

5.6.6.3.1. The Release and Deployment Plan (RDP) includes all activities related to issuing a new release of the software and its deployment.

5.6.6.3.2. The Contractor shall coordinate all release and deployment planning with the Purchaser. The Purchaser will inform the Contractor about the available dates for releases.

5.6.6.3.3. Individual release activities are accumulated over a period of at least ten (10) weeks and then dispatched all at once on each Wednesday of calendar week 07 (Feb), 17 (Apr), 29 (Jul), 39 (Sep) and 49 (Dec). In case such a day coincides with an NCI Agency Official Holiday in either Belgium or The

Netherlands the release day is on the following working day. The Release Calendar is given in Table 5-1.

Table 5-1 – Release Calendar

Release Day	2016	2017	2018
I. Week 07	17 Feb 16	15 Feb 17	14 Feb 18
II. Week 17	28 Apr	26 Apr 17	25 Apr 18
III. Week 29	20 Jul 16	19 Jul 17	18 Jul 18
IV. Week 39	28 Sep 16	27 Sep 17	26 Sep 18
V. Week 49	07 Dec 16	06 Dec 17	05 Dec 18

5.6.6.3.4. In addition there will be regular "patch days" on every third Wednesday of the month following the patterns of patch releases by Microsoft on "Patch Tuesdays". Absolutely acute patches can also be released out-of-cycle, based on the criticality as determined by the Operating Authority.

5.6.6.3.5. A successful release does not automatically lead to the deployment of such release; deployment activities will be planned, authorised and executed separately for each NCI Agency operated network.

5.6.6.3.6. The Contractor shall adjust the releases by also keeping the deadlines.

5.6.6.3.7. The Contractor shall deliver the RDP to the Purchaser at least two (2) weeks prior to the SQR.

5.6.6.4. Key Performance Indicators

5.6.6.4.1. The Contractor shall track the Key Performance Indicators (KPI) for each release including at least the following:

- Number of releases per year (if the optional Maintenance and Support Package is activated)
- Number of change items per release
- Number of new or modified lines of code per release
- Number of incidents per release (new issues because of the release)
- Number of new problems per release
- Number of un-corrected known-errors per release.

5.6.6.4.2. The Purchaser will use the KPIs to assess the status of maintenance.

5.6.7. Handover of Software Warranty and Licenses

5.6.7.1. The Contractor shall ensure that the software licenses are correctly attributed to the Purchaser's Organization that will actually use the application.

5.6.7.2. The Contractor shall provide the software warranty and licensing documentation, including accounts, related to any software subject to licensing to the Purchaser.

5.6.7.3. The Contractor shall ensure the warranty and license model allows for transfer of responsibility between the Purchaser and other NATO entities as required by NATO's organization structure.

5.6.7.4. The transfer of responsibility shall be carried out without incurring additional cost for the Purchaser.

5.6.8. Compliance with Operational Baselines

5.6.8.1. The Contractor shall ensure the integrity of the Operational Baseline maintained by SPA (NCI Agency) by planning and carrying out all the necessary actions to verify all necessary licenses are active and of the correct version and release as per SPA baseline.

5.6.8.2. The Purchaser will provide to the Contractor the list of software components of the latest available release of the OBL for the Contractor to verify compliance before each Baseline FAT.

5.6.8.3. The Contractor shall specify to the Purchaser at the earliest possible time the discrepancies that affect the OBL.

5.6.8.4. The Contractor shall provide all the necessary documentation, as required by the SPA, to process the request for inclusion of software in the OBL. The list of necessary documentation shall include but not limited to the following:

- System Manuals
- Design/architectural specification suitable for NITC security assessment (COTS software excluded)

5.7. Provision of Support

5.7.1. General

5.7.1.1. The Purchaser provides support to all its Information Systems under a Three-level Support Approach. The Purchaser will provide documentation from NCI Agency on the Service Management procedure in current use as PFE.

5.7.1.2. The Contractor shall provide First, Second and Third Level Support in accordance with the Purchaser's Support Concept.

5.7.1.3. The Contractor-furnished Second and Third Level Support processes shall be planned, executed, and controlled according to ISO/IEC 20000 and ITILv3 or equivalent.

5.7.1.4. The Contractor shall prepare an initial Service Level Agreement (SLA) based on a Purchaser-furnished template, defining service delivery terms and conditions for operational use and support of the TRITON capability after installation. The SLA will cover the services provided by the Purchaser to the Customer, until FSA and after FSA.

5.7.2. First Level Support

5.7.2.1. The Contractor shall provide First Level Support by maintaining a Trouble-Ticketing System and Service Desk.

5.7.2.2. Trouble-Ticketing System

5.7.2.2.1. The Contractor shall maintain his own Trouble-Ticketing System to track all the reported issues, incidents and problems.

5.7.2.2.2. The Purchaser's Trouble-Ticketing System shall be used for opening, modifying, tracking, and closing Trouble Tickets, and logging of all requests concerning the PBL and OBL.

5.7.2.2.3. The system shall be interfaced with the Purchaser's Service Desk Trouble-Ticketing System to be able to exchange (import, export) Incident Reports, Deficiency Reports and Change Requests.

5.7.2.3. Service Desk

5.7.2.3.1. Service Desk support includes on-site support to local users, incident management, and activation of Second Level Support if needed.

5.7.2.3.2. The Contractor shall implement an interim, centralised Service Desk function, located at the NCI Agency The Hague, which shall deliver the entirety of the support services for the TRITON Services.

5.7.2.3.3. The Contractor shall operate the interim Service Desk until the FSA.

5.7.2.3.4. The Service Desk shall constitute the single interface for all TRITON System Support Services.

5.7.2.3.5. The Service Desk shall handle incidents and requests and provide an interface for other activities, such as:

- Problem Management
- Release and Deployment Management
- Configuration Management
- Change Management.

5.7.2.3.6. The Service Desk shall provide First Level Support activities on a daily basis.

5.7.2.3.7. The Service Desk shall adopt the documentation, diagnostics applications and tools that are available and in use at the NCI Agency and whose description will be provided at as PFE after Contract Award.

5.7.2.3.8. The Service Desk shall be responsible for the actions listed in Table 5-2.

Table 5-2 – Responsibilities of the Service Desk

Serial	Requirement
1	Receive and record all calls from users.
2	Deal directly with simple requests and complaints.
3	Provide an initial assessment of all Incidents.
4	Make a first attempt at Incident resolution and /or refer to Second Level of support.
5	Monitor and escalate all Incidents according to the Incident escalation procedure.
6	Keep users informed on status and progress.

5.7.2.3.9. The Service Desk shall operate eight (8) hours per day during the NCI Agency The Hague business hours.

5.7.2.3.10. The Service Desk shall provide its services in the English language.

5.7.3. Second Level Support

5.7.3.1. The Second Level Support shall apply to the centralised system operation, administration and management tasks to maintain services across the OBL. It covers support fault isolation, in-depth technical assistance to First Level Support staff and on-site support when necessary.

5.7.3.2. The Contractor shall provide a Second Level Support personnel as On-Site Support. The main role of Contractor's personnel resident at the NCI Agency The Hague premises shall be the following:

- To undertake required maintenance activities along with First Level Support (on-site) tasks when required.
- To act as liaison between the users resident at the operational sites and the Contractor personnel resident at Contractor's premises for the Third Level Support purposes.
- To deliver Second Level Support expertise to assist the NATO support staff in providing changes to SOPs or instructions to reflect any changes to operating or support tasks resulting from the activation of system elements.

5.7.3.3. The Contractor furnished Second Level Support process shall create and deliver a Problem Analysis Report per identified Issue or set of Issues as the result of the Problem Management Process (Paragraph 5.6.5).

5.7.3.4. The Contractor furnished Second Level Support process shall create and deliver a Change Request as the result of the Problem Management Process work steps.

5.7.3.5. The Contractor furnished Second Level Support process shall create and maintain descriptions of all solutions (Quick Solution, Work Around, Patch, Baseline Release) to known issues in a COTS software database, Known Error Database (KEDB). The KEDB shall be established during the Build Processes and link issue(s) to solution(s) and corresponding documentation with the expert Contractor POC. This KEDB shall be delivered to the purchaser.

5.7.3.6. The Contractor shall provide Second Level Support by assisting the Purchaser in the maintenance and administration of the TRITON Reference System and its use in analysing operational problems and validating changes to the PBL.

5.7.3.7. The Contractor shall provide Second Level Support for the PBL after the OTRR until the FSA.

5.7.4. Third Level Support

5.7.4.1. The Third Level Support activities shall be undertaken by the Contractor at his premises during the System Transition, until the FSA, as defined in the System Operation Process and System Maintenance Process.

5.7.4.2. The Third Level Support provides support to the Second Level Support either locally (at Contractor premises) or externally (at Purchaser operational or support sites). It covers correction of deficiencies, and implementation and validation of approved changes to the functional, developmental and PBL.

5.7.4.3. The Contractor furnished Third Level Support process shall create and deliver the software patches/fixes and/or hardware repair as approved by the CCB in response to the Second Level recommendation. Before FSA this will be subject to Purchaser Contracting Authority approval. After FSA this will only be done if the Purchaser decides to activate the optional Maintenance and Support Package.

5.7.4.4. The Contractor shall provide Third Level Support during the Warranty Period on the OBL.

5.7.4.5. The Contractor shall provide Third Level Support after the Warranty Period if the Purchaser exercises the option to activate the optional Maintenance and Support Package.

5.7.4.6. The Contractor-furnished Third Level Support shall be provided at the NCI Agency premises until FSA.

5.8. Training

5.8.1. General

5.8.1.1. The Contractor shall provide training for TRITON users and support staff through a combination of self-study aids, including System User and Administrative Manuals (hard copy and interactive electronic), Computer-Based Training (CBT) and eLearning Training Materials (e.g. On-line Tutorials and On-line Help) in accordance with [Bi-SC DIR 75-7] and TRITON Increment 1 specific courses.

5.8.1.2. The Contractor shall plan, execute and control the Training Process as defined in the [Bi-SC DIR 75-7]. The Contractor shall perform the Training Needs Analysis (TNA), the backing document to justify all the training activities for TRITON.

5.8.2. Training Needs Analysis

5.8.2.1. Perform Task Analysis

5.8.2.1.1. The Contractor shall conduct a Task Analysis in accordance with [Bi-SC DIR 75-7], to identify and list all user/operator and maintenance tasks for each PBL system, subsystem and integrated system.

5.8.2.1.2. The TNA shall include identified roles that will use TRITON to accomplish their tasks.

5.8.2.1.3. The TNA shall assess the gap between the current skills of relevant staff and the tasks they will be expected to perform in the use and support of the TRITON OBL.

5.8.2.2. Perform Target Audience Analysis

5.8.2.2.1. The Contractor shall conduct a Target Audience Analysis in accordance with [Bi-SC DIR 75-7], utilizing any information already determined by the Purchaser Training Staff and produce a summary population table. An Excel spreadsheet is recommended in [Bi-SC DIR 75-7].

5.8.2.2.2. The Contractor shall assess the current skills of operational staff that will use TRITON and the importance and difficulty of tasks via discussions with Purchaser-identified experts.

5.8.2.3. Create a List of Operational Performance Standards

5.8.2.3.1. The contractor shall produce a List of Operational Performance Standards (LOPS) in accordance with [Bi-SC DIR 75-7.

5.8.2.4. Perform a Performance Gap Analysis

5.8.2.4.1. The contractor shall conduct a performance gap analysis in accordance with [Bi-SC DIR 75-7] to determine which Performance Objectives (POs) need E&IT either in full or in part.

5.8.2.5. Perform Difficulty Importance Frequency (DIF) Analysis

5.8.2.5.1. The contractor shall conduct a DIF or other equivalent criterion analysis in accordance with [Bi-SC DIR 75-7], to determine the priority and training effort to be applied to the POs.

5.8.2.5.2. This DIF analysis shall identify the difficulty and importance of each major task to be performed by each category of roles and the frequency with which the task will be performed. A possible format is identified in the [Bi-SC DIR 75-7].

5.8.2.5.3. For each task identified in the DIF analysis, the Contractor shall assess the knowledge and skill required to perform the task and recommend how training should be provided to meet these requirements.

5.8.2.6. Finalise the LOPS

5.8.2.6.1. Once the Performance Gap and DIF analyses have been completed, the contractor shall finalise the LOPS by appending the need for training or partial training as per [Bi-SC DIR 75-7].

5.8.2.6.2. Based on the recommendations from the DIF analysis, the Contractor shall identify in the TNA which of the TRITON Training Materials and training deliveries shall be offered to meet the training requirements.

5.8.2.7. Create Learning Objectives

5.8.2.7.1. The contractor shall take all the POs in the LOPS that require E&IT and create a list of Learning Objectives (LO) in accordance with [Bi-SC DIR 75-7].

5.8.2.8. Perform Training Options Analysis

5.8.2.8.1. The contractor shall conduct a training option analysis, including a cost-benefit analysis in accordance with [Bi-SC DIR 75-7], to determine the alternatives for the overall training approach, setting and location. The preferred option will be recommended in the TNA Final Report.

5.8.2.9. Create TNA Final Report

5.8.2.9.1. The Contractor shall provide a TNA Report in accordance with [Bi-SC DIR 75-7].

5.8.2.9.2. The Contractor shall base the scope, delivery methods, and duration of TRITON training courses and materials on the TNA.

5.8.2.9.3. The Contractor shall incorporate the findings of the TNA in the Training Plan, as confirmed by the Purchaser.

5.8.2.10. Complete Programme of Instruction (POI) Document II

5.8.2.10.1. The contractor shall complete Part 1 and Part 2 of the NATO POI Document II in accordance with [Bi-SC DIR 75-7].

5.8.3. Training Plan

5.8.3.1. The Contractor shall develop and maintain the TRITON Training Plan describing how it will meet requirements for initial and follow-on training.

5.8.3.2. The Training Plan shall be structured according to the template provided in [Bi-SC DIR 75-7] and address the results of the TNA.

5.8.3.3. The Contractor shall develop and maintain the Training Course Proposal and Justification (POI Document-II) based on the results of the TNA.

5.8.3.4. The Training Plan shall describe how it will meet the training requirements found after the TNA for initial and follow-on training.

5.8.3.5. This Training Plan shall address all stages of training development, delivery, and support covered under this Contract. The Training Plan shall describe in a coherent way how training will be developed, delivered, and maintained throughout the life of the TRITON capability.

5.8.3.6. The Training Plan shall describe the training documentation.

5.8.3.7. The Training Plan shall propose a training schedule, in relation to the overall Contract schedule.

5.8.3.8. The Training Plan shall describe the process for Training Evaluation.

5.8.3.9. The Training Plan shall describe the support to be provided by the Purchaser (manpower, services and material).

5.8.3.10. The Contractor shall adapt the Training Plan structure to the TRITON capability scope and submit it for Purchaser approval not later than the CDR milestone.

5.8.4. Training Programme

5.8.4.1. Perform Instructional Analysis

5.8.4.1.1. The contractor shall perform an instructional analysis in accordance with [Bi-SC DIR 75-7] that includes, but is not limited to, the following activities:

5.8.4.1.1.1 Identify all components and sub-components of the tasks that make up the support.

5.8.4.1.1.2 Apply target population information to determine current subject matter competence (knowledge, skills and attitude).

5.8.4.1.1.3 Group and sequence the components (Enabling Objectives - EOs) and sub-components (teaching points) into units suitable for learning.

5.8.4.1.1.4 Develop Enabling Checks. For each EO, the Contractor shall create and submit an Enabling Check and its scoring criteria.

5.8.4.1.1.5 Develop a scalar diagram to document the content and structure of the instructional programme.

5.8.4.2. Develop Learning Assessment Plan

5.8.4.2.1. The contractor shall develop an assessment plan in accordance with [Bi-SC DIR 75-7], which includes, but not limited to:

5.8.4.2.1.1 A concept for achievement testing, that specifies how each LO, and critical EOs, will be assessed,

5.8.4.2.1.2 A pass/fail policy, based on results of achievement tests,

5.8.4.2.1.3 Test/retest policies,

5.8.4.2.1.4 A concept for progress testing that specifies how each EO will be assessed.

5.8.4.3. Define Instructional Strategies

5.8.4.3.1. In accordance with the guidance provided in [Bi-SC DIR 75-7], the Contractor shall identify instructional strategies covering:

5.8.4.3.1.1 Instructional methods such as demonstration-performance, case studies or lectures,

5.8.4.3.1.2 Instructional media (e.g. pictures, diagrams, video recordings, models, simulators, real equipment, ADL, CBT),

5.8.4.3.1.3 Learning environment e, centralised instruction (bringing the learners to the instruction); distributed instruction (taking the course to the learners) or a combination of both.

5.8.4.4. Propose Instructional Strategy

5.8.4.4.1. To support the Purchaser's decision on the Instructional Strategy, the Contractor shall provide a Decision memo that:

5.8.4.4.1.1 Reviews the proposed strategies for their potential effectiveness in meeting the performance requirement,

5.8.4.4.1.2 Reviews costing for affordability and comparative efficiency,

5.8.4.4.1.3 Considers risks and organizational impact,

5.8.4.4.1.4 Develops a business case if resource implications are substantial.

5.8.4.5. Complete POI Documentation

5.8.4.5.1. The contractor shall complete POI Document II Part 2 and POI Document III in accordance with [Bi-SC DIR 75-7].

5.8.4.6. Create Instructional Specifications

5.8.4.6.1. The contractor shall use the products of the Instructional Analysis to create instructional specifications approved by the Purchaser's Training Manager that include the:

- EOs,
- Teaching points with pertinent references such as specific passages in technical publications,
- Enabling Checks where appropriate, with scoring criteria.

5.8.4.7. Develop Training Material

5.8.4.7.1. The Contractor shall produce appropriate Training Materials in accordance with [Bi-SC DIR 75-7], to include some or all of the following as required:

5.8.4.7.2. Syllabus

5.8.4.7.2.1 The Syllabus shall include the following elements:

- Course title
- Course description
- Learning objectives, as identified in the TNA and confirmed in the Training Plan
- Instructional methodologies to be employed in the delivery of the course
- Total number of instructional hours
- In-class assignments or laboratories
- Evaluation tools
- Performance standards.

5.8.4.7.2.2 A shorter Training Syllabus shall be provided to course participants.

5.8.4.7.3. Student Manuals

5.8.4.7.3.1 These are reference handbooks to be used and retained by the students. The content should be based on the POI.

5.8.4.7.3.2 The Student Manual shall describe the concepts, functions, and features presented in the course, including links or references to the relevant documentation included in the TRITON Product Baseline

5.8.4.7.4. Instructor Guides

5.8.4.7.4.1 These are instructional guidelines for use by the instructor during training preparation and execution. They outline the specific training steps that must be provided to satisfy the training plan. EOs are linked to detailed steps and procedures in student manuals, user guides, and any on-line documentation.

5.8.4.7.4.2 The Instructor Guide is best structured as a series of outline lessons, providing key points for the instructor to stress, some sample questions to ask, appropriate times to inject student progress tests and practical exercises, other instructional tips, and any activity aiding student learning of the related training objective.

5.8.4.7.5. Training Presentations

5.8.4.7.5.1 Training presentation shall include all slides or other information to be presented by the instructor during the course.

5.8.4.7.6. Hand-outs

5.8.4.7.6.1 These additional aids can supplement the Student Manuals when covering areas identified as difficult and/or particularly important.

5.8.4.7.6.2 They shall cover alternative approaches and provide realistic examples of task execution.

5.8.4.7.7. Training Scenario

5.8.4.7.7.1 The Contractor shall prepare Training Scenarios to be used with TRITON Training Systems.

5.8.4.7.8. Computer Based Training (CBT) or other media where this is a recommended solution,

5.8.4.7.8.1 Training aids of all types including real equipment, references and job aids,

5.8.4.7.8.2 Question database and some sample tests in a numbered sequence with guidance on where and when they should be used during the course.

5.8.4.7.9. The Contractor shall develop and provide the Training Materials for each Training Course.

5.8.4.8. Provide Recommended Training Materials List

5.8.4.8.1. The Contractor shall create and submit a summary of the recommended Training Materials, aids and equipment.

5.8.4.9. Conduct Trainings and Transfer to the NATO In-Service Training (IST)

5.8.4.9.1. The Contractor shall create and submit course time tables, lesson plans and support materials for the PBL Training.

5.8.4.9.2. Using the lesson plans and support materials, the Contractor shall conduct training courses for the target population and the NATO trainers.

5.8.4.9.3. The Contractor shall submit an Evaluation Report for each course with recommendations for any corrective action as required;

5.8.4.10. Initial Training Requirements

5.8.4.10.1. The Contractor shall provide Operator Training and User Training for each delivered Baseline to sustain a pool of operators in accordance with the Training Plan.

5.8.4.10.2. The Contractor shall provide System Administrator Training and System Support Training for each delivered Baseline to sustain a pool of system administrator and support staff in accordance with the Training Plan.

5.8.4.10.3. The Contractor shall provide System Maintenance Training and Trainer Training to support staff in accordance with the Training Plan.

5.8.4.10.4. The Contractor shall develop a Training Programme for:

- TRITON System Administrators (Site System Admins)
- TRITON Operators (MARCOM Operators)
- TRITON General Users (Users in any NATO Command and Nations)
- TRITON Support Personnel (NCI Agency CSU staff).
- TRITON Operational Trainers (NCI Agency trainers)
- TRITON Administrator Trainers (NCI Agency trainers)

5.8.4.10.5. The Training Programme shall be reviewed by the Purchaser and operational users prior to the Design Review for each Build Process and shall be provided at least two (2) weeks prior to the review (e.g. SwDR-1).

5.8.4.11. Training Data

5.8.4.11.1. The Contractor shall develop an operationally-realistic set of TRITON data, including a representative number of each Maritime Information Entity to support training objectives for use in TRITON Training Courses and Training Materials.

5.8.4.11.2. The Contractor shall install Training Databases to support Training Sessions. The training database shall be dynamic and allow replay of training scenarios.

5.8.4.11.3. The Contractor shall update the Training Data according to the feedback from the trainees.

5.8.5. Training Readiness Review

5.8.5.1. The Contractor shall conduct Training Readiness Review (TrRR) at the Purchaser's facility (NCI Agency The Hague) using the Working Groups (as described in Subsection 4.4) structure. The Contractor shall make available all Training Materials and aids/equipment (document based and computer based).

5.8.5.2. The Contractor shall provide functionally complete Training Materials at the TrRR for each Baseline.

5.8.5.3. The Contractor shall provide the documents given in Table 5-3 for the TrRR.

Table 5-3 – TrRR Documents

Serial	Requirement
1	Training Needs Analysis
2	Training Plan
3	Training Programme
4	Training Course Evaluation Report (TCER) Template
5	Training Materials
6	System Manuals
7	Computer Based Training (CBT)

5.8.5.4. The Purchaser will provide comments to improve the Training Materials. The Contractor shall implement the changes directed by the Purchaser and provide updated Training Materials as part of reviews organised within the Build Processes.

5.8.6. On-line Tutorials

5.8.6.1. The Contractor shall develop a set of On-line Tutorials, as specified in the Contractual SRS, to enable TRITON end users and self-service users to perform the tasks associated with their roles.

5.8.7. Computer-Based Training

5.8.7.1. The Contractor shall develop and provide a Computer-Based Training (CBT) capability as specified in the Contractual SRS. The CBT shall be provided for BL 2, 3, and 4, and then updated until FSA.

5.8.7.2. The TRITON CBT shall complement the TRITON classroom training and On-line Help and On-line Tutorials by defining and explaining the key concepts and terminology of the C2 of Maritime Operations and processes incorporated into TRITON features and functions.

5.8.7.3. All e-learning Training Material shall be prepared in compliance with the Sharable Content Object Reference Model (SCORM) Edition 2004.

5.8.7.4. The Contractor shall ensure that the software used to produce the CBT is included in the AFPL.

5.8.8. Test Crew Training

5.8.8.1. The purpose of the Test Crew Training is to train the Purchaser and Operational Community representatives on the functionality to be tested and how the tests will be performed.

5.8.8.2. The Contractor shall provide Test Crew Training (including system overview) to the Purchaser Test Crew participating in the tests during the test events.

5.8.8.3. The Contractor shall deliver the Test Crew Training at the Purchaser's facilities.

5.8.9. On-the-Job Training

5.8.9.1. The purpose of the On-the-Job Training (OJT) is to provide hands-on training to the operational users in a normal working situation.

5.8.9.2. The OJT shall include helping the operational user to perform initial operational tasks.

5.8.9.3. Each OJT shall take no less than two (2) days.

5.8.10. Training Courses

5.8.10.1. The Contractor shall develop and deliver the Training Courses for the TRITON capability.

5.8.10.2. These Training Courses shall utilise a combination of lecture and hands-on exercises to ensure students completing a course can perform to the level agreed to in the TRITON Training Plan. The training shall include:

- Training of Purchaser staff on the TRITON capability
- Development and delivery of Training Courses and course materials
- Development and maintenance of on-line tutorials

5.8.10.3. The Training Courses shall provide training for the various categories of roles based on the TNA or specific direction from the Purchaser.

5.8.10.4. The Training Courses shall be performed using Purchaser-identified training facilities.

5.8.10.5. The Training Courses shall be provided on the TRITON Training Systems or other, Purchaser-identified equipment, without interference to operational activities.

5.8.10.6. The initially defined Training Courses to be delivered are given in Table 5-4. Course names and contents can be optimised according to the TNA. Each course shall also have separate subjects for TRITON-NS and TRITON-NU.

Table 5-4 – Training Courses

Course Name	Subjects	Audience
System Administrator Training	• System overview • General use of TRITON (NS/NU) • System management functions • User management • Data management	System Admins at Installation Sites and Organizational Nodes
Operator Training	• System overview • Detailed use of all TRITON functions (NS/NU) • User interfaces	MARCOM Users (MOC Operators)

	• Controlling and monitoring system technical status • Controlling and monitoring system interfaces • SOPs • Speciality functions	
User Training	• System overview • General use of TRITON functions available for General Users (NS/NU) • User interfaces	General Users at NATO Commands
System Support Training	• System overview • Support concept • Installation of TRITON (NS/NU) • Configuring the system • Configuring the interfaces • COTS components • Logging • Problem resolution • Controlling and monitoring system status • Controlling and monitoring system interfaces	NCI Agency C2 Service Line; MARCOM Support Staff
System Maintenance Training	• System overview • Support concept • Software Maintenance (1st / 2nd Level) • Problem resolution	NCI Agency C2 Service Line
TDK Maintenance Training	• System overview • Support concept • Hardware Maintenance (1st / 2nd Level) • Software Maintenance (1st / 2nd Level) • Problem resolution	NCI Agency C2 Service Line; MARCOM Support Staff
TDK User Training	• System overview • Installation and de-installation of Deployable Kit on board • General use of TDK functions (NS/NU) • User interfaces • System Management functions • Configuring, controlling and monitoring ACP interfaces • Data management • SOPs	National Representatives (ship crew)
Nations Training	• System overview • General use of TRITON functions available for General Users (NS/NU) • User interfaces • Configuring Nation interface • Controlling and monitoring Nation interfaces • SOPs	National Representatives (HQ staff)
Trainer Training	• System overview • System Administration subjects • Operator Training subjects • System Support Training subjects • TDK User Training subjects	NCI Agency Trainers

5.8.10.7. Each session of a Training Course shall last no less than two (2) days and no longer than ten (10) days. The actual duration for each course shall be determined according to the TNA.

5.8.11. Course Delivery

5.8.11.1. The Contractor shall deliver Training Courses at Purchaser-specified locations using Purchaser-furnished facilities and equipment and the training version of the TRITON databases.

5.8.11.2. The Contractor shall provide each student attending a Training Course with an electronic copy and printed copy of the Student Manual for the course.

5.8.11.3. The Contractor shall provide each student attending a Training Course with a Feedback Form under paper format and request students to complete and return the form at the end of the course.

5.8.12. Training Course Evaluation Report

5.8.12.1. The Contractor shall submit to the Purchaser a Training Course Evaluation Report (TCER) for each training. The TCER shall contain the following:

- Student attendance and performance record
- Consolidated student feedback from feedback forms
- Problems encountered (if any)
- Actions taken or recommended
- Suggested follow-up actions.

5.8.12.2. The Contractor shall, as directed by the Purchaser's Project Manager, revise the Training Materials for each course to reflect student feedback from the initial session of each course.

5.8.13. Training Equipment

5.8.13.1. The Contractor shall develop the TRITON Training System for both NS and NU Domains to provide training sessions. The system configurations shall conform to their specification in the SyRS.

5.8.13.2. The Contractor shall be responsible for configuring the TRITON Training Systems and their preparation to support training sessions.

5.8.14. Software Maintenance Training

5.8.14.1. The Contractor shall provide Software Maintenance Training to the Purchaser's support staff at a Purchaser-approved location.

5.8.14.2. The training shall be at least five (5) working days for at least four (4) individuals.

5.8.14.3. The Software Maintenance Training shall include the following:

- System overview
- Software requirements overview
- Software architectural design
  - Software technology used
  - COTS products used

  - The high-level design of the software
- The detailed design of each software element
- Construction
  - Source code tree
  - Code walkthrough
  - Generation of software
- Testing and integration notes
- Installation and system configuration
- Configuration control and versioning system
- Case studies using sample modification on the source code

5.9. Management and Control of Logistic Movements

5.9.1. General

5.9.1.1. All items, including all spared and repaired goods, shall be Delivered Duty Paid (DDP), as defined in Incoterms 2010, to the NATO destinations identified in the SSS at Contractor's expense.

5.9.1.2. Prior to transportation, all deliveries shall be preceded by a Notice of Shipment. The format, content and timelines associated with this notes notice are specified in the relevant section of this document. All carriage costs shall be undertaken by the Contractor. The Contractor shall only pay the custom charges following authorisation by the Purchaser and he shall immediately inform the Purchaser of any problems that may arise (e.g. acceptance refusal by a country).

5.9.1.3. Delivery sequence of shipment related documents are shown in Figure 16.

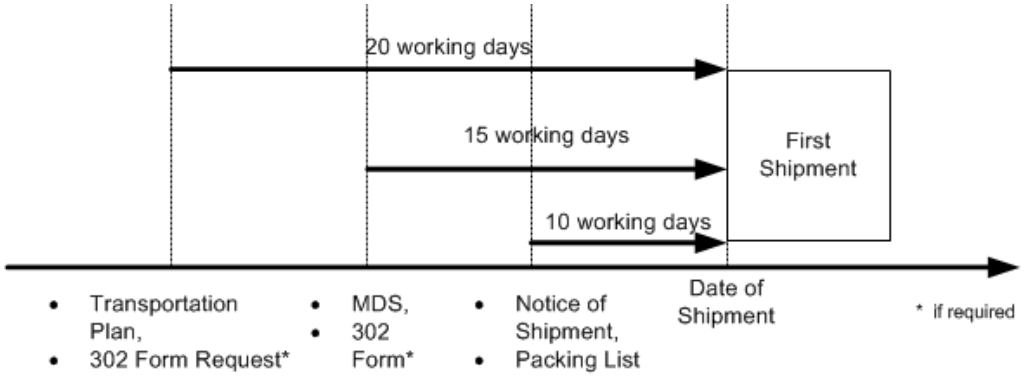


Figure 16 – Shipment Sequence

5.9.1.4. The Contractor shall be responsible for the timely request of Custom Forms 302, required for duty free import/export of supplies between certain countries. Details with regard to this requirement are specified in the relevant section of this SOW.

5.9.1.5. The Contractor shall create and maintain a Transportation Report that states the planned versus the current and final transportation results, including the delivery stages, location(s) and dates with the corresponding receiving NATO POC's and confirmations/signatures.

5.9.2. Transportation Plan

5.9.2.1. The Contractor shall develop and maintain the Transportation Plan (TransP) as an annex to ISP.

5.9.2.2. The TransP shall define all planned (partial-) shipments, locations, point of contact(s), transportation stages, schedules, and alternative schedules.

5.9.2.3. The TransP shall describe the end-to-end route, stages, and schedule of the PBL CI transportation from the Contractor's origin to its final operational destination.

5.9.2.4. The TransP shall offer alternative schedules with associated impact on the overall cost and schedule.

5.9.2.5. The Contractor shall present the initial version of the TransP for Purchaser approval not later than the CDR milestone.

5.9.2.6. The Contractor shall update the TransP if necessary and provide the updated plan at least two (2) weeks prior to the first equipment delivery.

5.9.3. Transportation

5.9.3.1. The Purchaser shall not be liable for any storage, damage or any other charges involved in such transportation of supplies prior to site delivery.

5.9.3.2. The Contractor is responsible for the availability of proper storage space and availability of material handling equipment that may be required for the equipment shipped to the destination/location. He may wish to liaise with the local Command and coordinate availability of such facilities and material through the Purchaser’s ILS Officer.

5.9.4. Preservation, Packaging and Packing

5.9.4.1. The Contractor shall, for the purpose of transportation, package, and crate or otherwise prepare items in accordance with the best commercial practices for the types of supplies (including computers, parts, CDs and documentation) involved.

5.9.4.2. All supplied items shall be packaged and packed by the shipping agent using the best commercial practices.

5.9.4.3. The packaging for deliverables shall be as follows:

5.9.4.3.1. Equipment: If the main equipment to be procured comprises servers and workstations or other electronic outfits (i.e. routers, switches), packaging shall normally be standard trade packs delivered by the manufacturer. For those repairable items that will be returned to a store/repair location, suitable re-usable packaging may be provided to ensure that they arrive at their destination secure and undamaged during transit.

5.9.4.3.2. Software CDs: In order to avoid damage, these items shall be wrapped and packaged in reinforced cardboard boxes as per standard trade packs.

5.9.4.3.3. Documentation: Packaging shall be standard trade packs.

5.9.5. Packing Lists and Marking

5.9.5.1. The Contractor shall supply packing lists for each consignment to allow for easy identification and mapping against the deliverables stated in the Schedule of Supply and Services.

5.9.5.2. Three packing lists shall be provided for each individual package/pallet as follows:

5.9.5.3. Two copies affixed outside in a sealed/weather-proofed enclosure

5.9.5.4. One copy inside the package/pallet

5.9.5.5. The packing list shall include at least the following:

- The Shipping Address
- Package number
- Contract Number
- CLIN Number as per Schedule of Supply and Services
- Item Description
- Part Number
- Serial Number
- Quantity
- Weight and Volume details
- Box number and number of boxes in the consignment
- Name and address of the Contractor, Purchaser and Consignor

5.9.5.6. In addition to standard commercial marking, all shipped packages shall show on a nameplate affixed outside of the package: the Project Name, contract number and shipping address, and the package shall be clearly marked with the text "AIS EQUIPMENT – NATO PROPERTY".

5.9.6. Notice of Shipment

5.9.6.1. Ten (10) working days prior to the delivery of any shipment of supplies, the Contractor shall provide Notice of Shipment to the Purchaser and to such other persons as are designated, in accordance with the instruction of the Purchaser.

5.9.6.2. The Contractor shall provide the Notice of Shipment with at least the following information:

- Purchaser Contract Number
- Contract line Item Number (CLIN), designation and quantities
- Items Description, Quantity and Manufacturer Part Number
- Destination
- Number and gross weight
- Consignor's and Consignee's name and address
- Method of shipment, e, road, air, sea etc.
- Date of shipment
- Number of the Form 302 used.

5.9.7. Custom Documentation

5.9.7.1. The Contractor shall be responsible for the timely request of approval of Custom Forms 302, required for duty free import/export of supplies between certain countries.

5.9.7.2. If applicable, the Contractor shall submit the Request for 302 Customs Form twenty (20) working days prior shipment date to the Purchaser.

5.9.7.3. Following receipt of the request by the Purchaser, normally a maximum of ten (10) working days are required for the issue of the form. These forms shall be originals and shall be delivered by mail/express courier. The written request for a Custom 302 form delivered by the Contractor shall contain the following information (a template for the format is available at the Purchaser):

- Purchaser Contract Number
- Contract line Item Number (CLIN), designation and quantities
- Destination
- Number and gross weight
- Consignor's and Consignee's name and address
- Method of shipment, e, road, air sea etc.
- Name and address of the freight forwarder.

5.9.7.4. If a country refuses to accept the Custom Form 302 and requires the payment of custom duties, the Contractor shall immediately inform the Purchaser by the fastest means available and obtain from the Custom Officer a written statement establishing that its country refuses to accept the Custom Form 302.

5.9.7.5. Only after having received Purchaser's approval, the Contractor shall pay these customs duties and shall claim reimbursement to the Purchaser.

5.9.7.6. The carrier shall be fully conversant with the application and use of Custom Form 302.

5.9.7.7. The Contractor shall be responsible to add the Custom Form 302 to the shipping documentation.

5.9.8. On-site Delivery

5.9.8.1. During the Site Survey, the Contractor shall obtain from the Purchaser the exact shipment addresses and NATO Points of Contact (POC).

5.9.8.2. Delivery, unless otherwise specified, shall be to a single location at each site subject to system installation.

5.9.8.3. Each site Point Of Contact shall be notified of all impending deliveries prior to their shipment. The notification shall include:

- Reception instructions
- All details of the shipped item as per Packing Lists
- Reception instructions
- An inspection and inventory check-up form

5.9.8.4. Each site POC shall be faxed a copy of the tailored reception instructions, at least by the date the shipping notice is given. The reception instructions shall include a reception check-out form to be used to inspect and inventory the received shipment.

5.9.8.5. The site POC will take delivery of the shipped goods and allow for their storage awaiting installation by the Contractor.

5.9.8.6. The Contractor shall expect that user-designated site personnel will be able to carry out a visual inspection of the received items in order to identify any external indications of damage. This will allow the Contractor to initiate a claim for damage to package content to the shipping insurance.

5.9.8.7. The Contractor shall acknowledge that the Purchaser representative cannot be held liable for not having reported any damage on received items.

5.9.8.8. The Contractor, as indicated in the reception instructions, shall request that no package be opened, even to conduct a visual inspection, unless written permission has been given.

5.9.8.9. The Contractor shall prepare and maintain a delivery schedule as part of the STrP.

5.9.9. Material Data Sheet and Inventory List

5.9.9.1. The Contractor shall provide the Material Data Sheet (MDS) to the Purchaser's ILS Officer in electronic format fifteen (15) working days before the first delivery of equipment.

5.9.9.2. The Contractor shall deliver the Inventory of Deliverables according to the MDS template with the guidelines for field completion will be provided by the Purchaser.

5.9.9.3. Right after signing of the Contract, the Contractor shall contact the Purchaser to verify the validity of MDS format. The fields included in MDS are listed below:

- Contract Line Item Number (CLIN)
- NATO Stock Number (NSN)
- Nomenclature (Short Item Description)
- Repairable item
- True Manufacturer Part Number
- True Manufacturer Code
- Vendor/Contractor Code
- Vendor/Contractor Part Number
- Quantity ordered
- Order Unit
- Serialized Item Tag
- Serial Number
- Serial Number Software Revision Level
- Serial Number Hardware Revision Level
- Other Serial Number attributes
- Subject to Property Accounting
- Currency
- Price
- Warranty Expiration Date
- Receiving/Inspection Depot

- Issue to customer
- Extended Line Item Description
- Part Number of next higher assembly
- Quantity in next higher assembly
- Quantity installed at Operating Unit (Customer Site)

5.9.9.4. Software Warranty and Licenses

5.9.9.4.1. The Contractor shall provide the software warranty and licensing documentation related to any software subject to licensing to the Purchaser.

5.9.9.4.2. The Contractor shall ensure the warranty and license model allows for transfer of responsibility between the Purchaser and other NATO entities as required by NATO's organization structure.

5.9.9.4.3. The transfer of responsibility shall be carried out without incurring additional cost for the Purchaser.

5.9.9.5. The Contractor shall establish and maintain at all times during the course of performance one Inventory List readily accessible by the Purchaser containing inventory information for all site deliverables (including hardware, software and documentation), their identification details and the location of all items across all the Purchaser's sites.

5.9.9.6. The inventory shall include all items delivered and shall comprise the following categories:

- Hardware, including main equipment, spare parts (where applicable) and installation materiel.
- Documentation, including COTS provider documentation and technical publications.
- Software carriers (i.e. CDs, hard drives) including COTS related software and developmental software (where applicable) including license codes and distribution target.
- Third party software packages, associated license code, point of contact (entity to which the license will be attributed within the Purchaser organization) and deployment location.

5.9.9.7. This inventory shall be exportable from the Contractor's system as an MS Excel file for delivery to the Purchaser on printed hardcopy and electronic media.

5.9.9.8. A single site deliverable inventory shall be made readily available and delivered to site together with the deliverables at the time of acceptance. Required changes shall be recorded during the acceptance process and fed back to the database.

5.9.9.9. An advance copy of the inventory shall be sent to the Purchaser's ILS Officer ten (10) working days before the first delivery.

5.9.10. NATO Codification and Labelling

5.9.10.1. The Configuration Management process shall provide for a single unique product identification numbering system for all the items delivered under the Contract.

5.9.10.2. The proposed numbering system shall be compliant with NATO Codification requirements (such as AC/135) although close compliance with this directive is not strictly required.

5.9.11. Recommended Spare Part List

5.9.11.1. The Contractor shall propose a Spare Part List for the TRITON Deployable Kits as defined in the SRS, Subsection 5.8.

5.9.11.2. The Spare Part List shall include the COTS equipment and other consumable items that are necessary for ship deployment (i.e. spare parts to be provided with TDKs for on-board First Level Support) and Second Level Support at site.

5.9.11.3. The Purchaser will have the right to procure only selected items from the Spare Part List.

5.10. Warranty

5.10.1. General

5.10.1.1. The Contractor shall provide Warranty Support for all TRITON PBL in the scope provided to the Purchaser under this Contract, for the Warranty Period.

5.10.1.2. The Warranty Support shall be applicable to all TRITON PBL elements delivered under any Work Package, without requiring further explicit reference in a Work Package.

5.10.1.3. The Warranty for TRITON PBL is limited to the scope provided by the Contractor to the Purchaser. The Purchaser, in consultation with the Contractor, may apply changes to the TRITON PBL. The scope of the Purchaser's changes will be excluded from the Warranty.

5.10.1.4. The Contractor shall ensure that the warranty conditions remain valid even if the equipment is moved or relocated during the Warranty Period.

5.10.1.5. As part of the Problem Management Process (paragraph 5.6.5) the Contractor shall identify and verify the warranty case, propose options for restoring the OBL service(s), and trigger Third Level Support or Third Level Maintenance actions.

5.10.1.6. The Contractor shall repair/ replace/ fix all hardware or software items received through the Support and/or Maintenance Process as per their internal procedures with the highest priority allocated and shall be responsible to return the Item to the NATO facility.

5.10.1.7. During the Warranty Period, repaired/exchanged goods shall be delivered directly to their original sites DDP Destination unless otherwise instructed by the Purchaser.

5.10.1.8. If the Contractor becomes aware at any time before acceptance by the Purchaser that a defect exists in any hardware or software item, the Contractor shall coordinate with the Purchaser and promptly correct the defect.

5.10.1.9. The Contractor shall be responsible for the provision of any alternative or superseding items, should the original part be no longer available ensuring ABL and OBL compliance.

5.10.1.10. During the Warranty Period the Contractor shall be responsible to implement all COTS hardware and/or software upgrades that are covered in the Warranty (it would include major version changes for the COTS).

5.10.1.11. The availability of COTS hardware and/or software upgrades shall be made known to the Purchaser and, if proposed for introduction by the Contractor for whatever reason, including any corrective action for an identified fault, shall always be subject to Purchaser approval.

5.10.2. Warranty Period

5.10.2.1. The Warranty Period for the hardware elements shall be two (2) years, starting from the time their formal acceptance after delivery.

5.10.2.2. The Warranty on repaired or replacement hardware elements is ninety (90) days from the date of return, or the remaining Hardware Warranty Period for the original covered product, whichever is longer.

5.10.2.3. The Warranty Period for the software, as OBL, shall be one (1) year, starting at the FSA.

5.10.2.4. For developed software components, the Contractor shall provide the Purchaser with a Warranty that the software component developed to satisfy the Purchaser’s requirements is fit for purpose.

5.10.2.5. For any breach of this Warranty, the Purchaser's exclusive remedy and the Contractor's entire liability shall be the re-performance of the deficient services or replacement of the deficient components, and if the Contractor fails to re-perform the services as warranted, the Purchaser is entitled to recover the fees the Purchaser paid the Contractor for those deficient services or components.

5.10.3. Warranty for Developed Software

5.10.3.1. The Contractor shall warrant that any developed Software Items shall perform according to the ABL and that any defects discovered shall be corrected.

5.10.3.2. The Contractor shall provide Third Level Maintenance and Support for the software during the Warranty Period.

5.10.3.3. The Warranty Support for developed software shall include software corrective and preventive maintenance.

5.10.3.4. Corrective maintenance

5.10.3.4.1. The Contractor shall provide reactive modification of the software to correct discovered problems.

5.10.3.5. Preventive maintenance

5.10.3.5.1. The Contractor shall provide modification of the software to detect and correct latent faults before they become effective faults.

5.10.3.6. The Contractor shall provide to the Purchaser without charge software maintenance releases that the Contractor makes available for the software feature release licensed to Purchaser.

5.10.4. Warranty for Developed Hardware

5.10.4.1. The Warranty Support shall include replacement of any faulty element of an HDI provided by the Contractor.

5.10.4.2. The Contractor shall provide Third Level Maintenance and Support for hardware during the Warranty Period.

5.10.4.3. The Contractor shall provide for a specific remedy such as an immediate correction or replacement in the event the hardware fails to meet the warranty conditions.

5.10.5. Warranty for COTS Hardware and Software

5.10.5.1. The Warranty Support shall include replacement of any faulty COTS hardware unit (e.g. server, storage unit, power supply) used in TDK.

5.10.5.2. The Warranty Support shall include maintenance of any COTS software (e operating system, support software) as provided by its vendor.

5.10.6. Warranty Cases

5.10.6.1. The Warranty Cases includes the defects or problems to be solved under the warranty clause. Defect means any condition or characteristic of the system that does not conform to the system specification.

5.10.6.2. Following shall be the minimum Warranty Cases:

- The deployed systems do not meet user requirements due to unacceptable failure rates
- Recorded symptoms and diagnostic results indicate that there is a defect.
- Repeatable actions that give the same faulty results
- Non-repeatable actions
- Degradation of performance in time
- Software defect that causes part or whole of the system malfunctioning
- System performance is less than the performance level measured and recorded during the performance tests of each OBL.

5.10.6.3. Exclusions

5.10.6.3.1. Following cases are excluded from warranty:

- Installation or maintenance of wiring, circuits, electrical conduits or devices external to the covered products;
- Force majeure events such as war, accident, fire, explosion, water damage, earthquake, lightning or any act of nature or other such event beyond control;
- Replacement of parts or repair resulting from failure to provide and continually maintain industry accepted electrical power, air conditioning and humidity controls in accordance with the product specifications;
- Service required to repair or restore covered products due to alterations or modifications performed by persons other than authorized service representatives;
- Failure of consumable parts (e.g. fuses, batteries, cables, sockets).

5.10.6.3.2. The Warranty shall not apply to alleged defects that the Contractor demonstrates to be in or otherwise attributable to NATO-furnished property as determined, tested, and verified by the tests and procedures set forth in

Paragraph _ of this contract. Notwithstanding this Warranty Case, a defect is not attributable to NATO-furnished property if it is the result of installation or modification of NATO-furnished property by the Contractor or of the integration of NATO-furnished property into any system delivered under this Contract if the installation, modification or integration of the NATO-furnished property voids or renders unenforceable any warranties otherwise applicable to the NATO-furnished property.

5.10.6.3.3. In any dispute respecting the application of the Warranty Cases or any other claim by the Contractor that a defect existing in any system (or element) delivered under this Contract is due to a cause for which the Purchaser is responsible or which is otherwise beyond the control of the Contractor, the Contractor shall bear the burden of demonstrating that the alleged defect is not within the coverage of this system (or element).

5.10.7. Management

5.10.7.1. The Contractor shall perform Warranty Management which should include project management activities as necessary during the Warranty Period.

5.10.7.2. The Contractor shall conduct the Problem Management Process (paragraph 5.6.5).

5.10.7.3. The Contractor shall submit the Warranty Report, at the beginning of the Warranty Period, which documents the identified Warranty Cases, affected CI's, taken activities, cost and schedule. Separate Warranty Reports shall be submitted for hardware and software.

5.10.7.4. The Contractor shall provide a Warranty Service Access Point as a local or toll-free telephone number accessible Monday through Friday during regular CET business hours. This facility shall be available during the Warranty Period.

5.10.8. Service

5.10.8.1. The Contractor shall be responsible for shipment of faulty items for repair or replacement, and of the repaired or replaced item to the affected site. This support shall include cost of parts, travel and per diem and shall not attract cost to the Purchaser.

5.10.8.2. The Contractor shall ensure availability and readiness for installation of replaceable hardware items within ten (10) days of fault notification.

5.10.8.3. It is also the Contractor’s responsibility to ensure that all spare/repair parts are current and maintained in a configuration approved by the Purchaser during the Warranty Period.

5.10.8.4. For defective software elements which are part of the PBL, the Purchaser may allow additional time to complete fault isolation, remediation and testing. The Contractor shall provide an estimated completion date for the fault isolation.

5.10.8.5. The Contractor shall provide the Purchaser with instructions for handling replacement actions.

5.10.8.6. The Contractor shall provide assistance by telephone and Internet electronic mail during the Warranty Period.

5.10.9. Recording

5.10.9.1. The Contractor shall maintain a Trouble-Ticketing System to track all repair and replacement actions for hardware and maintenance issues for software.

5.10.9.2. During the Warranty Period all problems that are encountered shall be recorded to a Problem Log, together with a clear description of the problem and including classification. The entries in the Problem Log shall include but not limited to the following information:

- Software or Hardware Item, Component or Module
- Problem Description
- Date Occurred
- Business Impact (Severity)
- Priority

5.10.9.3. This classification, as well as the classification of each logged problem, shall be jointly agreed by the Purchaser and the Contractor. To allow Problem Logging on a continuous basis during the Warranty Period the Contractor shall provide appropriate means (e.g. web site) accessible at all times by the Purchaser to manage the Problem Log.

5.11. 5-Year Maintenance and Support (optional)

5.11.1. General

5.11.1.1. The Contractor shall provide Third Level Maintenance and Support after the Warranty Period for a period of five (5) years if the optional Maintenance and Support Package is invoked.

5.11.1.2. The Purchaser shall have the right to invoke the Software Maintenance and Support Package any time after the FSA.

5.11.1.3. The Contractor shall provide the following types of software maintenance as described in Paragraph 5.4.3, Software Maintenance Process.

- Corrective Maintenance
- Preventive Maintenance
- Adaptive Maintenance
- Perfective Maintenance

5.11.1.4. The maintenance shall cover all software elements and components delivered under this Contract.

5.11.2. In-Service Support Plan

5.11.2.1. The Contractor shall update the In-Service Support Plan (ISSP) which includes the SMP.

5.11.2.2. The Contractor update the ISSP quarterly.

5.11.2.3. The ISSP shall include:

5.11.2.3.1. The preventive and corrective maintenance strategy to sustain service in the operational environment.

5.11.2.3.2. The scheduled preventive maintenance actions that reduce the likelihood of system failure without undue loss of services.

5.11.2.3.3. Planning for any additional adaptive and perfective maintenance request.

5.11.2.4. The Contractor shall deliver the first version of the ISSP within twenty (20) working days after the Wok Package is invoked.

5.11.3. Resources

5.11.3.1. The Contractor shall provide the necessary engineering support per year for applying Corrective and Preventive Maintenance.

5.11.3.2. The Contractor shall provide at least one (1) Full-Time Engineer (FTE) Equivalent support per year for implementation of any Adaptive Maintenance agreed with the Purchaser.

5.11.3.3. The Contractor shall provide at least two (2) FTE Equivalent support per year for implementation of any Perfective Maintenance agreed with the Purchaser.

5.11.4. Quarterly Maintenance Review

5.11.4.1. The Contractor shall plan and conduct Quarterly Maintenance Review (QMR) in order to determine the status of maintenance activities and planning for the next activities.

5.11.4.2. The QMR shall include reviewing the maintenance request, review and update Maintenance Documentation.

5.11.4.3. The first QMR shall be conducted in the first week of January, April, July, October, whichever is the closest after the package invoke date (i.e. first week of April if the invoke date is between 1 January and 31 March.

5.11.4.4. The QMR shall be executed at the Contractor premises.

SECTION 6: LABOUR CATEGORIES

6.1. General

6.1.1. This section outlines minimum educational and experience qualifications for Contractor staff supporting Work Packages under this Contract. The labour categories identified shall be available to support all Task Areas as required.

6.1.2. Substitution of experience or education is allowed as outlined in Table 6-1.

Table 6-1 - Experience/Education Substitution

Education	Equivalent Education + Experience	Equivalent Experience
Associates degree		4 years of relevant experience
Bachelor's degree	Associates + 2 years of relevant experience	6 years of relevant experience
Master's degree	Bachelor's + 4 years of experience	8 years of relevant experience

6.2. Management

6.2.1. Project Manager

6.2.1.1. Responsible for project management, performance and completion of tasks and delivery orders. Establishes and monitors project plans and schedules and has full authority to allocate resources to insure that the established and agreed upon plans and schedules are met. Manages costs, technical work, project risks, quality, and corporate performance. Manages the development of designs and prototypes, test and acceptance criteria, and implementation plans. Establishes and maintains contact with Purchaser, Subcontractors, and project team members. Provides administrative oversight, handles contractual matters and serves as a liaison between the Purchaser and corporate management. Ensures that all activities conform to the terms and conditions of the Contract and Work Package procedures.

6.2.1.2. Education: Master's degree in management, engineering, or business administration. Formal certification through Project Management Institute or equivalent source.

6.2.1.3. Experience: At least fifteen (15) years of experience in development of information systems, defence systems and project management of such systems, preferably in maritime domain. At least five (5) years as the project manager for an effort of similar scope and complexity, including the application of a formal project management methodology such as PRINCE2.

6.3. Project Management Support

6.3.1. Project Control Analyst

6.3.1.1. Establishes and maintains project schedule and cost baseline and analyses risks and potential impacts. Prepares project highlight reports.

6.3.1.2. Education: Bachelor's degree.

6.3.1.3. Experience: At least three (3) years of experience in project scheduling, project control, or project monitoring and reporting.

6.3.2. Webmaster

6.3.2.1. Provides website construction and administration, develops connections between databases and web-based front ends. Generates technical reports and related documentation as required. Provides expertise in the development and maintenance of web sites. Provides training on the uploading of documents, creating pages, links and other web functions. Maintains access rights to pages on web. Maintains reports and statistics on utilisation of the Project Website.

6.3.2.2. Education: Associates degree or two years of technical training.

6.3.2.3. Experience: At least one (1) year of experience in website support and at least one year in website construction.

6.3.3. Contract Security Specialist

6.3.3.1. Provides support in areas directly pertinent to administration, supervision, and control of facility security in an industrial and/or government environment. Possesses a working knowledge of government and industrial security regulations.

6.3.3.2. Education: Bachelor's degree.

6.3.3.3. Experience: At least three (3) years of experience in Contract security administration.

6.4. Engineering and Technical

6.4.1. Senior Engineer

6.4.1.1. Performs complex engineering tasks and multiple tasks simultaneously. Assists with or plans major research and engineering tasks or programs of high complexity. Directs and coordinates all activities necessary to complete a major, complex engineering program or multiple smaller tasks or programs. Performs advanced engineering research, hardware or software development.

6.4.1.2. Education: Master's degree in engineering.

6.4.1.3. Experience: At least ten (10) years of experience in engineering positions associated with design, development, evaluation, planning and operation of information systems, defence systems and large scale C2 systems preferably in maritime domain. Lead roles for at least five (5) years of experience in projects of similar size and nature. Member of recognised professional body.

6.4.2. Intermediate Engineer

6.4.2.1. Performs engineering tasks and additional duties as assigned. Assists higher level engineers with larger tasks. Manages or directs multiple engineering tasks, directing research and development activities as required. Performs advanced engineering applications programming and analysis for systems/equipment assigned.

6.4.2.2. Education: Bachelor's degree in engineering.

6.4.2.3. Experience: At least three (3) years of experience in engineering functions associated with the review, design, development, evaluation, planning and operation of electrical or electronic components, subsystems, or systems for government or commercial use.

6.4.3. Junior Engineer

6.4.3.1. Performs engineering tasks under the direction of higher level engineers. Performs independent research, conducts studies and analysis, and participates in the design and development of complex systems.

6.4.3.2. Education: Bachelor's degree in engineering.

6.4.3.3. Experience: At least one (1) year of experience in engineering functions associated with the review, design, development, evaluation, planning and operation of electrical or electronic components, subsystems, or systems for government or commercial use.

6.4.4. Senior Systems Engineer

6.4.4.1. Plans and coordinates project management and engineering. Provides comprehensive definition of all aspects of system development from analysis of mission needs to verification of system performance. Competent in technical disciplines as applied to government and commercial information and communications systems. Prepares trade-off studies and evaluations for vendor equipment. Recommends design changes/enhancements for improved system performance. Supervises the work of a design, integration, test, and implementation team.

6.4.4.2. Education: Master's degree in engineering or computer science.

6.4.4.3. Experience: At least seven (7) years of experience in system design and integration. At least five (5) years in the design, integration, or implementation information systems, defence systems and large scale C2 systems preferably in maritime domain.

6.4.5. Intermediate Systems Engineer

6.4.5.1. Performs system engineering assignments in support of the analysis of complex system design, formulating requirements, developing alternative approaches, conduct of studies, and application of standards. May function as a member of an engineering team assigned responsibilities for specific task areas.

6.4.5.2. Education: Bachelor's degree in engineering or computer science.

6.4.5.3. Experience: At least three years of experience in system design and integration.

6.4.6. Junior Systems Engineer

6.4.6.1. Conducts research and application of system design principles for the design, development, implementation, or support as a member of assigned task staffing. Develops alternative solutions, concepts, or processes through research into assigned systems and components.

6.4.6.2. Education: Bachelor's degree in engineering or computer science.

6.4.6.3. Experience: At least one (1) year of experience in system design and integration.

6.4.7. Senior Communications Engineer

6.4.7.1. Performs communications system transition planning, engineering design for integration with processing systems, specification development, standards, interface design, testing, and the conduct of transmission and traffic studies.

6.4.7.2. Education: Master's degree in engineering.

6.4.7.3. Experience: At least seven (7) years of experience in the engineering of communications systems via all transmission media.

6.4.8. Intermediate Communications Engineer

6.4.8.1. Prepares communications systems designs and technical documentation, and other design criteria. Implements COTS and emerging communications systems and develops technical plans, documentation, and support.

6.4.8.2. Education: Bachelor's degree in engineering.

6.4.8.3. Experience: At least three (3) years of experience in the engineering of communications systems via all transmission media.

6.4.9. Junior Communications Engineer

6.4.9.1. Conducts engineering analysis, develops technical documentation, investigate communications requirements, formulates network interfaces, and assists in project/program execution.

6.4.9.2. Education: Bachelor's degree in engineering.

6.4.9.3. Experience: At least one (1) year of experience in the engineering of complex communications systems via all transmission media.

6.4.10. Senior Network Engineer

6.4.10.1. Designs network topologies and architectures. Determines applicable hardware, software, and connectivity solutions. Supports implementation through configuration set-up, testing, and training of users.

6.4.10.2. Education: Master's degree in engineering and completion of a formal network certification program.

6.4.10.3. Experience: At least seven (7) years of experience in network systems. At least five years of experience with TCP/IP wide area networks.

6.4.11. Intermediate Network Engineer

6.4.11.1. Develops detailed network interface and configuration data. Surveys and evaluates applicable products. Prepares network diagrams. Provides guidance for system deployment and support.

6.4.11.2. Education: Bachelor's degree in engineering.

6.4.11.3. Experience: At least five (5) years of experience in network systems. At least three years of experience with TCP/IP wide area networks.

6.4.12. Junior Network Engineer

6.4.12.1. Develops network interface and configuration data for system components. Surveys and evaluates network products. Prepares network diagrams. Prepares routing tables and installation and support documentation.

6.4.12.2. Education: Bachelor's degree in engineering.

6.4.12.3. Experience: At least one (1) year experience in the engineering of complex communications systems via all transmission media.

6.4.13. Systems Integration Analyst

6.4.13.1. Develops and implements solutions using the optimal technology, platform, and interfaces Researches available tools and technologies to determine alternate technology solutions. Researches, implements, and supports multiple computing platforms, operating systems, processing environments, and telecommunications technologies. May conduct cost/benefit or feasibility analyses; perform capacity analyses and planning.

6.4.13.2. Education: Bachelor's degree in engineering or computer science.

6.4.13.3. Experience: At least seven (7) years of experience in the integration and implementation of information systems, defence systems, C2 systems, preferably in maritime domain.

6.4.14. Senior Software Programmer

6.4.14.1. Performs complex program development using standard and specialised languages to create special purpose software, modify existing programs, and enhance system efficiency and integrity. Translates detailed designs into software, tests, debugs, and refines software packages. Manages software development teams in modular development of complex applications. Provides technical direction to assigned programmers.

6.4.14.2. Education: Bachelor's degree in engineering or computer science.

6.4.14.3. Experience: At least seven (7) years of experience in the design, programming, and testing of applications software.

6.4.15. Intermediate Software Programmer

6.4.15.1. Analyses systems requirements and design specifications to develop block diagrams and logic flow charts. Translates detailed designs into computer software for specific applications. Prepares documentation, including program and user documentation.

6.4.15.2. Education: Bachelor's degree in engineering or computer science.

6.4.15.3. Experience: At least three (3) years of experience in the design, programming, and testing of applications software.

6.4.16. Junior Software Programmer

6.4.16.1. Performs programming tasks based upon specifications and flow diagrams. Translates concepts into program modules for testing, debugging, refinement, and integration with other modules. Prepares draft documentation including program and user documentation. Functions as a member of a software development team under the guidance of more experienced programmers.

6.4.16.2. Education: Bachelor's degree in engineering or computer science.

6.4.16.3. Experience: At least one (1) year of experience in the design, programming, and testing of applications software.

6.4.17. System Support Engineer

6.4.17.1. Designs and integrates system support applications and protocols to meet system requirements. Analyses architectural options for performance and manageability. Analyses and designs implementations to meet specialised message formats or interfaces.

6.4.17.2. Education: Bachelor's degree in engineering.

6.4.17.3. Experience: At least seven years of experience in the design, integration, and implementation of information systems. At least three years of experience with SNMP and system support applications.

6.4.18. Senior Test Engineer

6.4.18.1. Directs test planning, design and tools selection. Establishes guidelines for test procedures and reports. Coordinates with Purchaser on test support requirements and manages Contractor test resources.

6.4.18.2. Education: Bachelor's degree in engineering.

6.4.18.3. Experience: At least ten (10) years of experience in the planning and execution of testing information systems, defence systems, and large scale C2 systems preferably in maritime domain.

6.4.19. Intermediate Test Engineer

6.4.19.1. Designs and documents unit and application test plans. Transforms test plans into test cases and executes those cases. Supervises individual tests and prepares test reports.

6.4.19.2. Education: Bachelor's degree in engineering.

6.4.19.3. Experience: At least three (3) years of experience in the design and execution of information systems tests.

6.4.20. Junior Test Engineer

6.4.20.1. Performs testing activities under supervision of more experienced test personnel. Executes defined test cases and procedures. Collects and analyses test data; prepares test reports.

6.4.20.2. Education: Bachelor's degree in engineering.

6.4.20.3. Experience: At least one (1) year in the design and execution of information systems tests.

6.4.21. Test Technician

6.4.21.1. Provides installation and administration support to information system testing. Constructs and tests prototype equipment for electrical systems and components, consistent with engineering and other specifications. Executes tests and collects test data. Assists in preparing test reports.

6.4.21.2. Education: Associates degree or two years of technical training.

6.4.21.3. Experience: At least two (2) years of experience in the configuration and administration of information systems or test and measurement systems.

6.4.22. Information Systems Security Engineer

6.4.22.1. Analyses and develops network systems and information security practices to include: operating systems, applications, TCP/IP, security architecture, multi-level security, intrusion detection, virus detection and control, PKI, vulnerability assessment. Documents findings and recommend changes in procedures, configuration, or design.

6.4.22.2. Education: Bachelor's degree.

6.4.22.3. Experience: At least three (3) years of experience in information systems security. At least five years in information systems integration, implementation, or operation.

6.4.23. Information Systems Security Specialist

6.4.23.1. Provides support in implementing procedures and practices prescribed for safeguarding and control of an automated information system and the processing of classified information.

6.4.23.2. Education: Associates degree or two years of technical training.

6.4.23.3. Experience: At least two (2) years of experience as an Information Systems Security Officer for an operational system.

6.4.24. Field Engineer

6.4.24.1. Conducts site surveys, prepares implementation plans, prepares implementation procedures, supervises installation and activation, reports on installation status, manages repair and modifications to systems/equipment, performs field maintenance, and performs system configuration changes based upon approved specifications.

6.4.24.2. Education: Bachelor's degree.

6.4.24.3. Experience: At least seven (7) years of experience in the installation and support of information systems.

6.4.25. Senior Technician

6.4.25.1. Supervises technicians in the troubleshooting, repair, installation, training, integration, and upgrade of systems and equipment. Works closely with assigned engineers and systems personnel to support implementation and activation efforts.

6.4.25.2. Education: Associates degree.

6.4.25.3. Experience: At least seven (7) years of experience in the installation and maintenance of network and information systems.

6.4.26. Intermediate Technician

6.4.26.1. Performs troubleshooting, repair, refurbishment, and installation of systems and equipment. Performs factory or field testing of systems, development of maintenance or repair procedures, and supports installation teams in specific areas of expertise.

6.4.26.2. Education: Associates degree.

6.4.26.3. Experience: At least three (3) years of experience in the installation and maintenance of network and information systems.

6.4.27. Junior Technician

6.4.27.1. Performs troubleshooting, repair, and installation functions as assigned. May be assigned as technical support technician for specific systems or hardware. Performs factory or field testing and supports installation teams as assigned.

6.4.27.2. Education: Secondary school graduate with one year of technical training.

6.4.27.3. Experience: At least two (2) years of experience installing and maintaining network and information systems.

6.4.28. System Management Specialist

6.4.28.1. Analyses, develops, and maintains operational system configuration parameters. Establishes and implements system policy, procedures and standards, and ensures their conformance with system requirements. Ensures that security procedures are established and implemented. Provides technical assistance to operational, logistics, and system engineering staff.

6.4.28.2. Education: Bachelor's degree and completion of a formal system administration or network management certification course.

6.4.28.3. Experience: At least three (3) years of experience in the administration of distributed information systems.

6.5. Implementation Support

6.5.1. Logistics Management Specialist

6.5.1.1. Provides support in the development of support documentation to include as a minimum, elements such as support equipment, technical orders, supply support and computer resources support, process of evolving and establishing maintenance/support concepts.

6.5.1.2. Education: Bachelor's degree.

6.5.1.3. Experience: At least seven years of experience in supply and support of information systems. At least three (3) years in support of distributed systems in more than one NATO nation.

6.5.2. Logistics Analyst

6.5.2.1. Creates and helps execute plans for the ILS of complex systems. Analyses adequacy and effectiveness of current and proposed logistics support provisions. Supervises the efforts of other logistics personnel in the execution of assigned tasks.

6.5.2.2. Education: Bachelor's degree.

6.5.2.3. Experience: At least three (3) years of experience in ILS planning and analysis.

6.5.3. Inventory Specialist

6.5.3.1. Creates and maintains an inventory control system. Tracks materials, coordinates shipping and receiving, and supervises packing operations.

6.5.3.2. Education: Associates degree.

6.5.3.3. Experience: At least three (3) years of experience in shipping, receiving, and inventory control.

6.5.4. Shipping and Receiving Clerk

6.5.4.1. Coordinates the shipping and receiving of materials. Tracks property using automated equipment. Performs and records materials inventory checks.

6.5.4.2. Education: Secondary school graduate.

6.5.4.3. Experience: At least three (3) years of experience in shipping and receiving.

6.5.5. Technical Writer

6.5.5.1. Develops, writes, and edits materials, briefs, proposals, instruction books, and related technical and administrative publications concerned with work methods and procedures for installation, operations and enhancement of equipment. Organises material and compiles writing assignments for clarity, conciseness, style, and terminology. Prepares and edits documentation incorporating information provided by users, and technical and operations staff. Possesses a substantial knowledge of the capabilities of computer systems. Capable of writing, editing, and generating graphic presentations.

6.5.5.2. Education: Bachelor's degree.

6.5.5.3. Experience: At least three (3) years as a technical writer.

6.5.6. Senior Configuration Manager

6.5.6.1. Establishes and maintains a process for tracking the life cycle development of system design, integration, test, training, and support efforts. Maintains continuity of products while ensuring conformity to Purchaser requirements and commercial standards. Establishes configuration control forms and database.

6.5.6.2. Education: Bachelor's degree.

6.5.6.3. Experience: At least five (5) years of experience in specifying configuration management requirements, standards, and evaluation criteria in acquisition documents, and in performing configuration identification, control, status accounting, and audits. At least three years in computer and communication systems development, including physical and functional audits and software evaluation, testing and integration. At least two years of experience with application of configuration management tools.

6.5.7. Intermediate Configuration Manager

6.5.7.1. Maintains a process for tracking the life cycle development of system design, integration, test, training, and support efforts. Maintains continuity of products while ensuring conformity to Purchaser requirements and commercial standards. Maintains configuration control records and databases.

6.5.7.2. Education: Associates degree or two years of technical training.

6.5.7.3. Experience: At least three (3) years of experience in technical system configuration management. At least two years in communication and information systems development, including physical and functional audits and software evaluation, testing and integration.

6.5.8. Junior Configuration Manager

6.5.8.1. Prepares and coordinates change requests, configuration items, and system baselines. Maintains configuration control records and databases.

6.5.8.2. Education: Associates degree or one year of technical training.

6.5.8.3. Experience: At least one (1) year of experience in technical system configuration or document management.

6.5.9. Data Control Specialist

6.5.9.1. Performs assigned portions of managing the data input into complex information systems. Analyses and administers data for both the developing team and the customer. Handles daily administrative tasks, produces and edits technical reports based on data system processing, monitors use of data and performs updates as required. Participates in all phases of system development with emphasis on the data collection, input, documentation, and acceptance phases. Designs and prepares technical reports and related documentation, and makes charts and graphs to record results.

6.5.9.2. Education: Associates degree.

6.5.9.3. Experience: At least three (3) years of experience in administration of configuration management or technical documentation.

6.5.10. Quality Assurance Manager

6.5.10.1. Establishes and maintains process for evaluating software, hardware, and associated documentation. Determines the resources required for quality control. Maintains the level of quality throughout the system life cycle. Develops project quality assurance plans. Conducts formal and informal reviews and audits at predetermined points throughout the system life cycle.

6.5.10.2. Education: Bachelor's degree.

6.5.10.3. Experience: At least twelve (12) years in working with quality control methods and tools. At least five (5) years in supporting development projects of similar size and nature as Quality Assurance Manager.

6.5.11. Quality Assurance Specialist

6.5.11.1. Develops and implements quality standards. Reviews hardware, software, and documentation. Participates in formal and informal reviews to determine quality. Participates in the development of system quality assurance plans. Examines and evaluates design, integration, and test processes and recommends enhancements and modifications.

6.5.11.2. Education: Bachelor's degree.

6.5.11.3. Experience: At least four (4) years of working with quality control methods and tools.

6.6. Training Support

6.6.1. Instructional Systems Designer

6.6.1.1. Conducts the research, necessary to identify training needs based on performance objectives and existing skill sets; prepares training strategies and delivery methodology analyses; and prepares cost/benefit analyses for training facilities and deliverables. Develops training delivery plan, instructional guidelines, and performance standards and assessment mechanisms. Plans and directs the work of training material developers and coordinates activities with system development staff. Supervises the implementation and adaptation of training products to customer requirements.

6.6.1.2. Education: Bachelor's Degree.

6.6.1.3. Experience: At least three (3) years of experience in the design and development of training for information systems and defence systems using an Instructional Systems Design approach such as the Systems Approach to Training, Performance-Based Training, Analysis, Design, Development, Implementation, and Evaluation (ADDIE), or Criterion Referenced Instruction.

6.6.2. Senior Training Materials Developer

6.6.2.1. Conducts the research necessary to develop and revise training courses and prepares training plans. Develops instructor (course outline, background material, and training aids) and student materials (course manuals, workbooks, hand-outs, completion certificates, and course feedback forms). Trains personnel by conducting formal classroom courses, workshops, seminars, and/or computer based/computer-aided training. Provides daily supervision and direction to staff.

6.6.2.2. Education: Bachelor's Degree.

6.6.2.3. Experience: At least five (5) years in the preparation of technical training, including CBT materials.

6.6.3. Training Materials Developer

6.6.3.1. Conducts the research necessary to develop and revise training. Develops training materials (course outline, manuals, workbooks, hand-outs, completion certificates, and course feedback forms).

6.6.3.2. Education: Associates degree.

6.6.3.3. Experience: At least three (3) years of experience in the preparation of technical training materials.

6.6.4. CBT Developer

6.6.4.1. Uses CBT tool to design and implement course flowchart, text, animation, voice, and graphic displays.

6.6.4.2. Education: Bachelor's degree.

6.6.4.3. Experience: At least three years of experience in the preparation of CBT courses.

6.6.5. Senior Instructor

6.6.5.1. Supervises trainers who conduct technical training classes. Conducts training classes. Works closely with Purchaser personnel to determine training and scheduling requirements. Develops and maintains training materials. Reviews and provides inputs for technical documentation.

6.6.5.2. Education: Bachelor Degree.

6.6.5.3. Experience: At least four (4) years of experience in systems administration or operation and at least four (4) years as technical training instructor in defence systems and maritime C2 systems.

6.6.6. Junior Instructor

6.6.6.1. Conducts technical training classes. Prepares and updates training documentation.

6.6.6.2. Education: Bachelor's Degree.

6.6.6.3. Experience: At least four (4) years of experience in systems administration or operation and at least two years as technical training instructor.

6.7. Operational Support

6.7.1. System Administrator

6.7.1.1. Administers systems operations and configuration. Maintains user accounts and profiles. Performs system backup and restoration procedures. Troubleshoots operational problems. Coordinates system configuration and performance issues with central network support staff and Purchaser site personnel.

6.7.1.2. Education: Associates degree or two years of technical training.

6.7.1.3. Experience: At least one (1) year in systems administration of Windows Server systems. At least one year in the administration and operation of X.400 systems.

6.7.2. Network Manager

6.7.2.1. Oversees administration and operation of network and service management applications. Develops and implements operating procedures. Administers upgrades to system support and network management components. Collects operational performance data and performs performance analysis.

6.7.2.2. Education: Associates degree.

6.7.2.3. Experience: At least two (2) years in administration and implementation of SNMP or other system support systems.

6.7.3. Database Administrator

6.7.3.1. Manages network-wide configuration databases. Develops and implements data synchronisation procedures and resolves database discrepancies. Maintains and publishes network configuration tables and indices. Designs and implements queries and other utilities.

6.7.3.2. Education: Associates degree.

6.7.3.3. Experience: At least two (2) years in database administration.

6.7.4. Operational Support Manager

6.7.4.1. Organises, directs and manages operational support activities. Analyses system performance data and prepares reports and assessments. Meets with Purchaser personnel to coordinate support issues and coordinates with system deployment personnel on activation and cut-over. Ensures conformance with Work Package requirements.

6.7.4.2. Education: Bachelor's degree.

6.7.4.3. Experience: At least five (5) years of experience in the administration and operation of a distributed information system.

6.8. Functional Support

6.8.1. Senior Maritime C2 Functional Specialist

6.8.1.1. Provides support in the development of doctrine; operational concepts; requirements; tactics, techniques and procedures; standard operating procedures and other functional documentation. Supports testing and operational validation. Meets with Purchaser personnel to coordinate functional and operational implementation issues. Designs and prepares reports and related documentation.

6.8.1.2. Education: Bachelor's degree.

6.8.1.3. Experience: At least ten (10) years of experience in the Maritime C2 functional area in NATO or a NATO Nation. At least three (3) years in the development of Maritime doctrine; operational concepts; requirements; tactics, techniques and procedures; standard operating procedures and other functional documentation.

6.8.2. Intermediate Maritime C2 Functional Specialist

6.8.2.1. Provides support in the development of doctrine; operational concepts; requirements; tactics, techniques and procedures; standard operating procedures and other functional documentation. Supports testing and operational validation. Meets with Purchaser personnel to coordinate functional and operational implementation issues. Designs and prepares reports and related documentation.

6.8.2.2. Education: Associates degree.

6.8.2.3. Experience: At least five (5) years of experience in the Maritime C2 functional area in NATO or a NATO Nation. At least one year in the development of Maritime doctrine; operational concepts; requirements; tactics, techniques and procedures; standard operating procedures and other functional documentation.

6.8.3. Senior Graphical User Interface Designer

6.8.3.1. Provides support in the development of user interfaces, HMI design; requirements; techniques and other special areas related to usability. Supports testing and operational validation. Meets with Purchaser personnel to coordinate implementation issues. Designs and prepares reports and related documentation.

6.8.3.2. Education: Bachelor's degree.

6.8.3.3. Experience: At least seven (7) years of experience in the C2 functional area in NATO or a NATO Nation. At least three (3) years in the design and development of HMI for C2 systems, operational concepts, requirements, techniques and ergonomics.

6.8.4. Senior Geo-Specialist

6.8.4.1. Provides support in the development of Visualisation Component; geo-concepts; requirements; techniques and other GIS concepts. Supports testing and operational validation. Meets with Purchaser personnel to coordinate implementation issues. Designs and prepares reports and related documentation.

6.8.4.2. Education: Bachelor's degree.

6.8.4.3. Experience: At least seven (7) years of experience in the C2 functional area in NATO or a NATO Nation. At least three years in the development of GIS systems, operational concepts, requirements, techniques and procedures.

6.8.5. Intermediate Geo-Specialist

6.8.5.1. Provides support in the development of Visualisation Component; geo-concepts; requirements; techniques and other GIS concepts. Supports testing and operational validation. Meets with Purchaser personnel to coordinate implementation issues. Designs and prepares reports and related documentation.

6.8.5.2. Education: Associates degree.

6.8.5.3. Experience: At least four (4) years of experience in the C2 functional area in NATO or a NATO Nation. At least three years in the development of GIS systems, operational concepts, requirements, techniques and procedures.

SECTION 7: CONTRACT DOCUMENTATION REQUIREMENTS

7.1. General

7.1.1. All documentation provided to the Purchaser shall be written in English with spelling and usage based on the Concise Oxford English Dictionary, 12th Edition.

7.1.2. All documentation deliverables must be "stand-alone" with no dependence on other documentation or applications in the Contractor's environment for its comprehension. Likewise if there are hyperlinks to other areas of the Contractor environment, they must be fully available.

7.1.3. Documents shall not be marked with corporate logos or contain warnings limiting the rights to use or reproduction.

7.1.4. The document formats and templates shall be subject to Purchaser's approval. The Purchaser's templates shall be used as applicable.

7.1.5. As a general principle, one subject shall be described in one document, supporting traceability and maintainability.

7.1.6. Individual documents shall not contain repeated information such as system overview. Top level documents will describe such common information whereas lower level documents refer to them.

7.1.7. Documents shall be complete, concise and sufficiently detailed for its purpose. However, excessive details (e.g. source code level descriptions).

7.1.8. Document maintainability, including figures and drawings, shall be favoured. If figures are not embedded into the same file, a separate file including the drawings in the same order as they are used in the document shall be provided.

7.1.9. All delivered documentation may be subject to review by the Purchaser's IV&V Contractor as well as Purchaser's Project Team.

7.1.10. The security classification of the documentation shall follow agreed NATO security guidelines. Documentation developed under this project shall have its security classification shown on each page, top and bottom.

7.1.11. It is expected that none of the technical documentation requires a higher classification than NATO UNCLASSIFIED.

7.1.12. The convention to be used for numbers appearing in textual documents is for a comma to be the thousands separator and a period to be the decimal separator (e.g. 1,365,276.24).

7.1.13. The convention to be used for dates appearing in free text (e.g. quoting dates of meetings) is "day-month-year" and not "month-day-year" (e 6-4-2015 or 6 April 2015).

7.2. Documentation

7.2.1. The Contractor shall provide documentation related to the life cycle of TRITON including its development and operation.

7.2.2. Development Documents

7.2.2.1. The Contractor shall provide the development documentation as defined in the System Development Processes described in this SOW.

7.2.3. Operating Documentation

7.2.3.1. Documentation related to operating and maintenance of TRITON will cover how to use the TRITON functionality in support of the C2 of Maritime Operations, how to install and configure TRITON for static and afloat sites, how to provide its security and how to maintain the software and hardware.

7.2.3.2. The Contractor shall deliver the Operating Documentation to be used by TRITON operational users and administrators as specified in the Contractual SRS, Paragraph 4.8.2.

7.2.3.3. The Operating Documentation shall include at least the following:

- System User Manual (SUM)
- Quick User Guide (QUG)
- Briefing Manual
- System Administrator Manual (SAM)

7.2.3.4. The Contractor shall develop and maintain the Operating Documentation based on the ABL and PBL and shall describe the complete system by the explanation of functional blocks, components and system elements.

7.2.3.5. The Contractor shall make all Operating Documentation available as a printable document, printed hard copy and as an on-line source.

7.2.4. Reports

7.2.4.1. For all reports delivered under this Contract, the Contractor shall ensure the following standards are met:

7.2.4.1.1. The report shall be candid, forthright and complete.

7.2.4.1.2. The report shall contain only material that can be supported by evidence and confirmed by independent analysis.

7.2.4.1.3. The report shall provide evidence to support or justify the conclusions reached.

7.2.4.1.4. The report shall be concise. If necessary, supporting data should be placed in appendices or referenced as backup material.

7.2.4.1.5. The report shall include an Executive Summary of not more than one page in length.

7.2.4.1.6. The report shall use charts, graphs, matrices, tables, and other illustrative techniques to present data in an easily-understood form. Each illustration should be accompanied with a narrative showing how the data displayed is relevant to the process improvement.

7.3. Formats

7.3.1. Unless otherwise directed by the Purchaser, the Contractor shall furnish requested documentation as follows:

7.3.1.1. All contractual documentation (e.g. change proposals, invoices, etc.) shall be delivered in both paper and electronic format.

7.3.1.2. All project management documentation (e.g. plans, schedules, reports, etc.) shall be delivered as electronic copies in MS Office.

7.3.1.3. The rest of the deliverables shall be furnished as an electronic copy in a format which is best suited for review and maintenance by the Purchaser (e.g. Project Master Schedule in MS Project format, Project Highlight Reports in MS Word).

7.3.1.4. The Contractor shall use the same MS Office version as the Purchaser is using.

7.3.1.5. In general the following guidelines shall be used:

- MS Word for generating text documents
- MS Excel for tabular or matrix data
- MS Visio or MS PowerPoint for drawings
- MS Project for schedule
- MS PowerPoint for briefings.

7.3.1.6. Drawing files shall be provided together with the text documents.

7.3.1.7. The final versions of documents shall be converted into PDF file.

7.3.1.8. The rest of the deliverables shall be furnished as electronic copy of the agreed tools/media used.

7.3.1.9. Documentation shall be distributed as follows:

- One paper and electronic copy to the Purchaser's Project Manager.
- One paper and electronic copy to the identified IV&V Contractor.
- An electronic copy (MS Office file, drawing file and PDF file) to the Project Website.

7.3.1.10. Each document shall contain the following information for identification:

- Version of the document and version history
- Due date
- Delivery date
- CLIN number
- Status (e.g. Accepted/Approved/Draft).

7.4. Document Reviews

7.4.1. The Contractor shall submit all documentation for Purchaser review as described below. At each review cycle, the Purchaser will state if the document is likely to be accepted in its Final version.

7.4.2. During the development of a document, the Contractor may be required to provide subsequent versions of the documents (starting with version 0.1) for the Purchaser review.

7.4.3. The Contractor shall review any sub-contractor documents before submitting for Purchaser's formal review.

7.4.4. The Contractor shall provide the last Draft version (identified as version 0.9) of each deliverable for Purchaser review.

7.4.5. If the review is organized within a Build Process, the Contractor shall provide documents for the review at least two (2) weeks before the review date, and four (4) weeks otherwise, unless specified differently in the Work Package or SSS.

7.4.6. Attached to the documents to be reviewed, the Contractor shall send the invitation, including:

- Agenda
- List of Participant
- Date, time, location of the review

7.4.7. The Purchaser will provide comments, corrections, and suggested changes to the Contractor within two (2) weeks of receipt for deliverables being submitted part of the Build Process and four (4) weeks otherwise. The reports or other time-bounded documents may be reviewed in shorter duration.

7.4.8. The Contractor shall not rely on the Purchaser review process to fill in deficiencies or obtain missing parts from Purchaser.

7.4.9. In order to gain time, partial review may be applied for long documents.

7.4.10. The Purchaser will inform the Contractor about each delivery of document(s) with the state "Accepted" for internal review. The acceptance date can be used as a delivery date.

7.4.11. The Purchaser may "Reject" a document without competing a review if it is deemed to have significant deficiencies.

7.4.12. The Final version (1.0) shall be substantially complete and correct, and the delivery dates specified in the SSS will assume this.

7.4.13. The Contractor shall provide the Final version (version 1.0) of the document, for approval, within two (2) weeks after the review. The reports or other time-bounded documents may require shorter duration.

7.4.14. The Purchaser may "Approve" the Final version of a document and inform the Contractor. This document shall then be baselined.

7.4.15. Until FSA, the Contractor shall remain responsible for updating all the deliverable documents to reflect all the necessary changes (e.g. updating SDS according to a change implemented during OT&E).

7.4.16. The Contractor or the Purchaser may agree on new approaches and techniques to increase the efficiency of review process.

7.5. Contract Documentation Requirements List

7.5.1. The Contract Documentation Requirements List (CDRL) identifies the documents to be delivered under this Contract and the applicable quality standards by which they will be reviewed for acceptance.

7.5.2. The CDRL for this Contract is provided in Table 7-1. For each item, the table identifies the following:

- Cross-reference to the SOW paragraph requiring the document

- Document title
- Document acceptance requirements, where:
  - "A" (Approve) means the Purchaser must review and approve the initial submission and subsequent changes.
  - "I" (Information) means the item is provided to the Purchaser for information purposes only and the Purchaser will only request changes if it finds errors or omissions.
- Applicable quality standard against which the document will be reviewed for acceptance. If this SOW is the indicated Quality Standard, the term "SOW" is used.

Table 7-1 – Contract Documentation Requirements List

SOW Ref.	Title	Abbrev.	Type	A/I	When	Quality Standard
MANAGEMENT						
3.7	Project Management Plan	PMP	Plan	A	PMR	SOW
3.8	Project Product Breakdown Structure	PPBS	Annex to PMP	A	PMR	SOW
3.9	Project Work Breakdown Structure	PWBS	Annex to PMP	A	PMR	A Guide to the Project Management Body of Knowledge (PMBOK Guide) Practice Standard for Work Breakdown Structures
3.10	Project Master Schedule	PMS	Annex to PMP	A	PMR	SOW
3.12.4	Risk Management Plan	RMP	Plan	A	PMR	SOW
3.13.2	Quality Plan	QP	Plan	A	PMR	AQAP-2110, 2120, 2210
3.17	Project Highlight Report	PHR	Report	I	Monthly	PRINCE2
0	Project Management Review Report	PMR-R	Report	A	After PMR	SOW
3.16.3.6	Project Checkpoint Review Report	PCR-R	Report	I	Monthly	PRINCE2
3.12.6	Issue Register	IReg	Register	I	PMR	PRINCE2
3.12.5	Risk Register	RReg	Register	I	PMR	PRINCE2
3.13.5	Quality Register	QReg	Register	I	PMR	PRINCE2
3.3.8	Lessons Log	LLog	Register	I	PMR	PRINCE2
3.3.8	Lessons Report	LR	Report	I	At each milestone aligned to CP	PRINCE2
3.15	Minutes of Meeting	MoM	Report	A	3 days after meetings	SOW
4.6	System Development Plan	SDP	Plan	A	PMR	SOW
4.6.3	Requirements Implementation Schedule	RIS	Plan Annex to SDP	A	PMR	ISO 9241:2010
4.6.4	Usability Engineering Plan	UEP	Plan Annex to SDP	A	PMR	ISO 13407:1999

SOW Ref.	Title	Abbrev.	Type	A/I	When	Quality Standard
4.6.5	Security Accreditation Plan	SAP	Plan Annex to SDP	A	PMR	AC/35-D/2005-REV3 AC/35-D-1021-REV3
4.12.2	Test Management Plan	TMP	Plan	A	CDR, TRR	SOW
4.12.2.15	Security Test and Verification Plan	STVP	Plan Annex to TMP	A	CDR, TRR	AC/35-D/2005-REV3
4.12.2.16	System Validation Plan	SVP	Plan Annex to TMP	A	CDR, TRR	SOW
5.2	Integrated Support Plan	ISP	Plan	A	PMR, PDR, CDR, SQR	SOW
5.9.2	Transportation Plan	TransP	Plan Annex to ISP	A	CDR	SOW
5.10.7.3	Warranty Report	WR	Report	A	FSA	SOW
CONFIGURATION MANAGEMENT						
4.7.5	Configuration Management Plan	CMP	Plan	A	PMR	STANAG-4427
4.7.11.4	Configuration Audit Report	CAuR	Report	A	TRR, SiAR	SOW
SYSTEM REQUIREMENTS ANALYSIS						
4.8.3	System Requirements Specification	SyRS	Specification	A	SRR	AC/35-D/1015-REV3
4.8.5.1	Security Risk Assessment Report	SRA-R	Report	A	SRR	SOW
4.8.6	System Specific Security Requirement Statement	SSRS	Statement	A	SRR	AC/35-D/1015-REV3
4.8.6.1	Community Security Requirement Statement	CSRS	Statement	A	SRR	AC/35-D/1015-REV3
4.8.6.2	System Interconnection Security Requirement Statement	SISRS	Statement	A	SRR	[AC/35-D/1015-REV3
4.8.8.5	System Requirements Review Report	SRR-R	Report	A	After SRR	SOW
SYSTEM DESIGN						
4.9.2	System Design Specification	SDS	Description	A	CDR	IEEE/EIA 12207
4.9.2.16	Requirements Traceability Matrix	RTM	Annex to SDS	A	CDR	SOW

SOW Ref.	Title	Abbrev.	Type	A/I	When	Quality Standard
4.9.2.12	System Security Design Specification	SSDS	Annex to SDS	A	CDR	SOW
4.9.3.7	Preliminary Design Review Report	PDR-R	Report	A	After PDR	SOW
4.9.4.8	Critical Design Review Report	CDR-R	Report	A	After CDR	SOW
SOFTWARE IMPLEMENTATION						
4.10.2.4.4	Software Requirements Specification	SRS	Specification	A	SwRR	IEEE/EIA 12207
4.10.2.5.5	Software Architecture Description	SAD	Description	A	SwDR	IEEE/EIA 12207
4.10.2.6.6	Software Design Description	SDD	Description	I	SwDR	IEEE/EIA 12207
4.10.2.5.6	Database Design Description	DDD	Description	I	SwDR	IEEE/EIA 12207
4.9.2.16	Requirements Traceability Matrix	RTM	Annex to SDS	I	SwDR	SOW
4.9.2.17	TRITON Interface Control Description (NS and NU)	ICD	Description	A	CDR, SwDR-1,2,3	SOW
4.10.2.11	Software Version Description	SVD	Description	A	After each release	SOW
4.10.2.4.6.4	Software Requirements Review Report	SwRR-R	Report	A	After SwRR	SOW
4.10.2.6.8.4	Software Design Review Report	SwDR-R	Report	A	After SwDR	SOW
4.10.2.9.2	Software Test Description	STD	Description	I	TRR	SOW
4.10.2.9.3	Internal System Test Report	IST-R	Report	A	TRR	SOW
4.10.2.7.5	Source Code Review Report	SCR-R	Report	A	TRR	SOW
4.12.12.2	Security Test and Evaluation Report	ST&E-R	Report	A	TRR	SOW
HARDWARE IMPLEMENTATION						
4.10.3.2.2	Hardware Requirements Specification	HRS	Specification	A	HwRR	SOW
4.10.3.3.2	Hardware Design Description	HDD	Description	A	HwDR	SOW
4.9.2.17	TDK Interface Control Description	ICD	Description	A	HwDR, SwDR-4	SOW
4.10.3.6.2.4	First Article Acceptance Test Procedure	FAAT-P	Procedure	A	FAAT	SOW
4.10.3.8.2	Hardware Factory Acceptance Test Procedure	HwFAT-P	Procedure	A	HwTRR	SOW

SOW Ref.	Title	Abbrev.	Type	A/I	When	Quality Standard
4.10.3.2.3	Hardware Requirements Review Report	HwRR-R	Report	A	After HwRR	SOW
4.10.3.3.4	Hardware Design Review Report	HwDR-R	Report	A	After HwDR	SOW
4.10.3.7.1	Production Readiness Review Report	PRR-R	Report	A	After PRR	SOW
4.10.3.8.1	Hardware Test Readiness Review Report	HwTRR-R	Report	A	Before HwTRR	SOW
4.10.3.8.3	Sea Acceptance Test Procedure	SeAT-P	Procedure	A	Before SeAT	SOW
4.10.3.8.3.5	Sea Acceptance Test Report	SeAT-R	Report	A	After SeAT	SOW
SYSTEM INTEGRATION						
4.12.5	Test Readiness Review Report	TRR-R	Report	A	After TRR	SOW
4.12.4	Factory Acceptance Test Procedure	FAT-P	Procedure	A	Before each TRR	SOW
4.12.12.3	System Integration Test Procedure	SIT-P	Procedure	A	TRR	SOW
SYSTEM VERIFICATION						
4.12.12.2.5	Security Operating Procedures	SecOp	Procedure	A	TRR	AC/35-D/1014-REV2
4.12.12.2.6	Security Implementation Verification Procedures	SIVP	Procedure	A	TRR	SOW
4.12.12.5.5	User Assessment Test Procedure	UAT-P	Procedure	A	TRR	SOW
4.12.12.4.6	System Supportability and Maintenance Acceptance Test Procedure	SSMAT-P	Procedure	A	TRR	SOW
4.12.12.4.11	System Supportability and Maintenance Acceptance Test Report	SSMAT-R	Report	A	After SSMAT	SOW
4.12.12.6	Regression Test Procedure	RegT-P	Procedure	A	Before RegT	SOW
4.12.13.3	System Verification Review Report	SVerR-R	Report	A	After SVerR	SOW
SYSTEM TRANSITION						
4.13.2	System Transition Plan	STrP	Plan	A	CDR	SOW, AAP-48
4.12.12.4.3	Software Installation Guide	SIG	Manual	A	TRR	SOW, SRS
4.13.3.8	Site Survey Report	SiSR	Report	A	After Site Survey	SOW

SOW Ref.	Title	Abbrev.	Type	A/I	When	Quality Standard
5.6.6.3	Release and Deployment Plan	RDP	Plan	A	SQR	SOW
5.8.3	Training Plan	TrP	Plan	A	CDR, TrRR	SOW
5.8.4	Training Programme	TrPrg	Included in TrP	A	TrRR	SOW
5.8.2	Training Needs Analysis Report	TNA-R	Report	A	After TNA	SOW
5.8.4.7	Training Materials			A	TrRR	SOW
5.8.12	Training Course Evaluation Reports	TCER	Report	A	One week after each training	SOW
5.8.1.1	System User Manual Quick User Guide Briefing Manual System Administrator Manual	SUM	Manuals	I	TRR, SQR	SOW, SRS
4.13.4	Sustainment Qualification Review Report	SQR-R	Report	A	After SQR	SOW
4.13.6.1	Pre-Installation Check Procedure	PIC-P	Procedure	A	SQR	SOW
4.13.6.6	Site Activation Test Procedure	SiAT-P	Procedure	A	SQR	SOW
4.13.6.7.15	On-site UAT Report	UAT-R	Report	A	After On-site UAT	SOW
4.13.6.7.7	Organizational Node Activation Review Report	ONAR-R	Report	A	After each activation	SOW
4.13.6.9	Software Distribution List	SWDL	List	A	SQR	SOW
4.13.8.2	Site Acceptance Review Report	SiAR-R	Report	A	After each SiAR	SOW
4.13.9	Operational Test Readiness Review Report	OTRR-R	Report	A	After OTRR	SOW
4.13.11	Multi-Site Operation Test Procedure	MSOT-P	Procedure	A	Before the last SiAR	SOW
4.13.11.7	Multi-Site Operation Test Report	MSOT-R	Report	A	After MSOT	SOW
4.15.6.4	System Transition Readiness Review Report	STRR-R	Report	A	After STR	SOW
SYSTEM VALIDATION						
4.14.3	System Validation Test Procedure	SVT-P	Procedure	A	OTRR-2	

SOW Ref.	Title	Abbrev.	Type	A/I	When	Quality Standard
4.14.4.5	System Validation Test Report	SVT-R	Report	A	After SVT	SOW
4.14.6.6	System Validation Review Report	SVR-R	Report	A	After SVR	SOW
4.14.7.3	Final System Acceptance Report	FSA-R	Report	A	After FSA	SOW
SYSTEM OPERATION						
5.3, 5.11.1.4	In-Service Support Plan	ISSP	Plan	A	Before PSA	SOW
4.14.2.5	Operational Testing and Evaluation Report	OTER	Report	A	Before FSA	SOW
4.7.9	Deficiency Report	DR	Report	I	Anytime	SOW
SYSTEM MAINTENANCE						
5.3.2	System Maintenance Plan	SMP	Plan	A	SQR-2 and FSA	SOW
5.3.3	Obsolescence Management Plan	OMP	Plan (Annex to ISSP)	A	SQR-2 and FSA	SOW
4.16.3.3	Monthly Maintenance Review Report	MMR-R	Report	A	Monthly	SOW
5.4.4	System Maintenance Manuals (Software Maintenance Manual, Hardware Maintenance Manual)	SMM	Manual	A	SQR-2 and FSA	SOW
SOFTWARE TRANSITION						
4.17.2	Software Transition Plan	SwTrP	Plan	A	PSA	SOW
4.17.3.6	Computer Programming Manual	CPM	Manual	A	Before SwTrRR	SOW
4.17.4	Software Transition Readiness Review Report	SwTrRR-R	Report	A	SwTRR	SOW
4.17.6	Software Transition Readiness Test Report	SwTrVT-R	Report	A	SwTRVT	SOW
4.17.7	Software Transition Validation Review Report	SwTrVR-R	Report	A	SwTRVT	SOW

NATO Communications and Information Agency
Agence OTAN d'information et de communication

IFB-CO-13859-TRITON

FUNCTIONAL SERVICES FOR COMMAND AND CONTROL OF MARITIME OPERATIONS (TRITON)

INCREMENT 1

PROJECT SERIAL 2011/0IS03081

BOOK II – PART IV SOW ANNEX A

SYSTEM REQUIREMENTS SPECIFICATION (SRS)

Version 1.0

April 2016

Document History

Edition	Date	Description
1.0	20/04/2016	Release for IFB

Table of Contents

1. INTRODUCTION

1.1. Document Purpose

This System Requirement Specification (SRS) describes the external behaviour of the services to be delivered under the Maritime Command and Control Information Services (short name: TRITON) Project. It also describes non-functional requirements, design constraints, and other factors necessary to provide a comprehensive description of the requirements for the Functional Service.

1.2. Content

"Project TRITON" is the name given to all implementation activities associated with the delivery of services in support of Maritime Command and Control contained within the Bi-Strategic Command Capability Package 9C0107 “Functional Services for Command & Control of Operations”. The name "TRITON" was chosen by Allied Command Transformation (ACT) and the NCI Agency (former NC3A) in 2009 to simplify the way in which the acquisition activities associated with this project are described.

The full scope of capabilities will be achieved through an incremental approach. The **TRITON Increment 1 Project**, authorised as an NSIP project with code 2011/0IS03081, will deliver services to provide the users with Maritime Capabilities primarily the Maritime Situational Awareness (MSA) to replace the existing MSA Operational Prototype (MSA/BRITE) as well as to provide for a replacement of Maritime Command and Control Information System (MCCIS) functionality at the operational headquarters and centres. There will be other Increments in the future to support the Planning and Execution services for supporting C2 of maritime operations as the Maritime Headquarters.

This SRS covers the scope of the Project TRITON Increment 1 only. This SRS, as stored in the requirement management tool (DOORS), contains the currently identified set of requirements for the Project TRITON Increment 1.

The acronym "SRS" will be replaced with "SyRS" during the Contract execution.

1.3. Document Overview

This document consists of 5 sections:

- Section 1 provides an introduction and the use of this document.
- Section 2 gives a list of references used in the document.
- Section 3 provides a general description of TRITON as a product.
- Section 4 contains the functional requirements comprising the required functionality and their associated requirement attributes.
- Section 5 contains non-functional requirements.
- Section 6 provides the interface requirements.

1.4. Abbreviations, Acronyms and Definitions

Commonly used abbreviations, acronyms and definitions are given in Annex-D of the SOW.

1.5. Common Definitions

Organizational Node:

An Organizational Node provides an integrated set of TRITON functionality and a virtual repository for NATO Headquarters or Centres. An Organizational Node provides a logical structuring of users, functionality and information, and may be independent of the physical node structure (e.g. a physical node may support more than one Organizational Node).

User:

A User is an authenticated, standard user of TRITON who can access general functions on a particular type of information object (e.g. Track, Vessel Information, Person Data), usually with read-only privileges, based on assigned roles.

Authorised User:

An Authorised User is an authenticated, privileged user of TRITON who is authorised to perform a management (e.g. create, read, modify, approve, release, delete) on a particular type of information object (e.g. Track, Vessel Information, Person Data) based on assigned roles and privileges. A single user or a role or a user group can be designated as authorised user.

Information Product:

An Information Product is specific C2 information approved by the authorised user and represented as a data entity or a document by TRITON. An ADatP-3 Formatted Message is an example.

Information Object:

An Information Object is any kind of information flowing within the modules of TRITON.

Maritime Information Entity:

A Maritime Information Entity is a collection of Maritime Information Elements which holds the actual operational content, Information Products or Information Objects.

Classification:

NATO information falls into three categories:

- Classified
- Unclassified (within NATO, the marking UNCLASSIFIED, combined with an ownership marking, indicates that the information does not require security protection but is to be used for official purposes. The combined marking constitutes a proprietary marking and carries no security connotation).
- Public.

All NATO classified and unclassified information should carry a marking indicating its classification. Selection of the correct classification level is based upon the definitions and guidance provided by NATO Security Policy with regard to classified information and by the Policy on the Management of NATO non-Classified Information [C-M(2002)60] with regard to unclassified information.

Classification Markings:

NATO Security Policy [C-M(2002)49] requires that access to and release of NATO classified information be controlled. NATO classified information should be clearly marked to identify the required level of protection and to indicate releasability where appropriate. The available classification markings for TRITON are given below (The words are shortened for this document only):

- NATO UNCLASSIFIED (NU)
- NATO RESTRCTD (NR)
- NATO CONFIDNTL (NC)
- NATO SECRT (NS)
- UNCLASSIFIED (UC)
- RESTRCTD
- CONFIDNTL
- SECRT

The markings to be applied to NATO information are composed of four elements which have a specific purpose and an appropriate usage:

- Ownership

- Classification
- Releasability/Dissemination Limitation
- Administrative/Category.

In addition, data exchanged between differing security classifications needs to be labelled.

Client:

A user environment which consists of a workstation, operating system with a Web browser.

Server:

A computation environment on a virtualised platform.

TRITON Client:

The TRITON User Applications and Visualisation Capability running in Web Browsers on a Standard NATO Bi-SC AIS Workstation.

TRITON Server:

The standard NATO Bi-SC AIS virtualised server environment for TRITON which consists of Application Server, management and security software, and data storage.

Recognised File Formats:

TRITON will be able export and import data using files with recognised format. These format are defined here to provide reference for the requirements in this SRS. Following formats are identified:

Recognised Graphics File Format:

- Joint Photographic Experts Group, JPG/JPEG [ISO/IEC 10918]
- Portable Network Graphics (PNG) [RFC 2083]
- Graphics Interchange Format (GIF) [GIF]
- Bitmap (BMP)

Recognised Import File Format:

- Office Open XML Workbook (xlsx) [ISO/IEC 29500]
- Comma-Separated Value (csv) [ISO/IEC 29500]
- Extensible Markup Language (XML) [XML]

Recognised Export File Formats:

- Office Open XML Workbook (xlsx) [ISO/IEC 29500]
- Office Open XML Presentation (pptx) [ISO/IEC 29500]
- csv
- XML
- Portable Document Format (PDF) [ISO 32000-1]
- Image files in Recognised Graphics File Format.

1.6. SRS Conventions

This SRS is structured to functionally decompose the system into several layers. Each function is defined with a set of Heading, Description and Requirements. These terms are also used as Object Type in the Requirements Management Tool.

1.6.1. Heading

Each level of function has its own Heading with a brief Description. The lowest level of Headings contains the applicable Requirements.

1.6.2. Description

Each Heading is followed by a Description which includes descriptive text, definitions, explanatory diagrams, figures and examples. The text explains the key functionality and gives the definitions of specific terms used in the requirements. The diagrams used in this SRS are for illustrative purposes. The descriptive text will be used to refine the system-level requirements into relevant software or hardware requirements during the System Requirements Analysis Phase. The information given in the Description is complementary to the information given in the requirements. They are used to amplify the requirement statement.

1.6.3. Requirement

Each requirement addresses only one function or sub-function where that function and the relevant key terms are defined in the Description. Although the use cases and definition of terms are not repeated inside a requirement statement, it must be accepted that the requirement is bound to the functionality explained in the Description and the definition of the terms explicitly defined (a name or a term explained in the Description).

The requirements are individually identified by a unique number which are used at all times as the specific reference for each.

Types of Requirements:

The use of "shall", "should" and "will" in requirement statements is defined as follows:

- **Shall**: This requirement is mandatory and must be implemented.
- **Should**: This requirement is not mandatory; but in case several options are available, this one is the preferred solution. If it fits into the budget the implementation is highly desired.
- **Will**: This requirement is neither mandatory nor optional for this Increment, but will be mandatory in future Increments. As such it should be considered in design and architecture solutions of the current Increment as well.

User:

If a requirement indicates a user interaction, it also tells about the type of user. There may be as many users as needed. However, since the system interacts with only one person at a time, the definite article "the" is used. The user types referred in the requirements are defined below:

- **The user:** "The user" implies a person who is already authenticated to use the system with general read-only access rights. For example, "General TRITON User" is a role which can only view the RMP without applying any change on it.
- **The authorised user: "**The authorised user" implies a person who is already authenticated to use the system with special privileges. For example, "RMP Manager" is a role having all access rights to modify the RMP, but not the Operation Plan. System Administrator is another type of authorised user who can manage the system at low level.

User Interaction:

System requirements are stated from the perspective of both the system and the user. A requirement with the phrase "TRITON shall ..." means that the system must perform a certain function described inthe requirement. A requirement with the phrase "TRITON shall allow the user to ..." means that the a user interaction (e.g GUI window) is necessary to invoke a functionality and view the output.

Requirement Properties:

Each requirement has the Purchaser-filled properties (attributes) to emphasise its implementation. These are given below:

- Object Type : Requirement
- **Domain for Static** **:** NS / NU / Both / Not Applicable

- **Domain for Afloat** : NS / NU / Both / Not Applicable
- **Baseline** : BL 1 / BL 2 / BL 3 / BL 4
- **Qualification Method** : Test / Demonstration / Analysis / Inspection
- **Comment** : An explanation or clarification for a requirement.

1.7. Qualification Provisions

The requirements will be verified through qualification, herein defined as an endorsement with a guarantee and supporting documentation that the item being qualified satisfies the specified requirement(s). Each requirement is annotated with the method(s) to be used. The basic Qualification Methods are described in the following paragraphs. Further verification methods may also be used if necessary.

Note: In some cases, more than one verification method might be required in order to verify fulfilment of a requirement.

1.7.1. Test

Test (or testing) is the operation of the system/services, or a part of it, under controlled and specified real or simulated conditions, generally using instrumentation, other special test equipment or specific test patterns to collect data for later analysis. This verification method usually requires recorded results to verify that the requirements have been satisfied. Input data and results are provided in the test procedures.

1.7.2. Demonstration

The operation of the system, or a part of the system/services, that relies on observable functional operation not requiring the use of instrumentation, special test equipment, or subsequent analysis. It is a qualitative exhibition of functional performance, usually accomplished with no or minimal instrumentation or test equipment.

1.7.3. Analysis

Analysis is the review and processing of design products (documentation, drawings, presentations, etc.) or accumulated data obtained from other qualification methods, such as manufacturer's tests of a product to be mass-produced, to verify that the system/component design meets required design criteria. It may use analytical data or simulations under defined conditions to show theoretical compliance. Modelling and simulation may be used.

1.7.4. Inspection

Inspection is an examination of the item against applicable documentation to confirm compliance with requirements. It is the visual examination of a hardware item and associated descriptive documentation. Verification is based on the human senses (sight, touch) or other means that use simple measurement and handling methods. No stimulus is necessary. Passive resources such as metre rule or gauge may be used. For software, traceable documentation and code inspection can be used.

For Non-Developmental Items (NDI), Modified NDI and Developmental Items, hardware inspection is used to determine if physical constraints are met, and hardware and/or software, inspection is used to determine if physical quantity lists are met.

2. REFERENCES

This section provides as list of references used in the document. The abbreviated document titles given in square brackets "[…]" are used to refer to documents in this list.

2.1. STANAGs

[STANAG 1059] STANAG 1059 Letter Codes for Geographical Entities (NU)

[STANAG 1177] STANAG 1177 Dormant Q Message Publications - AHP-7(B), Ed.5, 2011 (NU)

[STANAG 1241] STANAG 1241 NATO Standard Identity Description Structure for Tactical Use (NU)

[STANAG 2019] STANAG 2019 Joint Symbology - APP-6(C), Edition 6, 24 May 2011 (NU)

[STANAG 2211] STANAG 2211 IGEO (Edition 6) Geodetic Datums, Projections, Grids and Grid References, 16 May 2001 (NU)

[STANAG 2586] STANAG 2586 NATO Geospatial Metadata Profile, 2013 (NU)

[STANAG 3809] STANAG 3809 Digital Terrain Elevation Data (DTED) Exchange Format Ed.4 2004 (NU)

[STANAG 4668] STANAG 4668 Warship - Automatic Identification System (W-AIS) Ed.2 (NU)

[STANAG 4669] STANAG 4669 Automatic Identification System (AIS) on Warships Ed.2 (NU)

[STANAG 5511] STANAG 5511 Tactical Data Exchange - Link 11/11B (NU)

[STANAG 5516] STANAG 5516 Tactical Data Exchange - Link 16 (NU)

[STANAG 5522] STANAG 5522 Tactical Data Exchange - Link 22 (NU)

[STANAG 5500] STANAG 5500 Concept of NATO Message Text Formatting System (CONFORMETS) ADatP-3, Ed.7, 2 November 2010 (NU)

[STANAG 7074] STANAG 7074 Digital Geographic Information Exchange Standard (NU)

[STANAG 7149] STANAG 7149 NATO Message Catalogue - APP-11(D), Edition 6, 25 March 2015 (NU)

[STANAG 7170] STANAG 7170 Additional Military Layers (AML) – Digital Geospatial Data Products, 2010 (NU)

2.2. Allied Publications

[AAP-6] AAP-6 Ed.2014 Ver.1, NATO Glossary of Terms and Definitions (NU)

[ACP-133] ACP-133 Allied Directory Services

[ACP-200] ACP-200 (D) Vol 2 Maritime and Mobile Tactical Wide Area Networking (MTWAN) Technical Guidance, March 2015 (NU)

[ADatP-3] ADatP-3 (A) NATO Message Text Formatting System (FORMETS) Concept of FORMETS (NU)

[ADatP-34] ADatP-34 NATO Interoperability Standards and Profiles (NISP) (NU)

[ADatP-4774] ADatP-4774 Confidentiality Metadata Label Syntax, Ed. A, February 2016 (NU)

[ADatP-4778] ADatP-4778 Metadata Binding Mechanism for Information Sharing, Ed.A, February 2015 (NU)

[AHP-7] AHP-7 Volumes - Dormant "Q" Message Publications (NS)

[AJP 3.1] AJP 3.1 Allied Joint Maritime Operations (NU)

[APP-6] APP-6 (C) NATO Joint Military Symbology, 24 May 2011 (NU)

[APP-11] APP-11 (D) NATO Message Catalogue, 1 December 2015 (NU)

[APP-15] APP-15 Ed.A, Ver.1 NATO Information Exchange Requirement Specification Process, June 2013 (NU)

[APP-20] APP-20 Ed. A Ver.2 Standard Ship Designator System (NU)

[ATP-01] ATP-01 Allied Maritime Tactical Instructions and Procedures (NC)

[ATP-2] ATP-2 Vol.II Naval Cooperation and Guidance for Shipping (NCAGS) Manual (NU)

[ATP-18] ATP-18 (G) (Navy) - Allied Submarine Operations (NC)

[AUIDP-1] AUIDP-1 NATO Guidance on Unique Identification (UID) of Items, July 2010 (NU)

2.3. Bi-SC Documents

[AFPL] AFPL - Approved Fielded Product List (NU)

[Bi-SCD 75-2] Bi-SC Directive 75-2, "Education, Training, Exercise and Evaluation Directive (ETEED)", 18 February 2010 (NU)

[Bi-SCD 75-7] Bi-SC Directive 75-7, "Education & Individual Training (E&IT)", 10 September 2015 (NU)

2.4. Military Committee Documents

[MC0367/2] MC 0367/2 NATO Maritime Surveillance and Coordination Concept, 20 August 2013 (NR)

[MC0195/9] MC 0195/9 NATO Minimum Interoperability Fitting Standards for Communications and Information Systems (CIS) Equipment Onboard Maritime Platforms, 6 March 2012 (NR)

[MC458/2] MC 458-02, NATO Training, Exercise and Evaluation Policy, 28 July 2009 (NU)

[MC0593] MC 0593, Minimum Level of Command and Control (C2) Service Capabilities in Support of Combined Joint NATO Led Operations, 20 February 2015 (NU)

[MCM0106] MCM-0106-2014 NATO Federated Mission Networking Implementation Plan v3.0, 08 July 2014 (NU)

2.5. Other NATO Documents

2.5.1. Security

[C-M (2002)49] North Atlantic Council, “Security within the North Atlantic Treaty Organization”, 17 June 2002 (NU)

[ACO-70-1] ACO Security Directive 70-1, 25 March 2009 (NU)

[AC/35-D/2004-REV3]

NSC/NC3B, “Primary Directive on CIS Security”, 15 November 2015 (NU)

[AC/35-D/2005-REV3]

NSC/NC3B, “Management Directive on CIS Security”, 12 October 2015 (NU)

[AC/35-D/1014-REV2]

Guidelines for the Structure and Content of Security Operating Procedures (SecOps) for Communication and Information Systems (CIS), 19 October 2006 (NU)

[AC/35-D-1015-REV3]

Guidelines for the Development of Security Requirement Statements (SRS), 31 January 2012 (NR)

[AC/35-D-1021-REV3]

Guidelines for the Security Approval or Security Accreditation of Communication and Information Systems (CIS), 31 January 2012 (NR)

[AC/322-D(2004)0019]

INFOSEC Technical and Implementation Guidance for the Protection of CIS from Malicious Software, 9 March 2004 (NU)

[AC/322-D(2004)0024]

NATO Public Key Infrastructure (NPKI) Certificate Policy (CertP) Rev.2, 18 January 2008 (NU)

NATO Public Key Infrastructure (NPKI) Certificate Policy (CertP) Rev.2 Add.1, 10 November 2009 (NU)

[AC/322-D(2004)0030]

INFOSEC Technical and Implementation Directive on the requirement for, and the selection, approval and implementation of, Security Tools (ST), 17 May 2004 (NR)

[AC/322-D/0030] AC/322-D/0030-REV5 - INFOSEC Technical and Implementation Directive for the Interconnection of CIS (NR)

[AC/324-D(2014)0008]

AC/324-D(2014)0008 - Archives Committee, Directive on the Preservation of NATO Digital Information of Permanent Value

[AM-86-1-1] AM-86-1-1 ACO Manual Number 86-1-1, ACO CIMIC Tactics, Techniques and Procedures (NU)

2.5.2. Interface Descriptions

[CBRN-FS ICD] To be defined.

[Core GIS SIP] NCI Agency Technical Instruction, AI TECH 06.02.14 Service Interface Profile for Geospatial Services - Map Rendering Service, 2016 (NU)

[ENV-FS ICD] To be defined.

[INTEL-FS ICD] Interface Control Document for the INTEL-FS Project, Ver. 1.1 (NU)

[JOCWatch ICD] NATO C3 Agency JOCWatch OIR Web Services Specification Operations Incident Reporting Standard Model Ver. 1.0, September 2011 (NU)

[NCIA-06.02.01] NCI Agency Instruction, INSTR TECH 06.02.01 Service Interface Profile for Security Services, 4 February 2015 (NU)

[NCIA-06.02.02] NCI Agency Instruction, INSTR TECH 06.02.02 Service Interface Profile for REST Security Services, 4 February 2015 (NU)

[NCIA-06.02.03] NCI Agency Instruction, INSTR TECH 06.02.03 Service Interface Profile for Security Token Services, 4 February 2015 (NU)

[NCIA-06.02.04] NCI Agency Instruction, INSTR TECH 06.02.04 Service Interface Profile for Policy Enforcement Points, 4 February 2015 (NU)

[NCIA-06.02.05] NCI Agency Instruction, INSTR TECH 06.02.05 Service Interface Profile for Enterprise Directory Services, 4 February 2015 (NU)

[NCIA-06.02.06] NCI Agency Instruction, INSTR TECH 06.02.06 Service Interface Profile for Messaging, 4 February 2015 (NU)

[NCIA-06.02.07] NCI Agency Instruction, INSTR TECH 06.02.07 Service Interface Profile for REST Messaging, 4 February 2015 (NU)

[NCIA-06.02.08] NCI Agency Instruction, INSTR TECH 06.02.08 Service Interface Profile for Publish-Subscribe Services, 4 February 2015 (NU)

[NCIA-06.02.09] NCI Agency Instruction, INSTR TECH 06.02.09 Service Interface Profile for a Publish-Subscribe Notification Broker with Subscription Manager, 4 February 2015 (NU)

[NCIA-06.02.10] NCI Agency Instruction, INSTR TECH 06.02.10 Service Interface Profile for a Publish-Subscribe Notification Consumer, 4 February 2015 (NU)

[NCIA-06.02.11] NCI Agency Instruction, INSTR TECH 06.02.10 Service Interface Profile for a Notification Cache Service, 4 February 2015 (NU)

[NCOP ICD] Interface Control Document for the NCOP Project, Ver. 1.4 (NU)

[NIRIS ICD] NIRIS Java API Specification, Ver. 0.2 (NU)

NIRIS Streaming ICD, Ver. 0.2 (NU)

NIRIS TITO SDK Ver. 3.7.0 (NU)

[NVG] NATO Vector Graphics (NVG) Ver. 2.0, November 2012 (NU)

2.5.3. Architecture

[AC/322-D(2004)039]

North Atlantic Council Document AC/322-D(2004)039, “NATO C3 Systems Interoperability Policy”, 13 September 2004 (NU)

[AC/322-D(2006)0007]

North Atlantic Council Document AC/322-D(2006)0007, “Guidance on the use of Metadata Element Descriptions for Use in the NATO Discovery Metadata Specification (NDMS)”, 14 February 2006 (NU)

[AC/322-D(2014)0010]

North Atlantic Council Document AC/322-D(2014)0010, “NATO Core Metadata Specification (NCMS)”, 18 December 2014 (NU)

[AC/322-D/0033]

North Atlantic Council Document AC/322-D/0033, “NATO Training Concept for Communications and Information Systems”, 26 October 2000 (NU)

[AC/322-D(2005)0037]

North Atlantic Council Document AC/322-D(2005)0037, “Bi-SC AIS Reference Architecture (RA), Version 2”, 27 September 2005 (NR)

[AC/322-D(2007)0048]

North Atlantic Council Document AC/322-D(2007)0048, “NATO Architecture Framework Version 3”, 23 November 2007 (NU)

[AC/322-D(2005)0053]

North Atlantic Council Document AC/322-D(2005)0053-REV1-COR1, “NNEC Data Strategy”, 13 May 2009 (NU)

[AC/322-D(2009)0015]

North Atlantic Council Document AC/322-D(2009)0015, "Strategy for the use of Open Source Software in NATO Systems", 27 April 2009 (NU)

[C3TAXO] C3 Taxonomy Perspective, Baseline 2.0, 10 November 2015 (NU) (endorsed on 11 February 2016)

[EAPC(AC/322-SC/5)N(2010)0011]

Euro-Atlantic Partnership Council Document EAPC(AC/322-SC/5)N(2010)0011, "NNEC Data Strategy Implementation Guidance", 31 May 2010 (NU)

[EAPC(AC/322-SC/5)EP(2005)0005]

Euro-Atlantic Partnership Council Document EAPC(AC/322-SC/5)EP(2005)0005, “NATO Policy for Data Management”, 10 February 2005 (NU)

[EAPC(AC/322-SC/5-WG/4)N(2008)0004]

Euro-Atlantic Partnership Council Document EAPC(AC/322-SC/5-WG/4)N(2008)0004, "Guidance for XML Naming & Design", 9 April 2008 (NU)

2.5.4. Procedures

[RMP-SOP] HQ, Allied maritime Command, NATO Recognised Maritime Picture Standard Operating Procedures (last promulgation: 10 October 2014 and Change 1 dated 09 October 2015) (NU)

2.5.5. Project Documents

[TBCE] Type "B" Cost Estimate: Provide Functional Services (FS) for Command and Control (C2) of Maritime Operations (NU)

2.6. Non-NATO Documents

[OTHTGOLD-2000] Operational Specification for Over-the-Horizon Targeting Gold Rev.D (2000)

[OTHTGOLD-2007] Operational Specification for Over-the-Horizon Targeting Gold (2007)

[IEC62320] IEC 62320-2 Maritime navigation and radiocommunication equipment and systems - Automatic identification system (AIS)

[MIL-STD-2525D] MIL-STD-2525D Department of Defence Interface Standard-Joint Military Symbology, 10 June 2014 (no classification)

2.7. Non-NATO Standards

[CMAPI] Common Map Application Programming Interface (CMAP) 1.3.0, Source: www.cmapi.org

[DTED] Digital Terrain Elevation Data (DTED) Geographic Information Exchange Standard, Ed.3

[ECMA-262] Standard ECMA-262, "ECMAScript Language Specification", Source: www.ecma-international.org

[FDIS 25010] ISO/IEC FDIS 25010:2010(E) Systems and software engineering - Systems and software Quality Requirements

[GeoTIFF] Geographic Tagged Image File Format, Ver. 1.8.2 28 December 2000

[GIF] CompuServe - Graphics Interchange Format (sm), Version 89a, GIF Version 89a

[HTML5] Hypertext Mark-up Language, Version 5 (HTML 5), W3C Candidate Recommendation, Aug 2013

[IBSTPI] International Board of Standards for Training, Performance and Instruction, Source: http://www.ibstpi.org/

[IEC 62320] IEC 62320:2015 Maritime navigation and radiocommunication equipment and systems - Automatic identification system (AIS)

[IHO S-4 INT] International Hydrographic Organization (IHO) Regulations of the IHO for International (INT) Charts and Chart Specifications of the IHO, Ed. 4.5.0, October 2014

[IHO S-52] International Hydrographic Organization (IHO) Specifications for Chart Content and Display Aspects of ECDIS, Ed. 6.1(.1), October 2014

[ISO 3166] ISO 3166:2013, Codes for the representation of names of countries and their subdivisions, Part-1,2,3

[ISO 8601] ISO 8601 Data elements and interchange formats - Information interchange – Representation of dates and times

[ISO 9241-110] ISO 9241 Ergonomics of human-system interaction - Part 110: Dialogue principle, 2006

[ISO 9241-210] ISO 9241 Ergonomics of human-system interaction - Part 210: Human-centred design for interactive systems, 2010

[ISO 19117] ISO/FDIS 19117:2012 Geographical information - Portrayal

[ISO 32000-1] ISO 32000-1:2008 Document management -- Portable document format -- Part 1: PDF 1.7

[ISO/IEC 8211] Information technology -- Specification for a data descriptive file for information interchange 1994

[ISO/IEC 9075] ISO-9075 Information technology -- Database languages -- SQL (Parts)

[ISO/IEC 9834] ISO/IEC 9834-8:2005 Information technology -- Open Systems Interconnection -- Procedures for the operation of OSI Registration Authorities: Generation and registration of Universally Unique Identifiers (UUIDs) and their use as ASN.1 Object Identifier components

[ISO/IEC 10918] ISO/IEC 10918-1:1994 Information technology -- Digital compression and coding of continuous-tone still images: Requirements and guidelines

[ISO/IEC 14882] ISO/IEC 14882:2003 Programming languages -- C++, 28 August 2007

[ISO/IEC 15445] ISO/IEC 15445:2000 Information technology (Document description and processing languages -- Hypertext Mark-up Language (HTML)

[ISO/IEC 19757] ISO/IEC 19757-3:2006 Information technology -- Document Schema Definition Languages (DSDL) -- Part 3: Rule-based validation -- Schematron

[ISO/IEC 23270] ISO/IEC 23270:2006(E) Information technology - Programming languages - C#, Edition 2, 1 September 2006

[ISO/IEC 23271] ISO/IEC 23271:2006 Information technology -- Common Language Infrastructure (CLI) Partitions I to VI, 27 September 2006

[ISO/IEC 23272] ISO/IEC TR 23272:2006 Information technology -- Common Language Infrastructure (CLI) -- Technical Report on Information Derived from Partition IV XML File, 7 August 2006

[ISO/IEC 29148] ISO/IEC 29148:2011 Systems and software engineering - Life cycle processes – Requirements engineering

[ISO/IEC 29500] ISO/IEC 29500-4:2012 Information technology -- Document description and processing languages -- Office Open XML File Formats

[JSR 270] Java Specification Request 270, "Java SE 6 Release Contents", 18 October 2006

[NMEA 0183] National Marine Electronics Association (NMEA) 0183 Protocol

[OASIS-SOA] Organization for the Advancement of Structured Information Standards (OASIS) Reference Model for Service-Oriented Architecture, v. 1.0, 1996. Source: http://docs.oasis-open.org/soa-rm/v1.0/

[OASIS-UDDI] OASIS Universal Description, Discovery, and Integration Specification (UDDI v 3.0) Spec Technical Committee Draft, 19 October 2004, Source: http://uddi.org/pubs/uddi_v3.htm

[OASIS-RPS] OASIS Web Services for Remote Portlets Specification v2.0, 7 June 2006

[OASIS-BPEL] OASIS Web Services Business Process Execution Language Version 2.0 , 11 April 2007

[OGC KML] Open Geospatial Consortium (OGC), Keyhole Markup Language (KML) Version 2.2.0, 2008

[OGC WFS] OGC Web Feature Service (WFS) Standard Version 2.0.0, 2010

[OGC WMS] OGC Web Map Service (WMS) Standard Version 1.3.0, 2006

[OGC WMTS] OGC Web Map Tile Service (WMTS) Standard Version 1.0.0, 2010

[OGC WPS] OGC Web Processing Service (WPS) Standard Version 1.0.0, 2010

[OGC WSCom] OGC Web Services Common (WSCom) Standard Version 2.0.0, 2010

[OpenSearch] OpenSearch Specification v1.1, Source: http://www.opensearch.org

[RFC 1738] Network Working Group, Uniform Resource Locators (URL), December 1994

[RFC 2078] Network Working Group, Generic Security Service Application Program Interface, Version 2, January 1997, Source: http://tools.ietf.org [RFC 2083] Network Working Group, PNG (Portable Network Graphics) Specification Version 1.0, March 1997

[RFC 3875] Network Working Group, The Common Gateway Interface (CGI) Version 1.1, October 2006

[RFC 3986] Network Working Group, Uniform Resource Identifier (URI): Generic syntax, January 2005

[RFC 4122] Network Working Group, A Universally Unique Identifier URN Namespace, July 2005

[RFC 4287] Network Working Group, The Atom Syndication Format, December 2005

[RFC 4510] Network Working Group, Light-Weight Directory Access Protocol-Technical Specification Roadmap, June 2006

[RFC 5023] Network Working Group, The Atom Publishing Protocol, October 2007

[RFC 5905] Internet Engineering Task Force, Network Time Protocol version 4 (NTPv4), June 2010

[RFC 7159] Internet Engineering Task Force, The JavaScript Object Notation (JSON) Data Interchange Format, 2014

[SoaML] OMG, Service Oriented Architecture Modelling Language Specification 1.0.1, May 2012

[SPARQL] SPARQL 1.1 Query Language, W3C Recommendation, 21 March 2013, Source: http://www.w3.org/TR/sparql11-query/

[SVG] Scalable Vector Graphics (SVG) 1.1 (Second Edition), W3C Recommendation, 16 August 2011

[XML] Extensible Markup Language (XML) 1.1 (Second Edition) W3C Recommendation 16 August 2006

[W3C MWBP] World-Wide Web Consortium, Mobile Web Best Practices 1.0, 29 July 2008, Source: http://www.w3.org/TR/mobile-bp/

[W3C OWL-2] World-Wide Web Consortium (W3C), "OWL 2 Web Ontology Language Document Overview", 27 October 2009

[W3C SOAPv11] W3C, Simple Access Object Protocol (SOAP) v. 1.1, 8 May 2000, Source: http://www.w3.org/TR/2000/NOTE-SOAP-20000508/

[W3C SOAPv12] W3C, SOAP Version 1.2 Part 1: Messaging Framework (Second Edition), 27 April 2007, Source: http://www.w3.org/TR/soap12-part1/

[W3C WCAG] W3C, Web Content Accessibility Guidelines (WCAG) 2.0, 11 December 2008, Source: http://www.w3.org/TR/2008/REC-WCAG20-20081211/

[W3C WS-SAML] W3C, Web Services Security: SAML Token Profile 1.1, 1 February 2006, Source: http://www.oasis-open.org/committees/download.php/16768/wss-v1.1-spec-os-SAMLTokenProfile.pdf

[W3C WS-Security] W3C, Web Services Security: SOAP Message Security 1.1, 1 February 2006, Source: http://www.oasis-open.org/committees/download.php/16790/wss-v1.1-spec-os-SOAPMessageSecurity.pdf.

[W3C WS-X509] W3C, Web Services Security: X509 Certificate Token Profile 1.1, 1 February 2006, Source: http://docs.oasis-open.org/wss/v1.1/wss-v1.1-spec-os-x509TokenProfile.pdf

[W3C WSDLv11] W3C, Web Services Description Language v. 1.1, 15 March 2001, Source: http://www.w3.org/TR/wsdl

[W3C XML-DigSig] W3C, XML Signature Syntax and Processing, 10 June 2008, Source: http://www.w3.org/TR/xmldsig-core/.

3. GENERAL DESCRIPTION

3.1. System Perspective

3.1.1. Business Process Basis for TRITON

Maritime Operations are the set of military activities that are conducted by maritime air, surface, sub-surface and amphibious forces to attain and maintain a desired degree of control of the surface, sub-surface, and air above the sea, influence events ashore, and, as required, support land, air and space operations. NATO ACO operations staff requires automated command and control information services to effectively plan, execute, monitor and assess Maritime Operations in responsive and timely manner.

Situated at the Operational Level, the Headquarters Allied Maritime Command (HQ MARCOM), located at Northwood - UK, is to be prepared to deliver command and control of the full spectrum of joint maritime capabilities, and to act as NATO's principal maritime advisor. From its static location, it must plan, conduct and support joint maritime operations in order to contribute to Deterrence and Defence, Crisis Management, Cooperative, and Maritime Security within and beyond NATO's Area of Responsibility. It is to maintain comprehensive situational awareness throughout NATO's maritime area of interest and be ready to exercise C2 of a Small Joint Operation (SJO) (maritime heavy) and act as the Component Commander to support up to a Major Joint Operation (MJO), within a comprehensive approach.

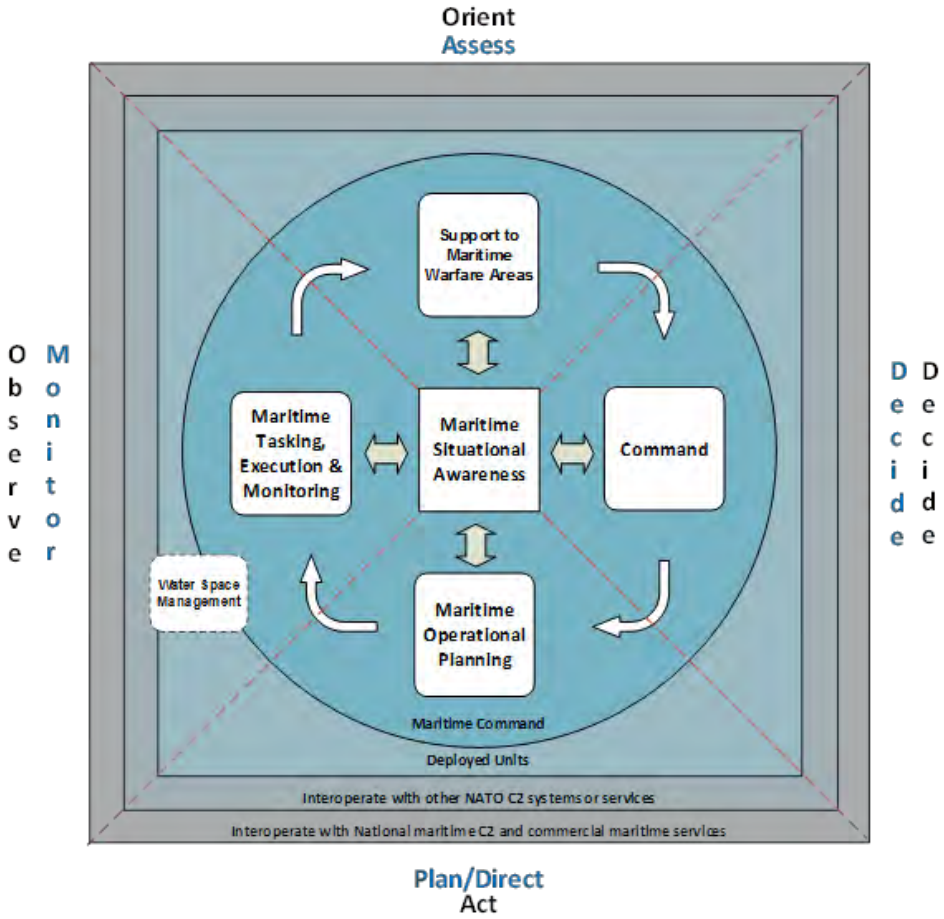
At sea, MARCOM is commanding all four Standing Maritime Groups which make up the Maritime Component of the NATO Response Force (NRF). MARCOM provides the four groups flagships with CIS support through established Deployable Kits and the necessary support during their deployments.

To ensure that these forces comply with the highest standard of readiness, MARCOM is also the leading headquarters for the organization and conduct of naval exercises within NATO. These exercises, whether maritime or joint (i.e. involving land and air components) focus on the operational certification of the units participating in the NRF, but also of the different headquarters commanding them.

HQ MARCOM operational activities follow a battle rhythm of staff functions that "specifically designed for an operations conducting process organization with a medium term decision cycle speed", with the exception of current operations using a short term daily cycle. MARCOM Battle Rhythm SOP 100 describes uses three interrelated decision cycles for short term current situations, medium term emerging situations and long term future situations (i.e. "What's next?").

Observe, Orient, Decide and Act (OODA) loop is usually drawn with arrows implying the actions are completed as a serial chain of events, with most early examples described at the tactical level. The OODA loop in higher command situations has also been referred to as a MADD diagram involving Monitor, Assess, Decide and (Plan) Direct functionality. The author of the OODA (MADD) process (by Col USAF John Boyd) actually went to great lengths to point out that it involves a continuous interaction checking between all components to produce what is effectively a set of parallel efforts. The rate at which each component is updated implies the limit on how fast a specific OODA loop can self-synchronize.

The OODA-loop diagram illustrates that TRITON needs to support command decisions by converting them using operational planning into actionable tasks for execution and monitoring the plans to assess when the outcomes justify further command decisions. The figure below illustrates the top level maritime operational relationships of five main C2 functions that TRITON must support.

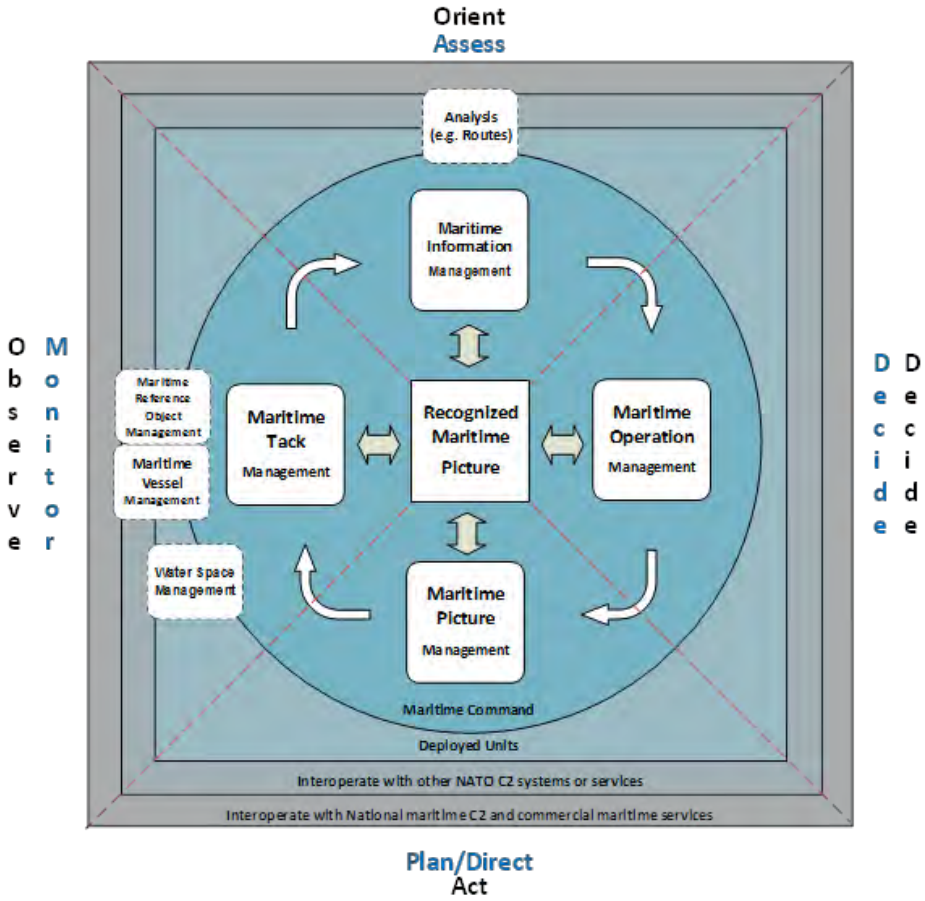


This top level OODA-loop diagram differs from most classical in that it also shows how the four components are kept informed and synchronized by Maritime Situational Awareness (MSA). This is because MSA is the key "… enabling capability which seeks to deliver the required information superiority in the maritime environment to achieve a common understanding of the maritime situation in order to increase effectiveness in the planning and conduct of operations". The need to ensure a common understanding by all participants means that MSA must be conducted at a much faster cadence than the other staff functions to ensure its products are available for the OODA loop to apply.

The diagram also illustrates how C2 activities at the heart of Maritime Command must enable direct interaction with its deployed units while also being able to interoperate with other NATO C2 systems or services, as well as National maritime C2 and commercial maritime services. Water Space Management (WSM) is shown here because, although it exists within the overall operational construct as the rest of MARCOM C2, it relies upon a distinct process to handle the special considerations for the way sub-surface traffic must be managed.

Due to asymmetric threats in the 21st Century, the realm of MSA transcends both the military and non-military realms and involves interoperability and/or collaboration with a wide variety of non-traditional data sources, organizations and actors. While this profile is unclassified, comprehensive MSA includes other architectural elements such as classified intelligence and locations of warships to provide the full Recognised Maritime Picture (RMP) upon which MSA is based.

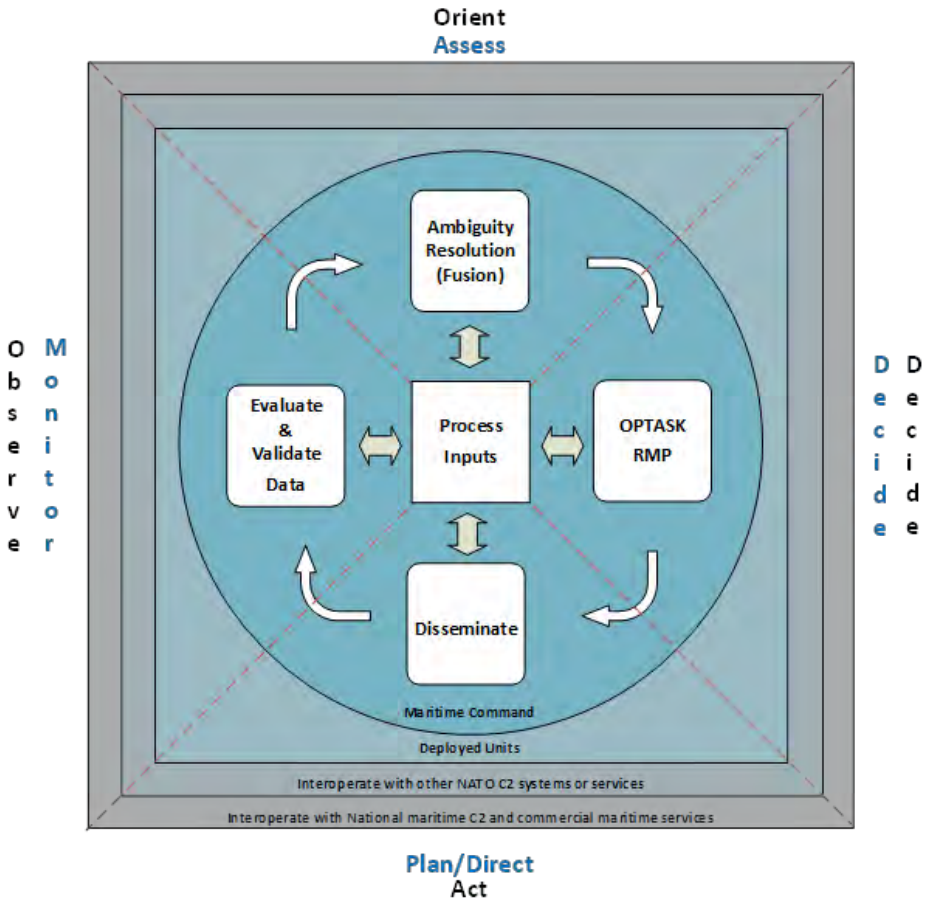
The figure below illustrates how internal MSA functions mimic the high level OODA-loop relationships, in terms of their orientation and the type of functionality they perform. The major difference is that the MSA business processes are focused on building and consuming the RMP that is the central enabling capability to conduct MSA.



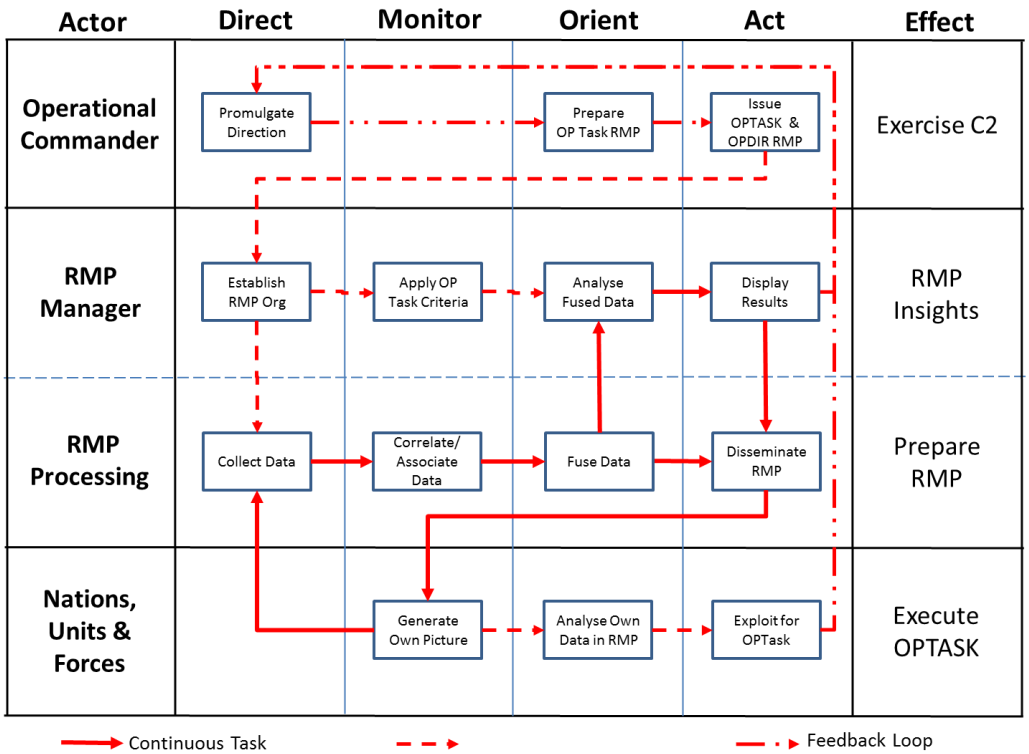
The RMP is an electronically produced display compiled from active and passive sensors covering a three-dimensional volume of interest in which all detected maritime contacts have been evaluated against threat parameters and assigned a recognition category and track number [AJP 3.1]. The RMP consists of all contacts in the maritime environment, both surface and subsurface, commercial, military and government platforms and vessels. The RMP is similar to the MSA process in that it must be updated more frequently than the surrounding OODA-loop processes.

The MSA process employs a wide range of management aspects used to build the RMP. Their positions in the OODA-loop diagram are nominal because the RMP that is accessed for MSA purposes is the product of a lower level RMP process described below.

The figure below illustrates the RMP process using OODA-loop functionality that is organized around the enabling capability of processing input data. The other four processes then refine and update data. The evaluation and validation of inputs and the dissemination of RMP updates to be highly automated and conducted continuously using the automated rules from OPTASK RMP. The ambiguity resolution of data using fusion techniques are also an ongoing activity but may require operator assessments to deal with complex cases. The RMP compilation task also includes a need to conduct detailed analysis, such as route assessments, that involve significant amount of time to complete. The intent of these is to use the results as a means to help automate portions of the fusion process.



The swim-lane version of the RMP diagram is presented below. It covers the same basic features but more clearly shows the process involves a continuous set of recurring concurrent activities involving many actors instead of a simple series of consecutive steps as implied by the OODA loop diagram. The figure below shows the RMP Process as Swim-lane OODA Loop.



The RMP swim-lane illustrates key relationships between the major actors from an OODA loop perspective. It avoids the usual tendency to describe the detailed business procedures already documented elsewhere and instead seeks to expose the major effects achieved from the RMP process. The four major swim-lanes are:

- The Operational Commander promulgating direction,
- The RMP Manager using organizational assets to seek RMP insights and automated technology to prepare the RMP,
- The RMP Processing to collect, correlate/associate, fuse and analyse the data,
- The Nations, units and forces both contribute data to and consume the RMP.

The backbone of the RMP swim-lane is the continuous task of processing to collect, aggregate (correlate/associate), fuse and analyse the data from units and forces in order to disseminate the RMP back to the units and forces for their use. That work is based on standing guidance from the Operational Commander as implemented by the RMP Manager. The process includes a feedback loop to amend operational commander direction based on insights gained while preparing the RMP or from units and forces exploiting it to pursue the OPTASK.

3.1.2. Purpose of TRITON

The purpose of the Project TRITON is to provide Functional Services for Command and Control of Maritime Operations, which will allow NATO and its Alliance members to conduct Maritime Security Operations (MSO). The services to be delivered for the entire capabilities of TRITON will provide the tools for the NATO operational user to plan and execute the full spectrum of maritime missions in a joint environment. They enable the operators to share and leverage the services provided by the Core Services implementation, as well as tools and capabilities offered through the other NATO Functional Services in order to facilitate a seamless operating environment for the users.

Currently, at the Strategic and Operational command levels, Maritime C2 processes are carried out using Maritime Command and Control Information System (MCCIS). In addition, MSA Demonstrator Prototype (MSA/BRITE) developed by ACT is used for White Shipping Monitoring. The future Maritime C2 and Information Services provide a flexible and agile command and control services for NATO operational use. At the delivery of its final Increment (possibly Increment 3), it will provide the following main capabilities for both static and afloat NATO Commands:

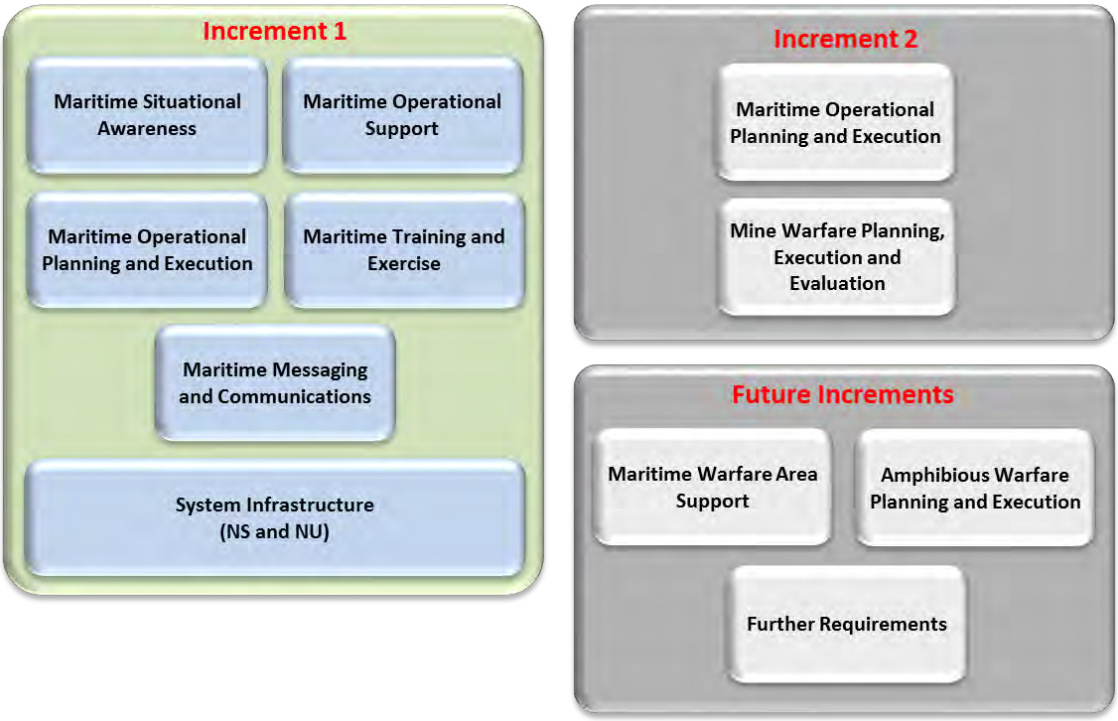
- Maritime Situational Awareness
- Maritime Operational Support
- Maritime Operational Planning and Execution
- Maritime Training and Exercise
- Information exchange with other NATO Systems or Services
- Information exchange with National maritime C2 systems and commercial maritime services.

The services delivered by the TRITON Increment 1 Project will cover a subset of overall capabilities and provide a foundation to build on for future Increments. The key capabilities to be provided through Increment 1 are:

- Replacement of MCCIS functionality that supports operational-level Maritime C2 and MSA
- Replacement of White Shipping part of the MSA functionality currently supported by the MSA/BRITE
- Utilising information received from National maritime C2 systems and commercial maritime services to build the White Picture and RMP
- Building and dissemination of RMP
- Building and dissemination of White Picture
- The basic information management of Maritime Operational Planning and Execution as a foundation for future build on

- The Water Space Management and Prevention of Mutual Interference (WSM/PMI)
- Interoperability with other NATO systems, capabilities and Functional Services
- Providing deployed functionality at sea with Deployable Kits for Afloat Command Platforms (ACP).

Future Increments will deliver the other Maritime C2 Capabilities as notionally depicted below:



3.1.3. Functionality

The objective of the Bi-SC AIS is to provide NATO commands with effective and integrated core (common to all users) and functional (specific to staff functions) services within both static and deployed contexts. The range of functional services for supporting the operational commanders includes the C2 capabilities for Air, Land, Maritime, Special Operations Forces (SOF), Joint Operations, Logistics and Intelligence.

TRITON, as the Maritime Functional Services within the Bi-SC AIS capabilities, enables users to collect, process, present and distribute information that supports the major functions of maritime operations. These services will support NATO Headquarters and Centres at both static and afloat locations. TRITON Functional Services will be operational at deployed sites, Afloat Command Platforms (ACP) in NATO-led task forces/groups basically Standing NATO Maritime Group (SNMG) and Standing NATO Mine Counter Measures Group (SNMCMG).

TRITON will be used in peacetime, exercises, and time of crisis (operations) throughout the static and deployed environments. TRITON will be used at both static and afloat NATO Command Structure to provide commanders with the required level of maritime information in order to make informed operational decisions. Nations will also be able to access TRITON functions, send their maritime information and receive RMP in various methods of information exchange.

The first Increment of the project will provide the key capabilities for both static and afloat sites. It is inferred that as NATO does not own maritime assets, Nations should be able to interoperate with TRITON from their national maritime C2 Information Systems.

TRITON will be installed only at the Authorised Locations, static or afloat sites. While static sites provide services for NATO Headquarters, afloat sites will be used by Command Task Groups as ACPs.

Afloat Command Platforms:

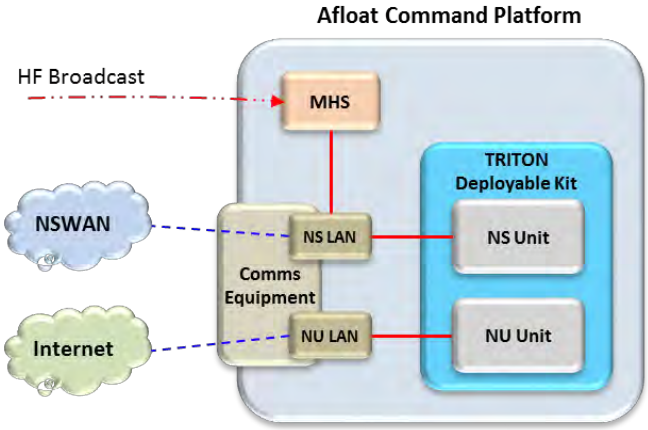
In addition static sites, "TRITON Deployable Kits" will be provided for the following platforms identified as ACPs, and installed prior to a mission:

- Standing NATO Maritime Group 1 and 2 (SNMG-1 and 2)
- Standing NATO Mine Countermeasures Group 1 and 2 (SNMCMG-1 and 2)

Other than these four instances, four spare kits will be used during task hand-over between the Command Ships.

These ACPs are expected to have the minimum CIS capabilities as defined in [MC0195/9]. The minimum level of C2 capabilities are currently described in [MC0593]. The communication methods applicable for ACPs are described in [ACP-200]. TRITON Deployable Kits will utilise the ship Local Area Network to access the NATO Wide Area Network through their communication equipment (Satellite or any other media).

ACPs will be able to exchange information with TRITON instances at static sites if communication lines are available. If no IP-level connectivity exists, ships may receive broadcasted data (e.g Formatted Messages) through the on board Message Handling System (MHS). Connecting the Deployable Kit to the ship MHS is a preference of the Nation who is providing the maritime asset. Following figure shows the possible methods of connectivity. If there is not data input from outside of the ACP, it will still be possible to enter manual data.



3.1.4. Security Domains

Maritime Functional Services will operate together with the other Bi-SC AIS Functional Services. However, some functions need to access the Internet and get information from commercial sources. Therefore, two security domains for operating TRITON are currently identified:

- NATO SECRT (NS) Operational Domain on NS Wide-Area Network (NSWAN)
- NATO UNCLASSIFIED (NU) Operational Domain on NU Network having controlled access to Internet

In future, NATO RESTRICTD (NR) network will be used as the Protected Business Network at static sites. It will cover the NU Domain as well. TRITON will be able to operate in NR domain as well as NU Domain.

The NU Domain will be used to gather information from commercial sources on the Internet and build the White Picture. The NS Domain will be used for compiling the Military Picture. With additional information and contributions needing to be kept classified, the WP will be improved further. The RMP will then be extracted from the Maritime Operational Picture (MOP) which is built using all pictures on the NS Domain.

TRITON can also be deployed in a MISSION NETWORK, which is configured specifically for a mission, having MISSION SECRT (MS) classification.

TRITON will provide Cross Domain Support which allows information transfer between differing security domains using the senario-specific NATO Information Exchange Gateways (IEG). Considering the current security regulations, only one way of information transfer from low side to high side will be allowed.

TRITON will use the Confidentiality Labels for the information objects according to the NATO Directives.

There may be further requirements to transfer selected information from high-side to low-side. In that case, TRITON will allow authorised users to control the information transfer.

In case TRITON-NS needs to exchange information with another system in a MISSION NETWORK, a scenario-specific IEG will be used.

3.1.5. System Approach

TRITON is the general name given for all implementation activities to provide all Maritime Functional Services. Although TRITON is a collection of services, the term "system" will occasionally be used for preserving functional decomposition for software and hardware including external interfaces. Throughout this document the word "TRITON" will be used as the name of the "Information System" to be developed and more extensions will be added to it in order to identify separate systems.

3.1.6. Naming Convention

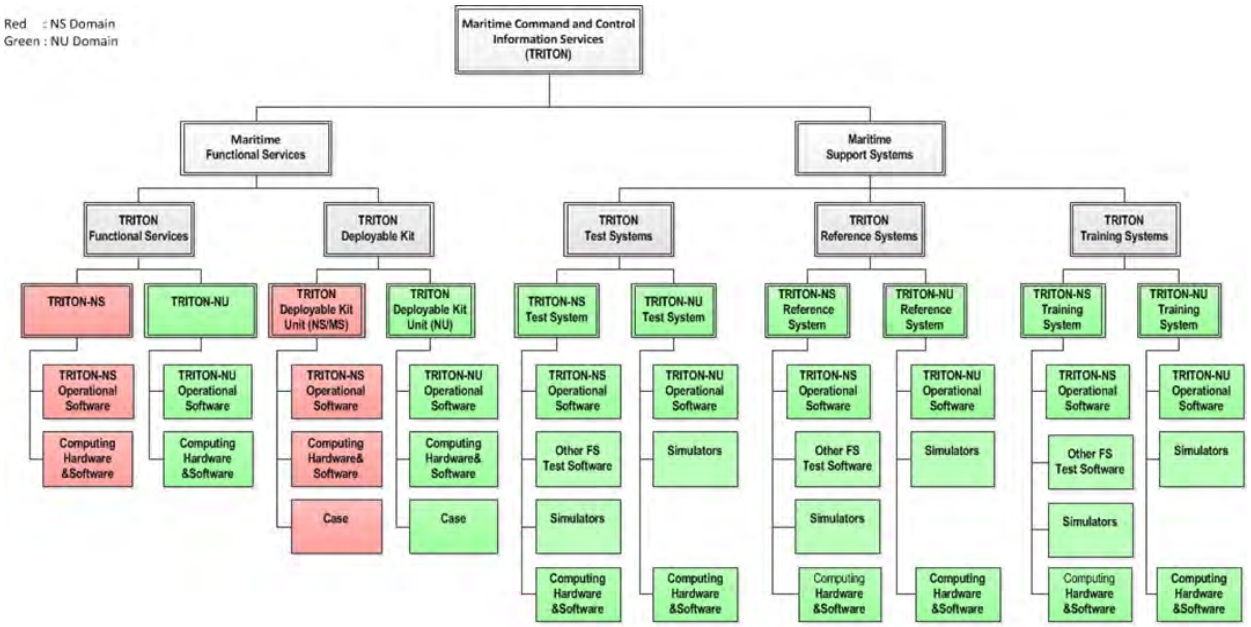
Following naming convention is used in the SRS to identify each service/system:

- TRITON : The generic name of the Maritime Command and Control Information Services.
- Maritime Functional Services: Implementation of Maritime Services within Bi-SC AIS.
- TRITON Functional Services : The name of the general Maritime Functional Services for operational use.
  - TRITON-NS : The name of the TRITON Functional Services used on the NS Domain.
  - TRITON-NU : The name of the TRITON Functional Services used on the NU Domain.
- TRITON Operational Software : The name of the overall software package to be implemented.
  - TRITON-NS Operational Software : The name of the operational software package configured for the NS Domain.
  - TRITON-NU Operational Software : The name of the operational software package configured for the NU Domain.
- TRITON Deployable Kit : The name of the system with operational software on portable hardware to be used on board ships.
- Maritime Support Systems : Implementation of support systems used for testing, maintenance and training.
  - TRITON Test System : The name of the software and hardware to be used for test purposes.
  - TRITON Reference System : The name of the software and hardware to be used for software maintenance purposes.
  - TRITON Training System : The name of the software and hardware to be used for training purposes.

The requirements in this SRS are specified as a breakdown of functions with a domain indication for each requirement. The configuration control of the operational software will allow the generation of separate software packages from the same source tree with the above-mentioned names.

3.1.7. Identification

The Functional Services and systems identified in TRITON Increment 1 Project context that form the Maritime C2 Information Services are given in the following diagram:



These services and systems with their components are described in Section 3 of this SRS.

3.1.8. Users of TRITON

The full implementation of TRITON will support the entire spectrum of NATO maritime activities, including monitoring merchant and military shipping and conducting NATO peacetime maritime operations (Operations such as Active Endeavour and Ocean Shield), as well as support for future major joint operations (Article 5) to further NATO military or political objectives.

TRITON will be used as a collection of operational-level C2 and Information Services at Maritime Headquarters and Command Centres which are called "Organizational Nodes". It is also expected that the capability will be used by the NRF HQs for Crisis Response Operations (CRO), coalition operations and other supporting activities, as authorised. Allied Command Transformation (ACT) will use TRITON capabilities for transformation experimentation related to Maritime C2 and for training and exercise purposes as well.

The maritime organizational breakdown of the Maritime Commander and subordinate Task Forces, Task Groups, and Task Elements will be using TRITON. The core of the TRITON Implementation will support the Component Commanders in planning and execution of their assigned tasks as well as providing overall situational awareness to the joint and maritime commanders.

The users at NATO Command Centres can access the TRITON services through the static systems at a centralized IT site or at other sites (Organizational Nodes). Users of Afloat Command Platforms (ACP) can also access all the TRITON services at static sites as well.

The user roles will be defined according to the current roles being used at both static and afloat command centres. In general, two groups of users will be accessing TRITON Services, and functions within those services:

- **General User:** A standard user who is capable of using the services with read-only privileges.
- **Authorised User:** A privileged user who is capable of accessing the authorised functions with privileges to manage (create, modify, delete) data.

Throughout the Command Structure, there will be roles like "General Users" who can access the general services and functions. Maritime Command (MARCOM) and selected deployed Headquarters will also have "Authorised Users" with roles like Maritime Operations Planner, RMP Manager, RMP Operator, System Technical Manager, Information Manager and Data Manager.

The role of System Administrators will be like power-user and they will be located at the Maritime Command and/or at a Central IT facility.

The non-operational installations of TRITON, as given below, will be accessed by those users having tasks in those facilities:

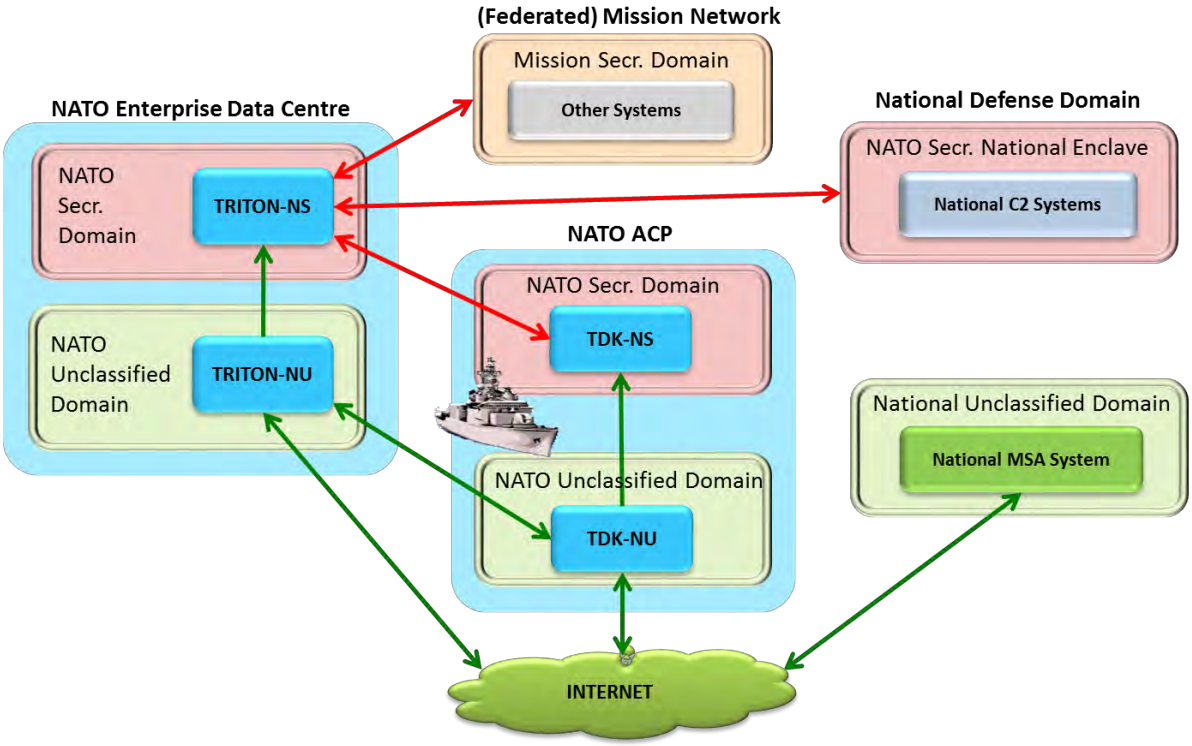
- Training System to be used for trainers and trainees (for Individual and Collective Training)
- Test System to be used by developers and maintainers at the NCI Agency
- Reference System to be used by maintainers at the NCI Agency.

3.2. Constraints

3.2.1. General Constraints

TRITON will rely on the information exchange capabilities established and maintained between NATO and non-NATO national and international information providers. TRITON will also rely on critical commercial as well as governmental transportation information and sensitive intelligence information.

Based on the Cross-Domain operation aspect of TRITON, all services will be provided for both NS and NU Domains for both static and afloat installations. TRITON operation on differing security domains is illustrated below:



Static and afloat installation of TRITON-NS can share information with other Organizational Nodes over NSWAN. The servers for each Organizational Node can also be accessed by Nations using Clients on the national side of NSWAN (National Enclave). Both static and afloat installations of TRITON-NU can

access commercial and government/non-military information resources on the Internet; it builds the White Picture and sends it to TRITON-NS over a secure connection, IEG-Data Diode.

Nations willing to share information can connect their C2 systems to the NSWAN via NATO IEG-A on National Enclave. On the other hand, Nations will continue to use MCCIS as their own national C2 system.

Nations can also access TRITON-NU over their own unclassified network. It will be Nations' responsibility to connect their systems to NSWAN.

TRITON can also exchange information with other systems on Mission Network such as MISSION SECRT Domain provided that NATO IEG-C is used and the data is labelled accordingly.

In future, static headquarters will operate on Protected Business Network including the NU Domain. Therefore, NU Domain will be combined in NR Domain.

One other primary constraint of the architecture is the available bandwidth for the ships assigned as ACPs in a Task Force/Group. ACPs will have TDKs where other ships can access TRITON services over their NSWAN connections. These connections can be as low as a couple of kilobits per second depending on the ship capability. TRITON Clients should be able to function at this low bandwidth environment with defined limitations.

In case ACP loses its connectivity to the static server, it must be able to continue its function with available data sources and local services. Database synchronisation, distributed operation, and degraded operation must be considered accordingly.

3.2.2. Relationship with Other NATO Projects/Programs

The Bi-SC AIS is one of the key elements of NATO CIS Capabilities, which includes a number of strategic sub-systems and Functional Services to be implemented under a Programme.

TRITON relationship with other NATO Functional Services is very essential for successful implementation of the full capability. Networked Interoperable Real-time Information Services (NIRIS) is one of the key enablers to receive and process Tactical Data Link information.

TRITON will also be integrated with Bi-SC AIS Core Services (Directory, Registry, e-mail etc.) as much as possible. The proper interfaces will be established with other services/systems using Service Oriented Architecture (SOA) implementation and STANAG-based information exchange baselines.

Since TRITON aims to replace the existing MCCIS and MSA/BRITE functionalities, existing data exchange methods and protocols will be preserved until full transition.

3.2.2.1. MCCIS

MCCIS provides the legacy core of the maritime C2 capabilities for NATO and will continue to exchange information in various configurations for NATO and for the Nations with TRITON. Therefore its maintenance will continue until full transition is achieved. TRITON will be designed to exchange information with the MCCIS 6.x as required.

3.2.2.2. MSA Demonstrator Fielded Prototype

The Baseline for Rapid Iterative Transformational Experimentation (BRITE) is an experimentation framework that allows for the rapid implementation of new ideas and capabilities to support experimentation. A prototype for MSA capability on BRITE (MSA/BRITE) was developed by ACT, fielded at the NATO Shipping Centre (MARCOM). It is currently maintained by the NCI Agency.

MSA/BRITE receives AIS and LRIT data from MSSIS and commercial sources, provides White Shipping Monitoring with a number of analysis functions. It will continue its operation in parallel to the initial TRITON implementation with NATO and the Nations. TRITON will be designed to make use of the information stored by MSA/BRITE as required.

3.2.2.3. NIRIS

Networked Interoperable Real-time Information Services (NIRIS) provides a platform-independent application programming interface and a web-service interface to C2 systems for reading and writing tactical data and converting message types.

NIRIS is an Enabling Service ensuring proper situational awareness via the provision of a set of services to enable data collection, dissemination and transformation to information in an interoperable manner based on NATO and commercial standards (e.g. Tactical Data Links (TDL), OTH-T GOLD, Friendly Force Tracking (FFT), and Civilian Convoy).

NIRIS consists of both hardware and software components which can be dynamically configured and deployed to provide the necessary services to support each COI's business cases within different contexts, such as data dissemination, track augmentation, data forwarding and interoperability assessments in-theatre, during exercises or to support verification and validation and training events.

TRITON will utilise NIRIS to receive surface and subsurface track information provided by the following:

- Link-11/11B
- Link 16 (and Joint Range Extension)
- Link 22 (future)
- AIS (if available)

3.2.2.4. Other Bi-SC AIS Functional Services

The capability to be acquired under the Maritime C2 Functional Services Capability Package will be a fully-integrated element of the Bi-SC AIS. In this context, TRITON will co-exist with other Functional Services like Intelligence Functional Services (INTEL-FS), Logistics Functional Services (LOGFS), Air Functional Services (AirC2IS), Land Functional Services (LC2IS), NATO Common Operational Picture (NCOP), Operations Planning Functional Services (TOPFAS) and others as they become available.

TRITON Increment 1 will have interfaces to other Bi-SC AIS Functional Services such as INTEL-FS, Environmental (ENV-FS), CBRN Defence (CBRN-FS) and NCOP.

It will have Cross-Domain Support by means of Data Diode and Information Exchange Gateway (IEG) for other systems residing in differing security domains.

3.2.2.5. BI-SC AIS Programme Management and Integration Capability

The Bi-SC AIS Programme Management and Integration Capability (PMIC) will provide the Integration Test-bed for the Bi-SC AIS. The PMIC facilities play a key role in certifying the integration and interoperability of TRITON Increment 1 with the Bi-SC AIS Core Services and other Bi-SC AIS Functional Services. It will host the TRITON Test Systems.

3.2.2.6. NATO General Purpose Communications Systems

TRITON Operational Software will be hosted by the hardware installed on NS Network; consequently data exchange will be supported by the NATO General Purpose Communications Systems (NGCS). TRITON design will accommodate the existing bandwidth and Quality of Service (QoS) limitations of the NGCS. Available bandwidth will always be considered especially for the connectivity between static and afloat servers and between Task Elements and ACP.

3.2.2.7. IT Modernisation Project

The Information Technology (IT) Modernization Project (CP 9C0150) aims to increase the efficiency and effectiveness of NATO's Information Technology (IT) infrastructure by:

- Renewing obsolete IT infrastructure with standard solutions, reducing the heterogeneity of hardware and software assets;
- Quantifying and increasing the availability of service levels
- Implementing NATO-wide Business Continuity and Disaster Recovery capabilities
- Enhancing the Information Security posture
- Increasing operational agility and flexibility by enabling reallocation of resources dynamically, as dictated by the operational situation;
- Bringing new ways of working by enabling a mobile work force
- Reducing the manpower and operations and maintenance costs required to provide and maintain services.

This project will provide the infrastructure (Virtualised Environment) to run TRITON at three Data Centres and a number of Enhanced Nodes. TRITON is expected to be compatible with the infrastructure services planned to be provided by this project. TRITON operational software will be installed on the Data Centres and other Authorised Locations as described in the SOW.

Provision of the portable hardware and operational software of TRITON Deployable Kits is included in the TRITON Increment 1 Project.

3.2.3. Solution Constraints

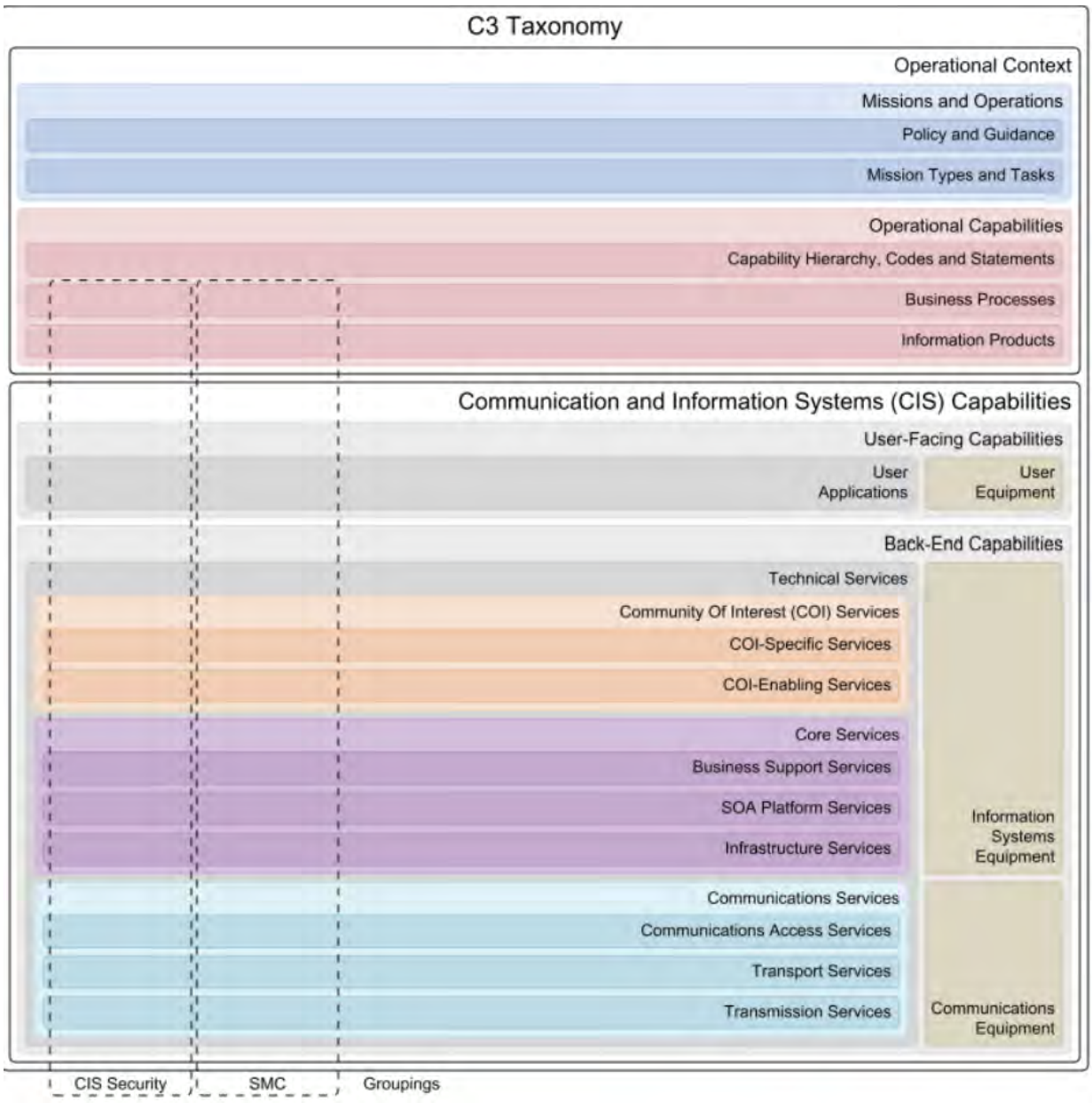
3.2.3.1. NATO Network Infrastructure

In a complex and federated enterprise like NATO there is a need for a generic structure or framework that can be used to align and synchronise various activities and projects that are on-going in parallel when the organization's CIS infrastructure transforms towards a common, network-enabled capability. TRITON will use the NATO Network Infrastructure initially defined as NATO Network Enabled Capability (NNEC) [AC/322-D(2005)0053]. This concept is being replaced with Federated Mission Network (FMN). Therefore, TRITON will use the available COI-Enabling and COI-Specific services to achieve maximum interoperability.

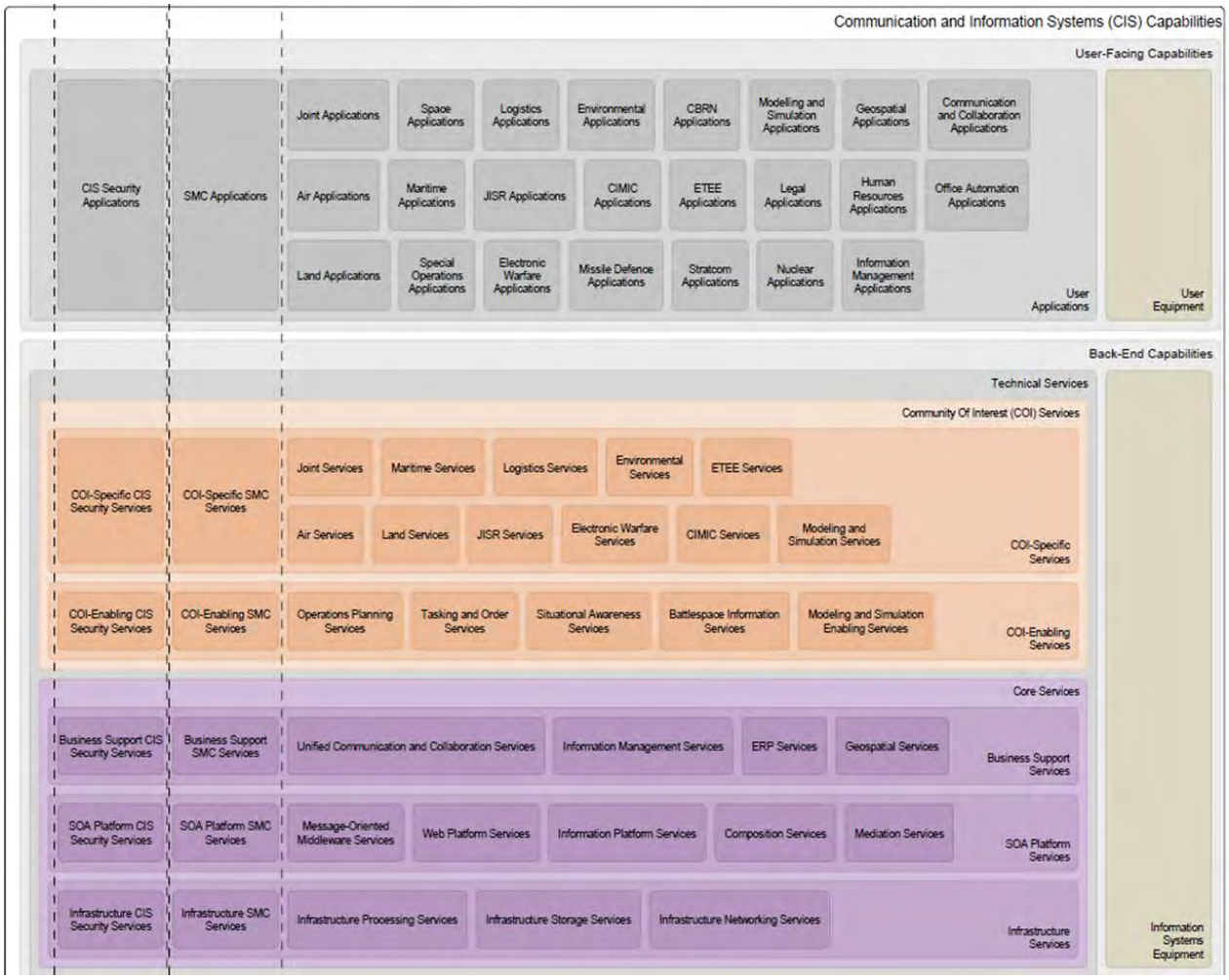
The basic services include the following but not limited to:

- Unified Communication and Collaboration Services
- Information Management Services
- Geospatial Services (Core Geographical Information System - CoreGIS)
- SOA Platform and SMC Services
- Infrastructure Services

The C3 Taxonomy [C3TAXO] provides the generic framework. The taxonomy is defined as a particular classification arranged in a hierarchical structure organised by supertype-subtype relationships. The picture below depicts the top levels of the C3 Taxonomy connecting the top-level political ambitions all the way to "the wire":



The User Facing Capabilities and Back-end Capabilities are shown below:

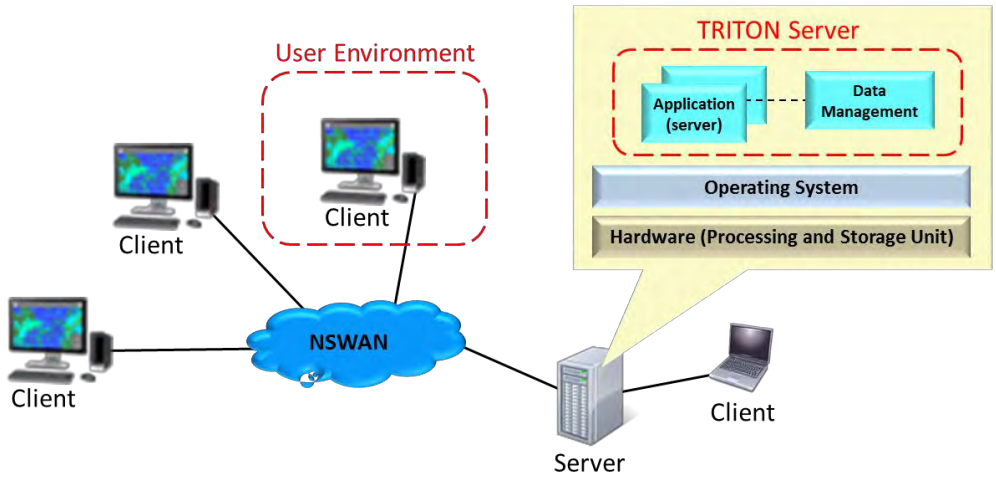


TRITON will be implemented in a SOA environment and provides the user-facing capabilities as Maritime Applications and Maritime Services.

TRITON will use the existing COI-Enabling Services and Core Services to the extent possible. The TRITON Target Architecture will take into account that some Core Enterprise Services are not entirely defined, not yet available, or will evolve. The Component-based Architecture approach will enable TRITON to leverage new Technical Services as they are implemented.

3.2.3.2. Client and Server

TRITON physical architecture consists of a "TRITON Server" which supports a high number of simultaneous users as "TRITON Clients" within the User Environment. Following figure illustrates the details of the Server running on the NS Domain.

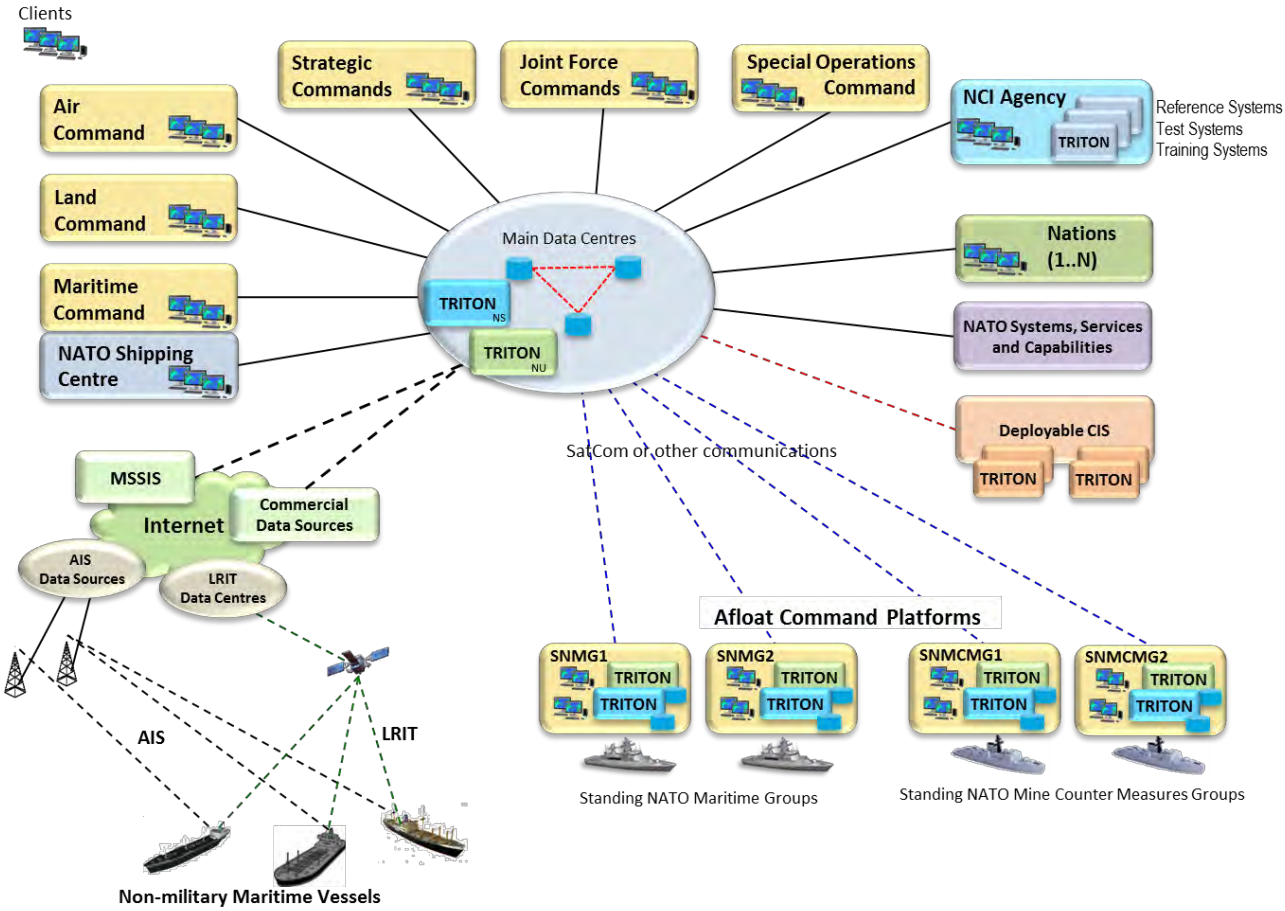


TRITON Servers will be installed on NATO Data Centres. Deployable Kits will also act as a Server. All Servers on all Instances will be synchronised in background, considering the available bandwidth and Area of Interest.

TRITON Clients provide the primary user functionality as Web-based User Applications which are accessible via standard Bi-SC AIS Web Browser (i.e. Internet Explorer).

3.2.3.3. Physical Architecture

The Physical Architecture of TRITON in operation is shown in the following picture:



TRITON will be installed on NATO Data Centres. All users from NATO commands and Nations will use "TRITON Clients" to access the services provided by the Servers. TRITON Deployable Kits will be installed on Afloat Command Platforms acting as a local server for the Task Force/Group. Afloat deployments of TRITON will have direct connection with the static servers on NSWAN allowing full functionality to be used. Allied ships not having TRITON on board will be able to access a selected TRITON Server over NSWAN using TRITON Clients.

Commercial shipping data are collected from related data centres by using Automatic Identification System (AIS) and Long Range Identification and Tracking (LRIT). AIS is a ship-born broadcast system that operates in the VHF maritime band. The AIS system is part of an international program established to support safety at sea. The International Maritime Organization's (IMO) International Convention for the Safety of Life at Sea requires AIS to be fitted aboard international voyaging ships with gross tonnage (GT) of 300 or more, and all passenger ships regardless of size.

LRIT is a designated ''International Maritime Organization'' (IMO) system which is used to collect vessel position information received from ships of IMO member states that are subject to the ''International Convention for the Safety of Life at Sea'' (SOLAS). LRIT devices on board the vessels securely transmit the ship's identity, location and date/time of the position over long ranges (via satellite). LRIT Data Centre is then disseminates this data to registered participants.

Whereas AIS is a broadcast system, data derived through LRIT will be available only to the recipients who are entitled to receive such information and safeguards concerning the confidentiality of those data have been built into the regulatory provisions.

TRITON will not directly interface the devices, but it will utilise the sources like Maritime Information Safety and Security System (MSSIS), IHS Fairplay and the LRIT Data Centre to get vessel data and build the White Picture on the NU Domain.

The WP data will also be used to aid the operators in the detection of anomalous behaviour at sea. The WP built on the NU Domain will be transferred to the NS Domain where it is enhanced with additional sources and classified information. The RMP is then built using Military and White Pictures.

The implementation of TRITON will not be bounded to the number of deployments and number of users. However, afloat deployment will consider unavailability of external services, and provide its own services to be used when operating in stand-alone mode even under low-bandwidth communication situation.

3.2.4. Implementation Environment

The Bi-SC AIS is NATO's Automated Information System used throughout the NATO Command Structure, in NATO Command Deployments and in NATO Exercises. Since TRITON is part of the Bi-SC AIS as defined in the Bi-SC AIS Reference Architecture, the implementation will be within this environment. Both static and afloat deployments of TRITON Functional Services will have the same hardware and operating systems.

3.2.5. Anticipated Workplace Environment

TRITON will be capable of operating on Local Area Networks (LAN) and Wide Area Networks (WAN). TRITON-NS will operate on the NS Domain for C2 purposes. A similar instance of the services, TRITON-NU, will operate on the NU Domain which requires controlled access to the Internet.

Working locations will be inside offices and bunkers for static sites and naval sheltered environment for afloat platforms.

TRITON may be installed on a Deployable CIS environment running in a specific Mission Network.

3.3. Assumptions

The assumptions for the technical aspects of the project are grouped in the following paragraphs.

3.3.1. Organization

NATO Command Structure does not change from that defined as of 01 December 2012 before delivery of Increment 1 of TRITON. Therefore TRITON will be deployed only at selected static command centres and Afloat Command Platforms (ACP) which need to have Server-to-Server connectivity over Wide Area Network (WAN).

3.3.2. Infrastructure

RMP:

TRITON will collect information from external systems, services and Nations, process them and build the NATO RMP. The RMP will then be made available to all NATO Command Structure and NATO Nations. NSWAN will be the primary communications and information systems (CIS) infrastructure for information exchange. The RMP may also be made available to Coalition and/or Partner Nations through the standard NATO CIS infrastructure through appropriate Information Exchange Gateways and Web services.

Information Security:

Information security with respect to the Organizational Nodes will be provided by TRITON Servers and Clients. However, data communication security (like IP crypto) is beyond the scope of the project. It is assumed that all information is exchanged securely.

ACP Connectivity:

ACPs are assumed to have sufficient communication capabilities (as defined in [MC0195/9]) to operate TRITON for both NSWAN access and Internet access. The availability of these networks on board ACPs is outside the scope of this project. However, TRITON architecture will take the bandwidth utilisation into considered during the overall design. In addition, stand-alone operation will be supported. It is assumed that ACPs have capabilities to receive Formatted Messages.

Nations Connectivity:

Nations' own CIS connection to NSWAN is outside the scope of this project.

NATO CIS Infrastructure:

The existing NATO CIS infrastructure will be used to the maximum extent possible. It is assumed that NATO infrastructure will be ready to use when TRITON needs to. There will be no other network or infrastructure specific to the provided services.

3.3.3. Other Systems

MCCIS and MSA/BRITE will remain operational until the end of the Project TRITON Increment 1 Transition Period. The Transition Period and its activities which will be coordinated with Nations is outside the scope of this project. The historical data previously collected by these systems will be used by TRITON when necessary.

Other Bi-SC AIS Functional Services are available and provide a data exchange interface suitable for developing an interface with TRITON. Integration with the Bi-SC AIS Functional Services that are not available at the time of construction will be postponed to future TRITON Increments.

All existing interfaces of MCCIS and MSA/BRITE with other systems and Nations will be preserved to achieve backward compatibility.

3.3.4. Test Environment

There will be a Programme Management Integration Capability (PMIC) Bi-SC AIS Integration Testbed (which will include representations of Bi-SC AIS Core and Functional Services as well as MCCIS and MSA/BRITE systems). TRITON Test System will be formed in PMIC laboratories to execute System Integration Testing (SIT).

3.3.5. Build Processes and Baselines

TRITON will be developed using "Incremental Development with Multiple Deliveries" approach. Each developmental cycle will be identified as a “Build Process”. The product to be delivered at the end of a Build Process is called a "Baseline (BL)".

TRITON will have four Baselines where each requirement in this SRS is initially allocated to. The Baselines and the capabilities are summarised below:

BL1:

This Baseline is named as "TRITON-NS (Partial)" and provides the following capabilities:

- System infrastructure on NS Domain
- Integration with Core Enterprise Services
- Maritime Operation Management
- Maritime Object Handling
- Maritime Picture display capability
- Interfacing with MCCIS

BL2:

This Baseline is named as "TRITON-NU (Full)" and provides the following capabilities:

- System infrastructure on NU Domain (reuse from NS Domain)
- Integration with Core Enterprise Services (NU)
- White Picture management
- Maritime Analysis functions
- Interfacing with external data sources, Nations

BL3:

This Baseline is named as "TRITON-NS (Full)" and provides the following capabilities:

- C2 support capabilities
- Operational planning (WSM/PMI)
- RMP management
- Interfacing with external data sources/services, Nations

BL4:

- This Baseline is named as "TRITON-ACP" and provides the following capabilities:
- Deployable Kit production (NS and NU)
- Local system infrastructure on NS/NU
- Interfacing with external data sources

C4ISR Visualisation Component

The geospatial visualisation capabilities of TRITON Applications will be provided by a component providing the following capabilities:

- Isolation of Client and Server using Web applications
- Displaying geospatial objects on maps
- A re-usable software component with a standard interface.

4. FUNCTIONAL REQUIREMENTS

TRITON Functional Requirements are used to specify the details of the services to be developed. This section defines the requirements under the following subsections:

- The required states and modes of operation
- TRITON Functional Services Requirements (with indication of NS or NU Domains and static or afloat sites)
- C4ISR Visualisation Component Requirements
- TRITON Deployable Kit Requirements
- TRITON Support Systems Requirements.

4.1. Required States and Modes

Primary use of TRITON will be at static sites within the NATO Command Structure. TRITON will also be used as a deployed system on NATO Afloat Command Platforms (ACP) at sea to support joint and maritime operations. For afloat and deployed operation, TRITON will operate normally, however it will also provide a degraded capability for local use with limited or no connectivity.

As a Client-Server model with Web-based access capabilities, TRITON will be used over Wide Area Networks with predefined "Operational Modes" and "Operational States". The purpose of the system will determine the Operational Mode while the runtime availability status of them determines the Operational States.

4.1.1. Operational Modes

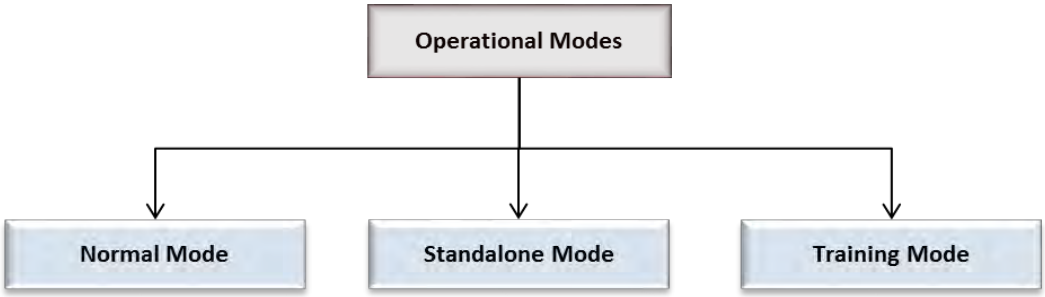
Operational Mode of TRITON defines the capability it can provide depending on its purpose. It also determines how the users will get the services provided by the system in case a mode change occurs.

4.1.1.1. Servers and Clients

For TRITON, Operational Mode of the system is determined according to its purpose and set to its Server during start-up. TRITON Functional Services can be used in one of the defined modes with certain limitations. TRITON Servers can run either on static sites or afloat sites. Clients do not have any mode of operation.

4.1.1.2. Mode Definitions

The TRITON Operational Modes are given in the following figure:



The definitions of these modes are given below:

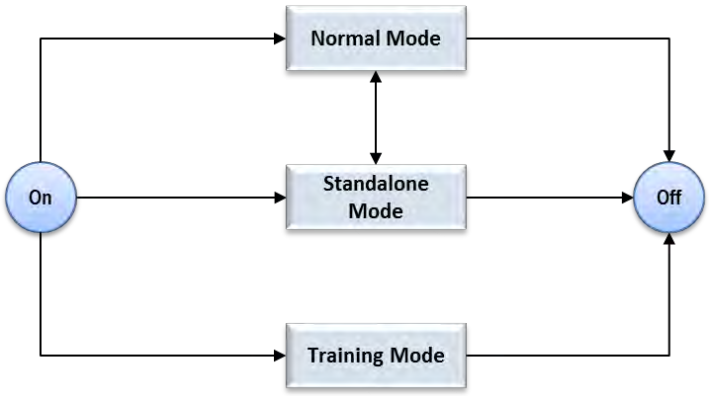
Normal Mode **:** TRITON is used for operational purpose on either a static or afloat site. The Server has connections to any other Functional Services as well as other TRITON Servers.

Standalone Mode : TRITON is used for operational purpose on an afloat site. The Server does not have any connection to other TRITON Servers or other Functional Services. Some functions of TRITON use internal core services with limited capabilities.

Training Mode : TRITON is used for training purposes. The Server runs in a closed environment and emulates the external world for training purposes.

4.1.1.3. Mode Settings

TRITON Operational Mode is set during the system initialisation. It can also be changed by operators during operation. Possible mode changes are depicted in the following diagram:



When the system is initialised for the first time, it will use the given default mode of operation. Training Mode is used in the Training System and it is initialised as Training.

Test and Reference Systems can use any of the modes.

Operational modes of TRITON-NS and TRITON-NU will be identical and managed by authorised users separately.

[T1-R001] *TRITON shall have Operational Modes, as described in the Description, which define its purpose of operational use.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Demonstration

[T1-R002] *TRITON shall allow the authorised user to set the Operational Mode during the system initialisation and change it during the operation.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Test

[T1-R003] *TRITON shall perform an internal check to determine if all the necessary services and interfaces are available for Standalone operation if it is initialised in Standalone Mode, and then sets its Operational State accordingly.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 4
Qualific. Method : Demonstration
Comment : The detailed criteria for checking the availability of services and interfaces will be determined during Software Requirements Analysis.

4.1.2. Operational States

TRITON will be able to change its Operational State automatically according to the conditions occur during run-time. The Operational States are defined separately for Servers and Clients.

4.1.2.1. Server States

Normal Mode is the standard Operational Mode of TRITON for operational use. There may be more than one TRITON Instance on the same network running with full functionality. Authorised users can change the Operational Mode either during initialisation or during run-time.

4.1.2.1.1. State Definitions

Operational States of TRITON Servers in Normal Mode are defined as follows:

On **:** Server is powered on.

Maintenance **:** Server is running, ready for maintenance, but not available for operational use.

Standby **:** Operational settings are loaded, Server is running, connected to other Servers, not processing any data.

Operational **:** Server is running with full functionality and connected to other Servers.

Degraded **:** Server is running, connected to other Servers, but some functions or dependent interfaces are not available.

Shutdown **:** Server is shutting down, no command is accepted.

After the Operational Mode of TRITON is changed to Standalone, the definition of Operational States for Server is changed as follows:

Maintenance **:** Server is running, ready for maintenance, but not available for operational use.

Standby **:** Operational settings are loaded, Server is running, no connection with other Servers, not processing any data.

Operational **:** Server is running with full functionality without connection to other Servers.

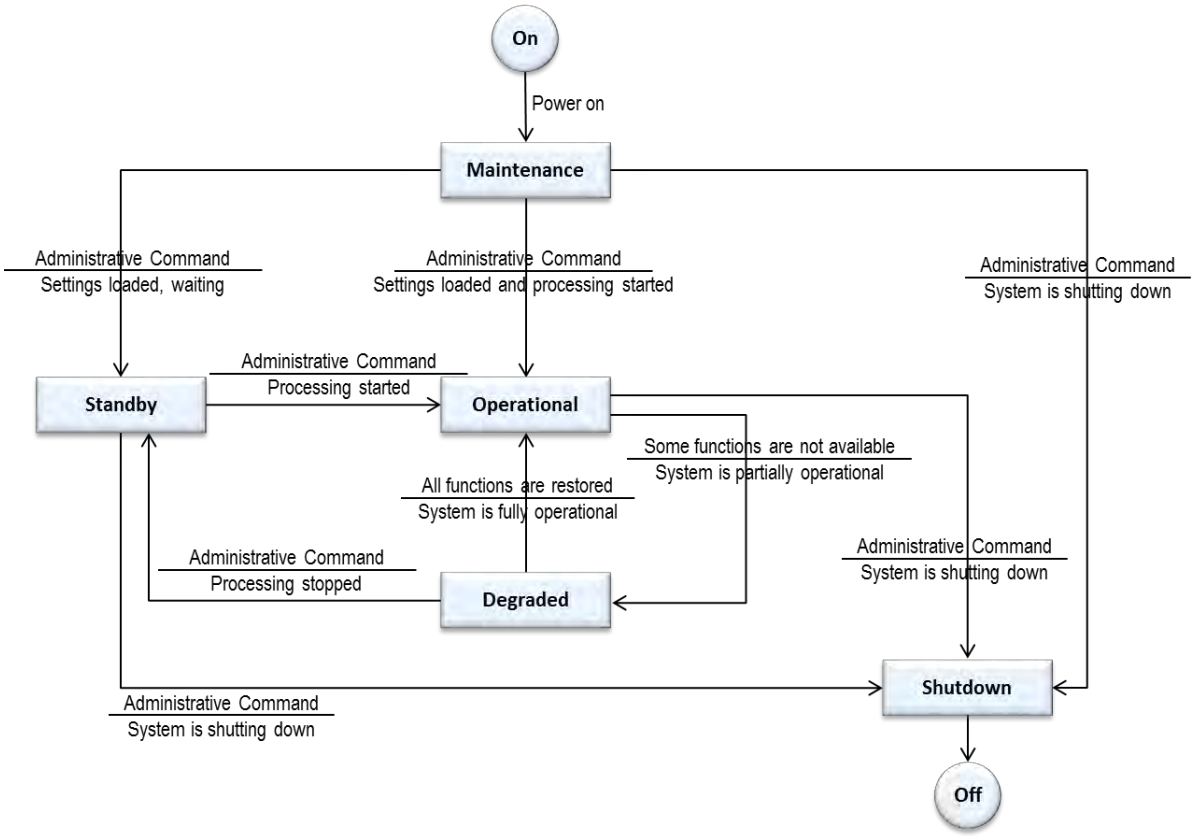
Degraded **:** Server is running, connected to other Servers, but some functions or dependent interfaces are not available.

Shutdown **:** Server is shutting down, no command is accepted.

When TRITON is in Training Mode, the Operational States for Standalone Mode are applicable.

4.1.2.1.2. State Transitions

TRITON Servers will change their operational states according to external or internal triggers. State Transitions for the Server are shown in the following sample state transition diagram:



[T1-R004] *TRITON shall monitor the system functions and interfaces that are specified in the System Configuration Settings as "critical" for operational state change.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Demonstration

[T1-R005] *TRITON shall allow the authorised user to modify the causes for Operational State changes in the System Configuration Settings.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Test

[T1-R006] *TRITON shall allow the authorised user to set the Operational State to Operational or Maintenance when the system is turned on. The default shall be Operational.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Test

[T1-R007] *TRITON shall allow the authorised user to change the Operational State manually with a notification to all users.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1

Qualific. Method : Test

[T1-R008] *TRITON shall change its state automatically from "Operational" to "Degraded" when the functions or interfaces specified in the System Configuration Settings are not available for a configurable maximum allowed time.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Test

[T1-R009] *TRITON shall change its state automatically from Degraded to Operational when all the functions and interfaces specified in the System Configuration Settings are available for a configurable minimum allowed time.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Test

[T1-R010] *TRITON shall switch to "Shutdown" state when an administrative command is issued by either an authorised user or the TRITON System Technical Management Function.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Demonstration

[T1-R011] *TRITON shall notify all Clients when the Server enters in the Shutdown state after a configurable time period (e.g. "The system is shutting down in 5 minutes").*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Demonstration

[T1-R012] *TRITON shall notify the authorised user if it detects connection failure to the specified TRITON Server for more than five (5) minutes while it is operating in Normal Mode, then automatically change its mode to Standalone Mode after waiting for configurable count-down period for the authorised user input.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 4
Qualific. Method : Test

[T1-R013] *TRITON Deployable Kit shall utilise its own infrastructure to support the operational software in Standalone Mode.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 4
Qualific. Method : Demonstration

4.1.2.2. Client States

TRITON Clients consist of Web-based applications including the Mission Application (AppView) and Visualisation Application (GeoView). Therefore their state will depend upon the connectivity with each other and with their servers. AppView determines the overall state of the TRITON Client.

4.1.2.2.1. State Definitions

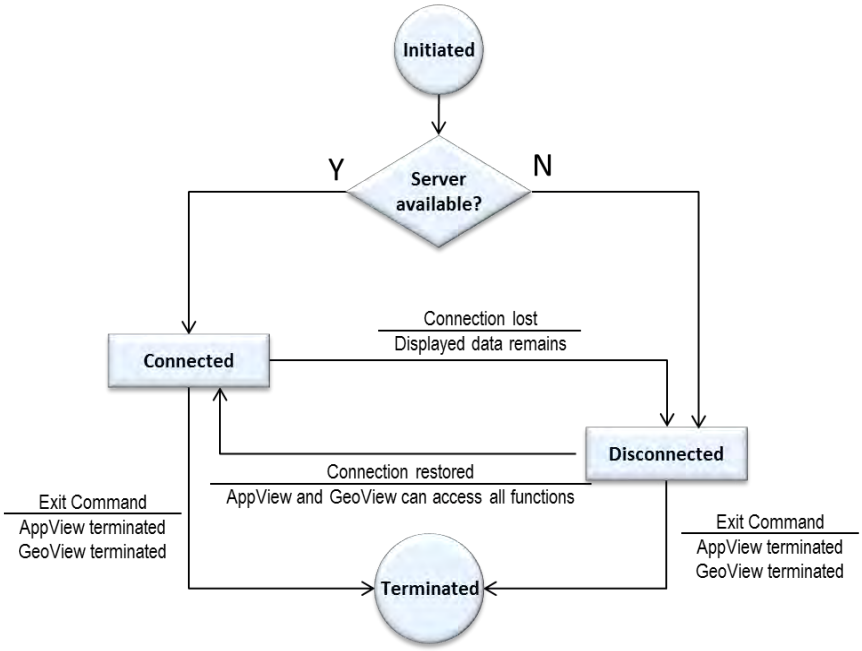
Operational States of TRITON Clients will be determined according to the Selected Server and defined as follows:

Connected : AppView is connected to the selected TRITON Application Server.

Disconnected : AppView has no connection to the selected TRITON Application Server.

4.1.2.2.2. State Transitions

The AppView state transitions are depicted in the following diagram:



[T1-R014] *TRITON AppView shall be available to all users if the standard NATO CIS Infrastructure and a workstation with a browser is available.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Demonstration

[T1-R015] *TRITON AppView shall be able to connect to a selected TRITON Server.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Demonstration

[T1-R016] *TRITON AppView shall switch to "Connected" state if it gets connected to the selected TRITON Server.*

Requirement Property :
- Domain for Static : Both

Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Demonstration

[T1-R017] *TRITON AppView shall allow the user to launch GeoView when it is in "Connected" state.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Test

[T1-R018] *TRITON AppView shall switch to "Disconnected" state if it loses its connection to the selected TRITON Server.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Test

[T1-R019] *TRITON AppView shall be able to detect network connection failure and automatically reconnect to the selected TRITON Server if the network connectivity is re-established within a configurable time period.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Test

[T1-R020] *TRITON AppView shall notify the user if it loses its connection to the selected TRITON Server, keep displaying the available operational data and shall not accept any operational function command.*

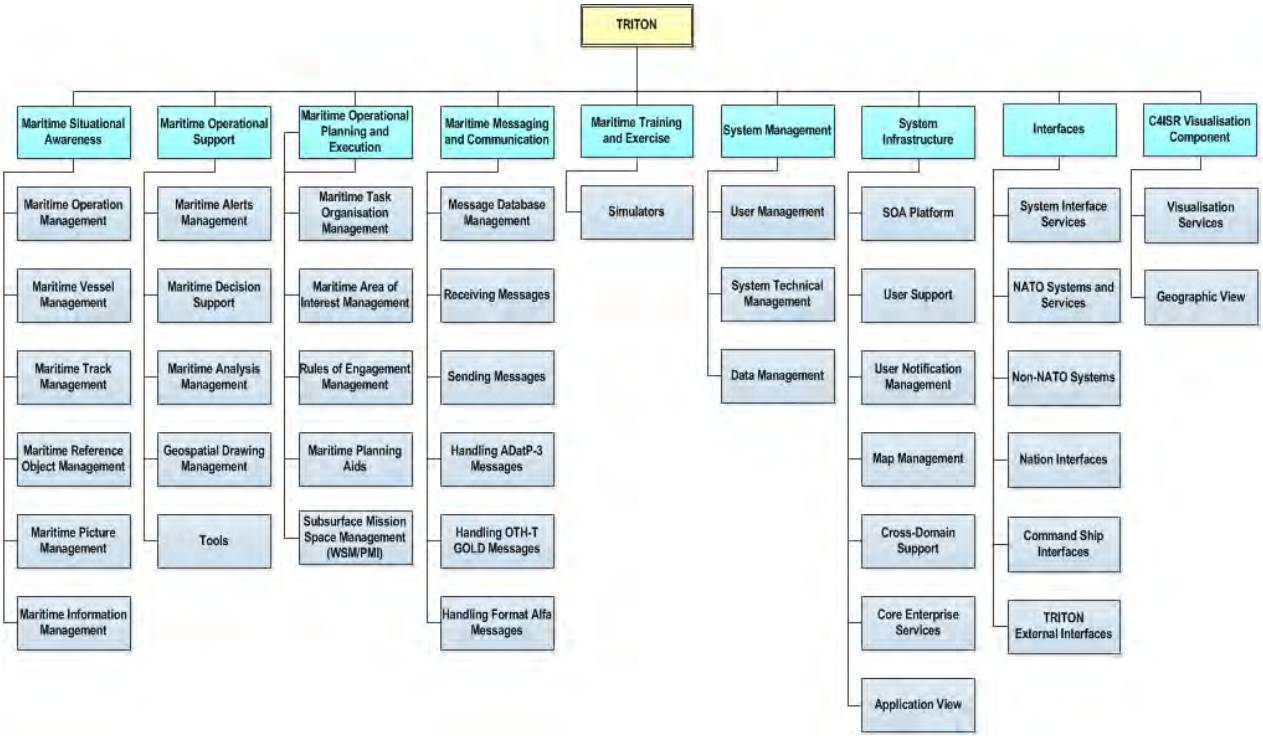
Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Test

[T1-R021] *TRITON AppView shall terminate with an Exit Command from the user with confirmation. If GeoView has been launched, it shall be terminated when the AppView is terminated.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Test

4.2. TRITON Functional Service Requirements

A Bi-SC AIS Functional Service enables users to collect, process, present and distribute information that supports the major functions of maritime operations which are the set of military activities conducted by maritime air, surface, sub-surface and amphibious forces to attain and maintain a desired degree of control of the surface, sub-surface, and air above the sea, influence events ashore, and, as required, support land, air and space operations. TRITON, as a full Bi-SC AIS Functional Service, will consist of a set of User Applications and Technical Services as explained in the Reference Architecture. The capabilities and functions of TRITON within the scope of Increment 1 are logically grouped into a structure. The following diagram shows the high-level breakdown of TRITON up to the second level.



Each functional group is elaborated further in the paragraphs of this Section. The lowest level components contain the system-level requirements. These components will be implemented as User Applications and Technical Services compliant to the C3 Taxonomy [C3TAXO]. Depending on the selected configuration identification method, the main functions will be mapped to system elements (configuration items and components) in the Product Breakdown Structure.

4.2.1. Maritime Operational Objects

TRITON uses Maritime Operational Objects to address all operationally related entities that need to be tracked, recorded and displayed. They are also known as Battle Space Object (BSO). A Maritime Operational Object has three entity types as shown below:

The definition of each entity type is given below:

Vessel **:** A maritime craft designed for transportation on water, such as ships, boats or submarines.

Track **:** Graphic and/or alphanumeric representation of successive positions of a moving object, point, or bearing whose position and/or characteristics are collected from sensors and/or other data sources. It can also be defined as a collated set of data associated with a track number for the purpose of representing the position and/or characteristics of point, or bearing (TRITON will use only point tracks).

Reference Object **:** A "Reference Point", a "Line" or an "Area" on earth that has an operational or tactical meaning.

Each type of entity is handled appropriately by its management functions.

4.2.2. Maritime Operation Management

Maritime Operation is a military action or the carrying out of a strategic, tactical, service, training, or administrative military mission; the process of carrying on combat, including movement, supply, attack, defence and manoeuvres needed to gain the objectives of any battle or campaign. Maritime Operations include any actions performed by forces on, under, or over the sea to gain or exploit command of the sea, sea control or sea denial, and/or to project power from the sea. In a joint environment, maritime forces do more than simply pursue the maritime objectives of the JFC's campaign [AJP-3.1]. There may be Tasks and Nested Tasks in a Maritime Operation as well. The duration of a Maritime Operation can vary. It may be for a couple of weeks, a couple of years or continuous. An example to a long-term operation is to collect and monitor "White Shipping" at the NATO Shipping Centre.

Maritime Operation Types:

The types of Maritime Operations as defined in AJP-3.1 are listed below:

- Surveillance and Reconnaissance
- Coastal Defence Operations
- Protection of Shipping
  - Sea Control
  - Distant and Close Escort
  - Naval Cooperation and Guidance for Shipping
  - Convoying
- Sea Control Operations
  - Establishment and Maintenance of a Recognised Maritime Picture
  - Shaping Operations
  - Barrier Operations
  - Layered Defence
  - Exclusion Zones
- Maritime Power Projection Operations
  - Maritime Air Strikes
  - Amphibious Operations
  - Special Operations Forces
- Maritime Support to Joint Air Defence
- Other Maritime Operations
  - Maritime Interdiction Operations
  - Embargoes and Quarantine
  - Blockade
  - Other

Due to the nature of a maritime operation, an exercise or training, a "Maritime Operation" will be the key logical grouping factor for delivering services in TRITON. All input data is processed and grouped within the context of associated Maritime Operation. Therefore, Maritime Operations are defined as a manageable entity with its own context and the related TRITON services are applicable to a particular operation only in its context. Each operation context defines an "Environment" so that users can access the TRITON services in that Environment. This approach requires the automated management of Maritime Operations controlled by the authorised users.

Maritime Operation:

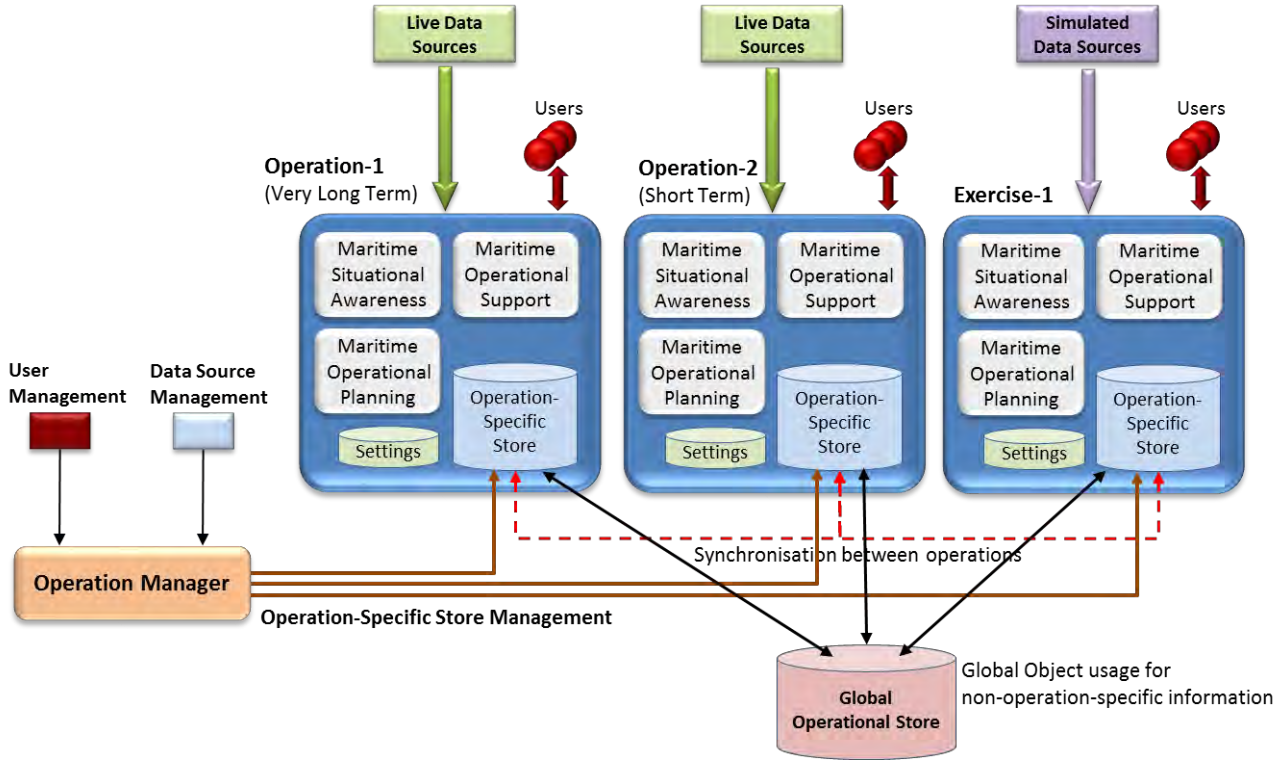
TRITON will maintain a list of Maritime Operations where each Maritime Operation is represented with at least the following attributes:

- Maritime Operation Identifier
  - Exercise Identification
  - Operation Codeword
  - Operation Alias Identifier
- Type (one of the above-mentioned operation types)
- Mode (live, exercise, mixed)
- Description (text)
- Objective (text)
- Security Classification
- Commander
- Begin/End Dates
- Status (in-preparation, active, inactive)
- Environment information (context)
- User Management data (user groups, users, privileges)
- Area of Operation (as an Area definition)
- Links to related documents (i.e. OPLAN, OPTASK RMP)
- Rules of Engagement List (associated to the ROE List)
- Associated Maritime Task Organization (see Maritime Task Organization Management)

The Maritime Operations List will be maintained by TRITON without any capacity limitation.

TRITON will maintain a logical store named as "Global Operational Store" to hold the information common to all operations at the global context. This includes the Vessel Database and other C2-related databases and lists (WSM/PMI Database etc.). When a new Maritime Operation is created, an "Operation-Specific Store" for holding the Maritime Operational Objects (Tracks, Vessels, Reference Objects and other data) is also created with a context called "Environment". This Environment is then filled with the selected information from the Global Operational Store.

The picture below depicts the concept of Operation Management, handling data flows and storing Maritime Operational Objects followed by their explanation:



Operation Manager:

The Operation Manager is a managing function in the System Management which acts as the central orchestrator to handle the creation of Environments specific to a Maritime Operation, management of users and data sources.

Users:

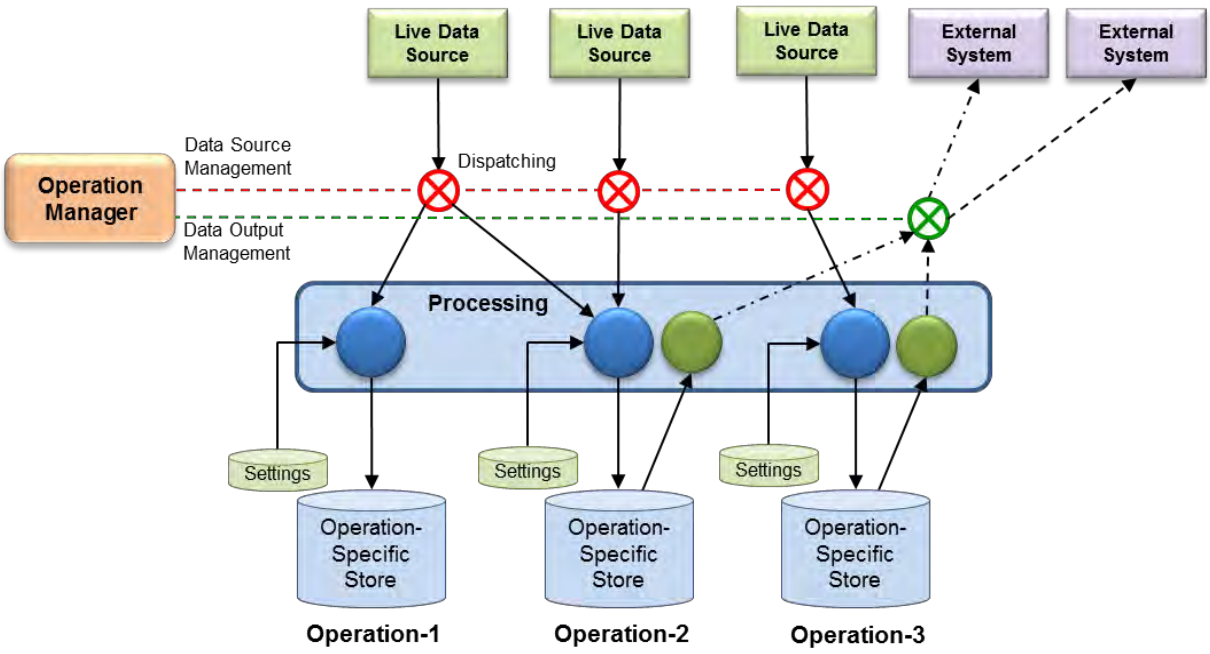
A user who wants to access TRITON services via a Client will initially be asked to select a Maritime Operation to which he/she will participate or view. After selection, the user will be able to enter into the Environment of the selected Maritime Operation. At any given time, a TRITON Client can access, if authorization provided, to as many Maritime Operations as the user wishes to access, including the RMP of that particular Maritime Operation.

Data Handling:

Operation-Specific Store also contains the data routing rules specific to the Maritime Operation so that incoming data (e.g. messages) are dispatched accordingly. The period and the destination of the generated Maritime Picture can also be handled in the same manner. The data generated in a Maritime Operation can be sent to other Operations according to their releasability labels.

Data Sources:

All external data sources (systems or services) are managed centrally by the Operation Manager which can dispatch the incoming/outgoing information flows from/to external systems/services. The Operation Manager is controlled by the Operations Administrator. The Operation Administrator manages the connection between the Operation-Specific Store and the data source by creating, modifying, deleting a connection, and monitoring their status. The concept of directing the flow of information under the control of Operation Manager is depicted in the following picture:



Operation Context:

All maritime functions will be available for any Maritime Operation regardless of their duration and classification. The logical store, Operation-Specific Store, will hold all the information related only to the Maritime Operation. It includes at least the following information:

- Name (the name of the Maritime Operation)
- Authorized users (with their roles within a Maritime Operation)
- Interfaces to external data sources (valid for the Maritime Operation)

- Operation-specific Vessels List (including COI/CCOI/VOCI/Custom Lists)
- TRITON Operational Object Databases (each object is uniquely identified in the global scope together with its security classification label and releasability label)
- Lists (e.g. C2 Areas, Person of Maritime Interest)
- There will be another store called "Settings" to hold the operation-specific configuration settings for Maritime Operational Object Management functions. Correlation Criteria settings is an example to this.

Each Maritime Operation will have its own data context with security classification and releasability labels. Operation-Specific Stores can synchronise their data according to these labels automatically.

Administration:

Each Maritime Operation has its own administration by the authorised user, Operations Administrator, who also configures the Environment including the Operation-Specific Store. Another administrative role, Operation-Specific Administrator, manages the users in a Maritime Operation and the settings for that Environment such as rules for Track Management and Picture Management. These settings can be configured according to the procedures (i.e. OPTASK RMP) associated to the Maritime Operation.

Databases:

TRITON Operational Object Databases are maintained separately in each Maritime Operation as part of their Operation-Specific Store. These databases store the Tracks, Vessels, Reference Object and other data such as WSM/PMI Areas and then used to build the RMP within the Maritime Operation Environment to conduct a specific Maritime Operation. All Maritime Operational Objects in databases have labels to indicate their releasability to Maritime Operations. When they are marked by the authorised user, the other Maritime Operations can access that information. In order to preserve the data integrity, only the authorised Maritime Operation can manage the Vessel Database in the Global Operational Store when the local one is updated. All privileges to Maritime Operations are given by the Operation Manager while local settings are configured by the Operation-Specific Administrator. If necessary, off-line databases can be used to feed data into the databases within a Maritime Operation. Databases can be archived into a designated storage to be referenced later on.

Processing:

Based on the configuration settings, TRITON redirects the flow of information from/to external systems/services to its internal functions to process build the relevant databases and to output the Information Products. An example to operation-specific processing includes reception, validation, correlation, identification, association and filtering of tracks and vessels within a specific Maritime Operation. Default rules will be applied over the incoming data according to the Mode of the Maritime Operation (for example, live data will not be accepted in a simulated Maritime Operation as defined in NATO RMP SOP (Section 4, Paragraph (e) [RMP SOP]). The Operation-Specific Store will then be used to build the Maritime Operational Picture. If the local information in the Operation-Specific Store is not sufficient for identification process, then the Global Operational Store will be used. For example, if an Operation-Specific Store doesn't contain all the information for a particular vessel identification such as MMSI, IMO number, then it will look for this information in the Global Operational Store.

Accessing Maritime Picture:

The inherent way of accessing (in addition receive the disseminated information) a Maritime Picture compiled within a Maritime Operation will be achieved by first accessing the relevant Maritime Operation and then use the Picture Management capabilities. In addition, TRITON will be able to disseminate RMP using Web services and Formatted Messages.

Off-line Use:

Maritime Operations can be used for off-line data analysis purposes. A specific Maritime Operation can be created as a working environment. The user can then import data from an external archive (e.g.

an exported Vessel Database) into this Maritime Operation. Any user accessing this Maritime Operation can visualise the objects on the GeoView and perform any analysis.

Applicability:

All the functions defined in this SRS will be applicable to each Maritime Operation in an independent manner in its context.

[T1-R022] *TRITON shall maintain a list of Maritime Operations.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Demonstration

[T1-R023] *TRITON shall allow the authorised user to manage (create, modify, delete, import) the Maritime Operations List.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Test

[T1-R024] *TRITON shall allow the authorised user to import Maritime Operation information from a selected TRITON Server of a selected installation.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Test

[T1-R025] *TRITON shall allow the authorised user to manage the databases in the Global Operational Store.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Test

[T1-R026] *TRITON shall allow the authorised user to manage (create, backup, restore, delete, import, export) the Operational-Specific Store. The user shall be able to import whole or part of previously exported Maritime Operational Object Databases into the internal databases of a Maritime Operation.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Test

[T1-R027] *TRITON shall allow the authorised user of a Maritime Operation to manage the users in that Maritime Operation.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Test

[T1-R028] *TRITON shall control and direct the flow of information coming from external data sources to a Maritime Operation.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Demonstration

[T1-R029] *TRITON shall control and direct the flow of information to external systems/services within a Maritime Operation.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Demonstration

[T1-R030] *TRITON shall allow the authorised user of a Maritime Operation to manage the flow of information to/from external data sources.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Test

[T1-R031] *TRITON shall allow the authorised user of a Maritime Operation to manage the sharing of data with other Maritime Operations according to the security classification and releasability labels.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Test

[T1-R032] *TRITON shall allow the authorised user of a Maritime Operation to make use of the shared data by other Maritime Operations according to the security classification and releasability labels.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Test

[T1-R033] *TRITON shall allow the authorised user of a Maritime Operation to manage the configuration settings applicable to information processing.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Test

4.2.3. Maritime Situational Awareness

Maritime Situational Awareness (MSA) capability allows the users to consult, manage and process shipping information both military and non-military. NATO MSA is an enabling capability which seeks to deliver the required information in the maritime environment to achieve a common understanding of the maritime situation to increase effectiveness in the planning and conduct of operations.

MSA covers both the military and non-military realms and involves interoperability and/or collaboration with a wide variety of non-traditional data sources, organizations and actors. While this profile is unclassified, comprehensive MSA includes other architectural elements such as classified intelligence and locations of warships to provide the full RMP.

The maritime environment comprises the oceans, seas, bays, estuaries, waterways, coastal regions and ports. Considerable resources for merchant shipping data are available ranging from commercially available databases to transient records of vessels passing through the world's ports posted on port websites.

Information related to non-combatant (civilian) vessels may be collected from both static reference external databases such as World Port Index (WPI) or Lloyd's Marine Intelligence Unit, and dynamic sources such as Automatic Identification System (AIS), Long Range Tracking and Identification (LRIT) system as well as from operator defined data. Combatant (military) vessels can be tracked by using the Tactical Data Link capabilities, Nations' reports and information collected by ACPs. Intelligence reports and any other inputs can be used to enhance the MSA. Warships AIS (W-AIS) [STANAG 4668], [STANAG 4669] may also be used if the data is available in reporting sources.

The MSA functionality in TRITON includes the management of Maritime Operational Objects (Tracks, Vessels and Reference Objects), Maritime Picture Management and Maritime Information Management. These functions enable users to access, collate, and merge validated data to build the global Maritime Operational Picture which will then be used to build the Recognised Maritime Picture.

4.2.3.1. Maritime Vessel Management

A maritime craft will be represented as a Maritime Vessel in TRITON. Virtually all maritime vessels in the world will be stored in a database called "Vessel Database". It will hold all naval units, merchant vessels, fishing vessels, pleasure crafts and government ships like coastguard, police, customs and research. The Vessel Types are defined in APP-20 as follows:

Combatants:

Naval, Coast Guard and Government-owned vessels/craft which possess some sort of inherent armed or combat capability primarily intended for offensive use. This group of vessels has the following sub-groups:

- Submarines
- Principal Surface Combatants
- Patrol Vessels
- River/Roadstead Patrol Vessels
- Mine Warfare Vessels
- Amphibious Warfare Vessels
- Special Warfare Vessels
- Coast Guard Vessels (including law-enforcement vessels)

Non-Combatants:

Auxiliary, Service Support or Merchant/Recreational Vessel types, which tend to be role specific. They may possess an armed or combat capability intended primarily for self-defence purposes. This group of vessels has the following sub-groups:

- Auxiliary Vessels
- Service and Support Vessels
- Government-owned Vessels
- Merchant Vessels
- Recreational Vessels

Once Vessel Database is accumulated, only the authorised user can manage (add, modify, remove) the Vessel Database. The information from various data sources such as Nation reports, intelligence reports and data links is analysed and correlated, and the available Tracks can be associated with Vessels in the Vessel Database. This database provides detailed, static information for those Tracks and stores the history. The authorised users can manually update the static attributes of Vessels like activity, status, capabilities, image.

All TRITON users can issue a search to find a specific Vessel and view its attributes including the last reported position and kinematic history. TRITON displays the Vessels using the same symbology as Tracks. RMP can be enhanced using this database in addition to the Track Database.

4.2.3.1.1. Vessel Definition

A maritime vessel, for both combatant and non-combatant, is represented in TRITON with a record in the Vessel Database. The primary sets of data stored are given below:

Identification Set:

A set of attributes called "Identification Set" is used to uniquely identify a Vessels in the Vessel Database. It consists of the following:

- Country
- Vessel Name
- Name synonyms
- International call sign
- Hull number (for combatants)
- IMO number (for non-combatants)

Kinematics Data:

Kinematics Data consists of with at least the following:

- Geographical position (latitude, longitude)
- Course and a speed
- Depth (for submerged vessels)
- Updating source identification
- Date-Time Group (DTG) of update

Journey Data:

Journey Data for non-combatants consists of the following:

- Departure port, DTG
- List of Last Ports of Call (at least ten (10))
- Next Port of Call and Estimated Time of Arrival (ETA as DTG)
- Arrival port, DTG

Event Data:

Event Data for non-combatants consists of the following:

- Events (text, e.g. attempt for hijacking)
- Response to Hailing
- Area
- DTG

Activity Data:

Activity Data for combatants consists of the following:

- Activity (for surface/subsurface platforms as defined in STANAG 5516)
- Maritime Mission

- Maritime Unit Task
- Begin DTG, end DTG

History:

History data for each Vessel consists of a list of records containing the following:

- Kinematics History : A timely set of Kinematics Data
- Journey History : A set of Journey Data
- Activity History : A timely set of Activity Data
- Event History : A timely set of Event Data

Vessel Data:

TRITON will store the data related to each Vessel with a record called "Vessel Data" which includes at least the following attributes:

- Unique identification (TRITON Vessel Number)
- Identification Set (as defined above)
- Current Maritime Operation
- Security Classification
- Releasable Maritime Operations (more than one Maritime Operation can be indicated)
- Picture designation (Recognised, Military, White, none)
- High Value Unit (yes/no)
- RMP designation
  - Included RMP Region identification
  - Excluded RMP Region identification
- Exercise Indicator
- Exercise Identification Set
  - Exercise Identity
  - Exercise Country (STANAG 1059, Annex C)
  - Exercise Vessel Name
- Vessel Type (combatant or non-combatant)
- For Combatants:
  - Ship Designator (one of the ship designators for combatant as defined in APP-20 Table 1A-1)
  - Class name (name of the class that the ship belongs to)
  - Sensor information (types, ranges, status, etc.)
  - Weapon information (types, ranges, status, etc.)
  - Damage status (text)
  - Endurance (fuel, oil status)
  - Speed capabilities (maximum, economical, cavitation speed (submarines))
  - Diving capability (submarines)
  - Commanding Officer
  - Activity History (as defined above)
- For Non-combatants:
  - Ship Designator (one of the ship designators for non-combatant as defined in APP-20 Table 1A-1)
  - LRIT Equipment Identifier
  - Voluntary reporting (whether or not contributing to voluntary reporting scheme with Format Alfa)
  - Number of crew

  - Number of passengers
  - Owner company and contact details
  - Speed capabilities (maximum, economical, cruise)
  - Endurance (range, duration)
  - Journey History (as defined above)
  - Detention List indication with the associated list if exists
- Standard Identity (STANAG 1241)
- AIS MMSI Number
- Physical characteristics (length, beam, draught, masthead-height, displacement, deadweight, etc.)
- Cargo (LPG, oil, chemicals, goods, material, food, machinery, container, etc.) and amount
- Built date and builder
- Launch and commissioning dates
- Propulsion (engine, steam, nuclear, sail)
- Status (operational, overhauling, maintenance, hijacked, decommissioned, lost, sank, etc.)
- Last Known Kinematics Data (as defined in the Description)
- Kinematics History (as defined above)
- Event History (Event Data)
- Image files
- Data files
- URL list for any external references
- Vessel List indication with the associated list (CCOI/COI/VOCI/Custom) if exists
- Local Remarks (text, DTG and originator)

Note: All time values are in UTC.

The attributes of Vessels will be determined according to the most recent Maritime Datasets available. Attributes as history information (Kinematics, Activity, Event, Journey) will have no capacity limitation. A configuration parameter History Period will be used to set the time period for storing data.

4.2.3.1.2. Vessel Database Management

Cuurently, there are over half a million maritime vessels of different sizes in the world. It is expected in near feature that this number will approach to five million. TRITON will maintain an internal storage called "Vessel Database" for dynamically storing and managing Vessels in all types and sizes as recognised by NATO. The Vessel Database will be optimised for quick access, update and retrieval without any physical capacity limitation, considering the future needs. The history information for each Vessel will also have no capacity limitation. For design purposes, the expected number of vessels in future will be used.

The authorised user can manage (add, modify, remove, export, import, backup) the Vessel Database. Vessel Database can be updated by importing data from external Maritime Datasets (see Maritime Information Management / Maritime Datasets). Whole or portions of the Vessel Database can be exported into a file in Recognised Export File Format.

[T1-R034] *TRITON shall maintain a Vessel Database to store all Vessels in the world in all types and sizes as recognised by NATO.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Demonstration
Comment : The Vessel Data definition will be finalised during SwDR.

[T1-R035] *TRITON shall use an optimised database structure for storing only the relevant data for relevant attributes for particular types of Vessels (for example, weapons data will be stored for only combatants).*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Inspection

[T1-R036] *TRITON shall allow the authorised user to manage (add, modify, remove, import, export, backup) the Vessel Database in each Maritime Operation scope. The user shall be able to export or import whole or part of the database.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Test

[T1-R037] *TRITON shall be able to store the attribute changes made by the authorised in the Vessel Database user for at least ninety (90) days.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Inspection

[T1-R038] *TRITON shall be able to store Kinematics History, Journey History, Activity History and Event History for each Vessel for a period of time set in the configuration parameter History Period.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Demonstration
- Comment : For test purposes ninety (90) days will be used.

[T1-R039] *TRITON shall allow the authorised user to set the configuration parameter "History Period" which is used for determining the period of history to be stored in the Vessel Database.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Test

[T1-R040] *TRITON shall notify the authorised user about the Vessels if their History Period is reached with an option of time extension.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Test

[T1-R041] *TRITON shall allow the authorised user to set the configuration parameter "Vessel History Distance" for each vessel type in order to determine the interval for updating the vessel positions in the Vessel Database.*

Requirement Property :

Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Test

4.2.3.1.3. Vessel Number Management

TRITON will use multi-level Vessel Identification. System-specific internal vessel identification mechanism may be hidden from the users, but a user-level vessel numbering scheme named as "TRITON Vessel Number" (TVN) will be maintained system-wide. TVN will be a decimal number sufficiently large to address all vessels in the Vessel Database. TVNs will be used to display vessels on GeoView even if they are not associated to tracks.

Each TRITON instance may have the same vessel number scheme, but separate pools (number blocks) can be defined and allocated for each of them. Similarly, a number block is allocated for each Maritime Operation.

[T1-R042] *TRITON shall use unique decimal numbers to identify vessels at user level.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Demonstration

[T1-R043] *TRITON shall allow the authorised user to allocate TVN pool for the entire system and each Maritime Operation by defining the first and last vessel numbers.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Test

[T1-R044] *TRITON shall assign a unique TVN to each new vessel added into the Vessel Database.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Test

4.2.3.1.4. Vessel Identity Management

TRITON can display vessels on the GeoView using the track symbology (e.g. APP-6) with the default Standard Identity (for Standard Identities see Track Identity Management) in the database.

Standard Identities:

All vessels in the Vessel Database will have the default Standard Identities as given below:

On the NS Domain:

- All alliance combatants : FRIEND
- All others : NEUTRAL

On the NU Domain:

- All types of vessels : NEUTRAL

In addition, TRITON will allow the authorised user to define the Standard Identities to be assigned to the vessels according to the current SOPs.

[T1-R045] *TRITON shall assign FRIEND as the default Standard Identity to all alliance combatant vessels in the Vessel Database and NEUTRAL to all other vessels on the NS Domain.*

Requirement Property :
Domain for Static : NS
Domain for Afloat: NS
Baseline : BL 1
Qualific. Method : Test

[T1-R046] *TRITON shall assign NEUTRAL as the default Standard Identity to all vessels including the alliance combatant vessels in the Vessel Database on the NU Domain.*

Requirement Property :
Domain for Static : NU
Domain for Afloat: NU
Baseline : BL 1
Qualific. Method : Test

[T1-R047] *TRITON shall allow the authorised user to assign a new Standard Identity according to [STANAG 1241] to selected vessels in the Vessel Database.*

Requirement Property :
Domain for Static : NS
Domain for Afloat: NS
Baseline : BL 1
Qualific. Method : Test

4.2.3.1.5. Vessel Management

Vessels in the Vessel Database can be managed (add, modify, remove, import, export) by the authorised user. Any attribute of any Vessels can be modified only by the authorised user. Vessel Database can be updated by importing data from external Maritime Datasets. Selected Vessels can be exported into a file in Recognised Export File Format.

Vessels in different Maritime Operations can be shared if they are labelled accordingly in their Releasable Maritime Operations attribute.

[T1-R048] *TRITON shall allow the authorised user to import data from recognised Maritime Datasets into the Vessel Database.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Test

[T1-R049] *TRITON shall check the key attributes of Vessel Data during the import process from a selected Maritime Datasets into the Vessel Database and prevent any duplications with notification.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Test

[T1-R050] *TRITON shall be able to use a Vessel Data Import Tool to import data from a selected Maritime Datasets into a file in Recognised Import File Format.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1

Qualific. Method : Demonstration

[T1-R051] *TRITON shall allow the authorised user to be able to export data from the Vessel Database according to a given selection criteria into a user-specified file in Recognised Export File Format.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Test

[T1-R052] *TRITON shall be able to share the Vessels in the Vessel Database among multiple Maritime Operations if they are labelled accordingly in their Releasable Maritime Operations attribute.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Demonstration

4.2.3.1.6. Vessel List Management

Vessel List Management provides managing (create, update, delete) dynamic lists of maritime vessels that are subject to close interest. A list will hold the names of a number of ships with a label explaining the purpose and context of the list. Following Vessel Lists, as defined in [MC0367/2], will be identified:

Critical Contact of Interest (CCOI):

Any platform in the maritime domain conducting activities qualified as illegal by international law and considered to be an imminent threat to NATO, NATO Nations maritime security interests and/or related assets.

Contact of Interest (COI):

Any platform in the maritime domain conducting activities qualified as illegal by international law considered to be a potential threat to NATO, NATO Nations maritime security interests and/or related assets.

Vessel of Collection Interest (VOCI):

Any platform in the maritime domain involved in any activity of intelligence interest.

Custom Watch List:

Any platform in the maritime domain conducting activities that do not qualify for one of the above but raise special interest for NATO. For example, NATO Shipping Centre Priority List can be created and maintained.

For the purpose of detailed situational awareness, COIs and VOCIs are sub-categorised in reporting according to the reason that led to their classification. The following seven types are being used in accordance with international law, including any applicable treaties and customary law and with full respect for any relevant United Nations Security Council Resolutions:

- Type 1: Platform/ Owner or Company possibly associated with terrorism;
- Type 2: Platform/ Owner or Company possibly associated with Weapon of Mass Destruction (WMD) Proliferation;
- Type 3: Platform/ Owner or Company possibly associated with illegal Immigration;
- Type 4: Platform/Owner or Company possibly associated with piracy, slave trade or engaged in other activities qualified as illegal by international law;
- Type 5: Platform having displayed suspicious behaviour;

- Type 6: Platform possibly posing an environmental concern;
- Type 7: Selected platforms of armed forces of non-NATO nations and other platforms as the situation dictates.

The Vessel Lists can be shared with national authorities using formatted messages.

Vessel Information:

For each Vessel List at least the following information will be stored:

- COI Category (CCOI/COI/VOCI and Custom Watch List)
- Vessel List identification (name)
- Activity (Terror, Weapon of Mass Destruction, Immigration, Illegal, Suspicious, Environment, Military, and/or Others)
- Current Maritime Operation
- Security Classification
- Releasable Maritime Operation
- RMP designation
  - Included RMP Region identification
  - Excluded RMP Region identification
- Description of the interest of the list
- Comments (e.g. "not to be hailed without approval")
- Date of validity of the list
- List of Vessels

There may be several Vessel Lists to be maintained concurrently. Each Vessel List also contains hundreds of vessels of interest. TRITON will not have a capacity limitation to store and manage the Vessel Lists.

[T1-R053] *TRITON shall maintain Vessel Lists to store CCOI/COI/VOCI and Custom Lists as defined in the Description.*

Requirement Property :
Domain for Static : NS
Domain for Afloat: NS
Baseline : BL 3
Qualific. Method : Demonstration

[T1-R054] *TRITON shall allow the authorised user to manage (create, modify, delete, import, export) the Vessel Lists.*

Requirement Property :
Domain for Static : NS
Domain for Afloat: NS
Baseline : BL 3
Qualific. Method : Test

[T1-R055] *TRITON shall allow the authorised user to define the default identities to be assigned to CCOI and COI vessels.*

Requirement Property :
Domain for Static : NS
Domain for Afloat: NS
Baseline : BL 3
Qualific. Method : Test

[T1-R056] *TRITON shall automatically assign the default identities to CCOI and COI vessels when the Vessel List is created.*

Requirement Property :
Domain for Static : NS

Domain for Afloat: NS
Baseline : BL 3
Qualific. Method : Test

[T1-R057] *TRITON shall allow the user to display the Vessels in the selected Vessel List in sortable tabular form with an option to indicate it on the GeoView.*

Requirement Property :
Domain for Static : NS
Domain for Afloat: NS
Baseline : BL 3
Qualific. Method : Test

[T1-R058] *TRITON shall allow the user to display the positions of the Vessels of the selected Vessel List on the GeoView based on user-selected criteria (e.g. type, date, country, area).*

Requirement Property :
Domain for Static : NS
Domain for Afloat: NS
Baseline : BL 3
Qualific. Method : Test

[T1-R059] *TRITON shall allow the authorised user to export selected Vessel Lists into a file in Recognised Output File Format and import Vessel Lists from a given file in Recognised Input File Format.*

Requirement Property :
Domain for Static : NS
Domain for Afloat: NS
Baseline : BL 3
Qualific. Method : Test

[T1-R060] *TRITON shall allow the authorised user to select a Vessel List and generate a Formatted Message (e.g. OTH-T GOLD CONTACT REPORT or ADatP-3 MARINTREP).*

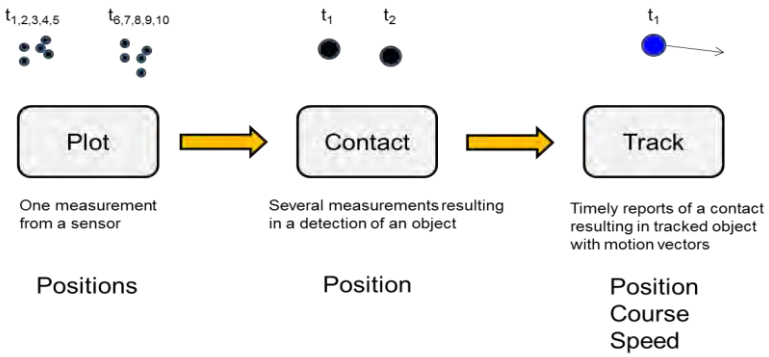
Requirement Property :
Domain for Static : NS
Domain for Afloat: NS
Baseline : BL 3
Qualific. Method : Test

4.2.3.2. Maritime Track Management

Starting from the sensor level, a sensor detection is called a "plot". Plots are used to build "contacts" reported by the sensors. Those contacts can then form a "track" if a tracking process is used either within the sensor or outside of the sensor.

A "track" is the representation of a moving object in terms of its position, course, speed and general characteristics. The information comes from external sources. Tracks may be in two forms: Point Tracks and Bearing Tracks. A Point Track may have two or three dimensions with course and speed. Bearing tracks can have only one dimension, an origin and an angle from true north.

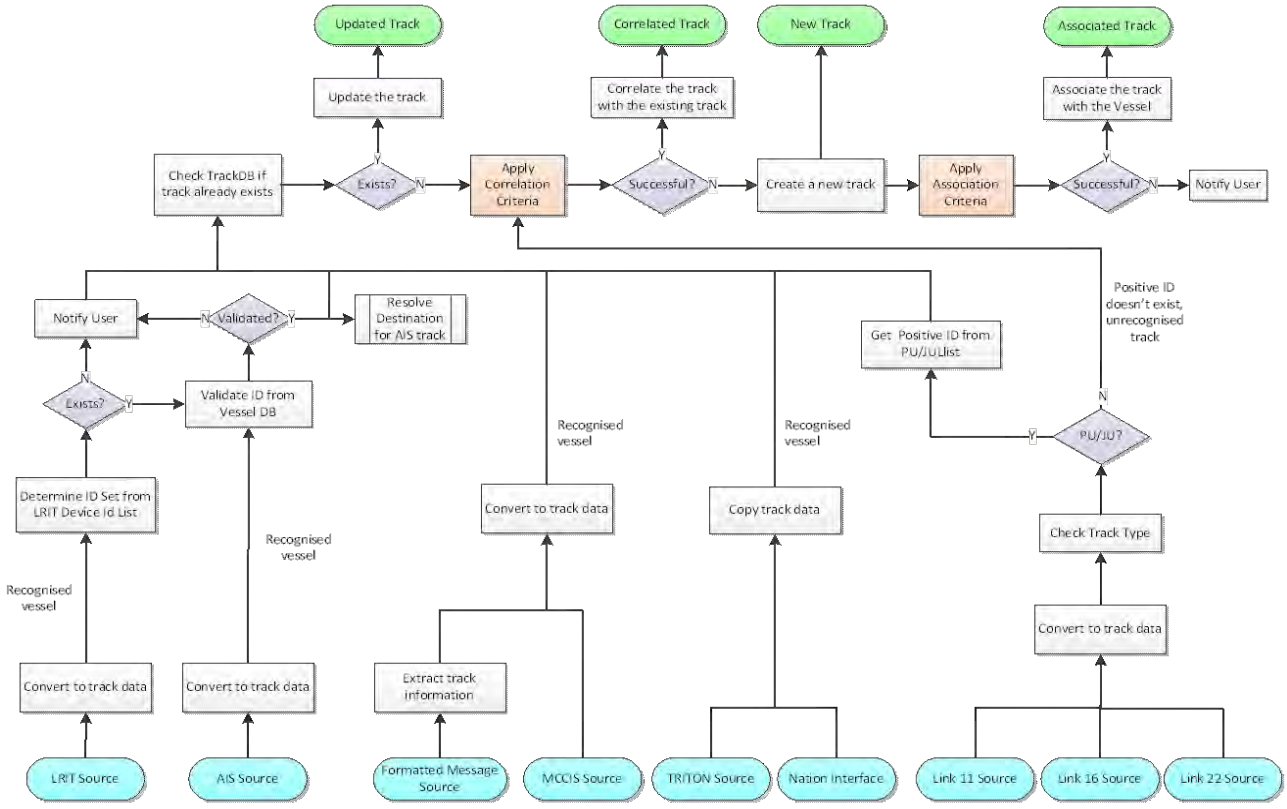
TRITON will use only point tracks, not contacts and sensor plots. The terminology distinction is depicted below:



TRITON will use the term "track" for both one-time report for a vessel and continuous on-line reporting of a vessel by a recognised source. For example, AIS track from an AIS source, NIRIS track feed or Nations' on-line track feeds are all considered as tracks. Similarly, a report received from a Nation using OTH-T GOLD message will also be treated as a track. The contact reports received from a source will be used to create a TRITON track if it doesn't exist, follow-on reports will be used to update that track. Tracks can be dropped by TRITON if no update is received within a specified time period. Tracks can also be deleted by its reporting source.

TRITON will support world-wide track management, which means all tracks detected and reported from different regions of the world will be identified uniquely in the system context. Therefore, unique number allocation will consider multiple TRITON instances.

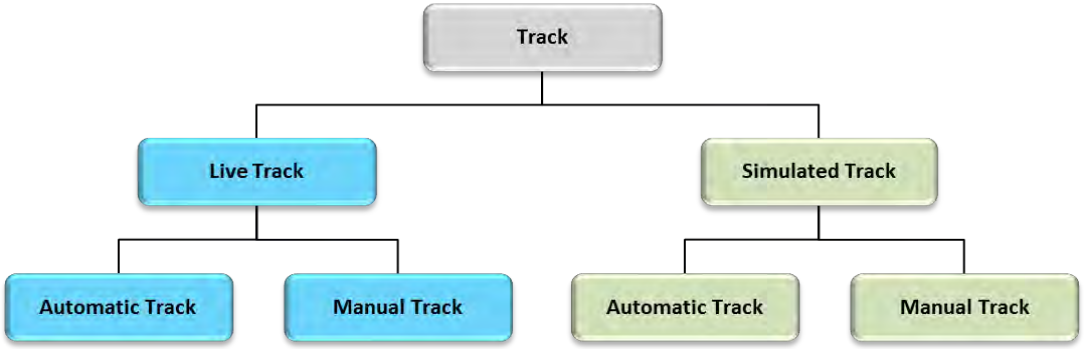
TRITON maintains an internal track store, creates tracks based on the received track data, updates them, correlates them if they are reported by different sources, and deletes them if they are deleted by source or not updated for a given time. A notional flow of data from sources to user-level tracks is illustrated in the following flowchart:



Each process and decision point is explained in relevant paragraphs and associated with requirements.

4.2.3.2.1. Track Definition

TRITON will process only point tracks using 3-dimensional coordinates. Geodetic positions (Latitude and Longitude) will be used to indicate the location on earth. Altitude and depth will be processed and displayed. TRITON track types are shown below:



The definitions of these track types are given below:

Live Track : A track that represents a real object in the world.

Simulated Track : A track that represents an imaginary object.

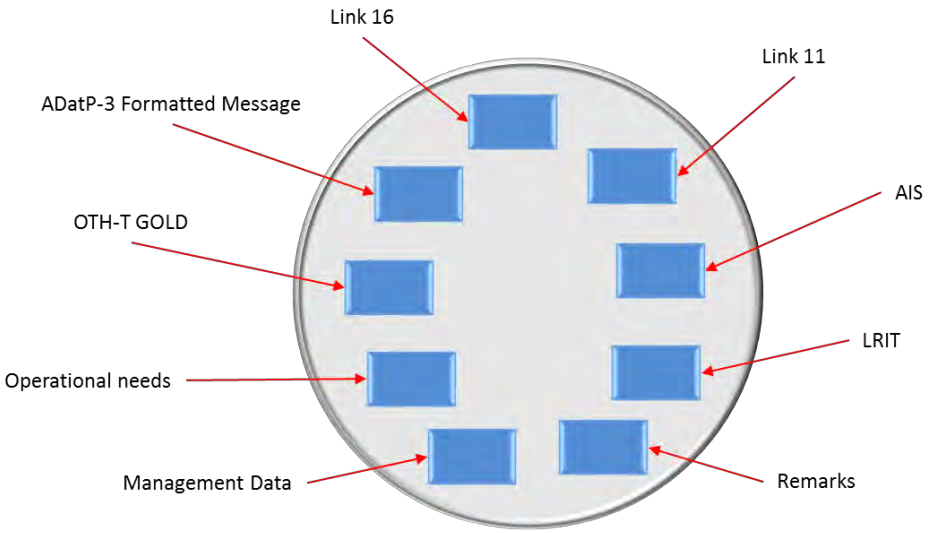
Automatic Track : A track reported by a sensor or simulator and updated continuously.

Manual Track : A track manually initiated and maintained by an operator.

AIS, LRIT, on-line Nation feed and TDL tracks are examples to automatic tracks. Nations report (via formatted messages) and user-initiated tracks are manual tracks.

The attributes for maritime objects may be different depending on the type of the vessel being tracked. TRITON will use a standard track definition internally which is a composition of several track types received from various sources. It is called "Track Data", which consists of a combined set of attributes for both combatant and non-combatant tracks. When received from external sources, depending on the type of the track, only the relevant attributes of a track will be used in the Track Data, which will then be processed, stored and displayed appropriately.

The figure given below conceptually depicts how the TRITON track definition is derived from several definitions of track:



Identification Set:

TRITON uses a set of attributes called "Identification Set" to uniquely identify a track. This set is also used to identify Vessels and includes the following:

- Country
- Vessel name
- Name synonyms
- International call sign
- Hull number (for combatants)
- IMO number (for non-combatants)

Kinematics Data:

Each Track Data record keeps the last known position and course-speed information using "Kinematics Data" which consists of the following attributes:

- Geographical position (Latitude / Longitude)
- Course and a speed (over ground)
- Depth (for subsurface tracks)
- Altitude (for air tracks)
- Elevation (for land tracks)
- Time of update (UTC)

Kinematics History:

The positions of a Track will be stored in its Kinematics History at an interval which will be computed by using a configurable system setting called "Track History Distance". The Track History Distance will be used to calculate the "Track Kinematics History Update Interval" according to the following formula:

Track Kinematics History Update Interval = Track History Distance / Current Track Speed

Example: If the Track History Distance is set to 2000 yards and the track speed is 20 kts, the Track Kinematics will be stored at every 180 seconds (3 minutes).

In a similar fashion, the positions of a Vessel associated to a Track will be updated in the Vessel Database at an interval which will be computed by using a configurable system setting called "Vessel History Distance". The Vessel History Distance will be used to calculate the "Vessel Position Update Interval" according to the following formula:

Vessel Position Update Interval = Vessel History Distance / Current Track Speed

Example: If the default for the Vessel History Distance is 2000 yards and the track speed is 10 kts, the Vessel position is to be updated at every 360 seconds (6 minutes).

The update intervals gets longer if the track speed gets lower. There will be separate Track History Distance and Vessel History Distance parameters for each vessel type (e.g. frigates, submarines, tankers, leisure boats).

Track Data:

TRITON uses "Track Data" record to store a Track in the Track Database. It will consist of at least the following attributes:

- Unique Identification (TRITON Track Number)
- Identification Set
- Source (track originator's type and identification)
- Current Maritime Operation
- Security Classification
- Releasable Maritime Operations (more than one Maritime Operation can be indicated)
- High Value Unit (Yes/No)
- Picture designation (Recognised, Military, White, none)
- RMP designation
  - Included RMP Region identification
  - Excluded RMP Region identification

- Track type (live, simulated)
- Update type (automatic, manual)
- Life cycle status
- Ship Designator (one of the ship designators for combatant and non-combatant as defined in APP-20 Table 1A-1)
- For Combatants
  - Tactical Data Link information (Link identification and Network Track Number if reported by a TDL)
  - Identity amplifier/modifying descriptor (combination of STANAG 5511 and STANAG 5516)
  - Activity (for surface/subsurface platforms as defined in STANAG 5516)
  - Special interest descriptor
- For Non-combatants
  - LRIT Equipment Identifier
  - Last Port of Call and Departure Date
  - Next Port of Call and Estimated Arrival Date
  - Destination (name and geographical position)
- Track Source (visual, radar, AIS, LRIT, asset-reported, nation-reported, intelligence, C2-system, TRITON instance, etc.)
- Other TRITON Track Number (if received from a source as another instance of TRITON)
- Environmental descriptor (surface, sub-surface, land, air, space, unknown) [STANAG 1241]
- Standard Identity [STANAG 1241]
- AIS Information (if available)
  - AIS Version
  - MMSI number
  - Receiver Type and ID
  - Heading
  - Rate of turn
- Exercise Indicator (if set)
  - Exercise Identification Set
    - Exercise Identity
    - Exercise Country [STANAG 1059] (Annex C)
    - Exercise Vessel Name
- Confidence Level
- Kinematics Data
- Time of last update
- Kinematics History (as defined above)
- Vessel of Interest status (COI/CCOI/VOCI/Custom, none)
- Local Remarks (text, DTG and originator)

Note: All time values are in UTC.

4.2.3.2.2. Track Database Management

TRITON will maintain an internal storage called "Track Database" for dynamically managing Tracks. There may be several thousands of Tracks to be managed and stored. The number of tracks will increase for White Picture as space-based AIS data sources become available, and small vessels also start using AIS devices. The number of vessels reporting AIS data will be approaching to five million

over the coming years. Therefore, TRITON Track Database will not have a physical capacity limitation. For design purposes, expected number of vessels will be used.

The Track Database will be optimised for quick access, update and retrieval.

[T1-R061] *TRITON shall maintain a Track Database to store all tracks within the Environment of a Maritime Operation with a standard "Track Data" representation as given in the Description of the Track Definition.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Demonstration
- Comment : The Track Data definition will be finalised during SwDR.

[T1-R062] *TRITON shall use a Track Database structure optimised to store only the relevant data for relevant attributes for particular types of vessels (for example, weapon information will be stored for only combatants).*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Inspection

[T1-R063] *TRITON shall allow the authorised user to set the configuration parameter Track History Distance for each vessel type in order to determine the interval for storing the Kinematics History in the Track Database. The details are given in the Description.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Test

[T1-R064] *TRITON shall allow the authorised user to purge the Track Database (delete all tracks) after confirmation.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Test

[T1-R065] *TRITON shall be able to share the Track Data among multiple Maritime Operations if they are labelled accordingly in their Releasable Maritime Operations attribute.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Test

4.2.3.2.3. Track Source Management

TRITON will have several track sources that are identified uniquely so that multi-source and track-to-track correlation will be possible. On-line, near-real time tracks will be received from external sources data such as NIRIS, MSSIS, AIS and LRIT. NIRIS provides the interface for TDLs used by maritime platforms. One NIRIS interface may have multiple sources. Nations feed their track data and contact reports using either on-line data stream or formatted messages. Each Nation is considered as a

separate track source for TRITON. The configurable source identification information will be displayed to the user within the track information set.

TRITON will use Confidence Level for each track source. Confidence Level will be a decimal number indicating the validity or certainty of the information provided in the track data. A larger value represents a greater confidence level. Tracks reported by a source will have a default Confidence Level which can then be used as a decision aid in correlation process and RMP filtering.

A System Interface Service (see System Management) will be used for each track source, capable of handling all track reports coming from a source.

It is expected that several millions of vessels will be reporting AIS data over the coming years. TRITON will be able to handle large number of tracks reported simultaneously. For performance and scalability reasons, a track source may be separated into multiple services, and filters can be applied.

TRITON will maintain a Confidence Level Table having default values for each track source. Track sources will assign a default Confidence Level depending on the type of the track it received from external world. For example, a reported track whose source is a radar will be indicated as such.

A sample table with values between 1 and 5 is given below:

Source	Confidence Level
Track Report from a NATO Asset with positive identification	5
Track Report from a NATO Asset without positive identification	4
Tracks received from TDL via NIRIS	5
Track received from a Nation	5
NATO AGS-Radar track (no ID)	3
NATO AGS-AIS track	1
NATO AGS-processed track	5
MSSIS	1
AIS Data Source	1
LRIT Data Centre	4
Correlated AIS and LRIT tracks	3
Correlated two AIS tracks	1
Correlated Radar and AIS tracks	4

[T1-R066] *TRITON shall identify each track source uniquely (i.e. maintaining a Source ID). A System Interface Service (SIS) shall be used for each external source where each individual track source is identified with a Source ID.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Demonstration

[T1-R067] *TRITON shall allow the authorised user to configure track sources dynamically (add, modify, remove) without re-starting the whole Application.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Test

[T1-R068] *TRITON shall assign the Releasable Maritime Operations label to a track source as received from the Maritime Operation Manager.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Test

[T1-R069] *TRITON shall allow the authorised user to control (allow or prohibit) input of tracks from a selected source into a Maritime Operation.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Test

[T1-R070] *TRITON shall be able to process all tracks received from a track source by taking the performance issues into consideration. Depending on the load, scalable services, pre-filtering, configurable update rates can be used.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Demonstration
Comment : Performance criteria for high number of track inputs will be determined at the CDR.

[T1-R071] *TRITON shall assign the source identification to each track when it is received for the first time and maintain it thereafter.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Test

[T1-R072] *TRITON shall maintain a Confidence Level Table, for each Maritime Operation, to be used as the default for track sources.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Demonstration

[T1-R073] *TRITON shall allow the authorised user to modify the Confidence Level Table, while the system is operating.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Test

4.2.3.2.4. Track Number Management

TRITON will use multi-level track identification. System-specific internal track identification mechanism is hidden from the users, but a user-level track numbering scheme named as "TRITON Track Number" (TTN) will be maintained system-wide. TTN will be a decimal number with sufficient digits to address all tracks.

Each TRITON instance may have the same track number scheme but differing pools (number blocks) can be defined. Similarly, a number block is allocated for each Maritime Operation.

Tactical Data Link (TDL) Track Numbers will also be stored in the Track Data if the tracks are received from TDLs.

[T1-R074] *TRITON shall use unique decimal numbers to identify tracks at user level.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Demonstration

[T1-R075] *TRITON shall allow the authorised user to allocate TTN pool for the entire system and each Maritime Operation by defining the first and last track numbers.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Test

[T1-R076] *TRITON shall assign a unique TTN to each new track received from external sources or initiated internally.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Demonstration

4.2.3.2.5. Track Identity Management

Tracks in TRITON have attributes for distinguishing them from each other by using identification information. If reported tracks have information which helps to derive country name and vessel name, then it is said to be Positively Identified. Some track sources may report tracks without positive identification but with Standard Identities.

Standard Identities:

The Standard Identities for platforms are described in STANAG 1241 and given below:

- UNKNOWN - An evaluated track that has not been identified (AAP-6)
- ASSUMED FRIEND - A track which is assumed to be a friend because of its characteristics, behaviour or origin
- FRIEND - A track belonging to a declared, presumed or recognised friendly nation, faction or group. (AAP-6)
- NEUTRAL - A track whose characteristics, behaviour, origin or nationality indicate that it is neither supporting nor opposing friendly forces (AAP-6).
- SUSPECT - A track which is potentially hostile because of its characteristics, behaviour, origin or nationality
- HOSTILE - A track whose characteristics, behaviour or origin indicate that it is a threat to friendly forces. Designation as hostile does not necessarily imply clearance to engage (AAP-6).

Tracks which have not been subject to the identification process but which are available for reporting will be reported with a status of PENDING.

Following amplifying/modifying descriptors identities can also be used for the tracks having special interest:

- KILO (friendly track with special interest)

- TRAVELLER (a SUSPECT surface track following a recognised traffic route)
- ZOMBIE (a SUSPECT air track conforming to ATC rules or following a recognised traffic pattern)

An identity other than UNKNOWN is only to be applied to a track if sufficient identification has taken place to meet the requirements of that identity.

A recognised track is defined as such because when its identification has been verified. During the RMP building process, reported tracks are evaluated by an assigned RMP Manager. Recognised tracks can then be associated to vessels in the Vessel Database.

Tracks that exist in the real world but are being used for exercise purposes can have an additional attribute named as "Exercise Indicator". When this indicator is set, the identity of friendly tracks can be amplified and marked that the track is acting as other than a FRIEND for exercise purposes and to include artificial data in certain fields. Artificial data for that track can be used for exercise purposes. The identity attribute can take the following values:

- EXERCISE PENDING
- EXERCISE UNKNOWN
- EXERCISE ASSUMED FRIEND
- EXERCISE FRIEND
- EXERCISE NEUTRAL
- JOKER (a friendly track acting as SUSPECT for exercise purposes)
- FAKER (a friendly track acting as HOSTILE for exercise purposes)

[T1-R077] *TRITON shall use Standard Identities as defined in STANAG 1241 for tracks on the NS Domain.*

Requirement Property :
Domain for Static : NS
Domain for Afloat: NS
Baseline : BL 1
Qualific. Method : Demonstration

[T1-R078] *TRITON shall restrict the user to assign SUSPECT and HOSTILE as Standard Identities to any track or vessel on the NU Domain.*

Requirement Property :
Domain for Static : NU
Domain for Afloat: NU
Baseline : BL 1
Qualific. Method : Test

[T1-R079] *TRITON shall restrict Standard Identity change for automatic tracks if the authorised user has already made a change on it.*

Requirement Property :
Domain for Static : NS
Domain for Afloat: NS
Baseline : BL 1
Qualific. Method : Test

[T1-R080] *TRITON shall automatically assign the Standard Identity FRIEND to a received track if it doesn't have a Standard Identity but its Ship Designator is combatant and its country is one of the NATO Nations as indicated in the NATO Standard Country Code Table.*

Requirement Property :
Domain for Static : NS
Domain for Afloat: NS
Baseline : BL 1
Qualific. Method : Test

[T1-R081] *TRITON shall allow the authorised user to assign a new Standard Identity to a received track with Ship Designator non-combatant.*

Requirement Property :
- Domain for Static : NS
- Domain for Afloat: NS
- Baseline : BL 1
- Qualific. Method : Test

[T1-R082] *TRITON shall compare the names in the Identity Set when a new positive identity (country and vessel name) is entered by a user for an existing track and notify the user if another track with the same name already exists.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Test

[T1-R083] *TRITON shall use the associated Vessel name if the reported names for correlated tracks are differing.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Test

[T1-R084] *TRITON shall allow the authorised user to assign Exercise Indicator and Exercise Identity to a track.*

Requirement Property :
- Domain for Static : NS
- Domain for Afloat: NS
- Baseline : BL 1
- Qualific. Method : Test

[T1-R085] *TRITON shall be able to process a received track with its Exercise Identity if its Exercise Indicator is set by the originator.*

Requirement Property :
- Domain for Static : NS
- Domain for Afloat: NS
- Baseline : BL 1
- Qualific. Method : Test

4.2.3.2.6. Track Life Cycle Management

TRITON automatic and manual tracks will have life cycle states that define their presence.

Initiation of automatic and manual tracks and managing their life cycle may be different due to the nature of track source, update rate and time late.

Automatic tracks need to be updated by their source at certain intervals. If they are not updated for a given time period then they are declared as "Lost". For example, AIS tracks are reported at intervals between two seconds and three minutes. If AIS information from a particular ship has not been received for a given period of time which set by the authorised user according to the type of the source and the speed of the ship, then that track becomes Lost. This may happen, for example, when the ship is out of AIS coverage (~50 nautical miles). If reporting starts again, a new track is initiated.

Similarly, other automatic track sources like TDLs or on-line feeds from NATO assets can be declared as Lost.

The default LRIT update rate is six hours, which can be increased to 15 minutes for a specified period of time. Since LRIT reports have positive identity and they are considered as manual tracks, they are never declared as Lost and the Vessel Database is updated automatically.

Manual tracks will have an attribute called "Time Late" which is the amount of elapsed time since the last report. This duration is used to determine the life of a manual track.

Track Life Cycle:

A sample definition for the track life cycle states are given below:

TRITON automatic track life cycle states:

Tentative : An automatic track is created and being checked for correlation.

Updating : Position of an automatic track is being updated.

Lost : Position of an automatic track is not updated for a Lost Track Duration.

Dropped : Automatic track is to be deleted.

Deleted : Automatic track is deleted.

TRITON manual track life cycle states:

Created : A manual track is created at a given position.

Updated : Position of a manual track is updated.

Expired : Manual track is not updated for a duration of Maximum Time Late.

Deleted : Manual track is deleted.

Lost Track Duration and Maximum Time Late are parametric values that can be altered by the authorised user in hours and minutes.

[T1-R086] *TRITON shall perform automatic and manual track life cycle management including creation, update and deletion.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Demonstration

[T1-R087] *TRITON shall automatically update automatic or manual tracks when new data report is received.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Test

[T1-R088] *TRITON shall allow the authorised user to set the Lost Track Duration for automatic tracks between 30 (thirty) seconds and ten (10) minutes depending on the type of its source and speed.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Test

[T1-R089] *TRITON shall declare an automatic track as Lost if it is not updated by its source more than the Lost Track Duration.*

Requirement Property :
Domain for Static : Both

Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Test

[T1-R090] *TRITON shall maintain the Lost tracks for the time period set by the authorised user a system configuration parameter after the user acknowledges the lost track indication.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Test

[T1-R091] *TRITON shall allow the authorised user to set the Maximum Time Late for manual tracks up to thirty-six (36) hours with one minute intervals.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Test

[T1-R092] *TRITON shall declare the manual track as Expired and notify to user about deletion of the track if the Maximum Time Late duration is exceeded.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Test

[T1-R093] *TRITON shall indicate (such as blinking or faded track symbol) Lost tracks and Expired tracks on the GeoView until they are deleted.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Test

[T1-R094] *TRITON shall continue maintaining automatic, correlated track until at least two tracks are left. If one more track is deleted, then the correlated track shall become normal track.*

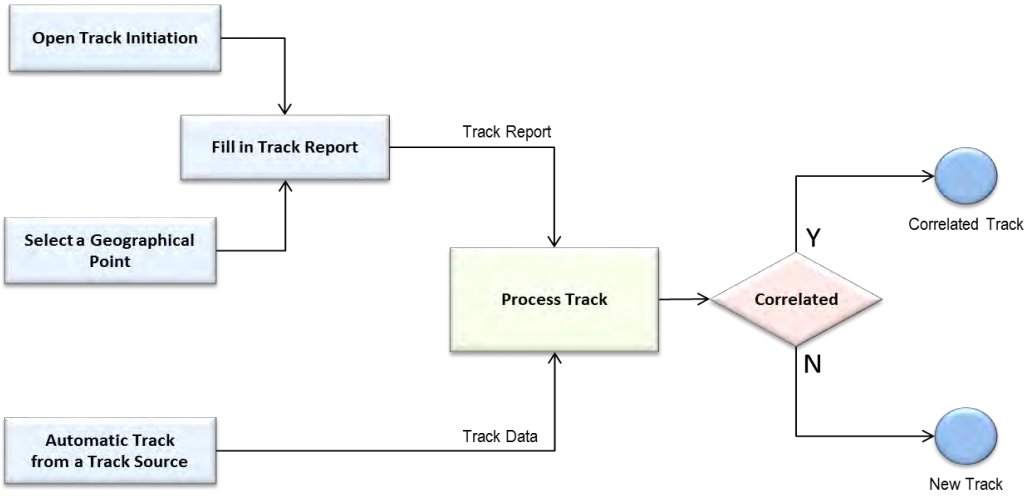
Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Test

[T1-R095] *TRITON shall stop displaying an associated track when it is deleted.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Test

4.2.3.2.7. Track Initiation, Update and Deletion

TRITON will use automatic and manual track initiation. Predefined track sources can initiate tracks and update them automatically. Authorised users can initiate new tracks manually, update or delete them. The process is illustrated below:



When the Track Report or Track Data is received from a source (Track Source or User), the Identification Set of the track is used as the unique key to process the track and locate it in the Track Database. The attributes of the Identification Set are automatically derived from the track attributes such as country information. If no country information is available for an AIS track, the MMSI number will be used to derive the flag information. If the Identification Set of the track is not found in the Track Database, then a new track will be initiated. If it is found in the database, then Correlation Process will be executed.

If the attributes of an automatic track is modified by the authorised user, then subsequent updates to the same track will not change its attributes.

The authorised user will be notified if new or conflicting data for attributes is received from any source. This conflict has to be resolved before the change is applied. A notification will be issued if the track already has user-overridden attributes.

Automatic tracks cannot be deleted by the users. However, if an authorised user wants to delete an automatic track, track deletion process is applied with a notification, and a new track will be initiated at the next track report of the track source.

Dead Reckoning (DR) can be used to move a track to a new position in given time with its present course and speed. Any user can use this feature, but only the authorised user can change the track position permanently. DR will use Rhumb Line calculation for short ranges and Great Circle projection for long ranges.

[T1-R096] *TRITON shall initiate an automatic track in the Track Database when it is received for the first time from a Track Source. The process is explained in the Description.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Demonstration

[T1-R097] *TRITON shall allow the authorised user to initiate a manual track with default attributes (and source as the user) at a given geographical position or at the pointed position on the GeoView. The user shall fill in Track Report and submit. The process is explained in the Description.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Test

[T1-R098] *TRITON shall allow the authorised user to manually update any attribute of a manual track. A notification shall be issued to the user if that attribute has already been changed by another authorised user.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Test

[T1-R099] *TRITON shall automatically update the attributes of an automatic track (e.g. AIS, LRIT) when they are changed by its source. TRITON shall check the non-kinematic attributes of an automatic track when a new track update is received. The updated attribute shall be applied to the Track Data only if it is not manually overridden by the authorised user.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Test

[T1-R100] *TRITON shall automatically update the kinematic attributes of an automatic track (e.g. AIS, LRIT) when they are changed by its source. The update rate shall be set inside the relevant System Interface Service.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Test

[T1-R101] *TRITON shall resolve destination name into geographical position using the Destination Resolution Function when a new AIS track is created.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Test

[T1-R102] *TRITON shall allow the authorised user to dead reckon a track or a vessel to the current time or a given time with its last known course and speed with an option of leaving at the new position or returning to the original position.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Test

[T1-R103] *TRITON shall allow the user to dead reckon (DR) a track or a vessel to the current time or a given time with its last known course and speed without leaving it at the new position.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Test

[T1-R104] *TRITON shall use Rhumb Line DR calculation of tracks or vessels for ranges up to sixty (60) Nautical Miles and Great Circle projection for longer ranges.*

Requirement Property :

Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Demonstration

[T1-R105] *TRITON shall dead reckon a track for the amount of time given by the user. The range shall be ten (10) minutes to eight (8) hours.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Test

[T1-R106] *TRITON shall automatically delete a manual track after Maximum Time Late has passed from its last update time.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Test

[T1-R107] *TRITON shall automatically delete an automatic track when it is deleted by its source (e.g. track is dropped in TDL or Nation feed explicitly drops it from its feed).*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Test

[T1-R108] *TRITON shall allow the authorised user to delete a manually-initiated track. A notification shall be issued if the track has one or more user-overridden attributes or it is associated to a Vessel.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Test

[T1-R109] *TRITON shall allow the authorised user to delete an automatic track. A notification shall be issued to indicate that the automatic track is being deleted, and a new track may be initiated at the next update.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Test

[T1-R110] *TRITON shall allow the user to slave a Reference Point or an Area to a track on a true or relative bearing and to assign independent course and speed.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Test

[T1-R111] *TRITON shall compute and use the Track Position Update Interval at each update process by using the Track History Distance given for the type of the vessel in the System Operational Parameters.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Demonstration

[T1-R112] *TRITON shall store the track positions in the Kinematic History of each track in the Track Database using the position and speed of the track at intervals indicated by the Track Kinematic History Update Interval.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Demonstration

[T1-R113] *TRITON shall keep the Kinematic History of a track for a duration of Maximum Time Late. After the time has elapsed, the last data position shall be dropped.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Test

[T1-R114] *TRITON shall be able to display Kinematic History of a selected track for a user-selected period of time on the GeoView.*

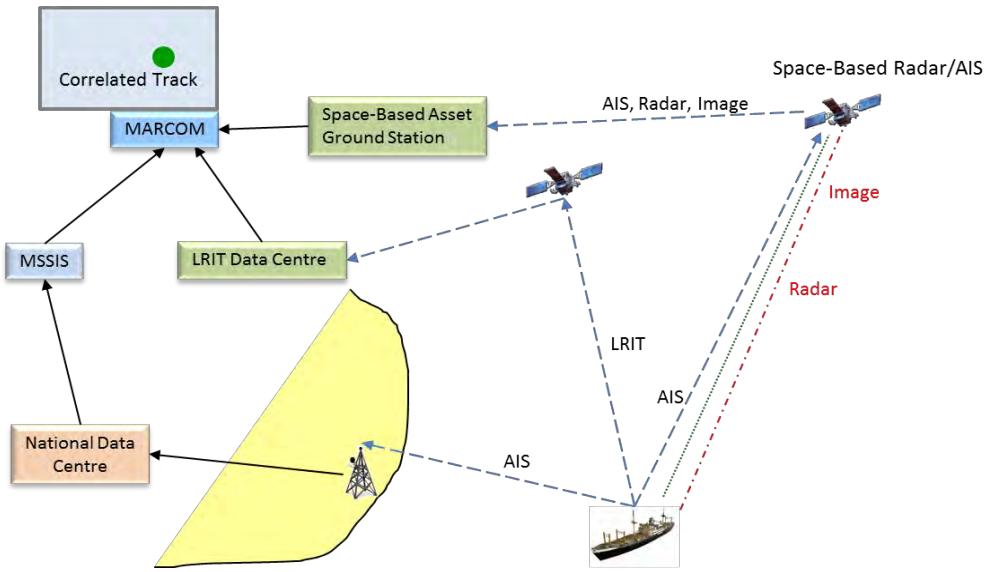
Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Test

[T1-R115] *TRITON shall delete all data including its Kinematic History when a track is deleted by either an authorised user or the source of that track with a notification if the track has user-overridden attributes or not associated.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Test

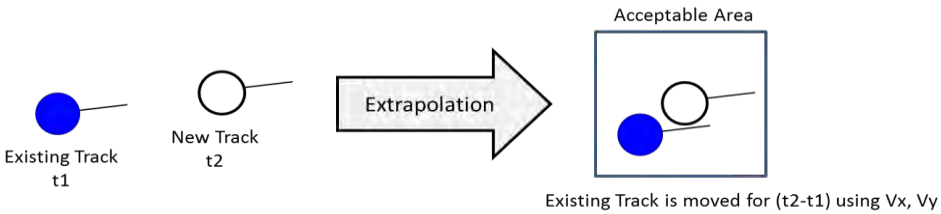
4.2.3.2.8. Track Correlation

Since TRITON will have several track sources, it is likely that the same maritime vessel may be reported to TRITON by more than one source. TRITON will handle track information received from multiple sources by using a correlation process. The objective of the correlation process is to provide the user with only one track if multiple sources report the same vessel. A scenario for correlating tracks from separate track sources, AIS and LRIT, is illustrated below:

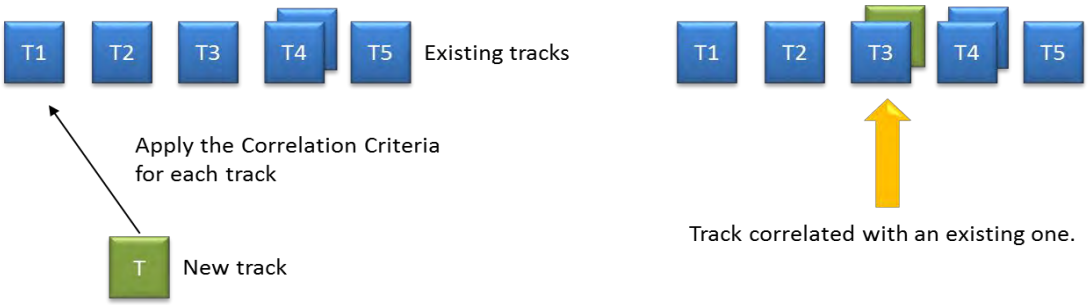


When a new real track is received, TRITON will check its positive identification and validate it. If the track has a positive identification, then TRITON will search for it in the Track Database using the Identification Set. If the Identification Set matches, then it correlates the two tracks. If not, a new track is created. If the track does not have a positive identification, then TRITON will try to correlate it automatically with an existing track using positional comparison. The nearest match will be used to correlate the tracks.

Positional comparison of tracks will be performed after extrapolation in order to bring the tracks to the same time domain. That is, the track with older update time will be temporarily moved to a future position based on its present course and speed for the amount of time difference between the two tracks' update time. If the aligned positions of the two tracks are within the allowed limits then they can be considered as correlated, the latest update time becomes the tracks update time. The concept is depicted below:



The figure below depicts how a new track is correlated with an existing one by scanning through the Track Database:



The track having higher Confidence Level will become the main track and the other one will be hidden from the users. If the new track has the same Confidence Level of the existing candidate track and the type of source is the same, then correlation will not take place. For example, an AIS track from a contracted live data source is in the Track Database. When a new AIS track from MSSIS is received, its Identification Set is searched in the Track Database and a match is found. Then, the Confidence Levels

are compared. If they the same, the time stamps are compared. If the time stamp of the new track is older than the existing one (due to processing latency in the source), then it will not be correlated.

Decorrelated tracks are treated as new tracks and processed accordingly only if their last time of update is not older than the Maximum Time Late. if so, the decorrelated track is deleted.

Correlation Criteria:

Two tracks can be correlated if the Correlation Criteria which includes at least the following checks are met:

- Both tracks are Live or both tracks are Simulated.
- Identification Set matches (Country, Vessel Name or its synonym match).
- IMO number matches.
- The differences in course and speed values are within the allowed ranges.
- The distance between the two tracks are within the allowed limit that is set by a configuration parameter.
- The basic attributes of the tracks are not conflicting (like identity, category, classification).
- Higher Confidence Level to be favoured to determine the values of the attributes.

Correlation Criteria will be configurable by an authorised user so that selected conditions can be used for correlation causing a user notification. There may be more than two tracks correlated with each other. The attributes of the correlated tracks will be combined according to the Confidence Level of the sources. The most recent and reliable kinematic information will be used to update the position of the correlated track.

Decorrelation Criteria:

Each update to correlated tracks will also cause a decorrelation check. Correlated tracks will be decorrelated if one of the conditions in the following Decorrelation Criteria is met:

- One of the basic attributes of the tracks is conflicting (like identity, category, type, classification change).
- The distance between the two tracks exceeds the allowed limit that is set by a configuration parameter.
- The differences in course and speed values are exceeding the allowed ranges.

When a track is decorrelated, it will be treated as a new track, processed as such and presented to the user. If the new track has a positive identity (e.g. unique vessel name), and it cannot be correlated then TRITON will perform an association check.

If a manual track is correlated with an automatic track, the track may be de-correlated when the distance between the tracks exceeds the allowed limit after subsequent updates to the automatic track.

Scalability:

Due to high number of tracks to be handled, special mechanisms for scaling the input and processing may be required. The design must handle scalability, especially for AIS data. For example, multiple levels can be used for the correlation; tracks of similar type are correlated first with each other, and then with the other types of tracks.

[T1-R116] *TRITON shall automatically correlate a new track with an existing track if the configurable conditions of the Correlation Criteria are satisfied.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Test
Comment : The algorithm will be finalised during Software Requirements Analysis.

[T1-R117] *TRITON shall automatically correlate a new track with an existing track and notify the authorised user if one or more of the authorised user-selected conditions of the Correlation Criteria are not being satisfied.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Test
- Comment : The algorithm will be finalised during Software Requirements Analysis.

[T1-R118] *TRITON shall automatically decorrelate the previously correlated tracks if the Decorrelation Criteria is satisfied.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Test
- Comment : The algorithm will be finalised during Software Requirements Analysis.

[T1-R119] *TRITON shall update each track under a manually correlated track even though their attributes do not match.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Test

[T1-R120] *TRITON shall allow the authorised user to manually correlate two tracks if automatic correlation is not successful.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Test

[T1-R121] *TRITON shall allow the authorised user to modify the Correlation and Decorrelation Criteria in the System Operational Parameters.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Test

[T1-R122] *TRITON shall not allow simulated tracks to be correlated with live tracks.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Test

[T1-R123] *TRITON shall use extrapolated positions of tracks for correlation and decorrelation checks as explained in the Description.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Test

[T1-R124] *TRITON hall keep one track if that track is correlated with another track, and display only the correlated track.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Test

[T1-R125] *TRITON shall use the highest Confidence Level of the correlating tracks to determine the Confidence Level of the correlated track.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Test

[T1-R126] *TRITON shall use the most recent kinematics information of the correlating tracks to set the kinematics of the correlated track (as explained in the Description).*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Test

[T1-R127] *TRITON shall treat a decorrelated track as a new track, and process it if its last time of update is not older than the Maximum Time Late. If it is older, then the decorrelated track shall be deleted automatically.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Test

[T1-R128] *TRITON shall display correlated tracks with an indication in the GeoView (e.g. a small dot on the symbol).*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Test

[T1-R129] *TRITON shall allow the user to view the detailed track information for each track under the correlated track.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Test

[T1-R130] *TRITON shall update each track under an automatically correlated track if their key attributes are not changed.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Test

[T1-R131] *TRITON "should" be scalable for processing high number of tracks (e.g. over 100,000) with high update rates (e.g. less than 30 seconds) and handle correlation.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Demonstration
Comment : The parameters allowing fine tuning will be determined during the Software Design.

[T1-R132] *TRITON shall be able to correlate a new track with an existing track in less than five (5) seconds within ten thousand (10,000) tracks.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Test

4.2.3.2.9. Track and Vessel Association

When a new live track with positive identity is received or a new positive identity is defined for an existing track, TRITON will check the Vessel Database automatically to find the matching vessel according to the Association Criteria. If the criteria are satisfied, the track will be said to be "associated" to the vessel by establishing a link between the track and the vessel. The kinematics of the track will be used to update the vessel position in the Vessel Database. When the track is displayed on the GeoView, its attributes are augmented with the information in the Vessel Database. For example, the physical characteristics of a ship is not in Track Database, but it can be stored in the Vessel Database.

Association Criteria:

Tracks will be checked against the Vessel Database with at least the following Association Criteria:

- The track is a Live Track
- The track Identification Set matches the vessel's (using the Name Matching Criteria of Search).
- The standard identification, type, category and classification attributes of the track match the vessel's.

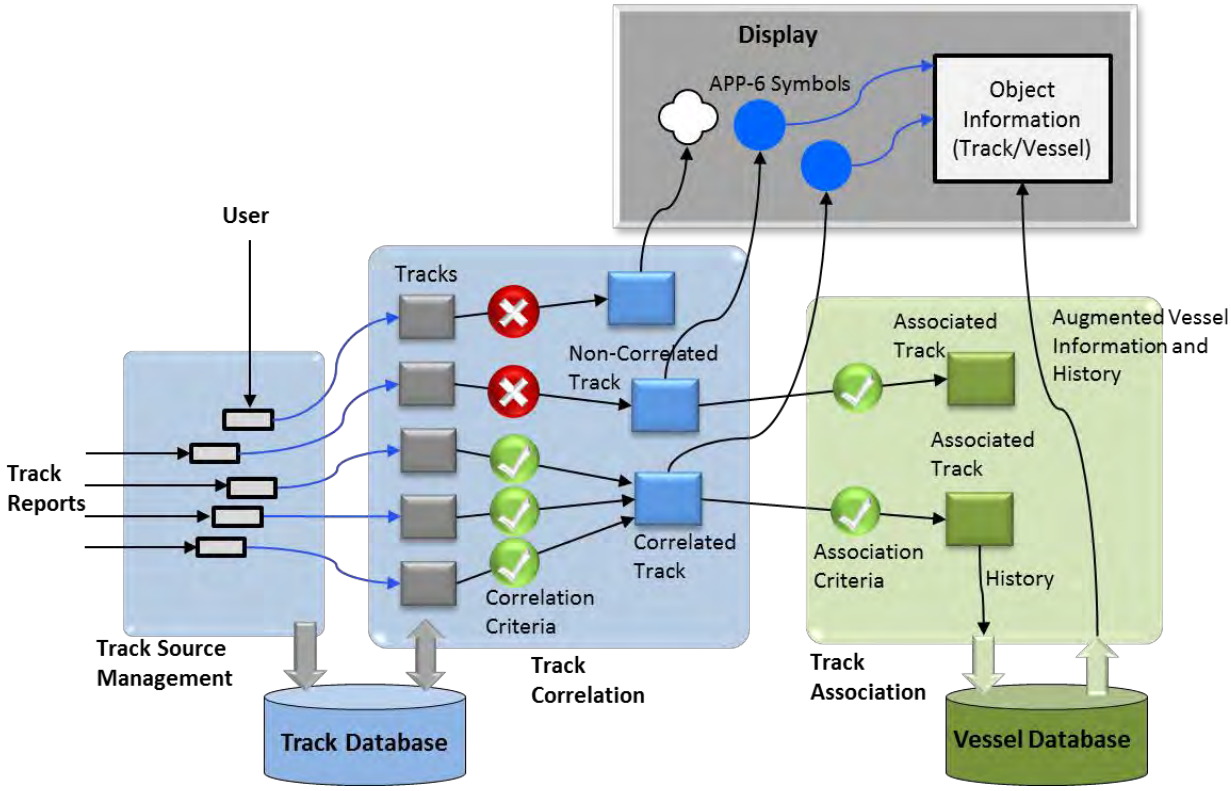
If a matching track identification is not found in the Vessel Database, the user will be notified.

Disassociation Criteria:

An associated track can be disassociated if at least one of the following Disassociation Criteria is met:

- If the Identification Set of the track is changed after an update (e.g. the name of a vessel is changed)
- If the associated track is deleted from the Track Database
- If the associated vessel is deleted from the Vessel Database.

Users will be able to display augmented vessel information for associated tracks. The relation of tracks, vessels and augmented information display is depicted below:



[T1-R133] *TRITON shall allow the authorised user to change the Association and Disassociation Criteria in the System Operational Parameters*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Test

[T1-R134] *TRITON shall automatically associate an automatic Live Track with an existing vessel in the Vessel Database if the Association Criteria is satisfied.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Test
- Comment : Bidders will be able to propose their own Association Criteria. The algorithm will be finalised during Software Design.

[T1-R135] *TRITON shall allow the authorised user to manually associate an automatic or manual Live Tracks with a Vessel even though some of the attributes of a reported Track do not match to the Vessel's.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Test

[T1-R136] *TRITON shall display associated Tracks and their augmented information with an indication on the GeoView.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both

Baseline : BL 1
Qualific. Method : Test

[T1-R137] *TRITON shall display the TTN of the Track if it is associated to a Vessel.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Test

[T1-R138] *TRITON shall notify the authorised user with an indication to the Track if its automatic association check fails.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Test

[T1-R139] *TRITON shall notify the authorised user about disassociation of an associated automatic Live Track and a Vessel if one of the Disassociation Criteria is met.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Test

[T1-R140] *TRITON shall automatically update Kinematic History, Journey History and Activity History information of a Vessel in the Vessel Database if the Vessel is associated to a Track. The kinematics information with the most recent time of update shall be used to update the Vessel kinematics.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Test

[T1-R141] *TRITON shall compute and use the Vessel Position Update Interval at each update process by using the Vessel History Distance given for the type of the Vessel in the System Operational Parameters.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Demonstration

[T1-R142] *TRITON shall update the Vessel positions in the Vessel Database using the position and speed of the associated Track at intervals indicated by the Vessel Position Update Interval.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Test

4.2.3.2.10. Simulated Track Handling

TRITON will support simulated tracks. If a track is tagged as Simulated, then this track will not be correlated with Live Tracks and will not be associated with vessels.

[T1-R143] *TRITON shall be able to process Simulated Tracks generated by its own simulators.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Demonstration

[T1-R144] *TRITON shall create a Simulated Track when a simulated link track is received from a TDL via NIRIS.*

Requirement Property :
- Domain for Static : NS
- Domain for Afloat: NS
- Baseline : BL 1
- Qualific. Method : Test

[T1-R145] *TRITON shall display Simulated Tracks as readily distinguishable from Live Tracks.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Demonstration

[T1-R146] *TRITON shall prevent correlation of Simulated Tracks with Live Tracks and association with Vessels.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Test

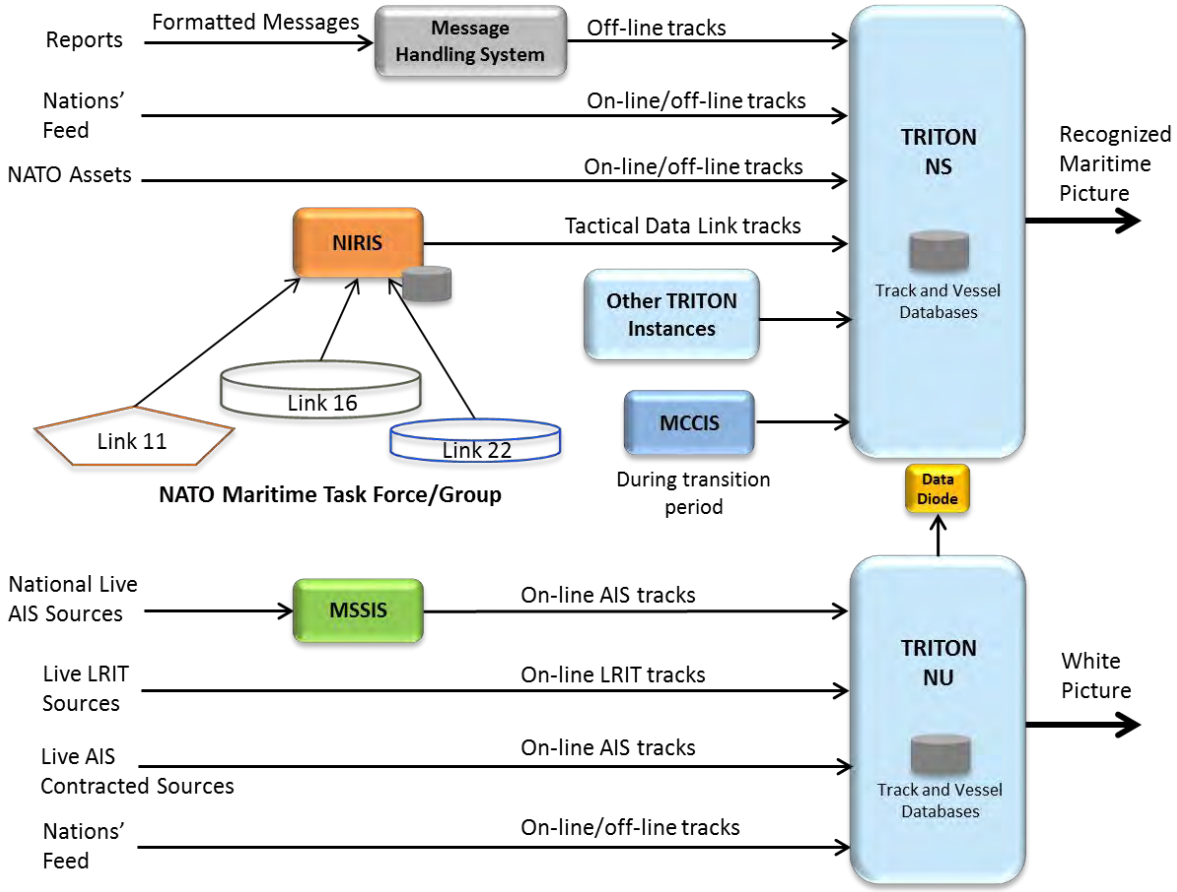
4.2.3.2.11. Track Interface Handling

TRITON will receive on-line and off-line track information from various sources. It will create internal tracks using the reports, correlate those tracks with the existing tracks if their key attributes match, associate the tracks with vessels if their key attributes match, and periodically update the Vessel Databases with the last reported positions of the track. Each update to an existing, associated track in the Track Database will also cause an update to the Vessel Database.

TRITON will not interface any physical device providing track (e.g. AIS device, Link 11). TRITON will not directly participate to any Tactical Data Link (Link 11, 16, 22) (TDL) either. However, it is expected that tactical tracks of a TDL can be received via NIRIS.

TRITON Deployable Kits will have capability to receive on-line or off-line tracks from the platform C2 system using TRITON ACP Interface.

Following picture illustrates the on-line and off-line track sources of TRITON for both NS and NU Domains.



Each track source may have its own track definition. TRITON System Interface Service (SIS) will convert the received track data into standard, internal track representation.

Although an external track source update the tracks at certain periods, TRITON SIS will update the Track Database at a lower update rate, configurable for each source, in order not to degrade the overall performance. For example, an AIS track may be updated at every 10 seconds by its source, but the TRITON SIS sends the updates to the Track Management at every 60 seconds. The update rate will be adjusted automatically if the user takes the track into close monitoring.

The tracks will be updated only when one of its attributes is changed. For example, a position update for an AIS track will be stripped from excessive and repeating data or invalid fields for not causing information clutter and performance degradation; only the changed position data will be updated.

Own Ship:

TRITON will maintain Own Ship information for each user so that the users on afloat platforms can take Own Ship to the centre of the GeoView as Own Position. Any track can also be designated as Own Ship.

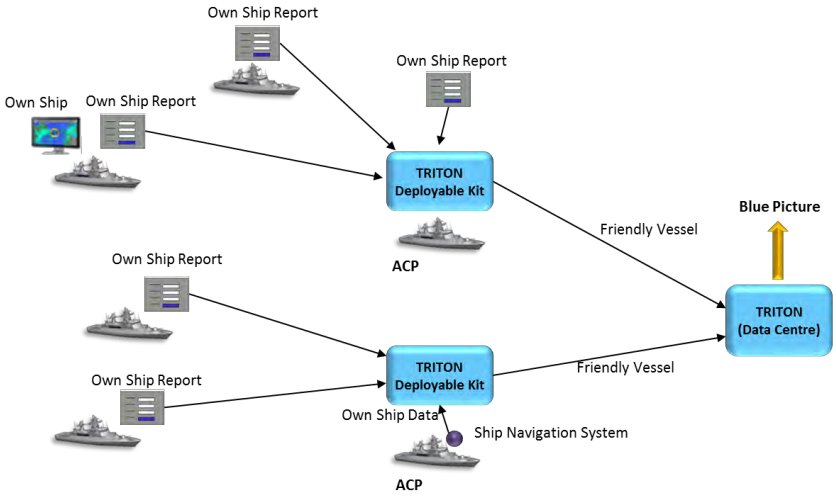
Own Ship Data:

TRITON Deployable Kits will maintain Own Ship Data which can be updated manually by the authorised user or automatically via the ACP Interface.

Own Ship Report:

Own Ship Report is similar to track reporting with a distinction that the Confidence Level has the highest value. When an authorised user on board an afloat platform fills in the data for the Own Ship Report, this information is automatically processed, and a track is initiated in the Track Database and then associated with a Vessel in the Vessel Database. If there is correlated track with this Report, the track attributes are updated with the attributes of the Report.

Handling Own Ship information is illustrated below:



[T1-R147] *TRITON shall handle track information received from external sources using standard interfaces and convert different track feeds and reports into standard, internal track representation using the TRTION Track Specification (NS or NU).*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Inspection

[T1-R148] *TRITON shall use configurable update rate for internal processing in each System Interface Services (SIS) which receives tracks from external sources.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Demonstration

[T1-R149] *TRITON shall allow the authorised user to control the internal update rate of the tracks that are received from a particular external source.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Test

[T1-R150] *TRITON shall automatically maximise the internal update rate of the tracks assigned to the Status Board for close monitoring purposes by any user.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Test

[T1-R151] *TRITON shall automatically maximise the internal update rate of a track if it is requested by a user in the Object Information Display (see GeoView).*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Test

[T1-R152] *TRITON shall update internal tracks when at least one attribute of a track is changed by its source.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Test

[T1-R153] *TRITON shall use separate source identification for each SIS acting as a track source (e.g. NIRIS Interface, Formatted Message Interface, MCCIS Interface, AIS Data Source Interface).*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Inspection

[T1-R154] *TRITON shall allow the authorised user to exchange track data between Maritime Operations according to their releasability attribute.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Inspection

[T1-R155] *TRITON shall manage Own Ship as a track and make it available for the GeoView to be displayed as Own Position.*

Requirement Property :
- Domain for Static : N/A
- Domain for Afloat: Both
- Baseline : BL 4
- Qualific. Method : Demonstration

[T1-R156] *TRITON shall allow the user to set a track as Own Ship on the GeoView.*

Requirement Property :
- Domain for Static : N/A
- Domain for Afloat: Both
- Baseline : BL 4
- Qualific. Method : Test

[T1-R157] *TRITON shall maintain Own Ship Data for the Deployable Kits.*

Requirement Property :
- Domain for Static : N/A
- Domain for Afloat: Both
- Baseline : BL 4
- Qualific. Method : Demonstration

[T1-R158] *TRITON shall allow the authorised user to manually update Own Ship Data for the Deployable Kits.*

Requirement Property :
- Domain for Static : N/A
- Domain for Afloat: Both
- Baseline : BL 4
- Qualific. Method : Test

[T1-R159] *TRITON shall allow the authorised user to create an Own Ship Report to provide reports for any afloat platform.*

Requirement Property :
Domain for Static : N/A
Domain for Afloat: Both
Baseline : BL 4
Qualific. Method : Test

[T1-R160] *TRITON shall process Own Ship Reports created by the authorised users on board afloat platforms and initiate manual tracks with the highest Confidence Level.*

Requirement Property :
Domain for Static : N/A
Domain for Afloat: Both
Baseline : BL 4
Qualific. Method : Test

4.2.3.3. Maritime Reference Object Management

Control measures are directives given to assign responsibilities, coordinate fires and manoeuvre, and control operations. They may be boundaries, special area designations, and other unique markings related to operational environment geometry and necessary for planning and management of operations. Control measure symbols represent control measures that can be portrayed graphically and provide operational information that cannot be displayed via icon-based symbols alone. They can be displayed as points, lines, areas or tactical mission tasks [APP-6].

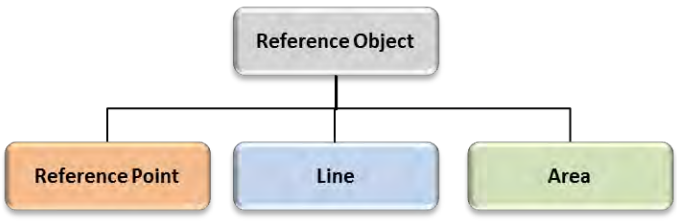
Maritime control measures are used by NATO to help the maritime component commander and his subordinate commanders to direct action by establishing responsibilities and to prevent ships, units, or aircraft from impeding one another and to impose necessary coordination. They aid the cooperation among forces without imposing needless restrictions on their freedom of action. In general terms, maritime control measures can be broken down into the following groups: points, lines, and areas [APP-6].

TRITON will support maritime control measures (reference points, special points, lines and areas) under "Reference Objects". TRITON will provide world-wide management of Reference Objects as well as within Maritime Operations, which are identified uniquely in the system context. TRITON will display the control measures according to APP-6. Control measures can be black, blue (friendly), red (hostile), green (obstacles), or yellow (chemical, biological, radiological, nuclear (CBRN) contaminated area fill).

4.2.3.3.1. Reference Object Definition

A Reference Object is a geographical or moving point, or a line or an area having an operational or tactical meaning (e.g. launch point, Data Link Reference Point, No-firing Area, minefield). Points, lines and areas are defined in support of the surveillance picture to mark points, lines or areas of special interest. Some of these move with an independent course and speed. Certain points and areas can be slaved to a moving track and its position shall be updated along with the updates to the track. This facilitates, for example, a Missile Engagement Zone (MEZ) to be established at a given position relative to a ship or force centre that is moving. Another example is Mine Danger Area.

TRITON Reference Object types are given below:

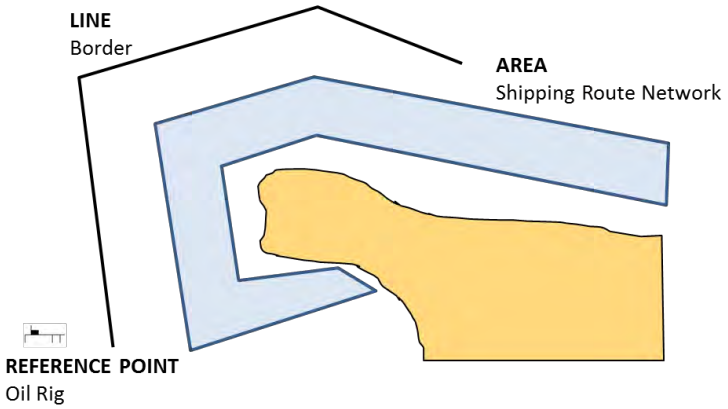


Reference Point: A Reference Point is a geographical coordinate for a special point or a real object. They are displayed using the selected symbology.

Line: A Line is a connection of at least two geographical points. It can be a polyline in any form.

Area: An Area is a closed, geographical shape. It can be a circle, ellipsis, rectangle or polygon. The last point of a multi-point area is always at the same position as the first.

The picture below shows some examples to Reference Objects on a GeoView.



Each Reference Object is represented with a set of attributes as explained and defined below:

Reference Point Data:

- Identification
  - ID Name (e.g. Mine Reference Number)
  - ID Number (e.g. 00456)
- Point Type and Amplification (to be optimised using the definitions in [STANAG 5516])
- Geographical position
- Altitude

Line Data:

- Identification
  - ID Name
  - ID Number
- Amplification (to be optimised using the definitions in [STANAG 5516])
- Geographical position of points of a line
- Drawing thickness and colour

Area Data:

- Identification
  - ID Name
  - ID Number
- Amplification (to be optimised using the definitions in [STANAG 5516])
- Geographical position of centre and radius of a circle, major/minor axis, vertices of a polygon
- Drawing and fill colours
- Transparency

Reference Object Data:

TRITON will use a record called "Reference Object Data" to store information for any type of Reference Object. It will consist of at least the following attributes:

- Unique identification (TRITON Reference Number)
- Name

- Type (Reference Point, Line, Area)
- Reference Point Data / Line Data / Area Data (to be selected depending on the Type)
- Current Maritime Operation
- Security Classification
- Releasable Maritime Operations (more than one Maritime Operation can be indicated)
- Picture designation (Recognised, Military, White, none)
- RMP designation
  - Included RMP Region identification
  - Excluded RMP Region identification
- Time Validity (in hours and minutes) (defined as Time Function in STANAG 5516)
- Exercise Status
- Reference Object specific data
  - Reference Point Data / Line Data / Area Data
- Course and speed
- Time of last update
- Slaved indicator (yes/no)
- Related track
- Remark.

4.2.3.3.2. Reference Object Database Management

TRITON will maintain an internal storage called "Reference Object Database" for dynamically managing Reference Objects. There may be several thousands of Reference Objects to be stored and maintained. The Reference Object Database will be optimised for quick access, update and retrieval without any physical capacity limitation.

[T1-R161] *TRITON shall maintain a Reference Object Database to store all types of Reference Objects within the Environment of a Maritime Operation with a standard Reference Object Data representation.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Demonstration

[T1-R162] *TRITON shall allow the authorised user to manage (add, modify, remove, import, export) the Reference Object Database.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Test

[T1-R163] *TRITON shall be able to share the Reference Object Data among multiple Maritime Operations if they are labelled accordingly in their Releasable Maritime Operations attribute.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Test

4.2.3.3.3. Reference Object Number Management

Reference objects will be uniquely identified by "TRITON Reference Number" (TRN). System-specific internal identification mechanism may be hidden from the users, but a user level numbering scheme will be maintained system-wide. TRN will be a decimal number which can address all objects in the database.

Each TRITON instance may have the same Reference Object number scheme but differing pools (number blocks) can be defined. Similarly, a number block is allocated for each Maritime Operation.

Tactical Data Link (TDL) Track Numbers will also be stored in the Reference Object Data if the objects are received from links.

[T1-R164] *TRITON shall use unique decimal numbers (TRN) to identify Reference Objects at user level.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Demonstration

[T1-R165] *TRITON shall allow the authorised user to allocate TRN pool for the entire system and each Maritime Operation by defining the first and last Reference Object numbers.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Test

[T1-R166] *TRITON shall assign a unique TRN to each new Reference Object received from external sources or created internally.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Demonstration

4.2.3.3.4. Reference Object Life Cycle Management

TRITON Reference Objects can be created, updated and deleted locally. Those objects that are received from external sources (e.g. Tactical Data Links) cannot be modified; they can only be displayed.

Reference Objects may have life cycles controlled by either automatically or manually. They can be assigned a Time Validity value which provides automatic deletion after the specified time elapses. If Time Validity is assigned as "Permanent", the Object will not be deleted automatically.

[T1-R167] *TRITON shall perform automatic and manual Reference Object life cycle management.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Demonstration

[T1-R168] *TRITON shall maintain the Reference Objects starting from their creation time for a period specified in the Time Validity.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Test

[T1-R169] *TRITON shall be able to create appropriate Reference Objects if Special Points, Lines and Areas are received from an external source such as TDL over NIRIS or Formatted Message over MHS.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Test

[T1-R170] *TRITON shall delete a Reference Object according to the criteria associated to the type of the object (e.g. Missile Impact Point can be deleted after its impact time exceeded).*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Test

[T1-R171] *TRITON shall provide a Time Validity value for Reference Objects for controlling its presence automatically in addition to user deletion. Objects having "Permanent" Time Validity shall not be deleted automatically.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Test

[T1-R172] *TRITON shall notify the user at least ten (10) minutes before the Time Validity of a Reference Object expires.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Test

4.2.3.3.5. Reference Object Creation, Update and Deletion

TRITON users will be able to manage (create, modify, update, delete) the Reference Objects in each Maritime Operation scope. Authorised users can create Reference Objects or they can be received from external sources such as Formatted Messages or TDLs. Their attributes can be modified by the authorised users or updated by their sources. Authorised users can dead reckon (DR) the position of Reference Objects if they have course and speed values. Reference Objects can be shared along with RMP if needed.

[T1-R173] *TRITON shall allow the user to manage (create, modify, delete) the Reference Objects in each Maritime Operation.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Test

[T1-R174] *TRITON shall allow the user to create a Reference Point, a Line or an Area by using the C2 Drawing facilities of the GeoView.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both

Baseline : BL 1
Qualific. Method : Test

[T1-R175] *TRITON shall update attributes of a Reference Object automatically if it is received from an external source.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Test

[T1-R176] *TRITON shall allow the authorised user to dead reckon a Reference Object to the current time or a given time with its last known course and speed with an option of leaving at the new position or returning to the original position.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Test

[T1-R177] *TRITON shall allow the user to dead reckon a Reference Object to the current time or a given time with its last known course and speed without leaving it at the new position.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Test

[T1-R178] *TRITON shall allow the user to dead reckon the position of a Reference Object if it has a course and speed value.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Test

[T1-R179] *TRITON shall use Rhumb Line dead reckoning calculation of Reference Objects for ranges up to sixty (60) Nautical Miles and Great Circle projection for longer ranges.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Demonstration

[T1-R180] *TRITON shall dead reckon a Reference Object for the amount of time given by the user. The range shall be ten (10) minutes to eight (8) hours.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Test

[T1-R181] *TRITON shall delete a Reference Object automatically if its external source drops it.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1

Qualific. Method : Test

[T1-R182] *TRITON shall provide the user with the capability to initiate Lines and multipoint Areas containing at least fifty (50) segments. The C2 Areas of the GeoView shall be used to visualise the Areas.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Demonstration

[T1-R183] *TRITON shall allow the user to assign independent course and speed to a Reference Object.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Test

[T1-R184] *TRITON shall allow the authorised user to exchange Reference Objects between Maritime Operations according to their releasability attribute.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Test

4.2.3.3.6. Reference Object Association

A Reference Object is said to be "slaved" if it is associated to a Track. An example of a slaved point is a marshal point used during aircraft recovery operations aboard an aircraft carrier.

TRITON will be able to slave a Reference Object to a Track using the Reference Object Association Criteria with at least the following checks:

- There is no conflict on Track type and Reference Object type (such as slaving a DLRP to a sub-surface track or Ground Zero to a Track).
- Reference Object has a reference point to align with the Track

TRITON will maintain the association relation between the Track and the Reference Object until one of them is deleted.

[T1-R185] *TRITON shall allow the user to slave a Reference Object to an indicated Track.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 2
Qualific. Method : Test

[T1-R186] *TRITON shall associate a Reference Object to a Track if the Reference Object Association Criteria is not conflicting.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 2
Qualific. Method : Test
Comment : The Reference Object Association Criteria will be finalised during Software Requirements Analysis.

[T1-R187] *TRITON shall notify the user if the indicated Reference Object cannot be associated with the indicated Track.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 2
Qualific. Method : Test

[T1-R188] *TRITON shall allow the user to indicate the reference point of the Reference Object for aligning its position to the slaved Track.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 2
Qualific. Method : Test

[T1-R189] *TRITON shall cancel slaving if either the associated Track or the Reference Object is deleted.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 2
Qualific. Method : Test

[T1-R190] *TRITON shall keep a slaved Reference Object at its last position if the Track associated to it has been deleted.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 2
Qualific. Method : Test

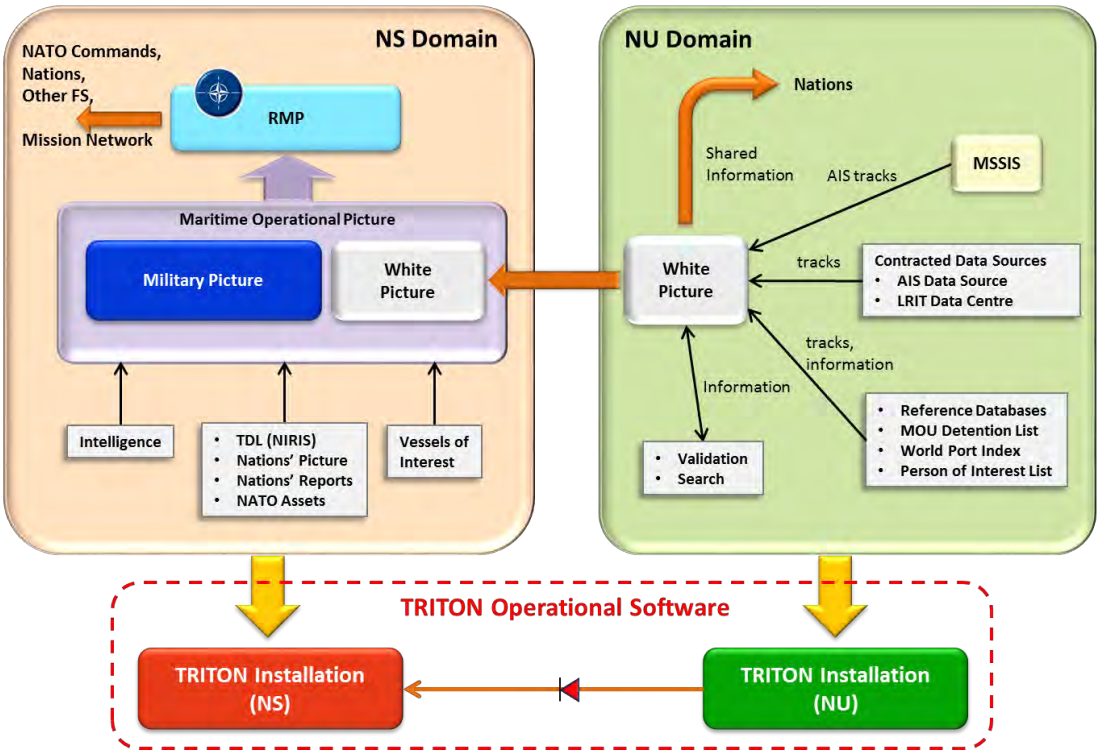
4.2.3.4. Maritime Picture Management

Maritime Picture Management functionality provides compiling and presenting the information related to both combatant and non-combatant vessels. The functionality builds the Maritime Operational Picture (MOP), in the broadest sense, which consists of all kinds of Maritime Operational Objects available. MOP is the overall collection of the following:

- **Military Picture (MP):** The collection of all recognised combatant Tracks, Vessels and relevant Reference Objects
- **White Picture (WP):** The collection of civilian maritime Tracks and Vessels with classification of non-combatants (merchant, fishing, pleasure, research, government etc.) and relevant Reference Objects.
- **Other Information:** UNKNOWN and PENDING tracks and other available supportive information

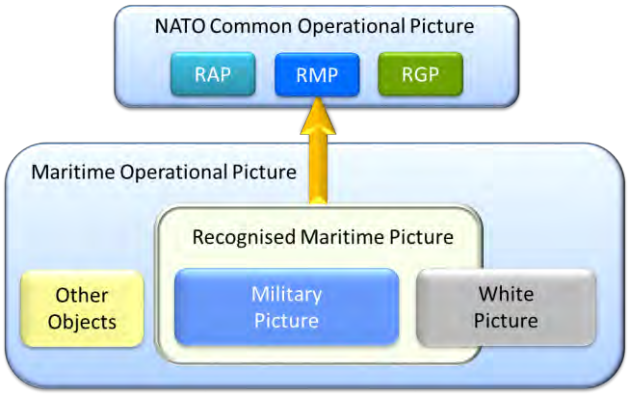
The NATO Recognised Maritime Picture (RMP) is a managed geographic presentation of processed all-source contact and information data, known at a given time, from all available assets, and compiled by an assigned RMP Manager. The RMP consists of all contacts in the maritime environment, both surface and subsurface, commercial, military and government platforms and vessels. RMP is compiled by using Military Picture and the relevant parts of White Picture.

Following figure depicts the relations and information flow between domains during maritime picture compilation:



The WP is built first on the NU Domain by using AIS and LRIT data from contracted sources and then the WP information is transferred to NS Domain. Here, the WP is elaborated more with the information received from NATO assets. The Military Picture is compiled using reports and data feeds from various NATO sources and Nations. Therefore two instances of TRITON will be at operation, one for each security domain, NS and NU.

The RMP is built on NS Domain as an operational, non-real-time, geographic presentation of recognised surface and subsurface units, forces, and operations. The RMP is one of the components of the NATO Common Operational Picture (NCOP). The relationship between these pictures are illustrated below:



The Maritime Picture Management functionality also allows the user to create, query, and retrieve current and historical information of underlying data (e.g. tracks, vessels, figures, ports, special points) comprising the MOP. It provides foundation for operational support functions, decision aid tools and maritime planning functions.

4.2.3.4.1. Operational Display

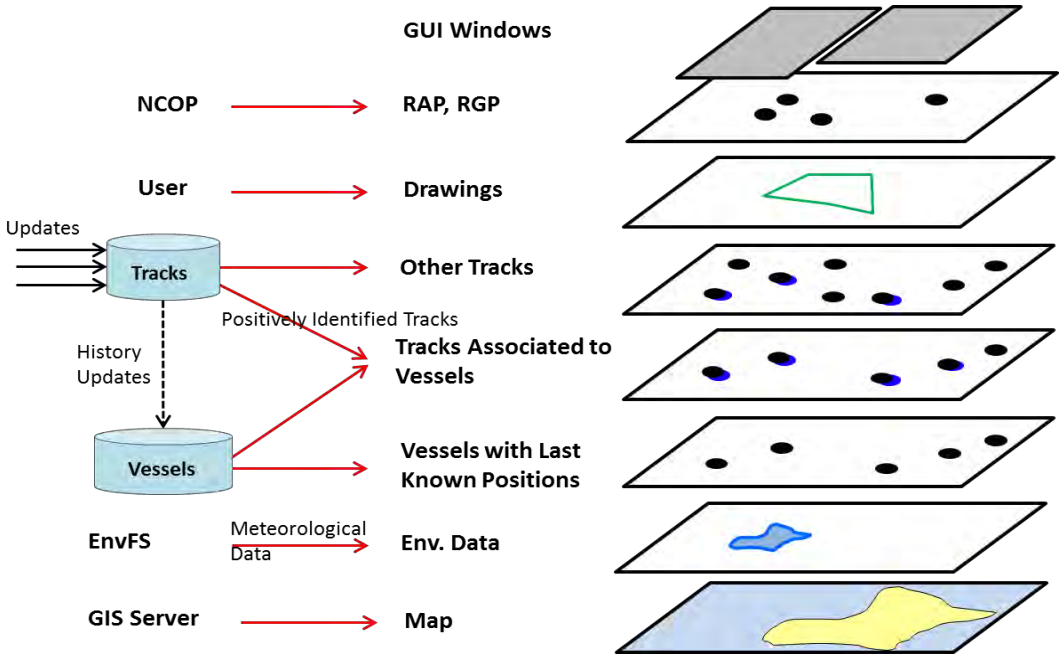
TRITON will manage all Maritime Operational Objects (Tracks, Vessels and Reference Objects), and display their detailed information on the Clients using two separate views:

Application View (AppView):

Application-specific user interfaces in textual form will be displayed in this view. When a user wants to display geospatial data, a separate application will be launched in another browser, GeoView, to display the geospatial information.

Geospatial View (GeoView):

This view displays digital maps, geospatial data, Maritime Operational Objects as well as information received from other Functional Services in separate layers (overlays). Following figure depicts how the layers are used to build the Maritime Picture.

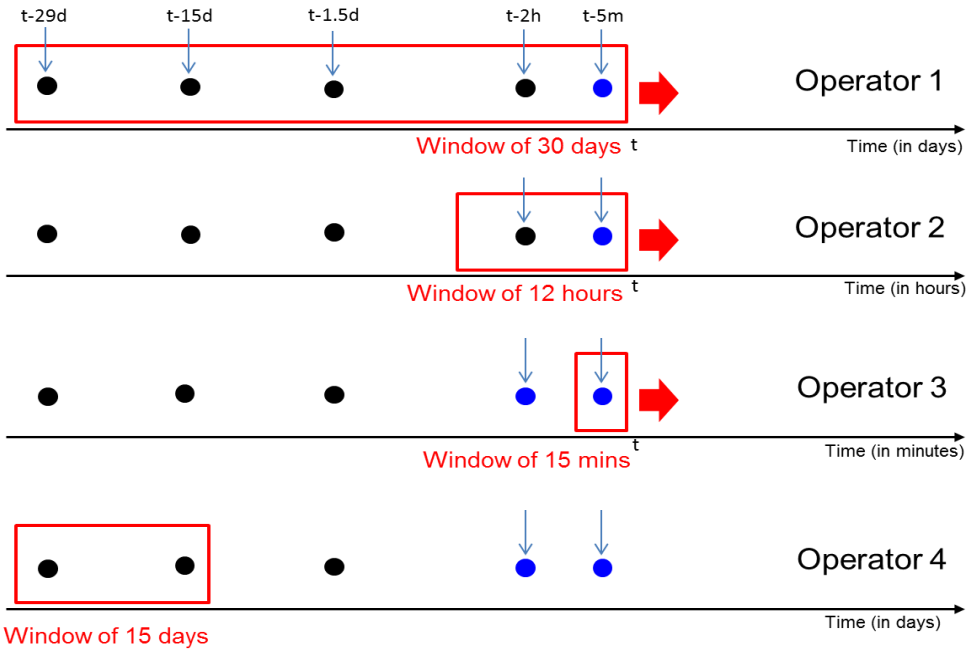


4.2.3.4.1.1. Picture Display

TRITON will be able to display all Maritime Operational Objects (Tracks, Vessels and Reference Objects) on the GeoView according to a configurable Display Criteria using a symbology set selected by the user (e.g. APP-6, NTDS). When TRITON is deployed on ACP, Own Ship indication will be set and displayed on the GeoView.

When users want to display a set of Objects, only those Objects inside the current Spatial Extent of the GeoView will be displayed and updated. Any changes in the Spatial Extent will be handled automatically. For example, when zoomed out, more objects will be displayed, but increased zoom-out will cause clustering of objects.

Users can adjust Time Windows to display Tracks and Vessels according to their operational needs. The figure below depicts how Time Windows are used for different settings with examples:

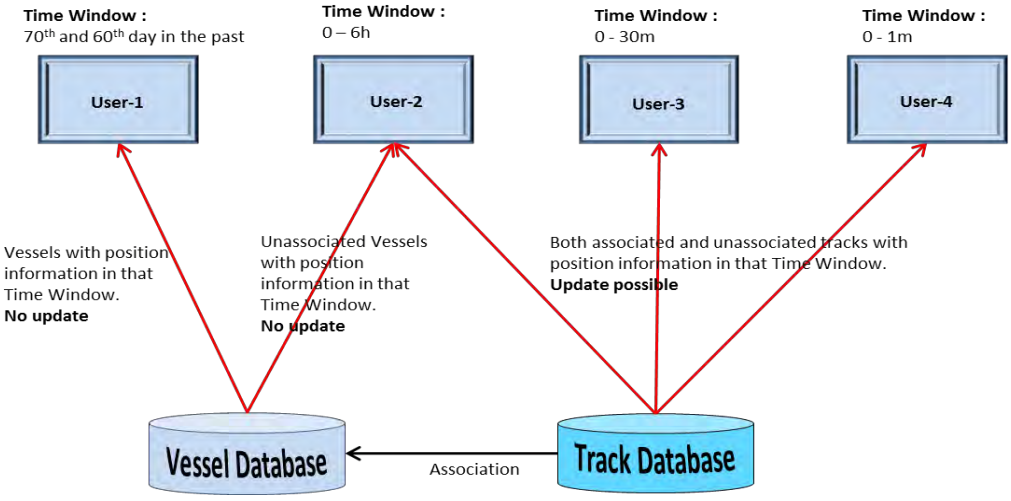


Those operators who need to work with historical data can set their Time Window long enough to cover the past activities of vessels (Operator 1 and 2). The tracks within the Window are updated and the Vessels are displayed if their last time of position update is within the Time Window.

Some operators (Operator 3) may want to see only the recently updated tracks and vessels with a specified Update Rate. Tracks will then be displayed if their last update time is within the Time Window.

Some operators can also set their Time Window totally in the past, giving a beginning and end date&time for historical analysis purposes (Operator 4). This setting prevents displaying the tracks with recent updates.

Vessels can be displayed as tracks if their last time of position update is in the Time Window. A conceptual example is illustrated in the following figure:



Examples to use of Track and Vessel Databases along with a Search function are given below:

- Display the last known positions of tankers in the indicated area, yesterday, between 0800 and 1800.
- Display the combatants of country 'C' with their last known positions in the indicated area in the last 12 hours.

Reference Objects are displayed in a similar way if their life cycle is within the Time Window.

Object Display:

TRITON will display Maritime Operational Objects in the GeoView with a symbology set selected by the user. The GeoView will adjust the spatial extent according to user-selected View Scale. The AppView will dispatch the request to filter out only those Objects within the extent and within the Time Window. For example, a user may issue a request to display the positions of the vessel 'X' between 051200ZJAN14 to 071200ZJAN14 with 60 minute intervals and plotted on the GeoView until cancellation.

Object Grouping:

Any user may view any number of Maritime Operational Objects in GeoView up to "Maximum Number of Objects to Display" setting. Depending on the number of object within the current Spatial Extent, TRITON may limit the number of Objects to be displayed by grouping more than one Object into one virtual Object. Similar types of Object can be grouped according to the distance between them. The grouping algorithm will consider the distance between objects as a configurable parameter and provide only the centre location information and number of objects grouped.

Update Rate:

If the number of Objects is less than the Maximum Number of Objects to Display for a particular GeoView, then the Objects will be displayed and the update rate for moving Objects will be determined according to the current display scale. For example, if the scale is 50 NM then the tracks can be updated as fast as they are updated by their sources. If the scale is 2000 NM, then the tracks will be updated at every 10 minutes.

[T1-R191] *TRITON shall display Maritime Operational Objects in the GeoView with a symbology set selected by the user in Layers.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Demonstration

[T1-R192] *TRITON shall allow the user to set a Time Window and Update Rate for Picture Display.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Test

[T1-R193] *TRITON shall allow the user to display the last known positions of Maritime Operational Objects based on the user-selected duration in the GeoView, within the current extent (only those Objects within the GeoView Spatial Extent shall be retrieved).*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1
- Qualific. Method : Test

[T1-R194] *TRITON shall provide and update only those Maritime Operational Objects which are inside the Spatial Extent of each GeoView. Only those Objects having the last update time within the given Time Window shall be displayed and updated.*

Requirement Property :
- Domain for Static : Both
- Domain for Afloat: Both
- Baseline : BL 1

Qualific. Method : Test

[T1-R195] *TRITON shall adjust the Update Rate for tracks to be displayed according to the Spatial Extent scale of the GeoView.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Demonstration
Comment : The algorithm will be finalised during the Software Design.

[T1-R196] *TRITON shall allow the user to display historical positions of Maritime Operational Objects within a given date-time period and with given time intervals, in sortable tabular format in the AppView with an option to display them in the GeoView.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Test

[T1-R197] *TRITON shall display in AppView and GeoView, the number of Maritime Operational Objects currently displayed in the GeoView, in the Area of Interest, and the Total Number of Objects in the selected Time Window. This information may be displayed with respect to the Layers.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Demonstration

[T1-R198] *TRITON shall group the Maritime Operational Objects if the number of Objects to be displayed in a GeoView is greater than the "Maximum Number of Object to Display" setting.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Test

[T1-R199] *TRITON shall be able to display the picture with the given Time Window, Update Rate and Spatial Extent within ten (10) seconds after the user request. TRITON AppView shall notify the user if the available bandwidth is not sufficient to receive the full requested picture from the server.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 4
Qualific. Method : Test

[T1-R200] *TRITON shall notify the user if preparing and displaying the requested history information will take longer than fifteen (15) seconds.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Test

[T1-R201] *TRITON shall display associated and unassociated tracks from Track Database and unassociated vessels from Vessel Database when users issue viewing request with a Time Window.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Test

[T1-R202] *TRITON shall use TTN of the track in the Object Label if the Track is associated to a Vessel and TVN of the Vessel if no Track is associated.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Test

[T1-R203] *TRITON shall display TTN, TVN and TRN in a distinguishable format (e.g. a letter indication such as T, V, R in front of the numbers) on the Object Label while displaying it on the GeoView.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Demonstration

[T1-R204] *TRITON shall allow the authorised user to set Own Ship when it is deployed on an ACP.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 4
Qualific. Method : Test

4.2.3.4.1.2. Object Display Control

TRITON will be able to display Maritime Operational Objects as the Maritime Picture on the GeoView according to user-defined Display Criteria set in the Object Display Control. Users will be able to define filters for the Objects to be displayed.

Display Criteria:

The configurable Display Criteria includes at least the following:

- Object type (e.g. only Tracks)
- Selected Object Attribute(s) (e.g. combattant, leisure, tanker)
- Geographical Area (a region) (e.g. a defined geographical area)
- Display-specific settings (e.g. Layer identification).

Display Option:

When AppView displays the objects in tabular format, it will provide the user with the following options to display them in the GeoView:

- Current Display: If one object is selected, and the object is within the current map extent, then the GeoView will display the object with an indicator (e.g. a yellow circle) without changing the Map Panel extent and centre.
- Centre Object: If one object is selected, the GeoView will move the Map Panel extent to take the object to the centre of the Map Panel without changing the zoom scale, and display it with an

indicator (e.g. a yellow circle). If the object is out of the extent, the GeoView will move the extent to take that object to the centre.

- Zoom to Object: If one object is selected, the GeoView will adjust the extent to take the object to the centre with a zoom level that covers the object within a pre-set percentage distance of the extent and mark it with an indicator.
- Group of Objects: If more than one object is selected, the GeoView will apply the same rules taking the furthest points of the group (e.g. furthest tracks on each direction) to be included in the extent.

[T1-R205] *TRITON shall provide the user with the control of displaying Operational Objects in the GeoView.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Demonstration

[T1-R206] *TRITON shall allow the user to manage (create, save, modify, delete) Display Criteria and Display Options as given in the Description. The Ribbon Bar of the AppView may be used to activate or de-activate them.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Test

[T1-R207] *TRITON shall filter the Maritime Operational Objects according to the selected Display Criteria and selected Display Option. This data shall be passed to the GeoView over the AppView using NMAPI.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Demonstration

[T1-R208] *TRITON shall allow the authorised user to adjust configuration parameters related to display options.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Test

4.2.3.4.1.3. Operational Information Display

Operational Information consists of detailed object information, planning information, system interface status information, results of a search in tabular form, control and monitoring functions. TRITON AppView will provide this information in relevant GUI panels and dialog boxes.

Object Information:

When a user needs more detailed information on a selected Maritime Operational Object either in a list displayed in the AppView or in the GeoView, a pop-up window called "Object Information Box" will be displayed. The Object Information Box will contain tabs which include at least the following for an object:

- Identification (e.g. ID, name, country, Standard Identity and Amplification, Category)
- Kinematics (e.g. Position, Course, Speed, Time of Last Update)

- Operational Information (e.g. Mission/Campaign/Operation, Task, Activity, Status)
- Intelligence information (query and result)
- Visual information (picture or video)
- Object-specific Information (any specific data for the object)

The user can issue an Intelligence Query to INTEL-FS regarding the object. The query result is displayed in the Object Information Box, Intelligence Tab.

Object Information Box can be used in both AppView and GeoView. The information to be displayed in the GeoView will be passed over the NMAPI.

[T1-R209] *TRITON shall be able to present Operational Information on the AppView using both dedicated panels and dialog boxes.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Demonstration
Comment : The design will be determined at SRR and finalised ad SwDR-1.

[T1-R210] *TRITON shall display the detailed information for a selected Maritime Operational Object in a pop-up window called "Object Information Box" on the View from which it is requested.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 1
Qualific. Method : Demonstration

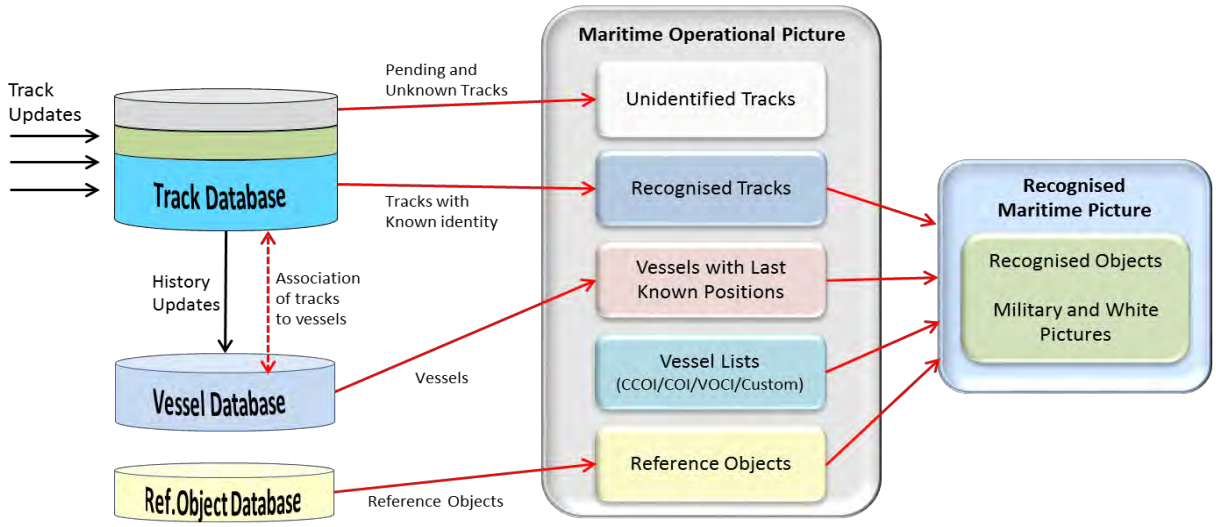
4.2.3.4.2. Maritime Operational Picture Management

Maritime Operational Picture (MOP) is the collection of all available Maritime Operational Objects. It includes all Tracks with all identities in the Track Database and all Vessels in the Vessel Database. Authorised user can see the MOP over the GeoView.

The MOP is built on the Maritime Operation Domain by using the Track Database, Vessel Database and Reference Object Database. It includes Tracks with standard identity PENDING and UNKNOWN which require further investigation in addition to the recognised Tracks having the other Standard Identities (FRIEND, ASSUMED FRIEND, NEUTRAL, HOSTILE and SUSPECT).

The recognised Tracks can be associated to vessels in the Vessel Database.

The Military and White Pictures are then used to build the RMP as depicted below:



[T1-R211] *TRITON shall build the MOP as a collection of all available Maritime Operational Objects on the NS Domain.*

Requirement Property :
- Domain for Static : NS
- Domain for Afloat: NS
- Baseline : BL 1
- Qualific. Method : Demonstration

[T1-R212] *TRITON shall be able to display the MOP in the GeoView as a Layer.*

Requirement Property :
- Domain for Static : NS
- Domain for Afloat: NS
- Baseline : BL 1
- Qualific. Method : Demonstration

[T1-R213] *TRITON shall allow the authorised user to modify the assigned Standard Identities for all types of Maritime Operational Objects in the MOP.*

Requirement Property :
- Domain for Static : NS
- Domain for Afloat: NS
- Baseline : BL 1
- Qualific. Method : Test

4.2.3.4.3. Military Picture Management

The Military Picture (MP) contains all friendly, hostile, suspect and neutral combatant tracks and vessels. There may also be other Reference Objects (Reference Points, Lines and Areas) in the MP.

TRITON will compile the MP only on the NS Domain using the track feeds coming from Nations, on-line and off-line own status reports from NATO assets and NIRIS. The Standard Identity FRIEND will be assigned to all friendly Maritime Operational Objects. If NATO maritime assets participate in a Tactical Data Link, and the link information can be received by NIRIS, then all Participating Units (PU/JU (NU in future)) are automatically declared as FRIEND. Authorised users can select friendly Maritime Operational Objects based on a user-selected filter (e.g. area, type, task).

Other Standard Identities will be assigned according to the current operational requirements set by OPTASK RMP.

[T1-R214] *TRITON shall be able to filter the Military Picture as a separately controllable collection of information according to the Standard Identities and display them as a layers on the GeoView.*

Requirement Property :
Domain for Static : NS
Domain for Afloat: NS
Baseline : BL 1
Qualific. Method : Demonstration

[T1-R215] *TRITON shall allow the authorised user to select Maritime Operational Objects as the Military Picture by using a filter on Standard Identity.*

Requirement Property :
Domain for Static : NS
Domain for Afloat: NS
Baseline : BL 1
Qualific. Method : Test

[T1-R216] *TRITON shall be able to display the Military Picture in the GeoView as a Layer.*

Requirement Property :
Domain for Static : NS
Domain for Afloat: NS
Baseline : BL 1
Qualific. Method : Demonstration

4.2.3.4.4. White Picture Management

White Shipping refers to commercial shipping including passenger, cargo, tanker, ferries, container vessels, fishing vessels and other non-military vessels. However, the current notion of White Shipping tends to be limited to such vessels that exceed 300 tons displacement per the IMO AIS requirement.

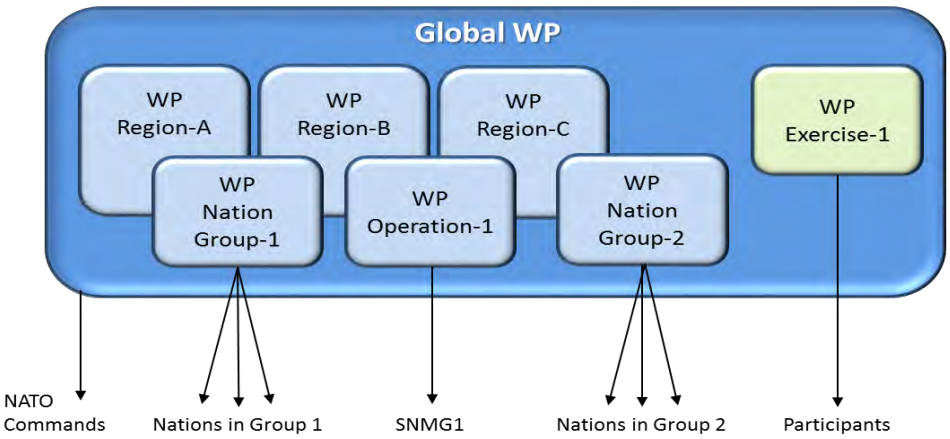
The current IMO requirement (effective 31 Dec 2004) for AIS is: "The regulation requires AIS to be fitted aboard all ships of 300 gross tonnage and upwards engaged on international voyages, cargo ships of 500 gross tonnage and upwards not engaged on international voyages and all passenger ships irrespective of size (i.e. AIS – class A).

“White+ Shipping” refers to the sharing information on all manner of commercial vessels regardless of their displacement/tonnage, length or other specifications. White Shipping displacement AIS requirement. While it is recognised that future commercial rules may mandate AIS transponders, A or B, on many other commercial vessels, including ferries, the intent of the “White+ Shipping” is to serve as a broad “other” category for commercial shipping to include all manner of non-warship vessels on the seas or in port.

The term "White Picture" will be used in TRITON to address all non-combatant (civilian) maritime vessels and tracks with classification of non-combatants (merchant, fishing, pleasure, research, government etc.). There may also be other objects like special points, lines, and areas in the WP.

TRITON will use Maritime Operational Object to represent WP data. All vessels, tracks and objects will be uniquely identified with TRITON Track or Vessel Number (TTN or TVN). In addition, country, vessel name, IMO number and MMSI number will also be used to positively identify tracks and vessels. Users can display any of these identification indicators as configurable labels on the GeoView.

According to certain operational needs, WP in global scope can be split into geographical regions so that dissemination can be managed according to the particular Area of Interest. The figure below depicts the WP Region concept:



TRITON will maintain a list of WP Regions which can be managed by the authorised user. Each WP Region has its own White Picture information, which can be disseminated at user-selected intervals. The WP Region in TRITON will have at least the following attributes:

- Region name
- Description
- Geographical Region (Area)
- Dissemination Rate

4.2.3.4.4.1. White Picture Compilation

TRITON will compile the WP first on the NU Domain using the track feeds coming from MSSIS, LRIT, AIS data sources, Nations' feed and off-line track reports. Tracks are built in the Track Database and then the Vessel Database will be updated for the associated tracks.

The WP will be built on the NU Domain and then transferred to the NS Domain. The WP on the NS Domain will be enhanced with additional track information received from NATO assets and other sources.

The WP on NU Domain can be separated into WP Regions according to geographical filters. Each Region can then be managed and shared with external users separately.

[T1-R217] *TRITON shall maintain the WP as a separately controllable and displayable collection of information on the NU and NS Domain.*

Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 2
Qualific. Method : Demonstration

[T1-R218] *TRITON shall be able to build the WP according to the settings of the Maritime Operation on the NU Domain.*

Requirement Property :
Domain for Static : NU
Domain for Afloat: NU
Baseline : BL 2
Qualific. Method : Demonstration

[T1-R219] *TRITON shall maintain a list WP Regions for each Maritime Operation on the NU Domain.*

Requirement Property :
Domain for Static : NU
Domain for Afloat: NU
Baseline : BL 2
Qualific. Method : Demonstration

[T1-R220] *TRITON shall be able to process received track information from external sources on the NU Domain, update the Track Database and the Vessel Database on the NU Domain.*

Requirement Property :
Domain for Static : NU
Domain for Afloat: NU
Baseline : BL 2
Qualific. Method : Demonstration

[T1-R221] *TRITON shall maintain the WP on the NS Domain with the WP information received from the NU Domain and the information received from NATO assets operating on the NS Domain.*

Requirement Property :
Domain for Static : NS
Domain for Afloat: NS
Baseline : BL 3
Qualific. Method : Demonstration

[T1-R222] *TRITON shall be able to display the White Picture in the GeoView as a Layer.*

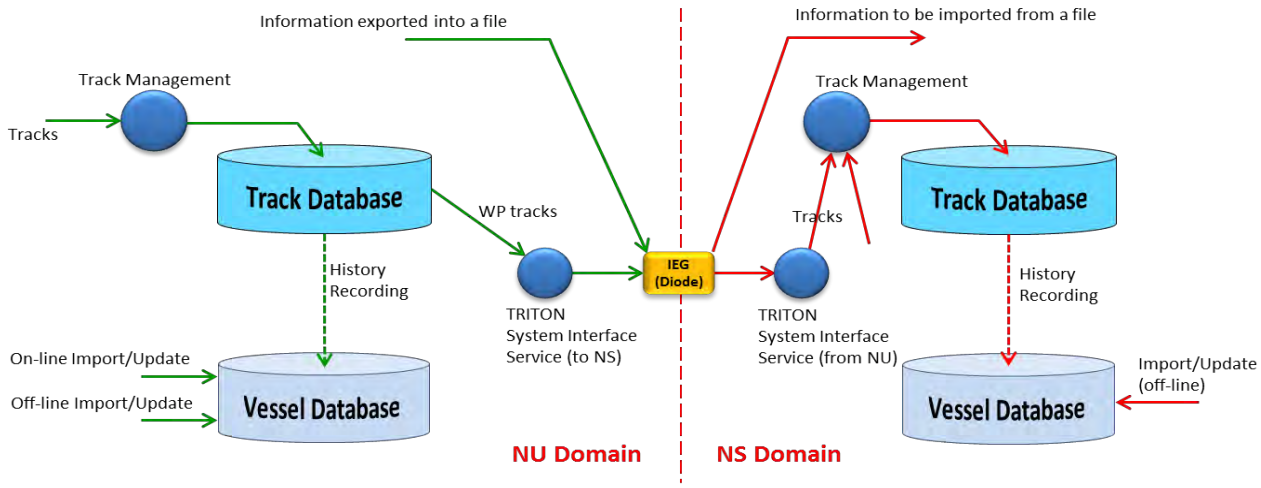
Requirement Property :
Domain for Static : Both
Domain for Afloat: Both
Baseline : BL 2
Qualific. Method : Demonstration

4.2.3.4.4.2. White Picture Transfer

WP will be compiled on the NU Domain, and the Maritime Operational Object Databases will continuously be updated. The track information from the Track Database will be transferred to the NS Domain automatically and continuously. An internal System Interface Service (SIS) will provide the user-monitored transfer over the Information Exchange Gateway (IEG) (requirements are in the Cross-Domain Support) with a configurable update rate. The SIS will put the data into files and send it to the IEG. The IEG accepts the labelled data in files and transfers them to the NS Domain. While transferring tracks from the NU Domain, the TRITON Track Numbers will also be transferred so that the relevant tracks can be addressed easily on the NS Domain.

On the NS Domain, another SIS receives the data coming from TRITON-NU, extracts track information and sends them to the Track Management for correlation and association process.

Following figure depicts the transfer of WP from the NU Domain to the NS Domain and the processing.



If other data needs to be transferred from the NU Domain to the NS Domain, then manual operation will be used. For example, transferring an Area can be achieved by first exporting it into a file on the NU Domain, transfer the file manually to the NS Domain over the IEG, and import the file on the NS Domain using the relevant function.

Data transfer from the NS Domain to the NU Domain will not be on-line.

[T1-R223] *TRITON shall transfer the WP information from the NU Domain to the NS Domain automatically.*

Requirement Property :
- Domain for Static : NU
- Domain for Afloat: NU
- Baseline : BL 2
- Qualific. Method : Demonstration

[T1-R224] *TRITON shall allow the authorised user to control and monitor the automated data transfer from the NU Domain to the NS Domain.*

Requirement Property :
- Domain for Static : NU
- Domain for Afloat: NU
- Baseline : BL 2
- Qualific. Method : Test

[T1-R225] *TRITON shall allow the authorised user to set the transfer parameters from the NU Domain to the NS Domain.*

Requirement Property :
- Domain for Static : NU
- Domain for Afloat: NU
- Baseline : BL 2
- Qualific. Method : Test

[T1-R226] *TRITON shall pass the WP information to the NS Domain over the IEG-Data Diode.*

Requirement Property :
- Domain for Static : NU
- Domain for Afloat: NU
- Baseline : BL 2
- Qualific. Method : Demonstration

[T1-R227] *TRITON shall be able to receive WP information from the NU Domain via the Data Diode and process the track information automatically.*

Requirement Property :
- Domain for Static : NS
- Domain for Afloat: NS
- Baseline : BL 3
- Qualific. Method : Test

[T1-R228] *TRITON shall allow the authorised user to transfer files having exported WP information from the NU Domain to the NS Domain over the Data Diode.*

Requirement Property :
- Domain for Static : NU
- Domain for Afloat: NU
- Baseline : BL 2
- Qualific. Method : Test

[T1-R229] *TRITON shall allow the authorised user to receive data files from the NU Domain and import them on the NS Domain.*

Requirement Property :
- Domain for Static : NS

Domain for Afloat: NS
Baseline : BL 3
Qualific. Method : Test

4.2.3.4.4.3. White Picture Sharing

NATO White Picture (WP) can be shared with Nations over the NU Domain. Nations who want to make use of NATO WP will be able to use the Web service (e.g. WP Service) to receive the vessels in the indicated Area of Interest. It will also be possible for other organizations to access the NATO WP by using the Web Service.

[T1-R230] *TRITON shall make the NATO WP available to external systems through Web Services (e.g. WP Service).*

Requirement Property :
Domain for Static : NU
Domain for Afloat: NU
Baseline : BL 2
Qualific. Method : Demonstration

[T1-R231] *TRITON shall allow the authorised user to control and monitor the dissemination of WP information according to the Releasability Label over Maritime Operations and the RMP Regions.*

Requirement Property :
Domain for Static : NU
Domain for Afloat: NU
Baseline : BL 2
Qualific. Method : Test

4.2.3.4.5. Recognised Maritime Picture Management

NATO RMP is a managed geographic presentation of, processed all source contact and information data known at a given time, of surface, sub-surface, amphibious and maritime air activities in the maritime operating environment. The NATO RMP is compiled in accordance with operational directives and tasking to support decision makers in the conduct of C2 of maritime forces and operations. The NATO RMP is an operational picture, not a tactical plot. It is not intended to be used to directly support weapon systems, target acquisition or engagements.

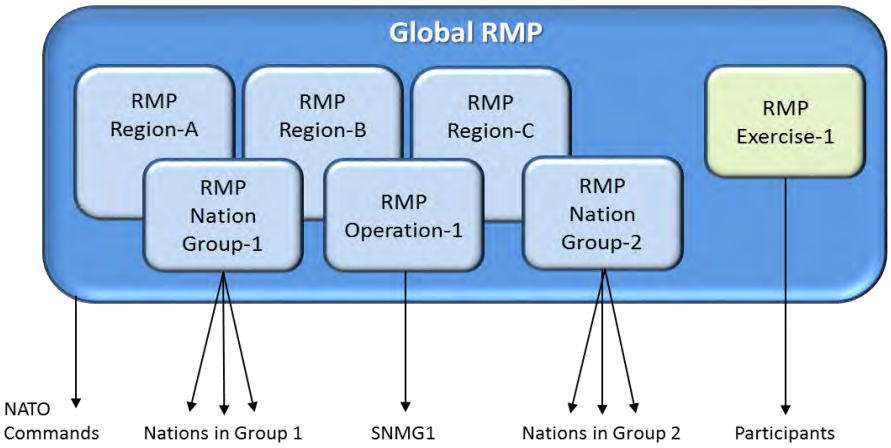
RMP data includes positional and operational data on friendly, neutral and adversary units and forces based on information provided from a variety of sources. Therefore, TRITON will build the RMP using the Military and White Pictures as components of the RMP.

Once the RMP is built, it can be shared by other Functional Services and Nations. TRITON will use the following methods to share and disseminate RMP:

- Making data available via a Web-service
- Sending track data to special users in NVG format
- Database synchronisation with other TRITON instances
- Nation Interfaces
- ADatP-3 formatted messages
- OTH-T GOLD messages

RMP is a global collection of recognised maritime objects. Although the RMP will be made available to TRITON Clients regardless of their location, it may be essential to disseminate the RMP with the currently used formats such as OTH-T GOLD messages to particular destinations. According to certain operational needs, RMP in global scope can be split into geographical regions so that dissemination can be managed according to the particular Area of Interest. For example, part of the RMP can be sent

to ACP which is conducting an operation at sea. Part of the RMP can be filtered before sending it to a particular Nation or Nation Group.



TRITON will maintain a list of RMP Regions which can be managed by the authorised user. Each RMP Region has its own Military and White Pictures, which can be disseminated at user-selected intervals. The RMP Region in TRITON will have at least the following attributes:

- Region identification
- Description
- Geographical Region (Reference Object - Area)
- Dissemination Rate

4.2.3.4.5.1. RMP Building

NATO RMP building uses filtering, validation, evaluation and correlation processes. TRITON will use the recognised (positively identified) tracks and the vessels with their last known positions assigned as Military and White Picture components. The RMP, with its components, will be made available to users allowing them to filter and display the objects within a given time frame.

The authorised user (RMP Manager) can create an RMP Region, select tracks and vessels to be included in this RMP Region by using the RMP Filter Criteria. The RMP Filter Criteria for each RMP component will provide the user to select at least the following:

- Standard Identity
- Classification
- Track Confidence Level
- Selected Vessel Lists (CCOI/COI/VOCI/Custom)

In addition, individual Maritime Operational Objects can be assigned to a selected RMP Region within the Current Maritime Operation.

All combatant vessels belonging to NATO Nations will be automatically assigned as FRIEND. The non-combatant vessels that are in Vessel List will be automatically assigned a Standard Identity and designated to relevant picture. The defaults will be as follows:

- Non-combatants (non-military) : NEUTRAL, White Picture
- VOCI Type 1 to 5 : SUSPECT, Military Picture
- VOCI Type 6 and 7 : NEUTRAL, White Picture
- COI : SUSPECT, Military Picture
- CCOI : HOSTILE, Military Picture

[T1-R232] *TRITON shall maintain a list RMP Regions for each Maritime Operation.*

Requirement Property :
Domain for Static : NS

Domain for Afloat: NS
Baseline : BL 3
Qualific. Method : Demonstration

[T1-R233] *TRITON shall use the recognised Tracks in the Track Database and the Vessels with last known positions in the Vessel Database on the NS Domain to build the RMP by using the RMP Filter Criteria.*

Requirement Property :
Domain for Static : NS
Domain for Afloat: NS
Baseline : BL 3
Qualific. Method : Demonstration

[T1-R234] *TRITON shall automatically designate tracks with classification of Combatant to the Military Picture of the global RMP.*

Requirement Property :
Domain for Static : NS
Domain for Afloat: NS
Baseline : BL 3
Qualific. Method : Test

[T1-R235] *TRITON shall automatically designate the Vessel Lists according to the default Picture of the global RMP.*

Requirement Property :
Domain for Static : NS
Domain for Afloat: NS
Baseline : BL 3
Qualific. Method : Test

[T1-R236] *TRITON shall allow the authorised user to designate Maritime Operational Objects to be included in the RMP according to their RMP designation information within the Current Maritime Operation.*

Requirement Property :
Domain for Static : NS
Domain for Afloat: NS
Baseline : BL 3
Qualific. Method : Test

[T1-R237] *TRITON shall allow the authorised user to designate a selected Vessel List to be included in the RMP of the Current Maritime Operation or excluded.*

Requirement Property :
Domain for Static : NS
Domain for Afloat: NS
Baseline : BL 3
Qualific. Method : Test

[T1-R238] *TRITON shall not allow the user to designate Simulated Tracks and Exercise Tracks into the RMP if the Maritime Operation is not of type Exercise.*

Requirement Property :
Domain for Static : NS
Domain for Afloat: NS
Baseline : BL 3
Qualific. Method : Test

[T1-R239] *TRITON shall be able to display the RMP in the GeoView as a Layer.*

Requirement Property :
Domain for Static : NS

Domain for Afloat: NS
Baseline : BL 3
Qualific. Method : Demonstration

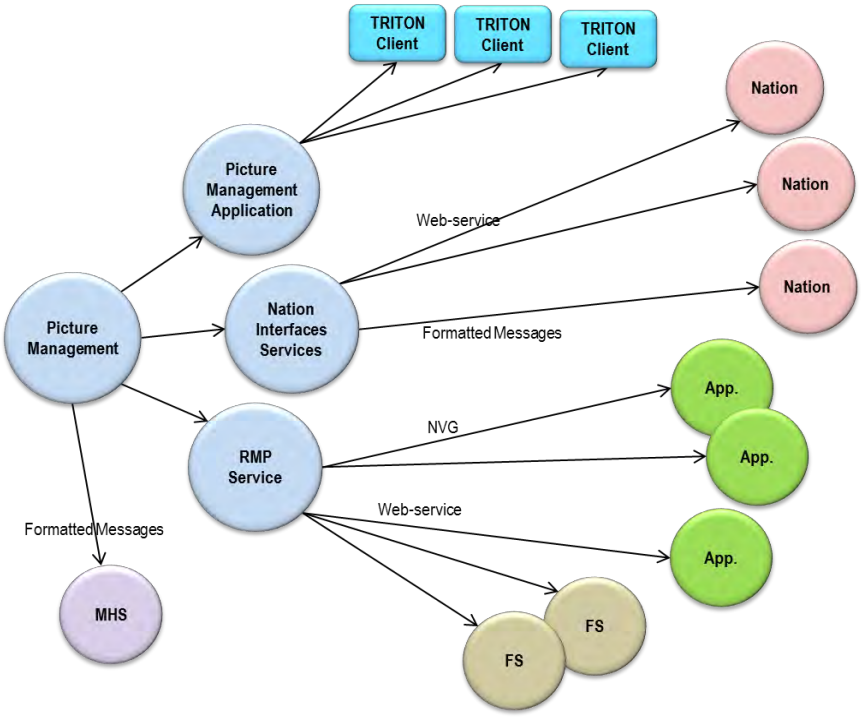
4.2.3.4.5.2. RMP Control and Sharing

NATO RMP is controlled by authorised users and can be shared with NATO Commands, HQs, Nations and other Bi-SC AIS Functional Services. While TRITON allows the users to access Maritime Operational Picture as well as RMP by means of Picture Display function configured for each Maritime Operation, it will also be able to disseminate the RMP using NVG format and APP-11/OTH-T GOLD messages. It will also make the RMP available for external access via the RMP Service. In addition, RMP can be exported into a file in a user-selected format.

Nations will be able to get any part of any RMP via a dedicated Nation Interface (Web-service).

Military and White Pictures within an RMP Region may have different dissemination rates depending on the operational use. For example, Military Picture every 20 minutes, White Picture every 60 minutes.

Following picture depicts how RMP can be disseminated with various options:



An authorised TRITON user will be able to generate Formatted Messages by either selecting Tracks on the GeoView or issuing a Track Search query.

[T1-R240] *TRITON shall make the RMP available over the RMP Service for external access.*
Requirement Property :
Domain for Static : NS
Domain for Afloat: N/A
Baseline : BL 3
Qualific. Method : Test

[T1-R241] *TRITON shall make the RMP available over the Nation Interface for each Nation.*
Requirement Property :
Domain for Static : NS
Domain for Afloat: N/A
Baseline : BL 3

Qualific. Method : Test

[T1-R242] *TRITON shall make the RMP available over the ACP Interface for the platform on which the Deployable Kit is installed.*

Requirement Property :
Domain for Static : N/A
Domain for Afloat: NS
Baseline : BL 4
Qualific. Method : Test

[T1-R243] *TRITON shall allow the authorised user to generate a selected Formatted Message after selecting the tracks on the GeoView or from a Search Result.*

Requirement Property :
Domain for Static : NS
Domain for Afloat: NS
Baseline : BL 3
Qualific. Method : Test

[T1-R244] *TRITON shall be able to generate RMPSITSUM message based on user-selected Tracks and Reference Objects.*

Requirement Property :
Domain for Static : NS
Domain for Afloat: NS
Baseline : BL 3
Qualific. Method : Test

[T1-R245] *TRITON shall be able to generate NAVSITSUM message based on user-selected Tracks filtered for correct identity.*

Requirement Property :
Domain for Static : NS
Domain for Afloat: NS
Baseline : BL 3
Qualific. Method : Test

[T1-R246] *TRITON shall be able to generate NAVSITREP message based on user-selected Tracks filtered for correct identity.*

Requirement Property :
Domain for Static : NS
Domain for Afloat: NS
Baseline : BL 3
Qualific. Method : Test

[T1-R247] *TRITON shall be able to generate MARINTSUM message based on user-selected Tracks filtered for correct identity.*

Requirement Property :
Domain for Static : NS
Domain for Afloat: NS
Baseline : BL 3
Qualific. Method : Test

[T1-R248] *TRITON shall be able to generate MARINTREP message based on user-selected Tracks filtered for correct identity.*

Requirement Property :
Domain for Static : NS
Domain for Afloat: NS
Baseline : BL 3
Qualific. Method : Test

[T1-R249] *TRITON shall be able to generate NAVPOSREP message based on user-selected Tracks filtered for correct identity.*

Requirement Property :
- Domain for Static : NS
- Domain for Afloat: NS
- Baseline : BL 3
- Qualific. Method : Test

[T1-R250] *TRITON shall be able to generate OTH-T GOLD CONTACT REPORT message based on user-selected Tracks.*

Requirement Property :
- Domain for Static : NS
- Domain for Afloat: NS
- Baseline : BL 3
- Qualific. Method : Test

[T1-R251] *TRITON shall be able to generate OTH-T GOLD ENHANCED CONTACT REPORT message based on user-selected Tracks.*

Requirement Property :
- Domain for Static : NS
- Domain for Afloat: NS
- Baseline : BL 3
- Qualific. Method : Test

[T1-R252] *TRITON shall be able to generate OTH-T GOLD OVERLAY-2 message based on user-selected Reference Objects.*

Requirement Property :
- Domain for Static : NS
- Domain for Afloat: NS
- Baseline : BL 3
- Qualific. Method : Test

[T1-R253] *TRITON shall be able to generate OTH-T GOLD OVERLAY-3 message based on user-selected Reference Objects.*

Requirement Property :
- Domain for Static : NS
- Domain for Afloat: NS
- Baseline : BL 3
- Qualific. Method : Test

[T1-R254] *TRITON shall be able to send the generated Formatted Messages containing the RMP or its Regions to the selected destination addresses at a selected Dissemination Rate.*

Requirement Property :
- Domain for Static : NS
- Domain for Afloat: NS
- Baseline : BL 3
- Qualific. Method : Test

[T1-R255] *TRITON shall allow the authorised user to select the destination system/service and send the RMP using NVG format [NVG].*

Requirement Property :
- Domain for Static : NS
- Domain for Afloat: N/A
- Baseline : BL 3
- Qualific. Method : Test

[T1-R256] *TRITON shall be able to export the RMP into Recognised Output File Format.*

Requirement Property :
Domain for Static : NS
Domain for Afloat: NS
Baseline : BL 3
Qualific. Method : Test

[T1-R257] *TRITON shall allow the authorised user to select the RMP component and export into a file in Recognised Output File Format.*

Requirement Property :
Domain for Static : NS
Domain for Afloat: NS
Baseline : BL 3
Qualific. Method : Test

4.2.3.4.6. Operational Object Search

TRITON will provide a Search Function for finding one or more Maritime Operational Objects being stored in the internal databases. TRITON will implement the Object Search function compatible to the specification given in [Open Search]. It will be accessible via the TRITON External Services (i.e. RMP Service, ICI Service).

The Search Function will have two options: Quick Search and Detailed Search.

Quick Search:

The Quick Search option will use the following Quick Search Criteria:

- Operational Object Number (Track Number, Vessel Number or Reference Object Number)
- Country
- Vessel Name
- International Call Sign
- IMO number
- MMSI number
- Range (from a given point or an Object)

Detailed Search:

The Detailed Search Function will use the Detailed Search Criteria which contains broader set of attributes (e.g. Descriptions, Remarks) of Operational Objects stored in the databases. Users can create search queries using the database fields, values, text search with wildcards (e.g. *, ?), intervals and logical operators (AND, OR, NOT) to define detailed search. Users can build Search Filters using the Detailed Search Criteria, save them in their Workspace, and re-use them to quickly initiate a new search. Examples of Detailed Search:

- Display the tracks having Activity related to Fishing in the specified area.
- Display the tracks carrying oil from a given port.
- Display the vessels replied (participating) to hailing in a given area in a given date interval.
- Display the vessels having helicopters on board.
- List the vessels capable of carrying containers with flag A.
- Display the current locations of the vessels in the VOCI having flag B.

Name Matching Criteria:

When TRITON executes a search using a given Vessel Name, it will use the Name Matching Criteria to compare it with other Vessel Names in the Vessel Database, both the Vessel Name and Synonyms. As there may be Vessel Names which contain special characters (e.g. '!'), the Search Criteria will be able to handle them as exceptional cases using the Name Matching Criteria. These special characters can either be excluded or the closest results are returned. The Name Matching Criteria will consider at least the following: