

CH 4–1. Purpose

The Defense Acquisition Guidebook (DAG), Chapter 4, provides guidance for Program Managers ([PMs](#)) and Product Support Managers ([PSMs](#)) to develop and execute successful sustainment strategies, and to document those strategies in a Life Cycle Sustainment Plan ([LCSP](#)) that aids program management, communication, and collaboration with critical stakeholders.

CH 4–2. Background

Life cycle sustainment comprises the range of planning, implementation and execution activities that support the sustainment of weapon systems. Best practice and guidance for ensuring that these systems meet sustainment objectives and satisfy user sustainment needs includes sustainment considerations in all phases of the program's life cycle. These acquisition lifecycle phases are formalized in [DoDI 5000.02](#), and offer PMs and PSMs guidance on the development and execution of effective [LCSPs](#) and the collaboration and information exchanges needed between sustainment and systems engineering communities.

CH 4–2.1 Purpose of Life Cycle Sustainment Planning

The purpose of life cycle sustainment planning is to maximize readiness by delivering the best possible product support outcomes at the lowest Operating and Support ([O&S](#)) cost. Sustainment is a distributed and long-term activity that requires the alignment of the program office, requirements community, systems engineers, sustainment commands, logistics community, resource sponsors, and others. These disparate communities of interest place a high value on planning and documenting plans, as they are likely to be executed over the course of years or decades. Sustainment planning begins before a material solution exists, to ensure that sustainment can be effectively executed when the first production quantities are fielded; it continues to evolve until disposal. Programs that emphasize sustainment early in the system life cycle deliver designs with the highest likelihood of achieving operational performance requirements and reduced demand for sustainment.

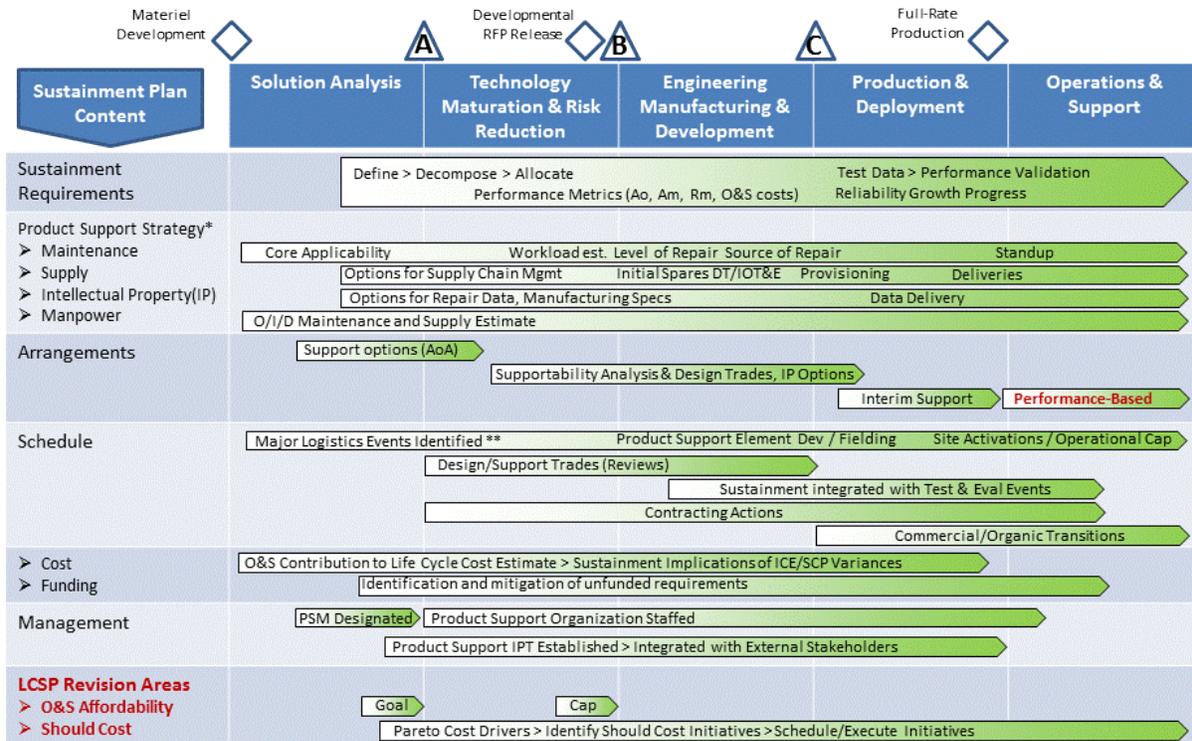
CH 4–2.2 Life Cycle Sustainment Overview

Life cycle sustainment planning is a key function of the defense acquisition system for the development of military capabilities. The goal of life cycle sustainment planning is to maximize readiness by delivering the best possible product support outcomes at the lowest [O&S](#) Cost.

While weapon system sustainment does not actually begin until the first production units are fielded, sustainment planning begins at the earliest stages of the defense acquisition system. Successful post-fielding sustainment performance depends on critical thinking during requirements development and solution analysis.

Figure 1 shows the major sustainment planning activities within the defense acquisition system program structure.

[Figure 1: Overview of Life Cycle Sustainment Activities](#)



< Note. Ao/Am/Rm = Operational Availability/Materiel Availability/Materiel Reliability; AoA = Analysis of Alternatives; Dev = Development; DT = Developmental Testing; Est = Estimate; Eval = Evaluation; ICE = Independent Cost Estimate; IOT&E = Initial Operational Test & Evaluation; LCSP = Life-Cycle Sustainment Plan; Mgmt. = Management; O&S = Operations & Support; O/I/D = Organizational-/Intermediate-/Depot (Levels of Maintenance); PSM = Product Support Manager; RFP = Request for Proposal; SCP = Service Cost Position; Specs = Specifications.

In this chapter, the terms “sustainment” and “product support” are used synonymously. The term “strategy” applies to the integration of the requirements, a product support package, and resources. The product support strategy should be developed as soon as possible in the life cycle of a program, preferably as soon as a materiel solution to a requirement is identified. The strategy is updated and refined throughout the product life cycle to disposal.

The execution of the strategy is outlined in an LCSP, which includes the array of product support functions required to sustain the product until the end of its useful life. The term “plan” applies to the elaboration of the strategy with the set of planning tasks and activities to stimulate critical thinking by managers and teams responsible for sustainment planning. The LCSP, serves as the central management tool for all aspects of the strategy and is developed in parallel with other Milestone A decision documents. To develop a best value solution to a product’s sustainment requirements, PMs ensure all aspects of logistics are covered.

The LCSP helps the PM develop a complete and detailed product support package, resulting in successful product support arrangements (PSAs). The product support package provides the detailed implementation approach for the product support strategy. A product support package consists of the combination of product support elements needed to achieve the sustainment requirements and the set of arrangements that programs establish with organic and commercial sustainment providers.

The backbone of the product support package is the Integrated Product Support (IPS) Elements. These 12 elements, described in detail in the IPS Element Guidebook, can be grouped into three buckets that cover the range of life cycle logistics functions. The three buckets and corresponding elements are:

- Life cycle management
 - Product Support Management
 - Supply Support
 - Packing, Handling, Storage, and Transportation ([PHST](#))
 - Maintenance Planning and Management
- Technical management
 - Design Interface
 - Sustaining Engineering
 - Technical Data
 - Computer Resources
- Infrastructure management
 - Support Equipment
 - Training & Training Support
 - Manpower and Personnel
 - Facilities and Infrastructure.

These IPS elements are relatively immature in the Materiel Solution Analysis ([MSA](#)) Phase, as there is too little data about the materiel solution to build a complete plan. As the logistics, requirements, engineering, and resource communities mature the program and refine the product support strategy, the PM increases the detail of each IPS element in the product support package to inform the execution of the strategy and [PSAs](#).

[PSAs](#) are the mechanisms for delivering the sustainment functions in the product support package. These arrangements are entered into with Product Support Providers ([PSPs](#)), who perform the required sustainment functions. These PSPs may be commercial industry, organic depot, or hybrid arrangements. Industry partner arrangements are governed under contract; service-level agreements govern work with organic depots. PMs and DoD Component-level stakeholders holistically evaluate the system (whether as a system, a system-of-systems, or components/sub-components) and the potential sustainment providers (industry, organic, or a partnership) through source or support/repair analyses to determine the best-value [PSAs](#).

The strategy, as manifested in the product support package and documented in the [LCSP](#), should grow with the development of the system. The product support package supports the Warfighter by maximizing reliability and availability, while also minimizing cost to the taxpayer.

CH 4–2.2.1 The Life Cycle Sustainment Plan

The Life Cycle Sustainment Plan ([LCSP](#)) is an evolutionary management document describing the program's approach to achieve a flexible, performance-oriented product support capability. This plan is the program's primary management tool to satisfy the Warfighter's sustainment requirements through the delivery of a product support package. The [LCSP](#) is expected to evolve throughout the acquisition process with the maturity of the system and provide clarity for the program's life cycle product support strategy. Additionally, it may be tailored based on varying entry points in the acquisition process.

The plan describes sustainment influences on system design, as well as the technical, business, and management activities to develop, implement, and deliver a product support package that maintains affordable system operational effectiveness over the system's life cycle. It also seeks to reduce cost without sacrificing necessary levels of program support. Development of a life cycle product support strategy and plan are critical steps in the delivery of the product support package. The [LCSP](#) remains an active management tool throughout the [O&S](#) phase and is continually updated to ensure sustainment performance satisfies the Warfighter's needs.

Program Managers (PMs) for all programs are responsible for developing and maintaining an [LCSP](#) consistent with the product support strategy, beginning at Milestone A. By Milestone B, the [LCSP](#) describes the actions for achieving sustainment requirements. By Milestone C, it describes the content and implementation status of the product support package (including any sustainment contracts) to achieve and maintain the sustainment requirements. After Milestone C, it describes the plans for sustaining materiel availability and for accommodating modifications, upgrades, and re-procurement.

CH 4–2.2.2 Principal Actors

The [DoDI 5000.02](#) designates a PM as the individual with responsibility for, and authority, to accomplish program objectives. This guidance was written to support the PM in execution of this responsibility. As the PM's key leader for sustainment planning, the Product Support Manager (PSM) has primary responsibility for implementing many of the actions, processes, and procedures included in this chapter. The PSM provides subject matter expertise to the PM for product support, from concept through disposal. The responsibilities of the PSM are defined in 10 USC 2337 (see [US Code](#)), although the PSM roles and responsibilities in the post-production [O&S](#) phase vary by DoD Component.

While this guidance is directed at the PM (and by extension, the PSM), there may be instances where there is no designated person for the role, such as during early capability or concept development. When there is no assigned PSM, trained life cycle logisticians (LCLs) in headquarters organizations or Program Executive Offices ([PEOs](#)), or temporarily assigned PSMs, can complete necessary actions. For lower tier programs (Acquisition Category III / IV), a PSM or life cycle logistics (LCL) staff with a portfolio of programs performs the necessary activities. Early in the Materiel Solution Analysis phase, when there may be no program office, this guidance uses the acronym "LCL" interchangeably to refer not only to *life cycle logistics*, but also to the individual responsible for sustainment planning—the *life cycle logistician*.

CH 4–2.2.3 Statute, Policy, and Guidance

PMs and PSMs should know and understand the statutory and regulatory mandates for sustainment. The major sustainment policy and guidance derive from:

- [US Code](#), Title 10, Section 2337, Life-cycle management and product support:

This is the governing statute requiring DoD to perform life-cycle management; it establishes and defines the role of the Product Support Manager (PSM).

- [DoDI 5000.02](#), Operation of the Defense Acquisition System:

This instruction establishes policy for the management of all acquisition programs, including requirements for life-cycle sustainment planning. The policy describes the content and approval requirements for [LCSPs](#) throughout the acquisition life cycle and into the Operating and Support ([O&S](#)) phase. Its Enclosure 6, Life-cycle Sustainment, documents the application of sustainment planning policies and procedures.

CH 4–3. Business Practice

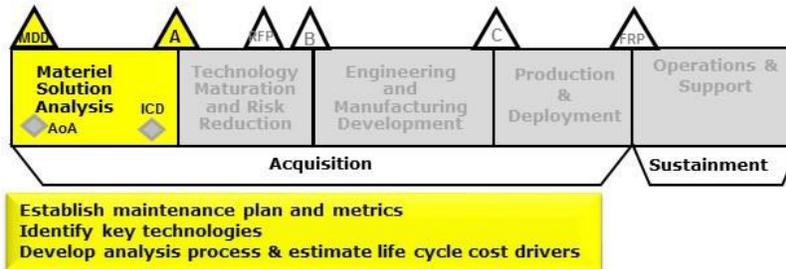
The Guidance section describes sustainment planning and execution across the program life cycle. It is organized by acquisition phase to support the DoD Component Life Cycle Logistician (LCL), Program Manager (PM), and Product Support Manager (PSM) as they shepherd a program through the defense acquisition system and into sustainment.

CH 4–3.1 Materiel Solution Analysis Phase

Sustainment planning begins at the earliest stages of the defense acquisition system. Successful post-fielding sustainment performance depends on thoughtful consideration during requirements development and solution analysis. The Materiel Solution Analysis ([MSA](#)) Phase provides the first opportunity to influence the supportability and affordability of weapon systems by balancing Warfighter requirements and operational capabilities with support capacity, capability, and cost.

An approved Materiel Development Decision (MDD) begins the [MSA](#) Phase and the Milestone A decision completes the phase. Prior to program office stand-up, which may be the case during the MDD and Analysis of Alternatives ([AoA](#)), the LCLs are responsible for initiating sustainment planning. Once the program office is initiated (usually before Milestone A), the PM and PSM assume primary responsibility for sustainment planning.

[Figure 2: MSA Sustainment Planning Activities](#)



MSA Focus:

- Definition/Decomposition of Warfighter's Sustainment Requirements
 - ICD
- Framing the Baseline Product Support Strategy
 - Core Determination
 - Predecessor System Strengths Weaknesses/Warfighter Priorities
- Defining Strategy for Analytical Process
 - Cost Drivers, Availability Degraders
- Sustainment Technologies Requiring Development
- Affordability Goals
- Alignment of AoA Results/Acquisition Strategy/Warfighter Requirements

[AoA](#) = Analysis of Alternatives; [FRP](#) = Full Rate Production; [ICD](#) = Initial Capability Document; [MDD](#) = Materiel Development Decision; [MSA](#) = Materiel Solution Analysis [RFP](#) = Request for Proposal.

CH 4–3.1.1 Materiel Development Decision

The Materiel Development Decision ([MDD](#)) is the entry point into the acquisition process for many new weapon systems. The Initial Capability Document ([ICD](#)), or other validated requirements document, and the [AoA](#) Study Guidance are required at this decision point to guide the program's execution of [MSA](#).

The LCL at MDD focuses on cost estimates and funding requirements necessary to conduct the range of logistics and sustainment studies and analyses. Supportability analysis may include [AoA](#), affordability assessment, sustainment Concept of Operations ([CONOPS](#)), and market research. Each of these provides logistics and sustainment data for the materiel solution alternatives.

CH 4–3.1.1.1 Initial Capability Document

The Initial Capability Document ([ICD](#)) is the first of the three major requirements documents in the Joint Capabilities Integration and Development System ([JCIDS](#)) that generate sustainment requirements. The lessons learned from fielded systems and capability-based assessments may help define the sustainment content in the [ICD](#). These analyses can be valuable in establishing sustainment constraints such as logistics footprint and weight, and human factors such as skill and education levels required for specific maintenance tasks.

Program offices should collaborate with requirements developers, sustainment commands, and DoD Component acquisition leadership (e.g., Assistant Secretary of the Army for Acquisition, Logistics and Technology; Deputy Assistant Secretary of the Navy for Expeditionary Programs and Logistics Management; Deputy Assistant Secretary of the Air Force for Logistics and Product Support) to

continually enhance sustainment effectiveness by factoring the lessons from legacy platform sustainment issues into new programs. Specifying sustainment capability gaps in the [ICD](#) helps ensure the [AoA](#) considers the potential product's entire life cycle and forms the basis for effective contractual requirements. See [CJCSI 3170.011 JCIDS Manual, Encl. D – Pages D-17 –28](#) for additional information on the [ICD](#).

CH 4–3.1.2 Analysis of Alternatives

The Materiel Development Decision directs the execution of the Analysis of Alternatives ([AoA](#)) through the [AoA Study Guidance](#) and [AoA Study Plan](#). This section focuses on the sustainment aspects of the [AoA](#) and defers to CH 2 for a more complete treatment of the [AoA](#).

During the [AoA](#), materiel alternatives are evaluated for operational suitability, ability to meet Warfighter [KPPs](#) and [KSAs](#), and affordability. LCLs participate in the [AoA](#) to influence technology trade-offs and provide subject matter expertise to identify risks and opportunities in cost, maintainability, and readiness that may be driven by technology options and the operational environment.

The LCLs should ensure that the [AoA](#) Study Plan considers sustainment in the study's ground rules, alternatives, and cost analysis. The ground rules should include assumptions relative to the operating environment that may impact supportability and warrant explicit planning and execution consideration. To preserve a fair comparison when evaluating alternative materiel solutions, LCLs should ensure that the maintenance and support concept is consistent for all alternatives and employment concepts (peacetime, wartime, contingency).

In some [AoAs](#), alternative support concepts (e.g., maintenance, training, supply chain) may also be evaluated to determine the most cost-effective support concept. The number of alternative support concepts that may be evaluated as part of the [AoA](#) is bound by the resources and schedule. It is critical that LCLs be included in the [AoA](#) study team to ensure the selected support concepts offer the greatest potential performance and cost benefits. An LCL's subject matter expertise can help the study better balance near-term design, procurement, and system performance decisions with long-term readiness and cost performance.

CH 4–3.1.2.1 Sustainment Criteria

Requirements trade-offs should balance performance characteristics (e.g., speed, payload and maneuverability) with sustainment (e.g., availability, reliability, and [O&S Cost](#)). These performance attributes may be included as criteria in the [AoA](#) to ensure study results retain a life cycle perspective.

CH 4–3.1.2.1.1 Materiel Availability

Materiel Availability (A_m) is a measure of the percentage of the total inventory of a system that is mission capable. More specifically, it is the share of end items operationally capable (ready for tasking) of performing an assigned mission at a given time, based on materiel condition. If the [ICD](#) identifies a gap in sustainment, this may be reflected in the selection of availability performance as an assessment factor in the [AoA](#).

The [AoA](#) assumes specific scenarios and [CONOPS](#) to baseline an affordability parameter across alternatives. LCL communications with resource sponsors and the requirements community should include sustainment strategies and their ability to meet availability requirements in current operations plans. Issues to highlight include historical availability rates, organic versus contractor logistics support in forward areas, and funding priorities.

CH 4–3.1.2.1.2 O&S Cost

During development of the Study Plan, the LCL should ensure that Operating and Support Cost ([O&S Cost](#)) is a criterion in the [AoA](#). [O&S Cost](#) may be a critical factor in selecting between multiple sustainment strategies. The cost estimators consider the specific sustainment differences between the [AoA](#) alternatives to be sustainment discriminators.

Cost estimates during the [AoA](#) often consider the life cycle cost (sum of acquisition, [O&S](#), and disposal costs). The cost estimator focuses on the sustainment discriminators that yield relative cost differences among the alternatives. The LCL supports the [AoA](#) cost estimating team by identifying and specifying

sustainment specific discriminators as assumptions in the [AoA](#) alternatives. Common sustainment discriminators in the [AoA](#) cost estimate may include but are not limited to:

- Maintenance strategy
- System/component weights
- Number of systems to be sustained
- Fuel usage/energy consumption
- System complexity
- Operational Tempo (OPTEMPO) constraints
- Required manning to operate/maintain/support
- Transportation requirements, including storage and environmental requirements
- Planned/required future upgrades
- Software refresh schedules/licensing agreements
- Hardware refresh cycles
- Projected service life

LCLs may also help identify legacy or analogous systems to use as sources of reference data. Legacy/analogous systems are those that perform the same (or similar) mission or share technical characteristics with the potential new system. Typically, little (if any) data is available on potential new systems considered as alternatives, but legacy/analogous system costs may offer useful insight as the basis of [O&S](#) Cost estimates during the [AoA](#).

In the course of conducting the [AoA](#), cost estimators identify and highlight areas of risk, the realization of which could lead to increased costs. These risk areas are often useful starting points for the LCL or PM to identify [O&S](#) Should Cost initiatives. While the [O&S](#) phase may be years or even decades in the future, the [O&S](#) Should Cost that influence system design typically yields the greatest long-term performance and cost benefits. Should Cost is covered more in Section 3.1.5.3.3.

CH 4–3.1.3 Sustainment Planning

DoD Components should begin product support planning as soon as the Milestone Decision Authority (MDA) determines that a materiel solution is needed to satisfy the capability requirement. This timing often precedes formal establishment of a program of record and staffing of a program office. PMs should use the insights and critical thinking embodied in such acquisition deliverables as the [AoA](#); Reliability, Availability, Maintainability, and Cost ([RAM-C](#)) Rationale Report; and Concept of Operations/Operational Mode Summary/Mission Profile (CONOPS/OMS/MP); and in requirement documents such as the [ICD](#) and Capability Development Document ([CDD](#)) as the logical basis for the sustainment plan.

During the [MSA](#) Phase, the PM (or LCL if a program office has not yet been initiated), develops a sustainment strategy based on the results of the [AoA](#) and trade studies, and recommends refinements to Warfighter requirements and sustainment metrics. The PM coordinates with the requirements, operations, and systems engineering communities to analyze the intended use of the capability and identify design considerations that enhance the operational suitability, sustainability, and affordability. The PM identifies and quantifies [O&S](#) Cost and readiness drivers as an integral part of the [AoA](#) and [MSA](#) and pursues opportunities for improvement.

Sustainment planning during [MSA](#) includes determining the capabilities and major constraints (e.g., cost, schedule, available technologies) that inform the acquisition strategy and program structure for both the system design and its sustainment. PMs explore alternative sustainment strategies. Based on the early system concept, the program may investigate different options for sustainment strategies that consider how best to use the government's investment in existing support infrastructure, maintenance capacity, supply support, and unique support capabilities offered by industry.

The PM uses trade studies and analyses to compare alternative sustainment strategies. Then, the PM establishes a baseline sustainment strategy based on the legacy system, analogous systems, existing component/sub-component level repair, and Warfighter and DoD Component preferences. This strategy includes an outline of product support, levels of repair, manpower, schedule, etc. The sustainment strategy is articulated in a draft [LCSP](#).

The PM uses the systems engineering process to assess technological risk that might result in failure to achieve performance requirements. As the PM considers system design alternative risk and opportunity analyses of candidate technologies, the PM should also consider the risks to achieving reliability goals, maintainability of the technology in its intended environment, and life cycle cost implications of the candidate technology. Risk considerations may include repair technologies that may need to be created and changes to the existing skill sets of maintenance personnel. The PM also identifies opportunities to apply new technologies and techniques that can enhance the maintainability of equipment and reduce life cycle cost.

CH 4–3.1.3.1 Analysis Process

The LCL/PM participates in trade studies, cost analyses, and business case analyses ([BCAs](#)) to evaluate the costs, benefits, and risks of different sustainment strategies. The depth of supportability evaluation may be constrained by available legacy data and analytical resources, but even high-level evaluation this early in system development can significantly reduce the risk of [O&S](#) Cost overruns and readiness shortfalls, post-fielding. The LCL/PM should also assess the timing of these analyses against the program development timeline.

The LCL/PM uses analytical techniques that enable comparisons of requirements, technologies, and systems against legacy/analogous systems to assess alternative sustainment strategies. Alternatives could include commercial and organic sources (when not constrained by law) of repair and supply, alternative levels of repair, or use of other DoD Components' or allied capabilities. The LCL/PM should analyze potential new sustainment technologies for inclusion in the sustainment strategy. The LCL/PM also conducts use studies to understand the impact to sustainment of the intended operational environment. The results of these analyses inform the program schedule, development of resource requirements, and the [LCSP](#). Further guidance can be found in the [Product Support BCA Guidebook](#).

The PM evaluates proposed maintenance technologies to understand reliability maturity, potential failure modes, and maintainability challenges. This allows the PM to identify potential sources of repair and further trade studies, and can help identify the need to develop new repair technologies or facilitate existing capabilities. The results of these evaluations feed Request for Proposal (RFP) development, data rights strategies, sustainment strategy, and [LCSP](#) development.

CH 4–3.1.3.2 Maintenance Planning

The PM uses the supportability analyses to develop a maintenance plan for the new system. This maintenance plan is part of the draft [LCSP](#).

The PM drafts a maintenance plan by comparing the legacy system with the intended use/environment of the emerging system, along with knowledge of the developing technology. The PM identifies when maintenance is likely to be required and at which level of maintenance (organizational, intermediate, or depot). The PM, working with systems engineers, drafts scheduled and unscheduled maintenance tasks based on engineering assessments of failure modes and effects, wear-out rates, life limits, need for corrosion inspections, etc. The PM considers conceptual system design(s) and uses the initial removal rate estimates for each replaceable/repairable item to forecast likely requirements, including spares and repair parts.

CH 4–3.1.3.2.1 Core Determination

Core logistics capability (See US Code Title 10, 2464) is required to ensure a stable source of technical competence to ensure effective and timely response to mobilization, national defense contingency situations, or other emergency requirements. Programs undergo a core determination process to evaluate whether the statutory requirements apply and informs the program's 2366a certification submission.

The core depot determination is based on whether the legacy platform was deemed core or if the new system supports a Joint Chiefs of Staff tasking. The determination process is governed by [DoDI 4151.20](#).

CH 4–3.1.3.2.2 Level of Maintenance

The maintenance plan identifies the planned levels of maintenance used to sustain the weapon system. The maintenance plan includes an outline of levels of repair, including core organic depot maintenance

when applicable, as well as the supply support plan. Organizational-level maintenance may be decomposed into repair by organic personnel, interim contract support, or the contractor logistics support. The PM also assesses the duration of contractor logistics support necessary to support any planned transitions to organic support and identifies legacy secondary items already organically supported and the Depot Source of Repair. The PM considers software sustainment depot support (organic versus Original Equipment Manufacturer (OEM) contractor field service representatives to inform the development of the [LCSP](#).

The PM highlights those new technologies that lack depot repair and may require further investment and development planning. This assessment of likely depots can help the PM identify expertise to evaluate facilitation requirements, schedules, and resources when depot-level maintenance is included in the maintenance plan.

Based on the proposed material solutions and technologies, the PM works with the DoD Component to identify potential sources of repair. Among the considerations in identifying sources of repair are capabilities to support similar system and subsystem hardware and software. Programs should investigate potential sources of repair both within a DoD Component and within other DoD Components.

The PM continually refines the maintenance plan in subsequent phases of the program. As the design matures, the maintenance plan serves as a key component of the [LCSP](#), cost estimates, RFP requirements, Intellectual Property (IP) requirements, and budget development.

CH 4–3.1.3.3 Manpower Assessments

The PM conducts manpower assessments and trade studies to determine required skill levels and training, optimal workforce personnel mix (military/civilian/contractor) and constraints. This analysis provides the basis for resourcing the program office, field activity, contractor, and Warfighter personnel. The assessed skill levels informs the Cost Analysis Requirements Description (CARD) development to ensure accurate cost estimates and budget formulation. For more, see the manpower assessment section in the OSD CAPE's "[Operating and Support Cost Estimating Guide](#)."

CH 4–3.1.3.4 Interim Support Requirements

Based on materiel solution and technology maturity, the PM assesses whether a contractor interim support period is required and the scope of support needed. Interim support requirements refer to temporary contractor support in lieu of a permanent support solution (organic or commercial) for a predetermined time that allows a DoD Component to deliberately plan and program for investment in required support resources (spares, technical data, support equipment, training equipment, etc.), while a permanent support capability is put in place. Interim support is usually required for support of prototypes and early test and production assets during development and initial fielding. The PM first identifies those support activities that are required prior to fielding the permanent support solution and then develops a plan for implementing the interim support solution and transitioning to the permanent support solution.

CH 4–3.1.3.5 IPT Development

During this phase, the PM establishes multidisciplinary integrated product teams ([IPTs](#)) that achieve the performance outcomes by integrating individual logistics support elements or technical disciplines. Teams include representatives from stakeholder organizations, including DoD Component headquarters, operational and logistics commands, and industry. IPTs include expertise from disciplines such as engineering, cost estimation, resource management, contracting, information technology, supply, maintenance, corrosion control, and transportation. The PM should ensure that IPTs for systems engineering, testing, cost estimating, resource management, and contract development include logistics expertise and stakeholder participants.

CH 4–3.1.4 Design Interface

The design phase can best influence sustainment outcomes, as decisions made during this time can make it easier to maintain and reduce [O&S](#) Costs. The systems engineering process relies on balancing often conflicting requirements such as weight versus reliability. The design decisions rely on thorough trade studies that can accurately and completely provide the life cycle cost impact for each alternative being assessed. It is difficult and expensive to redesign to restore reliability or maintainability; close

interaction between the sustainment, engineering, and design communities throughout the design phase delivers required maintainability and reliability.

The PM should formulate design requirements to minimize support equipment, including testing, measurement, and diagnostic equipment. When the use of support equipment cannot be eliminated, the PM should standardize support equipment design for the broadest possible range of applications, consistent with maintenance concepts.

The PM should also consider the use of [Condition Based Maintenance Plus](#) when selecting maintenance concepts, technologies, and processes for all new weapon systems, equipment, and materiel programs. Readiness requirements, life cycle cost goals, and Reliability-Centered Maintenance (RCM) based functional analysis should be formulated in a comprehensive reliability and maintainability (R&M) engineering program.

CH 4–3.1.4.1 Reliability, Availability, Maintainability, and Cost Rationale Report

The Reliability, Availability, Maintainability, and Cost (RAM-C) Rationale Report provides a quantitative basis for reliability requirements and improves cost estimates and program planning. The PM participates in the RAM-C analysis, along with the R&M engineer and cost analyst, to ensure that the Sustainment KPPs and KSAs are valid and feasible and that appropriate trade studies have been conducted to illustrate the trade space between the sustainment parameters. This report is used throughout the system’s life cycle as a baseline for how requirements are measured and tested. For more, see the [RAM-C Rationale Report Manual](#) and [CH 3 Section 4.3.19](#) Table 48 R&M Activities by Acquisition Phase.

CH 4–3.1.4.2 System Performance Specification

The PM ensures the draft system performance specification to support the Technology Maturation and Risk Reduction (TMRR) RFP translates the R&M threshold values from the draft CDD. Once reliability allocations have been made to key subsystems, the PM should track design performance and report shortfalls (if any) at design reviews and acquisition decision points. The PM can leverage the Sustainment Command subject matter experts (e.g., PEO logisticians or legacy/analogous program logisticians) to help assess the new system R&M engineering requirements against legacy/analogous platform performance to identify risks.

The PM should ensure the draft design specification includes R&M requirements (e.g., Built-in-Test Detection). The ICD and subsequent draft CDD Sustainment KPPs and KSAs should be measurable so they support the system demonstration during Developmental Testing. The PM can leverage DoD Component test and evaluation subject matter experts to help guide the draft design specification language (value and definition) and the Test and Evaluation Master Plan (TEMP).

CH 4–3.1.4.3 Alternative Systems Review

As part of the Alternative Systems Review (ASR), the PM ensures that sustainment requirements for the alternatives are consistent with the RAM-C Rationale Report and are captured and reflected in the draft CDD. Additionally, the PM ensures that these capabilities and requirements are achievable in the preferred materiel solution and that the results of the MSA Phase (capabilities, requirements, preferred system concept and planning) indicate acceptable sustainment risk for moving into TMRR. See [CH 3 Section 3.3.1](#) for additional information on the ASR.

CH 4–3.1.5 Milestone A

Milestone A is a risk reduction and investment decision. For product support planning, this decision establishes the product support strategy for the new capability. Table 1 lists key sustainment questions for the elements of the LCSP. This framework stimulates critical thinking but is not a complete listing of questions.

[Table 1: Key Sustainment Questions at Milestone A](#)

LCSP Section	Considerations
Introduction	Does the strategy require sustainment technology development?

Product Support Performance	Have the Warfighter requirements (including planned operational environment and availability) been included in the draft CDD and decomposed to affordable sustainment design-to requirements (both weapon system and support systems)?
Product Support Strategy	Have the plans for maintenance, supply, technical data, and manpower been defined such that cost and schedule estimates can be made? Are there alternatives? Are there planned sustainment trades?
Product Support Arrangements	Have the TMRR phase sustainment-related tasks been identified? Are legacy/analogous system PSAs applicable?
Product Support Package Status	Have the specific design features the PSM will assess in the TMRR phase design reviews been identified?
Regulatory/Statutory Requirements that Influence Sustainment	Has core depot applicability been addressed? Has the program included how and when the requirements will be met?
Integrated Schedule	Are logistics objectives linked to Program milestones? This includes Initial Operational Capability (IOC), Initial Operational Test & Evaluation (IOT&E), Full Operational Capability (FOC), Material Support Date (MSD), etc.? Are major logistics events identified in sufficient detail for estimating sustainment costs? Are analyses phased to support milestones?
Cost / Funding / Affordability	Are O&S Cost affordability goals established? Has a program office Life Cycle Cost Estimate (LCCE) been developed? Are there Should Cost management targets for sustainment?
Management	Is the PSM in place? Are IPTs in place to address TMTMRR RR phase sustainment issues? Does the program/ LCSP address competition across the system life cycle?
Supportability Analysis	What analyses ensure affordable logistics and readiness (Level of Repair Analysis [LORA], depot support, organizational manning, and use studies)? What alternatives have been identified as Should Cost initiatives?
Additional Sustainment Planning Factors	Are O&S Cost drivers for the legacy/analogous system and risk identified?
LCSP Annexes	Are sustainment Cost Estimates and their drivers identified?

CH 4–3.1.5.1 Draft Capability Development Document

Before Milestone A, the DoD Component's requirements developer formulates a draft Capability Development Document ([CDD](#)), informed by the [ICD](#) and the [AoA](#). This document contains all requirements for the system. The mandatory sustainment requirement is broken involves three attributes that enable affordable logistics performance: the Availability KPP, the Reliability Key System Attribute (KSA), and the [O&S](#) Cost KSA.

The draft CDD reflects DoD Component requirements based on information documented in a system's Operational Mode Summary/Mission Profile ([OMS/MP](#)). The PM should ensure the development of the CDD remains synchronized with the OMS/MP. This synchronization prevents acquiring a design based on outdated missions or modes that under- or over-specify the system's utilization or operating environments. The PM's knowledge of operating modes and profiles facilitates integration of requirements from other function domains to achieve the CDD's sustainment metrics. Additionally, OMS/MP data is useful in other logistics planning efforts such as facilitating maintenance cycle planning (organizational,

intermediate and depot), informing sustainment models and simulations, and determining infrastructure requirements. See [CJCSI 3170.011 JCIDS Manual, Encl. D – Pages 47 – 62](#) for CDD information.

Sustainment metrics are developed and measured together, as well as in concert with the other system KPP and KSAs. An unachievable value in any metric can have a ripple effect on the other sustainment or system performance metrics and may drive up development and [O&S](#) Costs. The LCL/PSM and the Chief Engineer collaborate on establishing and refining the sustainment metrics. The LCL/PSM should understand and influence the engineer's reliability and maintainability requirements, while the Chief Engineer should understand the support limitations of the planned sustainment strategy. This partnership ensures the overall system design supports realistic and suitable sustainment capabilities; it lays the foundation of cooperation through system development and production. Additionally, the sustainment metrics provide the linkage to integrate the product support elements.

The JCIDS Manual provides a useful reference of sustainment metric definitions across weapon system types in Table D-D-2, Recommended Sustainment Metrics, in the [CJCSI 3170.011 JCIDS Manual, Encl. D – Pages D – D-6](#)

CH 4–3.1.5.1.1 Key Performance Parameter: Availability

Availability defines the number of end items available for operational use as a share of the total number of end items in the inventory. Availability is central to determining the number of end items needed to fulfill the required number of operational units at any given time. The Availability KPP is divided into Materiel Availability (A_m) and Operational Availability (A_o), which are both important but focus on different aspects of availability. Figure 3 shows the calculations for each of the parameters.

[Figure 3: Calculating Available Metrics](#)

$$\text{Material Availability (\%)} = \frac{\text{\# of mission capable systems}}{\text{Total \# systems}}$$

$$\text{Operational Availability (\%)} = \frac{\text{Uptime (of a system or group of systems in a unit)}}{\text{Uptime + Downtime (of a system or group of systems in a unit)}}$$

The A_m KPP applies to the entire fielded inventory of systems, including training, prepositioned, attrition reserve units, etc. By accounting for the entire inventory of fielded items, A_m ensures that items that are in depot or in transit to depot are accounted for as sources of non-mission capable status for the DoD's total inventory. By providing a holistic view of a population of end items, A_m can be linked to DoD's operations plans requirements and ability to meet missions.

The A_o KPP focuses on availability of operational end items that are assigned to a unit and expected to be available. A_o is expressed as the percentage of time that a system or group of systems within a unit are operationally capable of performing an assigned mission and can be expressed as (uptime/ (uptime +

downtime)). In this case, non-mission capable systems are driven by component failure rates and capabilities and capacity of the support infrastructure. Support factors that drive mean downtime include maintenance, supply, and administrative delays. This metric allows the Warfighter to understand how frequently a system should be expected to be unavailable.

While A_m and A_o cover different aspects of availability, their values should be mutually supportive, achievable, and built on the lower-level sustainment metrics discussed in Section 0.

CH 4–3.1.5.1.2 Key System Attribute: Reliability

Reliability measures the probability that a system will perform without failure over a specified interval under specified conditions. Reliability should be sufficient to support the warfighting capability needed in its expected operating environment. Considerations of reliability support both KPP availability metrics, A_m and A_o . Reliability may be expressed initially as a desired failure-free interval that can be converted to a failure frequency for use as a requirement.

The Reliability KSA provides a baseline measure to guide design engineers as the system is developed. The KSA enables analyses of the resulting configuration to include reliability modeling, reliability allocation, reliability prediction, and failure mode effects and criticality analysis. System reliability has a direct impact on maintenance time and manpower, spare parts usage and investments, A_o , logistics infrastructure, and life-cycle costs.

The Reliability KSA provides the basis for the eventual system design specification that will be placed on contract. Collaboration among the requirement authority, the PM and/or LCL, and the systems engineer at this point can facilitate a reliability definition and quantification that support follow on analyses such as the [RAM-C](#), design trades, etc. For more on reliability, see [CH 3 Section 4.3.19](#).

CH 4–3.1.5.1.3 Key System Attribute: Operating & Support (O&S) Cost

O&S Cost covers all Cost Assessment and Program Evaluation (CAPE) [O&S](#) Cost elements (as defined in [Chapter 6 of the CAPE Operating & Support Cost-Estimating Guide](#)) across the program's life cycle. Its inclusion as a mandatory sustainment metric ensures that sustainment performance is not considered in isolation from the associated sustainment costs. Modifying any of the sustainment parameters has a waterfall effect on the others, especially [O&S](#) Cost. The PM should seek balance between each metric that reflects realistic availability and reliability requirements and associated [O&S](#) Costs to achieve them. The DoD Component cost community can help frame the [O&S](#) Cost impacts of availability and reliability requirements to inform trade-off decisions. The [O&S](#) Cost KSA definitions are identical to those in the [O&S](#) Cost objective and threshold set in the Acquisition Program Baseline (APB).

CH 4–3.1.5.1.4 Other Metrics and Attributes

Other non-mandatory sustainment metrics are useful tools to include in a requirements document and subsequent systems specification and contracts. Maintainability metrics, including Mean Downtime and Mean Time To Repair, provide the foundation of the Availability KPP outcome. Maintainability metrics allow the requirements developer to understand how long it takes to restore available status. Including maintainability in a requirements document helps improve logistics readiness. Other subordinate metrics that offer greater maintainability and availability fidelity include corrective maintenance, mission maintainability, and maintenance burden. See [CJCSI 3170.01I, Appendix A, Encl. D, Page D-A-19](#) for additional detail. The [DoD RAM-C Manual, Table 2-1, Page 8-10](#) also has a helpful matrix of metrics.

The draft CDD ensures the other sustainment-critical metrics enable the mandatory Sustainment [KPPs](#) and [KSAs](#). Examples of these metrics include logistics footprint, maintenance burden, transportability, and Built-In Test Equipment ([BITE](#)) fault isolation and detection rates with a false alarm rate. [CJCSI 3170.01 JCIDS Manual, Appendix A, Encl. D, 7.f – Page D-A-18](#) contains a list of potential additional sustainment KSAs and additional performance attributes in the [JCIDS](#).

Lessons learned from legacy and other current systems should inform the inclusion of maintainability, diagnostics, prognostics, tooling requirements, and other sustainment metrics early in the design process. The LCL/PM should use this information to drive explicit budget inputs for the development of new technologies to improve the reliability, maintainability, and supportability of DoD materiel, including the cost, schedule, and performance of the sustainment strategy.

CH 4–3.1.5.1.5 Affordability

The Affordability section in the draft CDD contains cost and funding data projections from the resource sponsor in support of the Milestone A decision. If the [O&S](#) Cost KSA exceeds the [O&S](#) Cost affordability constraint, the program's early development starts in an [O&S](#) Cost deficit. The PM uses this information to identify resource shortfalls and to align resource demand and logistics attributes. See Section 3.2.4.1.2 for more on [O&S](#) affordability.

At the Milestone A decision point, the DoD Component presents an affordability analysis and proposed affordability goals based on resources the resource sponsor projects to be available in the portfolio(s) of the program under consideration. From this analysis, the PM, with the resource sponsor, determines an affordability metric for these goals to be used throughout the program life. The PM tailors the [O&S](#) Cost metric to the type of program. Average annual [O&S](#) Cost per unit is the most common metric. Information systems programs with no production quantities frequently use average annual total [O&S](#) Cost over the first 10 years of fielding. Missile programs often use average annual [O&S](#) Cost per year, since most of the support costs on that type of system are not unit specific. The PM also ensures that the metric definition is clear about what it includes (i.e., the metric specifically identifies which CAPE [O&S](#) Cost Elements are included and whether or not disposal costs are included).

CH 4–3.1.5.2 Life Cycle Sustainment Plan in MSA

During the [MSA](#) Phase, the PM drafts the [LCSP](#) based on the baseline product support strategy. The [LCSP](#) draws on sustainment assumptions, analysis, and decisions determined in the [AoA](#), requirements, technology development strategy, and acquisition strategy. The [LCSP](#) to support Milestone A includes a definition/decomposition of Warfighter sustainment requirements and contains the framing assumptions for product support strategy development.

The [LCSP](#) includes the plan to determine cost and availability drivers, the Core Depot Determination, the results of analysis of legacy/analogous system sustainment strengths and weaknesses, and Warfighter requirements. The [LCSP](#) also identifies key sustainment technologies and addresses affordability targets.

Additionally, the PM uses the [LCSP](#) to aid in developing the RFP requirements, including specifications, statements of objectives, statements of work, and proposed deliverable data items.

CH 4–3.1.5.2.1 Schedule of Product Support Activities

The PM synchronizes product support development activities and analyses with the program master schedule events, including design reviews, test activities, RFPs, and contract development activities. The results guide the integration of activities within the program and ensure efficient and timely product development.

CH 4–3.1.5.3 Resource Management

While PMs do not control resource management functions that are external to the program office, they play a key role in supporting those that do by supplying necessary data and justifications and by reviewing resource management products. The PM works with cost estimators, program/budget managers, and resource sponsors to inform affordability analysis, resource requirements, cost projections and savings initiatives.

CH 4–3.1.5.3.1 Cost Estimating

To prepare the program for the Milestone A decision, the PM is involved in two major efforts related to [O&S](#) Cost estimating: the development of the [LCSP](#) and the development of the Independent Cost Estimate (ICE), Service Cost Position (SCP), and/or Program Office Estimate (POE). The [LCSP annotated outline](#) contains a full description of the [O&S](#) Cost information required to support the Milestone A decision.

The CAPE ICE, SCP, and/or POE cost estimates at Milestone A cover the entire life cycle, focusing on major cost drivers. A cost driver is a factor that influences or contributes to the cost. Major cost drivers are those inputs that change the total [O&S](#) Cost the most in absolute value (e.g., fuel consumption, number of units, program life span). If the MDA decides to carry forward multiple alternatives from the [AoA](#), the Milestone A estimate includes each alternative's LCCE.

It is important to include all [O&S](#) Cost elements (as defined in the [CAPE Operating & Support Cost-Estimating Guide](#)) since the ICE/SCP/POE becomes the basis for the budget after the Milestone A decision. For each CAPE [O&S](#) Cost element, the PM provides relevant requirements to the [O&S](#) Cost estimator.

Cost estimates at this phase rely on analogy to legacy/analogous systems. Cost estimators may ask the PM to identify legacy/analogous systems. Legacy/analogous systems are those that perform the same (or similar) mission or share technical characteristics with the system being estimated.

Cost estimators use the Cost Analysis Requirements Description (CARD) as the detailed description of the acquisition program to baseline the estimate. The CARD is a technical description of the program. The CAPE provides more information on the CARD in the [DoDI 5000.73](#). In the CARD, the PM defines the sustainment and logistics technical baseline in enough detail that the cost estimator can develop a credible estimate that reflects the planned sustainment strategy. The PM uses the [O&S](#), the Quantities and [O&S](#) Time Phased, and the Manpower Time Phased sections of the CARD template (available in the CAPE Cost Assessment Data Enterprise) to determine the data inputs required.

The sustainment assumptions in the [LCSP](#) are critical when developing the CARD. Once developed, the CARD will elaborate on sustainment assumptions such that the document offers cost estimating inputs that estimators can discretely price. The CARD likely references the [LCSP](#) for key assumptions and contains more technical detail and specific parameters useful in cost estimating. For example, the [LCSP](#) may report a system will use three levels of maintenance, while the CARD details six maintenance periods that last three months each and require 25,000 man-days of effort each period.

The MDA may direct the DoD Component to fund the program to either the ICE, SCP, or POE (or some combination thereof). The PM uses this decision in all future logistics funding submissions. As requirements change due to technical, programmatic, or planning changes in the program, the PM may need to highlight and explain discrepancies between the budgeted amount and the logistics requirements.

CH 4–3.1.5.3.2 Program Office Programming and Budgeting Activities

The PMs input at Milestone A focuses on funding requirements necessary to mature critical technology and reduce risks for the logistics and sustainment capabilities that comprise the materiel solution. Funding for important logistics and sustainment-related studies and analyses following Milestone A should support updates to the [AoA](#) and market research, as well as the Cost as an Independent Variable, Supportability, and Technology Risk Reduction assessments. Other funding considerations include those needed to establish the Supportability Integrated Product Team and the Integrated Logistics Support Management Program, as well as funds needed to initiate a Product Support BCA.

CH 4–3.1.5.3.3 Should Cost

Should Cost is an attempt to drive productivity improvement during contract negotiation and program execution by scrutinizing every element of program cost, assessing whether each element can be reduced relative to the year before, challenging learning curves, dissecting overheads and indirect costs, and targeting cost reduction with profit incentive. The [Better Buying Power](#) implementation memoranda and directives introduce the concept of Should Cost, which applies to both acquisition and [O&S](#) Costs.

Examining the [O&S](#) Cost drivers of legacy/analogous programs used in the Milestone A cost estimates points to likely targets for Should Cost initiatives in the new system. [Section 4.2.1 of the O&S Cost Management Guidebook](#) provides a full description of the types of analyses that help to identify [O&S](#) Cost drivers.

The [Should Cost Portal](#) provides examples of successful Should Cost initiatives across DoD Components, commodities, acquisition categories, and life cycle phases; it also provides Should Cost training, techniques, and tools. The PM documents [O&S](#) Should Cost initiatives in the [LCSP](#).

CH 4–3.1.5.4 Sustainment Quad Chart

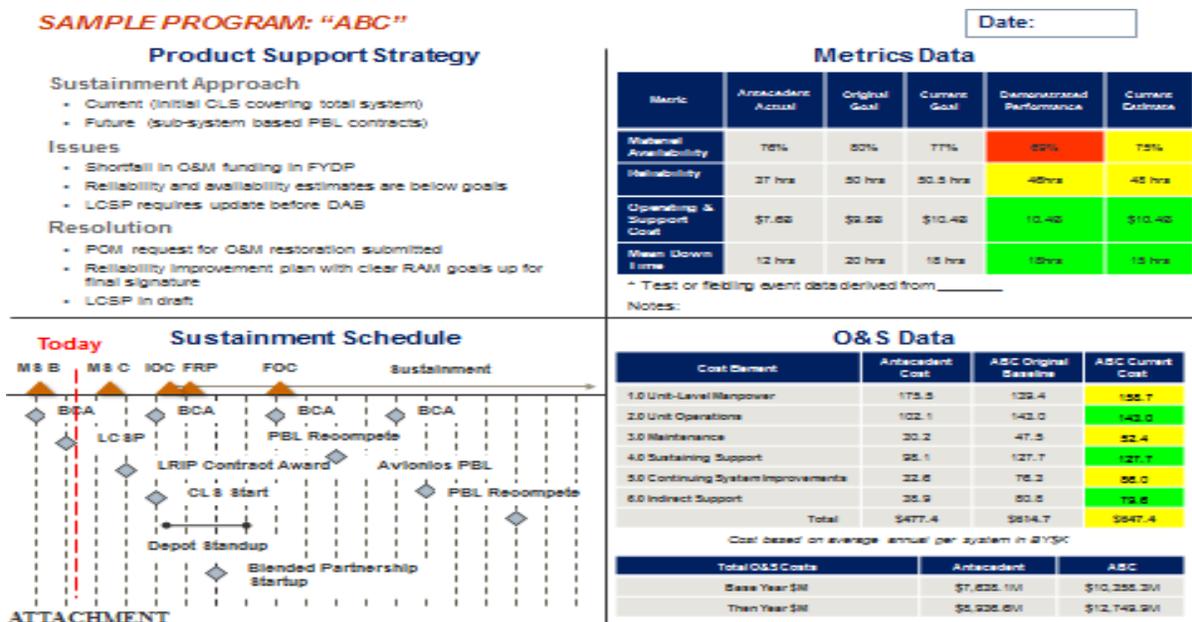
The Sustainment quad chart provides sustainment information in a standardized format that PMs use to report status at programmatic reviews. The quad chart helps the PM present the program's sustainment strategy, schedule, performance metrics, and cost during decision and in-progress reviews with milestone decision authorities. Reporting begins at program initiation and continues through each subsequent

milestone and production decision, and at other reviews when directed. The chart is the PM's platform to demonstrate successes or communicate issues. It highlights and promotes innovative sustainment strategies, improved readiness outcomes, and reductions on O&S Costs. Completion of the quad chart is also an opportunity to capture sustainment issues and strategy, and ensure the sustainment metrics and costs are affordable.

The chart contains four broad areas. The Product Support Strategy quad (upper left) highlights the current and planned sustainment approach. The PM details the issues in meeting the strategy and planned steps for resolutions. The Schedule section (lower left) shows specific key logistics events. Dates for issue resolution events and support strategy are included here. Metrics data (upper right) compares current estimates and demonstrated performance against both program goals and thresholds in addition to the previous system (where applicable). The O&S Cost data quad (lower right) offers both an annual and total cost comparison between the new system and the previous one. Colors for both right-hand quads show positive and negative performance.

The template for the Sustainment Quad Chart is in Figure 4.

Figure 4: Sustainment Quad Chart Template

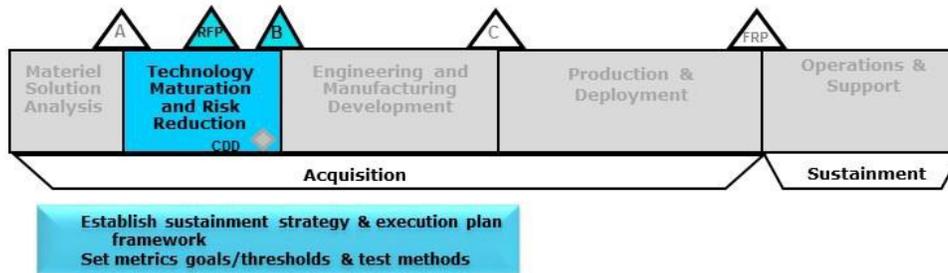


BCA = Business Case Analysis ; CLS = Contractor Logistics Support; DAB = Defense Acquisition Board; FOC = Full Operational Capability; FRP = Full Rate Production; FYDP = Future Years Defense Program; IOC = Initial Operational Capability; LCSP = Life-Cycle Sustainment Plan; LRIP = Low-Rate Initial Production; O&M = Operation and Maintenance; PBL = Performance-Based Logistics; POM = Program Objective Memorandum; RAM = Reliability, Availability, Maintainability

CH 4-3.2 Technology Maturation and Risk Reduction Phase

Planning for sustainment ramps up during the Technology Maturation and Risk Reduction (TMRR) phase. The PM evaluates the materiel solution for operational suitability, ability to meet KPPs and KSAs, and life cycle affordability. The PM defines risks and opportunities to sustainment and refines the sustainment strategy and requirements. Figure 5 outlines the major activities in TMRR, including development of the product support strategy and refinement of requirements and metrics.

Figure 5: TMRR Sustainment Activities



TMRR Focus

- Product Support Strategy
- Supportability design requirements to influence specifications RFP
- Intellectual Property Strategy
- Metrics – Goals and Thresholds:
 - System and Subsystem Level
 - Supply Chain
 - Sustainment Metrics
- Test Strategy for System Suitability and Supportability
- Supportability Analyses (BCAs/FMECA/RCM/LORA/etc)
- Affordability Cap
- O&S Cost Estimating – Assumptions, Resources, Estimates
- Core Workload and Estimates

BCA = Business Case Analysis; CDD = Capability Development Document; Failure Modes and Effects Criticality Analysis; FRP = Full-Rate Production; LORA = Level of Repair Analysis; O&S = Operations & Support; RCM = Reliability-Centered Maintenance; RFP = Request for Proposal; [TMRR](#) = Technology Maturation and Risk Reduction.

CH 4–3.2.1 Sustainment Planning and Analysis

Sustainment planning in [TMRR](#) refines sustainment requirements and the sustainment strategy. The resulting sustainment strategy in the [LCSP](#) shapes the Development [RFPs](#) for the next phase of the program, including specifications, objectives, tasks, and data.

CH 4–3.2.1.1 Sustainment Strategy

The PM revises the sustainment strategy during [TMRR](#) by conducting analyses that help identify risks and opportunities in [O&S](#) Cost, maintainability, availability, reliability, and readiness.

The PM uses the systems engineering process to assess and refine technological and programmatic risks to achieving performance requirements, including sustainment and affordability. The PM assesses risk and opportunities with maturing technologies to achieving reliability goals, maintainability of the technology in its intended environment, and life cycle cost implications of the technology. Considerations may include suitability for the intended operational environment, reliability and maintainability, manpower, impacts and repair technologies that may need to be created, skill sets of maintenance personnel, and [producibility](#). The program also identifies opportunities to apply new technologies and techniques that will enhance the maintainability of equipment or reduce life cycle cost.

The PM considers planning factors that take intended use, climate, terrain, and operational tempo for the system into account. Using a ground vehicle, for example, with notional numeric values:

- Are systems engineering limitations based on hours, miles, rounds (should the system be capable of 200,000 miles of driving without any major repair)?
- Will it be operated in a moderately dry climate with no extensive corrosion anticipated for 40 years (including dry rot or deterioration of wire harnesses)?
- What is the planned operational tempo in annual miles driven and in what environments?
- How many miles will it be driven off road?
- Will it demand long idling periods of time?
- How might deployments (with or without reset), intended maintenance (field, sustainment, DOL and Depot) and environment may potentially extend or shorten estimate?

This analysis may also include limitations on weight logistics footprint, manpower availability, and skills. Based on analysis of the intended use of the system and the decomposition of the Warfighter's requirements, the PM ensures that the system specification includes supportability design requirements. Specifications include:

- Availability and reliability requirements, such as mean time between failures, mean time between maintenance actions;
- Maintainability requirements such as Mean Downtime and Mean Time to Repair; and
- Built-in-Test/diagnostic requirements such as mean time to fault isolate and ambiguity metrics.

Supportability design requirements may also include logistics footprint restrictions, maintenance personnel skill level restrictions, and transportability requirements, including size and weight restrictions.

CH 4–3.2.1.1.1 Framework and Plan for Analyses

The PM reviews the design maturity of the proposed materiel solution and support system in conjunction with other program disciplines, including systems engineering and testing to develop an initial plan to mature and verify the system design, including product support. The PM develops an analytical framework that ties specific product support analysis to design maturity activities. The PM should conduct initial planning for design reviews and test events and consider the sustainment inputs and outputs for these events. The resulting analytical plan is documented in the [LCSP](#).

The PM identifies whether there are alternatives to the product support strategy or constituent elements of the strategy. The PM considers alternatives such as the current product support strategy for the legacy/analogous system and product support strategies used for similar systems currently in use by the U.S. Military, foreign militaries, or commercially. The PM conducts an analysis of availability and [O&S](#) Cost drivers, which can reveal potential alternatives for support.

Once alternative product support strategies are identified, the PM determines the types of trade studies and BCAs that will identify the costs, investments, and risks associated with each alternative strategy. The analyses may need to be executed at a system level or may be specific to a sub-system or single product support element. The PM can use the [Product Support BCA Guidebook](#) to assist in scoping and tailoring analysis.

The DoD Component might also conduct an Independent Logistics Assessment ([ILA](#)) to review the product support strategy and assess how the strategy leads to successfully and affordably operating and sustaining the system. See more on ILAs in Section 4.1.2.2 and in the [Logistics Assessment Guidebook](#).

The PM aligns the conduct of product support analyses, including BCAs, with the maturation of the system. These analyses are time phased and documented in the Integrated Master Schedule. For instance, when considering investments in depot level capabilities for sub-components, the PM might consider whether to wait until after Preliminary Design Review ([PDR](#)) or Critical Design Review ([CDR](#)) to conduct Level of Repair Analysis ([LORA](#)) to determine if components are economically repairable prior to completing Source of Repair Analysis.

CH 4–3.2.1.1.2 Product Support Package Development

The product support package is the collection of support elements required to field and maintain the readiness and operational capability of weapon systems, subsystems, and components. Development of the product support package during this phase starts with designing for supportability and technology trade-offs. The goal is affordable and technologically feasible design thresholds that satisfy Warfighter requirements. These design decisions will influence the support package, such as determining whether two- or three-level maintenance is appropriate, the range and depth of required provisioning, the need for unique support equipment, and technical manuals and training required to support the system.

Manpower, facilities, information systems, and the rest of the product support elements are also impacted by design and business decisions. The [LCSP](#) documents the product support package development status.

Some additional Product Support Package elements that warrant consideration include:

- Serialized Item Management techniques to effectively manage populations of select items throughout their life cycle. The PM should employ Item Unique Identification (IUID) (1) to enable life cycle management of assets; (2) to support asset valuation and accountability for audit readiness on the general property, plant, and equipment inventory and operating materials and supplies portions of DoD financial statements; (3) to identify unique items in financial, property accountability, acquisition, and logistics (including supply, maintenance, and distribution) automated information systems and business processes; and (4) to support counterfeit material risk reduction.
- Corrosion prevention and control programs and preservation techniques address corrosion throughout the system life cycle. Use of corrosion preventative and control methods may include effective design practices, material selection, protective finishes, production processes, packaging, storage environments, protection during shipment, and maintenance procedures.
- Opportunities to incorporate standardized (common) systems, components, spare parts, and support equipment, which preserve flexibility and options for competition in sustainment. The PM should consider [RFP](#) requirements that promote standard and capable manufacturing processes that could be used or repurposed to support depot activities and promote structured, consistent processes for software development and sustainment activities based on standard maturity models.

CH 4–3.2.1.1.3 Product Support Integrators and Providers

The PM performs value analysis that is documented and objective and that explores costs, benefits, and risks to determine the best product support integrator and providers. These entities are either commercial or organic, but special consideration should be given to exploiting organic capabilities, as DoD has already expended resources to acquire those capabilities. The PM should also include economic and readiness considerations and the potential for diminishing manufacturing sources. Analysis includes considerations for small business, competition requirements, and obsolescence issues as part of determining the supply chain in developing the Product Support Strategy.

The PM determines interim support requirements and specific solutions for support of prototype assets during development. The PM should consider contractor field service representatives as part of the Courses of Action (CoAs) assessment and product support solution. Additionally, integrating DoD civilian logistics assistance representatives into the support solution during development may facilitate transition to logistics assistance representatives at Initial Operational Capability ([IOC](#)) if they are part of the interim support and permanent support solution.

CH 4–3.2.1.1.4 Core Workload and Estimate

If the core determination results in required organic depot support, the PM works with DoD Component-level organizations to determine what workload will be maintained in the depot (e.g., engine, airframe, chassis). Once the type of work to be completed in the depot is determined, the PM develops an estimate for that core depot workload. The core depot workload assessment is measured projected man-hours.

Because specific design details may not be known prior to a [PDR](#), the PM may need to estimate the core workload man-hours based on data from legacy or analogous systems.

CH 4–3.2.1.1.5 Life Cycle Sustainment Plan Reviews

During the [TMRR](#) phase, the PM updates the [LCSP](#) to refine the activities that occur during subsequent phases of the program. The PM ensures that sufficient sustainment planning is in place to influence the [RFP](#). Depending on the Acquisition Category level, the PM holds [LCSP](#) review meetings with key stakeholders, including sustainment commands; Warfighter organizations; Office of the Under Secretary of Defense for Acquisition, Technology and Logistics; and DoD Component oversight organizations to discuss the Product Support Strategy. Potential discussion points:

- Identification of [LCSP](#) annexes to include and rationale for excluded annexes.
- Sustainment metrics (requirements) and their incorporation into the draft RFP.
- [O&S](#) Cost & Affordability Goals/Caps.
- Portfolio level affordability.
- Planned core applicability or requirements.
- Planning for IP and data rights strategy.
- Legacy system versus future program cost drivers.
- Should Cost initiatives.
- Developmental testing/operational testing integration with the Sustainment Plan.
- Transportability testing timeline.
- Impact of final source selection (before or after Milestone B).

A key benefit of developing an [LCSP](#) is to facilitate coordination among stakeholders who provide inputs to the system's ultimate sustainment or who execute functions specified in the plan. The purpose of [LCSP](#) reviews is to reveal program risks and challenges early and to discuss and coordinate mitigating actions.

CH 4–3.2.1.2 Maintenance Plan

As part of the revision of the sustainment strategy during [TMRR](#), the PM updates the maintenance plan based on design knowledge obtained during the [TMRR](#) phase and input from industry. Considerations may include whether the proposed material solutions are commercially available off-the-shelf ([COTS](#)) or government off-the-shelf ([GOTS](#)), require development of new repair capabilities, are deemed not economical to repair, or require intermediate/off-equipment field maintenance.

CH 4–3.2.1.2.1 Scheduled Maintenance

The PM considers how the system's service life will impact life cycle costs. As the design matures, the PM determines if scheduled maintenance may be required and how each maintenance event may vary depending on sub-component life. Other events to plan for could include recapitalization cycles, secondary item depot level repair, end item overhauls, and OEM-dependent depot repair (to include software sustainment).

Along with organizational and intermediate maintenance considerations, designing for supportability includes assessing the need for depot level overhaul. Analysis begins in this phase and is finalized as the design matures and fatigue and failure modes are better understood.

CH 4–3.2.1.2.2 Software Sustainment

The PM plans for software sustainment in two general categories: post-deployment software support and post-production software support.

The PM develops a sustainment strategy and potential source(s) of software support based on analyses of the system's operational and support requirements, as well as the operational concept. In developing the program's software sustainment strategy, the PM considers the extent of COTS and/or GOTS software; new software development; security classification; certification; and accreditation, including authorities to operate. The PM also considers test and integration needs, transition of operational software and support tools from the developer to the post-deployment support organizations, help-desk requirements, and safety critical requirements.

Properly phasing or programming for the software maintenance cost allows early budget planning for program support. Estimated costs for post-deployment software support include system patches, technology refresh, system help desk support, licenses, cybersecurity/information assurance vulnerability assessments, certification, initial field and depot software maintenance, and manning required for sustainment. Planning for technology refresh includes identifying the initial refresh year and the frequency of refresh.

CH 4–3.2.1.3 Resource Management

The PM's inputs during this phase focus on refining cost estimates and funding requirements necessary to mature critical technology and reduce risks for the logistics and sustainment-related capabilities that comprise the materiel solution.

CH 4–3.2.1.3.1 Program Office Programming and Budget Activities

Funding for important logistics and sustainment-related studies and analysis following Milestone B include that needed to update the [AoA](#), market research, and CAIV assessments, as well as to refine the Product Support BCA. Other funding considerations include corrosion prevention, Item Unique Identification (IUID), maintenance, supply chain management, sustaining engineering, and other plans.

CH 4–3.2.1.3.2 Affordability

The [O&S](#) Cost affordability goals documented in the Acquisition Decision Memorandum at Milestone A guide the cost and engineering trade-offs during [TMRR](#). As the design matures, the PM ensures that [O&S](#) Cost affordability remains a factor in engineering and sustainment trades.

If the [O&S](#) Cost estimate is at or near its [O&S](#) Cost affordability goal leading up to the Development [RFP](#) Release Decision Point, the PM actively manages known [O&S](#) Cost risks against that goal. At the Development RFP Release Decision Point, the MDA sets the [O&S](#) Cost affordability cap.

CH 4–3.2.1.3.3 Cost Estimating

Cost estimating during the [TMRR](#) phase supports the Development RFP Release and Milestone B decision through the update of the [LCSP](#) and the LCCE.

A DoD Component-approved draft [LCSP](#) is required to support this decision point ([DoDI 5000.02](#), Encl. 1, Table 2) based on the PM's update to the program's Milestone A [LCSP](#).

An updated [O&S](#) Cost estimate is not statutorily required for this decision point ([DoDI 5000.02](#), Encl. 1, Table 2). The CAPE may provide an updated estimate to the MDA to support the release of the RFP. No formal CARD update is required for this estimate, although cost estimators may ask the PM to provide data and/or validate assumption changes if the CAPE plans to provide an updated [O&S](#) Cost estimate to the MDA.

CH 4–3.2.2 Design Interface

In the [TMRR](#) phase, the PM allocates reliability and maintainability requirements in the design. Once allocations have been made to key subsystems, the PM should track design performance and report shortfalls (if any) at design reviews and Defense Acquisition Boards. The PM monitors system reliability performance in early integration test results. DoD Component or software lab test failures may yield insight into system design capability to achieve [R&M](#) requirements.

The PM ensures logistics support and overall sustainment performance requirements in the design specification are decomposed into functions/segments in the functional baseline at the System Functional Review. The PM updates the logistics supportability analyses as the latest R&M engineering analyses (including updated failure rate and failure mode data) are performed. The engineering analysis also identifies strategic design opportunities for focused diagnostics, prognostics, and performance monitoring/fault localization. The PM is an active participant in the [RAM-C](#) analysis to support the development of the [RAM-C Rationale Report](#) needed for the Development RFP Release and Milestone B.

The PM should align the design of hardware intensive [IPS](#) elements, including support equipment and Packing, Handling, Storage, and Transportation (PHST) concurrently and in coordination with the system design to ensure R&M degradation factors are mitigated. This includes damage during maintenance,

shock and vibration exposure in transportation and handling, exposure to extreme temperatures in transportation and storage, and relative humidity of the storage environment.

CH 4–3.2.2.1 Risk Reduction

The PM's focus throughout [TMRR](#) should be on mitigating the more challenging technical performance requirements (e.g., weight, power, etc.). If the program can emerge from [TMRR](#) with sufficient performance margin, the program design will be much lower risk to demonstrating all the design requirements (including [R&M](#)) in the Engineering and Manufacturing Development ([EMD](#)) phase. Conversely, with no margin in critical technologies entering EMD, R&M (and [O&S](#) Cost) may need reduced (traded away) to meet system weight or performance shortfalls as the design matures after [CDR](#). The PM input to proposed design changes that reduce weight should include the estimated impact to reliability and the resulting increase in [O&S](#) Cost.

CH 4–3.2.2.2 System Requirements Review and System Functional Review

As part of the System Requirements Review, the PM ensures that the sustainment capabilities requirements captured in the [CDD](#) are aligned with sustainment requirements specified in the system performance specification. During the System Functional Review, the PM also ensures that the specified sustainment capabilities and requirements are achievable in the system design resulting from the technology maturation and demonstration activities. Additionally, the PM assesses the results of these risk reduction activities and identifies risks that may impact the upcoming system functional analysis and decomposition of sustainment requirements. For additional information, see [CH 3 Section 3.3.2](#) on the System Requirements Review and [CH 3 Section 3.3.3](#) on the System Functional Review.

CH 4–3.2.2.3 Preliminary Design Review

As part of the Preliminary Design Review ([PDR](#)), the PM ensures that all sustainment requirements have been analyzed, decomposed, allocated to Configuration Items, and captured in program documentation. Allocated sustainment requirements should have full traceability back to the system performance specification, the [RAM-C](#) Rationale, and the CDD. The PM also ensures that the specified sustainment capabilities and requirements are achievable in the system preliminary design as defined in the Configuration Items specifications. Additionally, the PM assesses the preliminary design from a sustainment perspective and identifies risks that may affect 10 USC 2366b (see [US Code](#)) certification, the program/system detail design in EMD, Product Support Package preliminary design, and the Milestone B decision.

The PM needs to ensure the [PDR](#) includes all [R&M](#) thresholds from the CDD. The design now includes derived requirements that support maintainability (such as Built-in-Test, capability fault detection, and false alarm rate). Throughout [TMRR](#), the PM encourages design trades to support [Condition Based Maintenance Plus](#). These prognostic and fault detection capabilities are justified by their contribution to meeting availability and maintainability. As part of the software development strategy requirements, the PM identifies documentation required for software sustainment (either commercial or organic).

See [CH 3 Section 3.3.4](#) additional information on [PDRs](#) at both the subsystem and system levels.

CH 4–3.2.3 Development RFP Release

In the June 2011 Defense Acquisition Executive (DAE) memo, "Improving Milestone Process Effectiveness," the DAE states that the Development Request for Proposal ([RFP](#)) Release Decision Point (also known as the Pre-[EMD](#) or the Pre-Milestone B review) is the "most important single decision point in the entire life cycle."

This decision point is also critical to a program's product support planning, establishing in contracts and design specifications those elements that are critical to delivery of the capability and its attendant product support. Table 2 provides some [TMRR](#) phase product support considerations in preparation for this decision. As previously noted, this is not an all-inclusive list but provides a basic framework for critical thinking for product support planning.

[Table 2: Key Sustainment Questions at Pre-Milestone B RFP Release](#)

LCSP Section	Considerations
Introduction	Has the program identified the tasks required to integrate sustainment features into the weapon system and identified the required Product Support Package design requirements?
Product Support Performance	Are Warfighter requirements traceable to RFP specifications (availability, reliability, O&S Cost)? How will the requirements be tested and verified?
Product Support Strategy	Can the product support plan be traced to the RFP? Does the RFP reflect the IP/data rights strategy? Does the RFP include supportability trades for the Product Support Strategy?
Product Support Arrangements	Does the LCSP include process and timeline for determining PSAs , including support during IOT&E and any Low-Rate Initial Production (LRIP) options?
Product Support Package Status	Does the schedule include evaluation points to assess status of product support development?
Regulatory/Statutory Requirements that Influence Sustainment	Are core depot transition (contractor to organic) requirements addressed?
Integrated Schedule	Are program milestones (IOC IOT&E, FOC , MSD, etc.) linked to logistics objectives? Are support element delivery dates aligned with the TEMP ?
Cost / Funding / Affordability	Have O&S Affordability goals been established? Has a program office LCCE been developed, and does it include disposal costs? Have O&S Should Cost initiatives been identified?
Management	Are the organizational structure and interfaces with key stakeholders identified? Is there sufficient expertise to conduct a source selection?
Supportability Analysis	Is the analytical framework traceable to the RFP, and are explicit provisions included for trade studies, LORA, depot support, organizational manning, and use studies?
Additional Sustainment Planning Factors	Can the O&S Cost drivers, assumptions and risks be addressed in RFP? Can they be mitigated? Does the RFP include assertions for Intellectual Property rights and provisions for data pricing and delivery where needed?
LCSP Annexes	Is Core Depot Applicability addressed?

CH 4–3.2.3.1 Capability Development Document

Required capabilities are refined in the [TMRR](#) phase. The sustainment strategy builds on the capability gaps and requirements highlighted in the [MSA](#) Phase and documents them as requirements in the validated Capability Development Document ([CDD](#)). The PSM partners with the systems engineer to refine the threshold and objective range value for each sustainment metric. Studies, trades, data models, and analyses executed in [TMRR](#) identify the technical capabilities, risks, and limitations of the alternative sustainment strategies and design alternatives. These results influence the final values assigned in the [CDD](#), confirming or refining those identified in the draft [CDD](#). Feedback from [TMRR](#) phase testing and modeling improves the realism, affordability, and testability of sustainment metrics.

The sustainment metrics identified in the [CDD](#) flow into the system specification and subsequent contract [RFP](#). The specific values for Sustainment [KPPs](#) and [KSAs](#) in the [CDD](#) require vetting by Service and Office of the Secretary of Defense testing agencies. The PM should be aware if developmental testing, reliability modeling, or technology improvement efforts show outcomes not supporting requirements from the draft [CDD](#). The approved [CDD](#) should reflect results from [TMRR](#) events to avoid unachievable or

unaffordable capabilities. The CDD is the last opportunity to influence sustainment requirements without significant cost, schedule, or performance impacts later in program development. See [CJCSI 3170.011 JCIDS Manual, Encl. D – Pages D-47-62](#) for additional information on the CDD.

CH 4–3.2.3.2 [LCSP](#) and Product Support Strategy

The PM participates in the Pre-Milestone B [RFP](#) development and the review of industry proposals prior to award. The PM's goal is to ensure that the RFP conveys the sustainment strategy, specified sustainment requirements, and required data and deliverables to industry. The RFP includes requirements for the contractor to propose data development and delivery, and sustainment metrics. The PM should consider sustainment outcomes in developing incentive or award fees.

The PM uses the [LCSP](#) to assist in the development of the RFP Statement of Work (SOW), which articulates product support requirements to the Contractor for the [EMD](#) phase that will allow a product support package to be delivered during production. The SOW includes the requirements for analyses, design interface, and product support development and test activities.

The [LCSP](#) articulates the decomposition of sustainment metrics that will be included in the RFP specifications, the proposed verification processes/test points, and the major analytical work that will be required from the contractor, and the data deliverables and IP that the government will require of the contractor to execute the product support strategy.

CH 4–3.2.3.3 Reliability and Maintainability in the EMD [RFP](#)

When the PM prepares the Engineering and Manufacturing Development ([EMD](#)) RFP package, it should include demonstrating [R&M](#) requirements. Any R&M requirements that remain medium or high risk after [TMRR](#) phase testing should be reflected in the incentive planning. The PM should consider an incentive for the contractor to remain within a set percentage boundary for the reliability growth curve throughout EMD. The PSM considers requesting production tooling be designed for subsequent use by the organic depot. The contract should require the design delivery data package include a complete bill of materials to support the PSM's obsolescence tracking and management responsibilities (see [FY14 NDAA](#), Sec 803). The PM considers how anti-tamper and foreign military sales requirements will impact the design specification. The RFP for EMD should include a contractor sustainment support Contract Data Requirements List ([CDRL](#)) to provide all test failure data (to include vendor and sub-vendors) and report all repair work and repair cost data for each warranty (if applicable) repair. Contractor repair data will inform cost estimates and organic sustainment planning.

CH 4–3.2.3.4 Sustainment Planning

As early as the [TMRR](#) phase, the PM can use the [LCSP](#) to develop RFPs that provide potential vendors with sustainment requirements and insight into the operational and maintenance environments in which the materiel solution must perform. While preparing for the Milestone B source selection process, the PM considers the following evaluation criteria:

- Reliability risk based on each vendor's capability to meet potential reliability metrics and the threshold hours/miles.
- Successful transportability testing prior to source selection.
- [O&S](#) Cost estimates. The government could chose to provide an [O&S](#) Cost model/formula and assumptions of [CONOPS](#) and usage or could request specific data from each bidder independently to evaluate [O&S](#) Costs. The PM ensures that the [O&S](#) Cost evaluation include total government costs to operate and support the system, not just contractor costs.

The PM uses the [LCSP](#) to develop [RFP](#) requirements that consider sustainment and reliability outcomes during the Pre-Milestone B RFP process:

- The System Performance Specifications support the RFP and clearly identify sustainment and reliability requirements.
- The Program Office evaluates achieving reliability requirements as a condition for source selection.

In the Special Contract Requirements section of the RFP (Section H), the program provides a Milestone B evaluation guideline. The PM lists sustainment criteria that will be refined and updated during each successive phase, and outlines exact procedures and criteria that will evolve over the program life. The PM identifies criteria for the decision to exercise a Low-Rate Initial Production ([LRIP](#)) option upon source selection and informs vendors when the government intends to make final source selection. While not an all-inclusive list, the PM should consider these source selection criteria:

- Evaluate EMD performance against the Systems Performance Specification, including all aspects of reliability and sustainment requirements.
- Assess quality of the logistics management information data, provisioning planning, and technical manuals.
- Analyze price of LRIP/Full-Rate Production ([FRP](#)) ceiling price and not-to-exceed price for a specified number of end items.
- Evaluate the system reliability models and predictions that support the specification requirements. Including reliability metrics enables evaluation of offeror's approach and expected R&M performance. For example, define a specified mileage/hour mean time between operational mission failure through a combination of reliability growth testing and operational assessment per approved program reliability growth curve.

As early as the [TMRR](#) phase, the program can address [O&S](#) Cost management through a series of [CDRL](#) requirements. The Program Office could use reports required in the [RFP](#) and SOW to track part consumption trends, cost drivers, and failure causes to improve training, redesign when necessary, increase reliability, and decrease [O&S](#) Cost. Examples include (1) Class IX Service and Consumption Report(s) that outline and track sub-component replacement; (2) Parts Repair Report(s) to track when a line replaceable unit is removed, returned to service rates, scrap rates, and sub-component failures. The PM could use these and other reports called for in the RFP and SOW to track part consumption trends, cost drivers, and failure causes to improve training, redesign when necessary, increase reliability, and decrease [O&S](#) Cost.

CH 4–3.2.3.5 Software Sustainment

The RFP should require complete software documentation. Without documentation, the Product Support Provider (whether contractor or organic) has limited insight into how the software was designed and implemented. Incompleteness or omissions in documentation increase software maintenance costs because software engineers have to reverse engineer the code to determine how it works. In addition, this process increases the risk of inadvertently introducing errors into the code.

To support transition to the software Product Support Provider ([PSP](#)), the PM should determine what constitutes complete documentation for their system. At a minimum, it should address why the system was designed, how it was developed, what it consists of, where functions were allocated to different subsystems, and an overall architecture or blueprint. Plans on how the program office intended to handle [COTS](#) and configuration management issues are essential for sustainment and continued implementation. Interface definitions must be documented. Database designs and their documentation are essential to understanding their purpose within the system. Also, the development environment needs to be defined so the sustainment organization knows what tools were used to develop and support the system. This information is contained in the following documents:

- Initial Design Document
- System/Subsystem Design Document
- System and Software Architectures
- [COTS](#) Management Plan
- Configuration Management Plan
- Interface Control Document
- Database Design And Documentation
- Software Development Environment Documentation

In the software development strategy, the PM includes documentation required for software sustainment (either commercial or organic). The program office should ensure that while the program is being developed, software sustainment tasks are not forgotten or removed from the development contractor's tasking. While the development contractor may not necessarily be selected as the sustainment organization, the development contractor is responsible for developing and maintaining documentation that the sustainment organization will need. The program office is responsible for ensuring that the contractor does not create documentation that is proprietary or undeliverable. (Note: Even though it was cancelled in 1998, the [MIL-STD-498](#), Section 5.13, Preparing for Software Transition, contains good background and reference material in this area).

CH 4–3.2.3.6 Should Cost

The Development RFP provides an opportunity for implementing Should Cost initiatives by setting requirements for addressing system deficiencies and risks. For example, if the engineers and cost estimators identified repair time as an [O&S](#) Cost driver, the PM may develop a Should Cost initiative to reduce repair time. The Development RFP may include language that provides an incentive for the bidder to design the system in a way that reduces repair time.

The [Should Cost portal](#) provides examples of successful Should Cost initiatives across DoD Components, commodities, acquisition categories, and life cycle phases; it also provides Should Cost training, techniques, and tools.

CH 4–3.2.4 Milestone B

Milestone B is the critical decision point in an acquisition program because it commits the organization's resources to a specific product, budget profile, choice of suppliers, contract term, schedule, and sequence of events leading to production and fielding. For product support planning, many of these activities affect the effectiveness and cost of sustainment. Table 3 provides some considerations necessary to implement effective and efficient product support.

[Table 3: Key Sustainment Questions at Milestone B](#)

LCSP Section	Considerations
Introduction	Has the sustainment program been adjusted to take into account the source selection results? Does the program address support of developmental testing and any early operational capabilities or assessments?
Product Support Performance	Have metrics for availability, reliability, and cost been established? Are requirements traceable to contractual design requirements? How will the sustainment requirements be tested and verified? Is a reliability growth plan in place?
Product Support Strategy	Are the product support requirements defined (organizational maintenance, depot level maintenance, training, support equipment, technical data)?
Product Support Arrangements	Are PSAs to support IOT&E and contract options in place?
Product Support Package Status	Are the product support package requirements defined (organizational maintenance, depot level maintenance, training, support equipment, technical data)? How will the product support package be tested and verified? Has a Milestone-B ILA been completed and risk mitigation planned?
Regulatory/Statutory Requirements that Influence Sustainment	Has core depot workload been estimated? Is preliminary Depot Source of Repair complete?

LCSP Section	Considerations
Integrated Schedule	Does the schedule reflect detailed product support elements development and fielding plans aligned with program milestones? Does the schedule align supportability analysis to decision points?
Cost / Funding / Affordability	Have O&S affordability caps been established? Have CAPE ICE and SCP been reconciled? Do RDT&E and acquisition budgets include product support element development and delivery? Are O&S Should Cost initiatives initiated?
Management	Is the organizational structure in place (government and contractor)? Are projections of organizational structure and manpower to support fielding and operations identified?
Supportability Analysis	Is there a detailed plan for completing required analyses?
Additional Sustainment Planning Factors	Are mitigation plans in place for O&S Cost drivers and risks?
LCSP Annexes	Are Source of Repair Analysis results, a Depot Source of Repair decision, projected core depot workload, and BCA results documented?

CH 4–3.2.4.1 [LCSP](#) to Support Milestone B Review

The Life Cycle Sustainment Plan ([LCSP](#)) is formally approved by the acquisition executive or that person's designee prior to the Milestone B decision to enter into [EMD](#). The PM updates the [LCSP](#) to reflect the results of the [RFP](#) and/or source selection to inform the activities during EMD. For competitive procurements, if the PM cannot update the [LCSP](#) to reflect the results of the source selection prior to Milestone B, the PM can propose a schedule to the acquisition executive to update the plan after source selection.

CH 4–3.2.4.1.1 Intellectual Property Strategy

By Milestone A, the PM will have developed an Intellectual Property ([IP](#)) Strategy that includes planning for the acquisition and delivery of data that will be required to execute the sustainment strategy. Planning for the IP Strategy should begin by the [TMRR](#) phase, although it is not required to be included in the [LCSP](#) until the [FRP](#) decision review (DR). While preparing for the source selection at Milestone B, the PM addresses:

- The cost of the Technical Data Package (TDP), both for the entire package and broken out by component/sub-component. TDP is an important selection criterion, as acquiring data rights may be needed to support future competition.
- Regardless of the government's decision to purchase the TDP, the Program Office normally includes an Operation, Maintenance, Installation, and Training (OMIT) clause that obligates the winning vendor to provide necessary repair instructions for government purposes (i.e., establishment of organic repair capabilities).
- Technical manual, national maintenance work requirements, depot maintenance work requirements, and troubleshooting and repair procedures could also be included in Integrated Product Support (IPS) Contract Line Item Numbers.

The PM may consider establishing a future decision point for choosing to buy or not to buy technical data, to support the [LRIP](#) decision. The PM should plan for the delivery of technical data and IP rights and should consider the following options for [RFPs](#) and contracts early in the program's life cycle:

- Priced contract options to address potential future delivery of technical data previously not acquired (for legacy systems, previous ships in the same class, or earlier contracts).

- Comprehensively establish program contracts to provide the government with all anticipated technical data requirements. If an unforeseen need for technical data emerges, the Deferred Ordering of Technical Data or Computer Software clause ([DFARS 252.227-7027](#)) allows the government to contractually require delivery of technical data developed under an existing contract for use in future procurements.
- If the Program Office identifies additional data not previously acquired or if additional license rights are required for previously contracted data, the PM can determine how to proceed, considering the costs, benefits and risks involved. Alternatives such as data escrow or an option for acquiring data at a later point in time may be considered.

The PM should plan to obtain unlimited rights for noncommercial technical data and computer software that is funded exclusively at government expense. The PM should negotiate for Government Purpose Rights, where practicable, for privately funded technical data required for the sustainment of critical systems. Provisions could include deliverables to the government for technical data that allows, where practicable, distribution to other industry organizations throughout the life cycle of the system.

The PM reviews the rights associated with each data in the contractor's proposal or identified during program supportability analyses. If the long-term needs of the government can be satisfied with the rights as offered, the Program Office may choose not to acquire additional rights. If the rights offered would not support the long-term needs of the program, the contractor may be directed to seek an alternate item to meet the design needs. If an alternate item is not available, the Program Office may consider the pursuit and cost of additional license rights. Alternatively, proactive planning may provide for the use and protection of the data subject to the limited rights license.

Table 4 provides FAR/DFARS clauses regarding technical data that may be included in all contracts and in future solicitations and contracts to account for and protect government data rights.

[Table 4: Technical Data Clauses](#)

Clause Number	Clause Title
252.227-7013	Rights in Technical Data-Noncommercial Items
252.227-7014	Rights in Noncommercial Computer Software and Noncommercial Computer Software Documentation
252.227-7015	Technical Data-Commercial Items
252.227-7017	Identification and Assertion of Use, Release, or Disclosure Restrictions
252.227-7019	Validation of Asserted Restrictions-Computer Software
252.227-7025	Limitations on the Use or Disclosure of Government-Furnished Information Marked with Restrictive Legends
252.227-7027	Deferred Ordering of Technical Data or Computer Software
252.227-7028	Technical Data or Computer Software Previously Delivered to the Government
252.227-7030	Technical Data-Withholding of Payment
252.227-7037	Validation of Restrictive Markings on Technical Data

CH 4–3.2.4.1.2 Cost Estimating

In preparation for Milestone B, the PM should ensure revisions to the [LCSP](#) are factored into updates to the [O&S](#) Cost estimate. The Office of the Under Secretary of Defense for Acquisition and Sustainment (OUSDA&S) [LCSP](#) annotated outline offers guidance on structuring [O&S](#) Cost information to support the program's transition to detailed design. Revisions to the CARD are the PM's mechanism for translating changes in the [LCSP](#) since Milestone A into an updated [O&S](#) Cost estimate. Knowledge gained through [TMRR](#) allowed the PM to add planning detail to the sustainment strategy. The PM should focus on these key sections of the CARD: [O&S](#) Quantities, [O&S](#) Time Phased, and Manpower Time Phased. The CAPE provides more information on the CARD in the [DoDI 5000.73](#).

At Milestone B, the cost estimators update the LCCE, including [O&S](#) and disposal costs, by evaluating changes in sustainment assumptions since the Milestone A cost estimate. Changes to sustainment assumptions are likely due to key learning points resolved as part of the [TMRR](#) and reflected in the current programmatic and technical baseline of the system. Additionally, Milestone A cost estimate assumptions based on legacy and analogous systems may be updated to incorporate engineering and planning factors for the new system. Where [O&S](#) Should Cost initiatives identified in preparation for Milestone A and during [TMRR](#) have yielded results, cost estimators should adjust assumptions accordingly, and PMs should highlight such successes as part of the Milestone B preparation.

The program's Business Financial Manager (BFM) enters the MDA's funding direction in the APB. Specifically for [O&S](#), the APB reflects the [O&S](#) Cost estimate as the objective [O&S](#) Cost value in both Base Year and Then Year dollars. The BFM sets the threshold value as the objective value plus 10 percent. An APB [O&S](#) Cost breach occurs when the current estimate is more than 10 percent greater than the objective. When a breach occurs, the PM, with the help of cost estimators and the BFM, explain the [O&S](#) Cost increase in a Program Deviation Report to the MDA.

The PM also monitors the [O&S](#) Cost estimate with respect to the [O&S](#) Cost affordability cap. Affordability puts the life cycle cost of a new system within the context of the DoD Component budget and/or a portfolio of systems. The DoD Component resource sponsor (for example, the Service "-8"), not the PM, is responsible for developing the [O&S](#) affordability analysis. The [O&S](#) Cost affordability goal is not a cost estimate. It is the amount of long-term DoD Component funding available for the system.

DoD Components have the flexibility to conduct affordability analyses differently. Enclosure 8 of [DoDI 5000.02](#), establishes eight basic constructs that apply across any affordability analysis. The [O&S](#) Cost affordability analysis covers the entire planned service life of the system. An affordability cap, equivalent to a KPP, is established at Milestone B and documented in the program's APB.

CH 4–3.2.4.1.3 Should Cost

By the Milestone B decision, PMs should be investigating potential cost drivers based on design parameters for Should Cost Initiatives. For example, if the system designers expect that the repair time of a particular component is part of the critical path of the entire maintenance period, the PM may recommend a Should Cost initiative to reduce the repair time of that item.

PMs also begin to evaluate if previous [O&S](#) Should Cost initiatives are delivering expected savings. For example, if the PM created a Should Cost initiative to reduce how often a maintainer replaces a particular component, modeling may provide a count of how many times the component will need to be replaced in operation. Once the PM is confident that the Should Cost initiative will yield the expected results, the PM provides the technical parameters and expected savings associated to the [O&S](#) Cost estimator and reflects the changes in the CARD. The [O&S](#) Cost estimator incorporates the information into the updated [O&S](#) estimate.

The PM should consider steps the program might take to ensure the viability of future [O&S](#) Should Cost initiatives. For instance, the PM may anticipate establishing a post-fielding Should Cost initiative that involves multi-vendor competition for supply support. A key success factor in implementing such a Should Cost initiative is the program's access to and legal right to use part data in competitive procurements.

Establishing the appropriate data rights assertions and beginning the process of pricing and procuring the data may be most cost effectively done through the [EMD](#) contract.

The [Should Cost portal](#) provides examples of successful Should Cost initiatives across DoD Components, commodities, acquisition category, and life cycle phase; it also provides Should Cost training, techniques, and tools.

The PM should record all [O&S](#) Should Cost initiatives in the [LCSP](#). The [LCSP](#) annotated outline contains a full description of the Should Cost initiative information required to support the Milestone B decision.

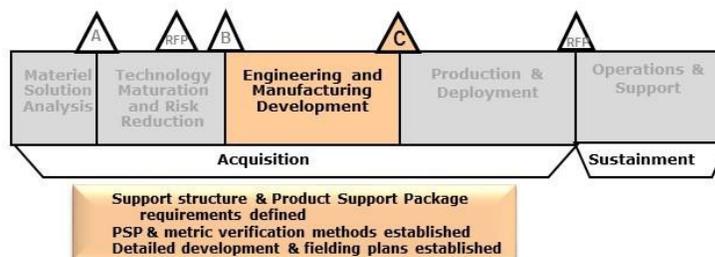
[O&S](#) Should Cost initiatives are a way for the program to meet established [O&S](#) Cost affordability constraints. However, the PM should not stop developing and implementing [O&S](#) Should Cost initiatives if/when the [O&S](#) Will Cost estimate is lower than the [O&S](#) Cost Affordability constraint. PMs use [O&S](#) Should Cost initiatives as an ongoing way to improve the [O&S](#) Cost and performance of the system.

CH 4–3.3 Engineering and Manufacturing Development Phase

The sustainment focus during the Engineering and Manufacturing Development (EMD) phase is to plan for development, testing, and delivery of the product support package. As the system design matures, the PM continues to influence the design to reduce risks in reliability, maintainability, availability and [O&S](#) Cost. The PM also conducts additional analyses to refine the Product Support Strategy and plans for the initial fielding of the weapon system and the transition to [O&S](#). Figure 6 depicts the sustainment activities during EMD.

BCA = Business Case Analysis; EMD = Engineering and Manufacturing Development; FMECA = Failure Modes and Effects Criticality Analysis; FRP = Full-Rate Production; LORA = Level of Repair Analysis; [O&S](#) = Operations & Support; RCM = Reliability-Centered Maintenance; RFP = Request for Proposal; [TMRR](#) = Technology Maturation and Risk Reduction.

Figure 6: EMD Sustainment Activities



EMD Focus

- Plan to define product support package & supply chain
- Detailed product support element requirements
- Detailed product support package development & implementation
- Logistics Assessment/Sustainment Issues/Risks/Opportunities identification
- Execution of analytical strategy (BCAs/FMECA/RCM/LORA)
 - Trade Studies results/impacts
- Performance verification methods
- Fielding plans
- Detailed Resource Requirements/Execution Plan
- Supports O&S Estimates/Depot Workload Projections
- Should Cost opportunities

CH 4–3.3.1 Sustainment Planning: Product Support Package Development

The PM's sustainment focus during [EMD](#) is the product support package. The product support package is further defined by assigning sustainment requirements to specific subsystems and equipment. Support plans for both the system and its logistic support system are developed as the system design matures. The PM ensures the program documentation, and planning, programming, and budgeting actions are put into place to develop, field, and sustain the product support package. Technical Performance Measures are established to monitor the linkage between design and supportability; they may be jointly developed by the systems engineering and product support teams at the start of the program and managed during EMD.

The PM ensures the elements of the product support package have been tested and demonstrated (organizational maintenance, training, support equipment, technical data), the reliability growth is on target, and the sustainment metrics are achievable by Full Operational Capability ([FOC](#)). The following key elements are included as part of the product support package development:

- Technical manuals
- Support equipment requirements, unique support equipment (organic, intermediate, depot), and provisioning for common and unique support equipment
- Spares and support equipment required to support testing and initial fielding, and to ensure sufficient funding and provisioning is in place
- Identifying field service representatives needed during Developmental Test and Operational Test, and at [IOC](#), and sufficient funding and training in time to support development and fielding
- Interim support requirements and resources

CH 4–3.3.1.1 Trade Studies and Analyses

During [EMD](#), the PM oversees the execution of planned technical and business analyses as the design develops and matures. Supportability analyses, modeling and simulation, and life cycle costing are applied and integrated with the systems engineering process in increasing levels of detail. These analyses help evaluate the relative costs and benefits of support and maintenance strategies, identify and mitigate sustainment risks, and create the data required to justify the support strategy. The [Product Support BCA Guidebook](#) provides analytical techniques for performing cost/benefit analyses. [RCM](#) analysis, [LORA](#), and Depot Source of Repair Analysis should be considered.

CH 4–3.3.1.2 Product Support Element Requirements

Integrated Product Support ([IPS](#)) Element trades are made as part of ongoing negotiations between Warfighters and sustainers to finalize [PSAs](#) requirements for Product Support Integrators ([PSIs](#)) and [PSPs](#). From this, the PM updates the product support organization according to each IPS element, including the entities, required service levels, [PSAs](#), information channels, and any other pertinent information.

CH 4–3.3.1.3 Product Support Package Validation

In the [EMD](#) phase, the PM ensures that testing validates that the design meets the sustainment requirements. The Systems Engineering Plan ([SEP](#)) includes the processes to validate the required product support package performance. The PM also ensures that sustainment metrics are estimated based on the latest configuration and test results. Finally, the PM ensures that the approved product support package's capabilities, including supply chain and other logistics processes and products, are demonstrated and validated.

CH 4–3.3.1.4 Maintenance Plan

The Product Support ([PS](#)) Integrated Product Team (IPT) updates the maintenance plan based on [EMD](#) analyses. Failure Modes and Effects Criticality Analysis ([FMECA](#)), Reliability-Centered Maintenance (RCM) and LORA results, as well as cost benefit analysis, may drive changes to the level of repair. The PS IPT should include maintenance experts, both military and depot-level civilian maintainers, to evaluate specific maintenance analyses as the system evolves, including:

- **Levels of Repair:** The LORA begun prior to the [PDR](#) is finalized after the CDR. The analysis provides recommendations as to whether subcomponents are economically repairable and at what maintenance level the task can be accomplished. The output from this analysis informs the final maintenance plan, provisioning requirements, manpower and training assessments, and technical manual and support equipment requirements.
- **Logistics Analysis:** During EMD, PMs supervise various logistics analyses such as LORA, task analysis, and RCM analysis, etc. Contractors may provide logistics data with deliverables previously outlined and formatted in the contract SOW and developed in training packages and technical manuals using the results. The Program Office reviews the analyses and logistics data to determine effectiveness and for use during source selection.

After source selection, contractors refine the system's design for [LRIP](#) and update their logistics analyses and support products.

CH 4–3.3.1.5 Core Workload and Depot Source of Repair

Prior to Milestone C, the PM refines core depot workload estimates based on the [CDR](#). The PM also works with DoD Component stakeholders to identify potential depots for all components/sub-components of the program. The Depot Source of Repair analysis and decision process helps select the location for the depot workload and helps ensure effective use of commercial and organic depot maintenance resources that deliver best value to the program. The PM also projects the date and the funding for those depots to commence operation ([IOC](#) plus four years).

CH 4–3.3.1.6 Supply Chain Evaluation

The supply chain is finalized to reflect the product support strategy. Every aspect of the supply chain supports the Warfighter required performance and cost metrics. Processes are put in place to automatically and electronically share data and information between all Services, agencies, and commercial entities in the supply chain. The supply chain evaluation focus is on ensuring operational supportability and verifying performance. It includes a comprehensive description of the elements and fielding plan.

CH 4–3.3.1.7 Development of PSAs

Most product support strategies depend on product support arrangements ([PSAs](#)) with both organic and commercial industry. The PM determines the blend of public and private providers, and the relationship between them, to achieve an effective product support strategy that delivers Warfighter operational readiness. Programs should seek to effectively deliver the requirements of the product support package at best value to the government while attractive to commercial providers. Performance metrics used to measure achievement of the required outcomes and the solution (and associated product support package) are adjusted as required to effectively and affordably sustain the weapon system. Decisions made during the development phases impact the ability to execute performance solutions and arrangements after fielding.

The weapon system design should minimize the need for logistics resources, thus reducing [O&S](#) Costs. During development, the [LCSP](#) addresses supportability requirements and the technical and product support data needed to use competition and other sources of supply during sustainment. As the program transitions from development to fielding and sustainment, performance based arrangements may be used with product support integrators and/or providers to align the supply chain with Warfighter outcomes, or the PM may retain the responsibility and risk for performance at the program level.

CH 4–3.3.1.8 The Product Support Package and Metric Verification Methods

The Test and Evaluation Master Plan ([TEMP](#)) includes the means to verify that the product support elements that comprise the package (e.g., training, support equipment, maintenance and operator publications, spares, etc.) can achieve stated thresholds. Developmental and operational testing methods include parametric estimation, engineering analysis, modeling and simulation, and demonstration.

Supportability analysis is performed as design and other technical information on the equipment reaches maturity. This analysis is performed for the weapon system and support equipment as an integral part of the systems engineering processes and events. Data collection is via the SEP and TEMP. Examples of

data collection and reporting are FRACAS (Failure Reporting, Analysis, and Corrective Action System) methods, and [LORA](#) using the collected failure and repair data to determine optimal maintenance levels. (See also [CH 3 Section 4](#) for additional planning considerations.)

CH 4–3.3.1.9 Development of Fielding Plans

Each DoD Component develops a fielding plan that provides sufficient time and information to plan, program, and budget for the necessary materiel, personnel, skills, and facilities to receive, train, use, maintain, and support new weapon systems. Fielding plans should address and support the transfer of any displaced systems remaining in service. Fielding plans include all information required to track, stock, ship, and account for the new end items and any additional items associated with the new equipment (e.g., tools, support equipment, spares, manuals, etc.).

The PM plans fielding with the Service Materiel Command or Hardware Systems Commands. For joint programs, fielding plans are generally addressed in a Memorandum of Agreement between the DoD Components. When international partners are involved, the Joint Program Office may use a charter to outline general governance that allows for detailed fielding planning among DoD Components and international partners. Unless stated otherwise, DoD Components retain their fielding authority. For programs that support either joint or individual DoD Components, fielding plans identify variant type, quantity, number of lots, scheduled purchase plan, and location/agency/unit by date and quantity.

CH 4–3.3.1.10 Software Sustainment Transition Plan

During [EMD](#), the program plans the transition of software support to sustainment. The PM, using output from design reviews, LORA, and Source of Repair Analysis processes, develops transition plans that may include transition of support databases, development and software support environment infrastructure, laboratory and test environments, and spares. The PM plans for licensing agreements and other arrangements that will allow access to [COTS](#) and proprietary software needed to sustain software capability. The PM develops draft release procedures with the Warfighter/end users so that the system can be periodically updated with minimal impact to operations. The program plans the transition of system documentation and the stand-up of help desk, server, and software maintenance functions in conjunction with the software developer and the designated software sustainment organizations.

During the transition to post-production software support (Milestone C), fielding occurs, the hardware production line ends, and software maintenance reaches steady state. For post-production software support, the PM should be sure to program funding for the cost of government labor to include field service engineers (government and contractor), certification and accreditation, lab operation, license updates, and the risk management process. (Office of the Secretary of Defense has replaced the information assurance process with updated cybersecurity requirements and the risk management process).

CH 4–3.3.1.11 Data Rights

By Milestone C, the Intellectual Property Strategy documents how much technical data is optimal for the government to purchase. For example, analysis may reveal the return on investment is much greater when purchasing only the technical data for 30 secondary items at \$500M versus \$4B for the entire vehicle's system technical data.

CH 4–3.3.2 Design Interface

During the [EMD](#) phase, the PM continues to assess and refine technological and programmatic risks to achieving performance requirements, including sustainment and affordability, and works with design engineers to demonstrate the [R&M](#) requirements during Developmental Test.

As technologies are integrated into the design, the PM assesses risk and opportunities with the system to achieving reliability thresholds, maintainability of the technology in its intended environment, and life cycle cost. The PM includes an analysis of sustainment risks at major program reviews such as CDRs and Production Readiness Reviews ([PRRs](#)). Risks may include operational environment suitability, reliability, and maintainability, manpower, and repair technologies. [Producibility](#) and required maintenance skills are also taken into account. Risks should be discussed and documented in the [SEP](#); see [CH 3 Section 2.2](#) and [CH 3 Section 4.1.5](#)

The PM then develops mitigation plans for identified risks and continues to identify opportunities to apply new technologies and techniques that will enhance the maintainability of equipment or reduce life cycle cost. These opportunities may be documented and tracked as Should Cost initiatives or incorporated into the program of record as part of the maturing design.

Entrance criteria for the CDR include design considerations impacting R&M thresholds. The PM addresses any shortfalls in meeting the sustainment requirements from the CDD and provides a plan to achieve a balanced design that considers all requirements, including [BITE](#)/Predictive Health Monitoring. The PM performs trade studies to determine which Predictive Health Monitoring capabilities demonstrate sufficient value for inclusion in the final design. The PM should monitor reliability growth, understand the impacts of trends, and identify and monitor critical technical performance parameters throughout EMD. Without margins in critical performance factors, the program design may not achieve R&M thresholds (which get traded off) and meet the [O&S](#) Cost cap. Additionally, the PM's program schedule and budget should include planning for obsolescence beginning in EMD.

CH 4–3.3.2.1 Software Sustainment

The PM should monitor the software developer's progress, including complete and current software documentation, which should include sufficient detail to support a system's successful transition to the sustainment organization. The PM should monitor the software developer's progress to ensure these documents stay on the development schedule.

Lack of appropriate documents limits insight into how the software was designed and implemented, and the software engineers may have to reverse engineer the code to determine its function. Reverse engineering increases the risk of inadvertently introducing errors into the code.

A software architecture feature to consider requiring is interchangeability of different [COTS](#) software products in the software architecture. System architecture should be designed such that the system, as a whole, is insulated from COTS internal product interfaces. When COTS products change, it should not drive changes to the system design interfaces. Consideration should also be given to COTS products that perform the same or similar functions so that alternative products may be options for future integration. For example, sometime during a system's life cycle, a COTS product may need replacement for fiscal or functional reasons. Programs should ensure that alternative products are available and functional within the architectural constraints. If the system depends on a specific COTS product that has no acceptable alternatives, performing future upgrades and sustainment could be difficult or impossible.

CH 4–3.3.2.2 Developmental Test and Evaluation

The PM monitors and analyzes Developmental Test and possibly early Operational Test event results to justify the required investments to address any R&M shortfalls. The PM needs to understand test results to identify any remaining high or medium risks to meeting R&M. The PM should request a deficiency correction plan to address these risks in the RFP for the [LRIP](#) contract incentive plan.

CH 4–3.3.2.3 Preliminary Design Review

The Preliminary Design Review ([PDR](#)) may occur after Milestone B for non-[MDAP](#) programs. For additional PDR discussion, see [CH 3 Section 3.3.4](#).

CH 4–3.3.2.4 Critical Design Review

As part of the Critical Design Review ([CDR](#)), the PM assesses the sustainment capabilities and attributes of the system (and subsystem) design and assesses this capability against the [CDD](#) and the allocated sustainment requirements defined at [PDR](#). The PM also considers how the sustainment attributes of the detailed design integrate with the capabilities of the product support package. Additionally, the PM assesses the detail design from a sustainment perspective and identifies risks that may impact the depot workloads and estimates of the 2366b certification, product support package development, maintenance demonstrations, and other sustainment-related test events. See [CH 3 Section 3.3.5](#) for additional information on CDR purpose and the timing of CDRs at both the subsystem and system levels.

CH 4–3.3.2.5 Test Readiness Review

As part of any Test Readiness Reviews, the PM assesses the readiness for test (readiness of test planning, test article(s), and test environment) from a sustainment perspective and assesses how the test will verify and/or validate sustainment capabilities and requirements. Test results should inform the product support package development. See [CH 8 Section 3.9.1](#) for additional information on TRRs.

CH 4–3.3.2.6 System Verification Review

As part of the System Verification Review, the PM should assess the collective results of system verifications to determine the extent to which sustainment requirements have been successfully verified and, more importantly, determine sustainment performance shortfalls. Of critical importance are the impacts of these shortfalls on the Capability Production Document ([CPD](#)), and the product support package as it readies for system deployment. The PM should ensure that all system verification and validation information is reflected in the Product Support Package. Deployment risks and impacts should be fully defined and appropriate mitigation actions included in the program’s plan and budget. See [CH 3 Section 3.3.6](#) for additional information on System Verification Review.

CH 4–3.3.2.7 Production Readiness Review

As part of the Production Readiness Review (PRR), the PM assesses the readiness of production processes and facilities to ramp to volume and meet the system’s end item and sustainment demands. The PM assesses how the proposed production methods may affect sustainment and identifies the sustainment risks associated with increased levels of production rate ([LRIP](#) and [FRP](#)). Any sustainment risks should inform the product support package design and the program’s planning for production and deployment. See [CH 3 Section 3.3.7](#) for additional information on PRR.

CH 4–3.3.3 Milestone C

As noted in [DoDI 5000.02](#), the activities undertaken by the PM to finalize designs for product support elements and integrate them into a comprehensive product support package are approved as part of the Milestone C decision. Table 5 shows a sample of the considerations taken by a PSM and staff to prepare for implementing a system’s product support package.

[Table 5: Key Sustainment Questions at Milestone C](#)

LCSP Section	Considerations
Introduction	Does the program have an executable plan to deploying the Product support package based on the achieved design as reflected in the test results?
Product Support Performance	Are requirements included in the CPD? Has the product support package been tested and demonstrated (organizational maintenance, training, support equipment, technical data)? Is the reliability growth on target? Are sustainment metrics achievable by FOC ?
Product Support Strategy	Are product support elements defined and resources programmed? Is the Depot Source of Repair finalized?
Product Support Arrangements	Are PSAs to support IOT&E and contract options in place and ready for execution? Are future arrangements and alternatives defined?
Product Support Package Status	Are Product support elements defined and resources programmed? Has a Milestone-C ILA been completed and risk mitigation executed?
Regulatory/Statutory Requirements that Influence Sustainment	Has the Depot Source of Repair been finalized and workload estimate updated? Is the depot stand-up planned and funded?

Integrated Schedule	Are detailed site fielding plans, product support elements delivery tied to program milestones (IOC IOT&E, FOC, MSD, etc.)?
Cost / Funding / Affordability	Have O&S affordability caps been updated? Have updated CAPE ICE and SCP been reconciled? Have disposal costs been updated to the final production design? Do acquisition budgets include product support element delivery? Are O&S Should Cost initiatives implemented?
Management	Is the organizational structure in place (government and contractor)? Are projections of organizational structure and manpower to support fielding and operations identified?
Supportability Analysis	Are analyses complete and results implemented?
Additional Sustainment Planning Factors	Are detailed site fielding plans refined?
LCSP Annexes	Is the Depot Source of Repair documented as part of the CLA? Are supportability analyses results documented? Are depot workload projections updated?

CH 4–3.3.3.1 Capability Production Document

The PM refines the sustainment requirements from the CDD with engineering and test events into the [CPD](#) metrics. The CPD prepares a program for a production decision and verifies that all proposed requirements fill capability gaps. Sustainment KPP and KSA values are refined based on lessons learned in development, testing, and modeling in the [EMD](#) phase and through PM engagement with resource sponsors. These refinements in CPD capability requirements should also be integrated with engineering and testing plans.

During the EMD phase, the testing and engineering community conducts verification and validation of each sustainment technical parameter. The PM's engagement with both communities in the prior [TMRR](#) phase enables successful testing of sustainment capabilities in EMD.

See [CJCSI 3170.011 JCIDS Manual, Encl. D – Pages D-67-81](#) for additional information.

CH 4–3.3.3.2 Life Cycle Sustainment Plan

The Life Cycle Sustainment Plan ([LCSP](#)) at Milestone C should lay out the plan to verify sustainment metrics and requirements, deliver product support to test and evaluation assets, and provide support for initial fielding. It should include addressing any interim contractor support requirements, identifying depot sources of repair and anticipated depot workload, and providing plans to implement the product support strategy over time. The [LCSP](#) is updated based on the results of engineering design reviews and should provide the findings of ILAs. Design decisions can impact the product support package by driving changes in failure rates, [O&S](#) Costs, maintenance plans, discard decisions, provisioning requirements, required support equipment, technical data, and training. The PM also should identify opportunities to reduce [O&S](#) Costs using Should Cost initiatives, address risks to sustainment, and identify mitigation strategies.

CH 4–3.3.3.2.1 Cost Estimating

During the [EMD](#) phase, the [O&S](#) Cost estimate can change to reflect updated testing data and [O&S](#) Should Cost initiative results. Cost estimating supports the Milestone C decision through the update of the [LCSP](#) and the LCCE. The Office of the Under Secretary of Defense for Acquisition and Sustainment (OUSD(A&S)) [LCSP annotated outline](#) offers guidance on structuring [O&S](#) Cost information to support the program's transition to production. The PM should continue to update and refine the CARD to ensure [O&S](#) Cost estimates align with the most up-to-date sustainment planning assumptions. The CAPE provides more information on the CARD in the [DoDI 5000.73](#). Revised cost estimates may also be required if the program experiences a [Critical Nunn-McCurdy Breach](#). The PM should monitor changes to the [O&S](#) Cost estimate in the context of the [O&S](#) Cost affordability cap.

At Milestone C, the cost estimators update the LCCE, including [O&S](#) and disposal costs, from Milestone B to reflect the current programmatic and technical baseline. An ICE is only required if the Milestone C decision authorizes [LRIP](#). The PM provides actual testing data and results to the cost estimators for incorporation into the updated [O&S](#) estimate, as well as cost savings from any successful [O&S](#) Should Cost Initiatives.

CH 4–3.3.3.2.2 Should Cost

[O&S](#) Should Cost initiative opportunities continue after development, although PMs can expect these later Should Cost initiatives to yield lower savings since it is difficult to change design characteristics once the system is built. By the Milestone C decision, Should Cost Initiatives may reflect [O&S](#) Cost drivers highlighted during testing.

As the program's design is finalized, [O&S](#) Should Cost initiatives that were geared toward significant design influence should have achieved their desired effect. The PM should continue to identify design controllable [O&S](#) Should Cost options that may lend themselves to future engineering changes. Development and Operational Tests are likely to provide insights into possible design controllable [O&S](#) Should Cost initiatives. In addition, the program should collaborate with the respective materiel support providers—government and commercial—to identify sustainment productivity improvement opportunities that may be formalized in [O&S](#) Should Cost initiatives. Such opportunities are likely to exist in maintenance, supply support, facilities, support equipment, training, storage, transportation, and information systems, among other areas. This is a valuable point in the acquisition process for the PS IPT to actively seek input and subject matter expertise from materiel commands, the original equipment manufacturer, and third party logistics providers. The [Should Cost portal](#) provides examples of successful Should Cost initiatives across DoD Components, commodities, acquisition category, and life cycle phase; it also provides Should Cost training, techniques, and tools. The PM records the [O&S](#) Should Cost initiatives in the [LCSP](#).

CH 4–3.3.3.2.3 Program Office Programming and Budget Activities

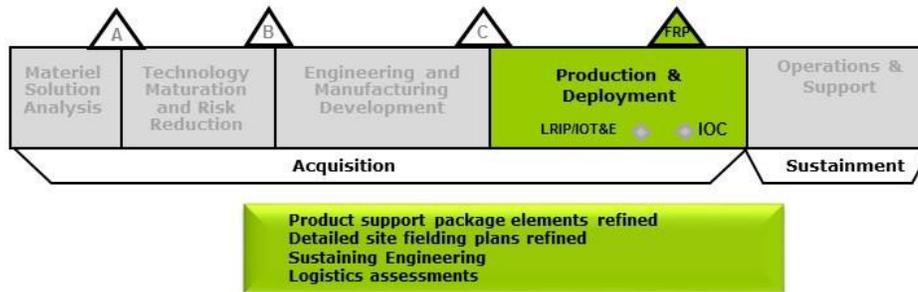
PMs inform cost estimates and develop funding requirements to support the Milestone C decision. The PM's input at Milestone C focuses on cost estimates and funding requirements necessary to procure and sustain logistics and sustainment-related capabilities to stand-up support for the operational test assets and initial production systems (initial spares, support equipment, information systems, initial training capability, etc.).

CH 4–3.4 FRP&D Phase

During the Production and Deployment (P&D) phase, the sustainment function in the program shifts from planning to execution and oversight. The PM, with support from the PS IPT, executes the planned delivery, verification, and deployment of the product support package to support the early production items. The PM refines and executes plans for initial fielding of the product support package for Operational Test events, [IOC](#), interim support, and transition to [FOC](#). Supply support and depot maintenance capabilities are put in place, and [PSAs](#) (such as Interim Contractor Support contracts, Public Private Partnerships, and Performance-Based Logistics [PBL] arrangements) are executed and monitored to ensure that providers are achieving required performance.

The P&D phase includes the FRP DR, which authorizes Full-Rate Production (or full deployment) of the system. Figure 7 depicts the sustainment activities during P&D.

[Figure 7: P & D Sustainment Planning Activities](#)



LCSP Focus

- Fielding plan details and adjustments
- Logistics assessments
 - How sustainment performance requirements will be measured, managed, assessed and reported (Availability/Reliability/Maintainability/Affordability)
- Identification of Sustainment Risks/Issues and Resolutions
 - Design demonstrated/Early Fielding Issues
- Analytical and management processes for :
 - Refining product support package elements
 - Fielded performance management and metrics
 - Cost drivers and availability degraders
- Refinement of Resource Requirements/Workload Estimates/Cost Estimates
- Should Cost Initiatives

FRP = Full-Rate Production; IOC = Initial Operational Capability; IOT&E = Initial Operational Testing and Evaluation; [LCSP](#) = Life-Cycle Sustainment Plan; LRIP = Low-Rate Initial Production; [O&S](#) = Operations & Support; RFP = Request for Proposal

CH 4–3.4.1 Sustainment Planning & Execution

Sustainment planning during FRP&D centers on incorporating lessons learned from beginning phases of implementing the product support package, refining the fielding plan, and contracting for sustainment. The PM uses the [LCSP](#) during this phase to manage the program's fielding efforts and to execute the required product support infrastructure, including [PSAs](#), maintenance and supply capabilities, and sustaining engineering and logistics functions. The PM updates the [LCSP](#) based on results from logistics evaluation reports on operating procedures, maintenance procedures, maintenance analysis reports, and Packing, Handling, Storage, and Transportation ([PHST](#)) verification reports.

CH 4–3.4.1.1 Delivery of Product Support Elements

The product support package is fielded at operational sites where sustainment and product support capabilities may be proven in an operational environment. Performance is measured against availability, reliability, and cost metrics. As testing is executed, the program identifies issues, establishes remediation plans, and executes appropriate mitigation steps. Finally, the product support organization is measured against its ability to meet planned A_m , reliability, [O&S](#) Cost, and other sustainment metrics required to support the Warfighter. The following are typically among the first elements that may be implemented as part of the product support package:

- Technical data delivery.

- Support equipment requirements, unique support equipment (Organization, Intermediate, and Depot), and provisioning for common and unique support equipment.
- Spares and [PHST](#) required to support fielding, funding and provisioning. The PM re-evaluates PHST and support equipment designs and design interfaces to ensure compatibility with production configuration and revalidates, by test and initial field data, the adequacy of design.
- Field service representatives, sufficient funding and training in sufficient time to support fielding.
- Interim support requirements and resources.

The PM also focuses on cost estimates and funding requirements necessary to fund delivery of the product support package, sustain fielded systems, and meet training and operational readiness requirements within affordability constraints. Other logistics and sustainment-related funding considerations include those needed to investigate Engineering Change Proposals ([ECPs](#)), develop Modification Work Orders (MWOs) and initiate pre-planned product improvements.

CH 4–3.4.1.2 Fielding Plan Details and Adjustments

The PM provides support required to sustain the system within the budget. The PM may need to tell senior management the consequences and impacts on the Sustainment [KPPs/KSAs](#) of budget constraints. The PM also coordinates with the contractors, supply chain elements, and operators to integrate their individual efforts in executing the [LCSP](#). Additionally, the PM monitors changes to the design, operational environment, and supply chain to adjust the product support elements within the product support package. Finally, the PM looks for improvements to reduce the product support package cost.

The PM can use a program management dashboard that employs such tools as statistical process control charts or real-time performance meters to provide program updates. The PM monitors leading indicators that can aid in identifying and mitigating potential product support issues.

The PM uses continuous data collection to validate that availability, reliability, and cost performance is consistent with or diverges from the [LCSP](#). If the analysis indicates a change in sustainment planning is warranted, the PM should update the [LCSP](#) as necessary. Changes in sustainment planning may include modifications to repair procedures, training, technical data/manuals, and inventory levels. The resulting changes to the product support package ensure effective and cost efficient readiness.

CH 4–3.4.1.3 Sustainment Contracting

As systems are fielded and logistics demand can be reasonably forecasted, the PM may begin implementing performance-based arrangements. Initially, such arrangements may be short-term cost-type incentive arrangements until sufficient cost data and technical data on failure modes and rates and field reliability data are collected. Cost-type incentive contracts share cost risk between the government and the [PSP](#), allowing for incremental transfer of risk to the [PSI](#) and/or PSP. Later arrangements may use a combination of fixed-price contracts with incentives and other consideration as the design stabilizes. Long-term periods of performance may be used to incentivize industry investment, provide for continuous product improvement, and reduce cost. Public-Private Partnerships are an excellent way to leverage the best of government and commercial expertise. The commercial PSI or PSP provides lean repair processes, a responsive supply chain for bit/piece parts, and sustaining engineering. The public sector provides a skilled workforce at competitive labor rates and repair and transportation assets. Once fielded, the performance-based arrangements are measured against their ability to directly meet or support planned A_m , R_m , [O&S](#) Cost, and other sustainment metrics. For more, see the [PBL Guidebook – Page 24](#).

CH 4–3.4.1.4 Transition of Software Support

During FRP&D, the program begins to transition software support to sustainment. The transition includes transition of support databases, development and software support environment infrastructure, laboratory and test environments, and spares. The program establishes release procedures with the Warfighter/end users so that the system can be updated (perhaps frequently) with minimal impact to operations. The program supports the transition of system documentation and the stand-up of help desk, server, and software maintenance functions in conjunction with the software developer and the designated software sustainment organizations.

CH 4–3.4.2 Design Interface

During this phase, the system design requirements are verified and validated for operational suitability. Feedback from initial operational testing may require re-analysis of product support elements within the product support package. Initial fielding may also reveal system design deficiencies, which may require engineering changes that affect product support.

The PM assesses ECPs for impact on the sustainment plan and [O&S](#) Cost. The PM can request that the [FRP RFP](#) include maintenance of the Logistics Supportability Analysis database (where applicable) or other support and supply data, to support future modifications and obsolescence re-designs. The PM can also request a [CDRL](#) in follow-on production RFPs for delivery of all contractor repair work data. The CDRL should include repair work scope and repair cost and recommended design improvements or value engineering proposals to further reduce [O&S](#) Costs.

The PM should update relevant supportability analyses and support planning based on results of the contractor's [R&M](#) analyses, failure diagnosis, problem investigation, functional and environmental qualification tests, and R&M demonstration tests.

The PM monitors the design factors for possible reliability degradation due to shock and vibration exposure in transportation and handling, exposure to extreme temperatures in transportation and storage, and expected relative humidity in the storage environment.

CH 4–3.4.2.1 Operational Test Readiness Review

As part of the Operational Test Readiness Review ([OTRR](#)), the PM assesses the system's sustainment readiness and capability to support operational test. Logistics support elements (e.g., spares, maintenance procedures, repair parts, and training) need to be in place with the operational testers. Additionally, the PM ensures that the sustainment performance of the system is sufficient to support operational test objectives and that the sustainment risks associated with the operational test have been analyzed and appropriate risk mitigation alternatives determined. See [CH 8 Section 3.9.2](#) for additional information on OTRR purpose and timing.

CH 4–3.4.3 FRP Decision Review

The Full-Rate Production ([FRP](#)) Decision or Full Deployment Decision authorizes the program to proceed to FRP or Full Deployment. The [LCSP](#) at FRP focuses on measurement and assessment of sustainment performance, sustaining A_m , and adjustments to the product support package.

The purpose of FRP is to review manufacturing processes, acceptable performance and reliability, and the establishment of adequate sustainment and support systems. Table 6 provides some considerations for product support planning, implementation, and monitoring that correspond with this decision review.

[Table 6: Key Sustainment Questions at FRP Decision Review](#)

LCSP Section	Considerations
Introduction	Has the program demonstrated that the sustainment requirements have been met or will be achieved at FOC ? Does the program have a correction plan for any problems?
Product Support Performance	Has the product support package been demonstrated in operations (organizational maintenance, training, support equipment, technical data)? Is the reliability growth on target? Are the sustainment metrics achievable by FOC ? Are issues identified and mitigation plans in place?
Product Support Strategy	Are the product support elements in place? Are performance-based arrangements established or being executed as planned?
Product Support Arrangements	Are PSAs executed?

Product Support Package Status	Are all product support elements in place? Has the ILA been completed and risk mitigation executed?
Regulatory/Statutory Requirements that Influence Sustainment	Is the core depot stand-up on track to meet the required date?
Integrated Schedule	Will program meet MSD and core depot schedules? Have fielding plans been adjusted for mitigation plans and ECPs?
Cost / Funding / Affordability	Are O&S affordability caps being met or on track to be met? Have updated CAPE ICE and SCP been reconciled? Do Acquisition and/or Service O&M budgets include product support element delivery? Have O&S Should Cost initiatives been completed and/or additional initiatives been established?
Management	Does the Organizational structure support fielding schedule, operations and sustainment?
Supportability Analysis	Are results validated from operational data and additional analyses identified? Are should cost efforts underway to help reduce/control sustainment costs?
Additional Sustainment Planning Factors	How is feedback from fielding and operations incorporated into the program to drive should cost initiatives?
LCSP Annexes	Are sustainment costs & their drivers tracked in revalidating if the product support strategy needs to be updated?

Additionally, the PSM updates the [LCSP](#) to support the FRP decision based on satisfactory performance in IOT&E and other evaluations. The PSM documents any deficiencies in the product support package based on initial deployment and plans and resources to correct those deficiencies.

The [LCSP](#) details how fielded performance of the system is measured, how system level performance is sub-allocated to [PSPs](#), and how [PSI](#) and/or PSP performance is measured, assessed, and reported. Metrics (e.g., availability rates, failure rates, repair rates, supply fill rates) may be established for each indenture of product support.

CH 4–3.4.3.1 Cost Estimating

The PM's main involvement in the FRP [O&S](#) Cost estimate is in the refinement of the CARD to reflect sustainment changes to the programmatic and technical baseline since Milestone C. For more on cost estimating, see Section 0.

CH 4–3.4.3.2 Should Cost

As the program nears [FRP](#), operational test and fielding data provides insight into major cost drivers and areas in which [O&S](#) Should Cost initiatives are likely to yield the greatest benefit. While there still may be modest, incremental opportunity to influence [O&S](#) Costs through engineering changes, the program should dedicate increasing effort to identifying Should Cost initiatives that target active cost management among the organizations and infrastructure supporting what may be a rapidly growing inventory of fielded systems.

Where a program's sustainment planning includes interim contractor support, [O&S](#) Should Cost initiatives should seek contract incentives that align performance objectives with cost control objectives for the PSP or PSI. Should Cost initiatives may also yield benefits where they streamline or accelerate transition from contractor support to organic support. Additionally, shifting from a sole source commercial support provider to a competitive situation may constitute one or more [O&S](#) Should Cost initiatives as the program ramps to full fielding and steady state [O&S](#). Where a program's sustainment plan calls for longer term commercial support and demand variability sufficiently predictable to support fixed price contracting,

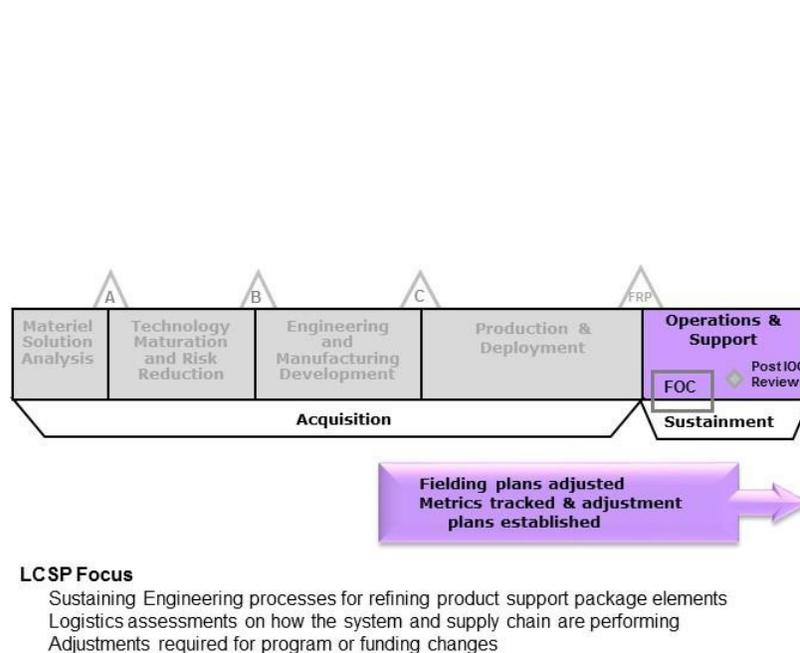
[O&S](#) Should Cost initiatives may center on establishing longer term performance-based arrangements at component, sub-system or system levels ([see the PBL Guidebook](#)).

The PM should record all [O&S](#) Should Cost initiatives in the [LCSP](#).

CH 4–3.5 Operating and Support Phase

The Operating and Support ([O&S](#)) phase is the culmination of the sustainment planning done in the previous phases. During this phase, the PM is focused on supporting the Warfighter's operations and training by executing the sustainment strategy, monitoring the performance of the system, assessing the effectiveness and affordability of the product support strategy, and making adjustments to the product support package. Figure 8 depicts the sustainment activities during [O&S](#).

Figure 8: O&S Phase Sustainment Planning Activities



FOC = Full Operational Capability; FRP = Full-Rate Production; IOC = Initial Operational Capability;
[LCSP](#) = Life-Cycle Sustainment Plan; [O&S](#) = Operations & Support

CH 4–3.5.1 Monitor System Performance

As the product support strategy is executed, the PM monitors the performance of the operating system and identifies risks and issues to continuing to achieve the Warfighter's sustainment goals affordably. The PM assesses risks and opportunities that may result from changes in [CONOPS](#), ECPs, or the industrial base, or results of analyses of the maturing system.

As shortfalls in system performance operation are identified in [O&S](#), the PM conducts analyses to determine the best Courses of Action (CoAs). Corrective actions may require maintenance plan changes, process changes, modification of agreements, changes to product support elements, or system design changes. The PS IPT may need to conduct BCAs, systems engineering trades, and logistics analyses to

determine the most effective CoA. Potential CoAs may include changes to maintenance procedures, levels of repair, or product support elements, or system/component redesigns.

CH 4–3.5.2 Assessing Product Support Performance

In the [O&S](#) phase, the PM monitors product support performance against sustainment metrics and takes corrective action if needed. The product support package is refined and adjusted based on performance, evolving operational needs, and improvement initiatives. PMs ensure that support systems and services have been delivered and depot maintenance is being performed as outlined in the [LCSP](#).

With the system operational, actual data is available as a basis for analysis and product support decision making. This data may reveal risks in operational usage, system reliability, demand rates, response times, funding requirements, and product support package performance, which require mitigation.

PMs should revalidate their program's product support strategy and ensure that it still meets suitability and affordability requirements. Indeed, 10 USC 2337(b)(2)(g) [see [10 USC 2337 \(US Code\)](#)], requires a revalidated BCA when the product support strategy is changed, or every five years, whichever comes first. PMs should continually monitor and assess the sustainment strategy's suitability, particularly regarding changes in operating conditions or program assumptions. The PM also helps inform the life extension and disposal decisions, although the PM is not the decision authority. Additionally, incremental development of systems may require multiple configurations or blocks of a weapon system, and the product support strategy should reflect these requirements.

CH 4–3.5.2.1 Monitoring and Assessing the Supply Chain

The PM tracks and reports supply chain performance and its effectiveness. Tracking should include the sustainment metric drivers in the supply chain and the root cause of performance shortfalls. Special emphasis is placed on tracking the drivers for the key enabler technologies that most impact A_m .

PMs also work closely with their [PSIs](#) or supply support activities to monitor the health and efficiency of the supply chain. The risk of Diminishing Manufacturing Sources and Materiel Shortages ([DMSMS](#)) increases over time, and the PM should monitor this through annual assessments of the supplier base health.

As performance-based arrangements are implemented with industry, a balance should be reached between using increased competition to keep a downward pressure on prices and contract lengths that encourage investment in process and product improvement through innovation. The goal is to deliver reliable performance at reduced costs versus competing simply to drive cost down without regard to increasing the variability in performance experienced by the Warfighter. If the item is sole sourced to one manufacturer, emphasis should be placed on contractor reliability investments using an appropriate period of performance that allows a return on such investment.

CH 4–3.5.2.2 Software Sustainment

Software sustainment during [O&S](#) includes managing system obsolescence, technology refresh, source code escrow, vendor license management, and [COTS](#)-aggregate system architectures. Programs should ensure that Integrated Master Schedules for incorporating COTS products align different products and versions to minimize management complexity.

CH 4–3.5.2.3 Resource Management

During [O&S](#), the PM works with cost estimators, program and budget managers, and resource sponsors to use actual sustainment cost data to align resource requirements, cost projections, and savings initiatives. The PMs input during this phase focuses on cost estimates and funding requirements necessary to sustain the fielded systems and meet training and operational readiness requirements within affordability constraints. Specific inputs include funding requirements related to replenishment spares and support equipment, hardware and software depot maintenance, modifications, system safety investigations, etc. Other logistics and sustainment-related funding considerations for the program include those needed to conduct post-fielding reviews, execute a technology refreshment program, ensure system security, and provide for resource sustainment contracts and service-level agreements.

CH 4–3.5.2.3.1 Should Cost

[O&S](#) Should Cost initiative opportunities do not end once the system is fielded, although PMs should expect later Should Cost initiatives to yield lower savings since it is difficult to change design characteristics once the system is built. After [IOC](#), Should Cost Initiatives may reflect [O&S](#) Cost drivers highlighted during operation and use of the system.

This is also the time for the PM to evaluate whether the prior [O&S](#) Should Cost initiatives have produced the expected savings. For example, if the [O&S](#) Should Cost initiative was to reduce how often a particular component is replaced, operational data will confirm how many times the component actually needed replacement.

The [Should Cost portal](#) provides examples of successful Should Cost initiatives across DoD Components, commodities, acquisition category, and life cycle phase; it also provides Should Cost training, techniques, and tools.

CH 4–3.5.2.3.2 Cost and Software Data Reporting Requirements

Monitoring of sustainment contracts is also important for tracking and forecasting expenditures. The PM's role in the Cost and Software Data Reporting (CSDR) process is to work with the cost estimators and contracting professionals to ensure that the [CDRLs](#) are included in sustainment contracts beginning with the development of the [RFP](#) through the signing of the contract. The CAPE requires CSDR for sustainment contracts totaling greater than \$50M, regardless of contract type. The OSD CAPE's Cost Assessment Data Enterprise (CADE) website provides more CSDR and related information at the [CDSR Reporting Timeline webpage](#).

CH 4–3.5.2.4 Sustainment Review

As part of Sustainment Reviews during [O&S](#), the PM ensures that sustainment performance of fielded units has been continually assessed and all service-use data (e.g., readiness degraders, changes in operational usage or environment, material failures, hazard reports, etc.) have been collected, analyzed, and assessed for operational and safety risks. The PM ensures that trend analysis is used to determine sustainment performance drivers and that planning is in place to address system modifications, [ECPs](#), and other actions to resolve sustainment issues and improve sustainment performance over time. Monitoring the supply chain for obsolescence and diminishing manufacturing sources is part of this activity. FY17 NDAA Section 849(c) and correspondingly [DoDI 5000.02](#), Encl 6, Para. 6, requires each military department to conduct major weapon system Sustainment Reviews not later than five years after achieving initial operational capability and throughout the life cycle. Additionally [DoDI 5000.02](#), Encl 6, Para. 5 Product Support Reviews, requires PSMs to assess logistics as a focused part of [PSAs](#) and technical reviews for all MDAP weapon systems.

CH 4–3.5.2.5 Independent Logistics Assessment

In addition to Sustainment reviews, [DoDI 5000.02](#), Encl 6, Para. 5 also requires DoD Components to conduct ILAs throughout the acquisition process. The Independent Logistics Assessment (ILA) assesses the program office's product support strategy and how it will lead to the successful operation of a system at an affordable cost. The PM can refer to the [LA Guidebook](#) for details on how to plan, schedule, and execute periodic ILAs following FRP. Defense Acquisition University also has additional [ILA resources](#), including links to individual DoD Component guidance.

CH 4–3.5.3 Adjusting the Product Support Package

The PM assesses the effectiveness of the sustainment plan to evaluate and revise the product support package due to changes in operational requirements (operational tempo, operational environment, mission changes), sustainment challenges (infrastructure and/or capabilities), or funding constraints. Changes to the sustainment strategy that ultimately lead to revisions of the product support package should involve an assessment of different courses of action such that relative costs, benefits, and risks are clearly understood. (See [Product Support BCA Guidebook](#) for additional guidance).

After fielding, a program and its product support package may undergo changes based on realities in the field. Operations may drive program changes through shifts in [CONOPS](#), the threat environment, and the organization. Technology changes may also drive product support updates, including modernization to address obsolescence in the form of ECPs and the introduction of new technologies. The PM ensures

there is sufficient logistics and sustaining engineering expertise to monitor the fielded performance of the system, conduct analysis, identify root causes of performance shortfalls, and make ECP recommendations. The PM collects and analyzes actual field data and justifies potential design modifications to achieve [R&M](#) requirements and/or further reduce [O&S](#) Cost.

CH 4–3.5.3.1 Capturing Program Changes

The [LCSP](#) remains the central document for sustainment planning throughout the programs life cycle and should reflect changes to the product support package. When changes in the product support package warrant, the PM updates the [LCSP](#). Updates align the changing needs of the Warfighter and the DoD Component's evolving sustainment requirements with the product support strategy.

The [LCSP](#) annotated outline contains a full description of the items required in the [LCSP](#) update, but significant potential items to update may include:

- Scheduled events such as ECP incorporation, test events, etc., that impact sustainment;
- Maintenance plans for the system and components, including changes to the [LORA](#);
- Results of any trade studies or BCAs, including changes to PSPs, sources of repair, and resource requirements;
- Design changes due to performance shortfalls, obsolescence issues, or modernization;
- [O&S](#) Cost estimates based on evolving programmatic assumptions, tracking of actual expenditures, and performance of Should Cost initiatives; and
- Funding and budgeting changes due to actuals from fielded systems, operational shortfalls, and budget environment.

Incorporating changes to sustainment plans ensures continued system performance and addresses Warfighter needs throughout the program life.

CH 4–4. Additional Planning Considerations

[DoDI 5000.02](#) encourages the tailoring of acquisition approaches to most efficiently achieve program objectives. Section 4 identifies considerations specific to different system types.

- Section 4.1 provides guidance specific to Major Defense Acquisition Programs and Major Weapon Systems, as the rest of the guidebook is intended to be broadly applicable to all programs.
- Section 4.2 presents considerations specific to systems that are being rapidly acquired and/or fielded.
- Sections 4.3 through 4.8 offer considerations for tailoring sustainment plans to the unique design, development, and operational features of different system types, including vehicles, ships, aircraft, information systems, munitions, and space systems.

CH 4–4.1 MDAP Processes

This section offers guidance for tailoring and adapting sustainment planning for the unique needs of Major Defense Acquisition Programs ([MDAPs](#)).

CH 4–4.1.1 Milestone A

At Milestone A, MDAPs have one additional assessment requirement.

CH 4–4.1.1.1 10 USC 2366a Certification and Core Logistics Determination

In general, 10 USC 2366a (see [US Code](#)) requires that the Milestone Decision Authority (MDA) determine that an MDAP is sufficiently mature to enter technology development. Section (b)(5) of the statute requires a determination that sustainment planning has been done and that a core logistics determination has been made. In addition, 10 USC 2464 (see [US Code](#)) requires the Service to establish organic depot repair capabilities for core workload.

To meet the sustainment planning requirements in these statutes, prior to Milestone A, the DoD Component produces a core logistics determination to evaluate whether the statute applies to the

proposed material solution. (Note: The Army is an exception and does not provide a Core Determination to PMs. The Army determination process for the PM is outlined in [Army Regulation 700-127](#).)

CH 4–4.1.2 Milestone B

At Milestone B, MDAPs have two additional assessment requirements.

CH 4–4.1.2.1 10 USC 2366b Certification and Core Workload Assessment

In [10 USC 2366\(b\), provisions \(3\)\(E\) and \(3\)\(F\)](#) require the MDA to certify to Congress that an [MDAP](#) has conducted sufficient logistics planning to inform an independent cost estimate and that the program has estimated core depot workload prior to approving entrance into [EMD](#). The MDA-approved Milestone B [LCSP](#), along with the approved Service Cost Estimate, meets the requirement. The Program Manager (PM) develops a projection of core depot workload (if any) in terms of projected man-hours, which will be required at Milestone B to satisfy the requirements for MDA certification that the program has met the requirements of 10 USC 2366b provision (3)(F) (see [US Code](#)). Because specific design details may not be known prior to a [PDR](#), the PM may need to estimate the core workload man-hours based on data from predecessor or similar systems.

CH 4–4.1.2.2 Independent Logistics Assessment

An Independent Logistics Assessment (ILA) is an analysis of a program's supportability planning. Execution of the ILA is at the discretion of the DoD Components but preferably by a team independent of the program. For example, in the Army, the [PEO](#) assigns an ILA lead and team not associated with the program. The PM can refer to the [LA Guidebook](#) for details on how to plan, schedule, and execute an ILA to support the Milestone B decision. An ILA is an assessment of the product support strategy and an assessment of how this strategy leads to successfully operating a system affordably. Conducting the ILA early in the program phase where the design can be influenced is critical to fielding a sustainable system. The ILA should then be re-done at each milestone and periodically thereafter as the design matures.

The ILA provides the PM an independent assessment of the sustainment issues and risk with the program. The PM develops plans to resolve issues and mitigate risks. The PM documents the results of the ILA, as well plans for resolution in the [LCSP](#). The PM incorporates risks into the program's risk management process.

An ILA is required for review by the MDA for MDAPs at Milestone B. The [Logistics Assessment Guidebook](#) is an important reference for understanding and conducting these reviews.

CH 4–4.1.3 Milestone C

At Milestone C, MDAPs have one additional assessment requirement.

CH 4–4.1.3.1 Independent Logistics Assessment

An Independent Logistics Assessment (ILA) is required for review by the MDA for MDAPs at Milestone C. At Milestone C, the ILA should verify that each product support element has been addressed and that the resources required for fielding have been programmed. The ILA should also help identify program risks to achieving availability, reliability, and maintainability of the system in its intended environment affordably. Refer to the DoD Component [LA Guidebook](#) for details on how to plan, schedule, and execute an ILA to support Milestone C decision reviews.

CH 4–4.1.4 Full-Rate Production Decision Review

At the Full-Rate Production Decision Review (FRP DR), MDAPs have one additional assessment requirement.

CH 4–4.1.4.1 Independent Logistics Assessment

Independent Logistics Assessments ([ILAs](#)) offer programs and their respective Services an opportunity to evaluate the effectiveness of sustainment plans once [IOC](#) has been achieved. Results of ILAs should be used to adjust the product support strategy as needed to ensure sustainment requirements can be met and [O&S](#) Costs remain affordable. For more on ILAs, see Section 4.1.2.2.

CH 4–4.2 Rapid Acquisition and Fielding

Rapid fielding activities support urgent operational needs field capabilities in less than two years. In contrast to a traditional program, sustainment of a rapid capability typically involves fewer assets. Contract line items in the development and procurement contract usually govern sustainment of these end items. While rapidly deploying and sustaining capability to the Warfighter are the most essential goals of rapid acquisitions, PMs should ensure contractors have in place processes and procedures to collect sustainment data for the capability, primarily focused on contractor actions, workload, and resources necessary to ensure asset availability. This requires the PM to apply critical thinking to determine what data collection is feasible given the mission, location, access, and operating environment. Collecting sustainment data for a carrier launched unmanned aerial vehicle differs greatly from collecting data for a short range unmanned aerial vehicle operating in a contested environment.

The collection of sustainment data is useful for the duration of the immediate mission, as it gives the PM insight into needed improvements in both system performance and supportability, such as for training, spares, technical data, operating software, support equipment, and maintenance ([DoDI 5000.02](#), Encl. 13, 4d(3)(a)—Page 149). During the Disposition Analysis process, collected sustainment data informs the disposition options as determined by the designated disposition official and provides data for development of planning, programming, and budgeting data for all three disposition options: disposal, continuation in current contingency, and program of record ([DoDI 5000.02](#), Encl. 13, 4e(5)—Page 150).

For capabilities that continue in the current contingency or transition to a program of record, operational sustainment data supports the product support strategy, including development of the Integrated Product Support elements. This data informs performance and sustainment metrics, requests for proposals, and contracts. It also helps identify critical reliability, availability, and maintainability improvements for the current configuration. Sustainment data also provides critical information for the sustainment analyses to determine the system's product support strategy through public, private, or hybrid [PSAs](#).

CH 4–4.3 Ship Systems

Ships and other system-of-systems programs are some of the most complicated weapons the DoD buys and sustains. The complication arises from the interdependency of the systems in a single entity (like a ship) where multiple program offices (or commands or agencies) manage the individual systems. Each system may be its own MDAP or Acquisition Category program outside of the major ship program. The PM should communicate with all organizations within the program's sphere of influence and be able to articulate which systems are included in the sustainment planning/execution for the ship program. There may be systems that are not part of the acquisition of the ship but that become part of the sustainment planning once installed on the ship. The PM should maintain relationships with all stakeholders to ensure a smooth transition from designing to building to sustaining the system.

For ship programs, the sustainment metrics may need to exist at a lower level than the entire platform. While every sub-system on a ship has a role and is important, the PM should consider that a single failure or even the failure of a specific sub-system may not cause mission failure. The precise definition of the sustainment metrics is a way to reflect this. Some programs, particularly submarines, create a list of mission critical systems. Mission critical systems are those systems whose failure would prevent the ship from continuing its mission and force the ship to wait for repair. Once these mission critical systems are identified, the PM defines the sustainment metrics in a way that supports accomplishment of the mission. This can also focus sustainment planning and execution on the most important elements of the program. The availability metric can be shaped to reflect this. For example, a program may set an availability metric based on Mean Time Between Mission Critical System Failure.

CH 4–4.4 Aircraft

Aircraft sustainment cost is usually centered on a few key subsystems (e.g., engines, ejection seats, or auxiliary power units) that are generally not developed by the air system prime contractor. These subsystems are critical to the success of the program, but PMs should carefully manage the allocations to the sub-contractors for system performance, reliability, and sustainment cost. Program Management Reviews should include assessing performance of these sub-contractors to meet the requirements.

CH 4–4.4.1 GFE versus CFE and When to Break Out

Successful acquisition programs have procured key subsystems as Government-Furnished Equipment (GFE) to, for example, the airframe OEM. The GFE contracts give the PM greater control over the performance of the sub-system contracts. This avoids the risk that the airframe prime will sub-optimize the engine design (in this example). This could happen when the prime has the ability to require additional thrust from the engine to alleviate airframe weight increases. Increasing the engine thrust output may be the easier path for the prime but usually results in a decreased engine's life limits and significant increases in engine [O&S](#) during the system's life cycle. If the engine (or other cost-intensive subsystem) is to be procured through the prime during the development phase, the program office should perform BCAs to determine when and if those subsystems can be broken out to be procured and sustained as GFE. This may reduce the likelihood of future non-value added pass-through charges paid to the prime contractor.

CH 4–4.4.2 Sustaining Modified Common Commercial Aircraft Systems

The government will often buy a successful commercially operated civilian aircraft to be modified for military use. Examples are the Navy's P-8A based on the Boeing 737 and the U.S. Air Force KC-46 based on the Boeing 757. The core determination analysis should carefully discern between sustainment of the common commercial airframe and the mission-unique systems. Decisions on sources of repair for commercially derived military platforms should be supported by holistic assessments of the costs benefits and risks of commercial, government, or some mix of both.

CH 4–4.4.3 Cost Saving Initiatives for Common Commercial Aircraft Systems

Often, the common commercial airframe is flown from the final assembly plant to another facility for modification and installation of mission-unique systems. These aircraft can be on the ground for three years or more. Consider requiring only a temporary use of the engines and removing/returning them. Delaying purchase of the common commercial engines until the modified aircraft is ready to begin flight test avoids the cost of storage and cost of maintaining the engines to keep up with Federal Aviation Administration mandated engineering changes for the three-year (or longer) period. Also, consider requiring the aircraft system and components can be capable of being downgraded to Unclassified to support maintenance periods. Top Secret components have costly logistic burden in maintenance and the supply chain.

CH 4–4.5 Space Systems

Space system acquisitions generally have two major segments: the space segment (i.e. space vehicle/satellite) and the ground segment. Sometimes, launch is considered an additional segment. The ground segment is further decomposed to ground or control (tracking, telemetry, and communication) systems, and user equipment and terminals, any of which may have mobile elements.

Due to the extreme nature of the space environment and the inability to effect hardware repairs and upgrades once on orbit, the requirements and design of space segments tend to be extremely robust. Sustainment planning should consider costs associated with putting space vehicles/satellites into storage, ensuring their health and safety while in storage, and the costs associated with bringing them out of storage and making them ready for shipment and launch. Sustainment planning should also focus on the support provided for the health of the space vehicles/satellites while on orbit performing their mission (maintaining required orbit, anomaly resolution, etc.) via the tracking, telemetry, and command system and the necessary support to maintain the system's software.

Sustainment planning for the ground segment is similar to that of other terrestrial systems and the planning processes and elements as outlined in the Planning sections of this chapter. However, a space system's ground segment operating requirements are usually around the clock 365 days per year and primarily consist of COTS, or COTS-modified, hardware and software. These elements increase the criticality and importance for PMs to ensure a rigorous and disciplined examination of all aspects of the ground segments support strategy, including planning for organic depot support and determination of the minimum essential IP and data rights for sustainment.

COTS and COTS-modified hardware and software used in ground segments can be as much as 98 percent of the total system. As such, PMs should put in place processes and procedures to track upgrades in the commercial product that provide enhanced processing capability, capacity, and storage. Additionally, the PM should monitor and assess counterfeit and DMSMS risks across the system's life cycle. This process will require accelerated technology refresh cycles of 3-4 years, which are generally greater than that of other terrestrial COTS and COTS-modified systems and affects both the security

certification and accreditation of the system and the system's operation and support costs.

On-orbit work or work to manage the satellites after launch is costly because the space vehicle/satellite cannot be off-line for repair, modification, or upgrade for extended periods. To address this, space systems acquire technical expertise services for the space segment as on-site operational support. Also acquired is a variety of ground equipment that mimics the satellite/space vehicle for testing of software changes (e.g., SILS). PMs ensure these test assets maintain configuration alignment with the primary ground control segment. The PM should ensure that IP provisions in the development and production contracts support the sustainment plan. These provisions should be explicit in terms of data delivery where the program plans to compete sustainment for the system. A system's support planning has to include the operational support technical services, maintenance, and upkeep of the support systems, as well as the primary ground segment that communicates with the satellite (tracking, telemetry, and command).

Finally, space systems are completely net-centric and therefore have more robust program protection, cybersecurity, and computer network monitoring requirements than most terrestrial platforms. PMs should ensure the processes and procedures put in place for space systems (space and ground) to gain and maintain a system's authority to operate are maintained across the system life cycle. This may require both Red Team and Blue Team testing for major software releases and hardware interfacing with the Defense Information Systems Network.

CH 4–4.6 Munitions and One-Time Use Systems

Munitions and other one-time use systems have unique sustainment considerations, as they may be inactive for long periods of time between delivery and use, so stockpile reliability and monitoring strategies are important considerations to achieving required readiness and availability outcomes. These strategies support Serviceable in Service Times and other age limits (e.g., a 10-year wooden round concept) with stockpile sampling used to extend life intervals. PMs should plan for the resources in terms of budget, talent, and facilities necessary to conduct the stockpile reliability and age exploration programs.

Material Availability (A_m) requirements for munitions typically have high values, as most munitions are considered "up" while in storage or awaiting use, with only a small amount in depots or in the transportation pipeline. The A_m requirement directly supports Warfighter needs and includes quantities necessary for live fire testing, age exploration and destructive testing supporting stockpile reliability programs.

Sustainment strategies for munitions vary according to the testability and reparability of the end item. A key enabling technology for testable systems is [BITE](#). The PM's advocacy for including diagnostic and prognostic capabilities in requirements documents allows testable and repairable systems to remain in the field rather than a time-based return for overhaul. Portable BITE sets enable a PM to conduct inspections outside of the organic or commercial depots and enhance stockpile reliability programs, saving transportation costs. While BITE helps collect the data on electronic components (guidance and control), other components (energetics and fuses) may need to be destructively tested or require physical inspection to determine if they are still serviceable.

Packing, Handling, Storage, and Transportation ([PHST](#)) requirements are a key [O&S](#) Cost driver for missiles and munitions, and reducing transportation requirements allows significant cost savings. Storage maintainability design factors include ensuring access to desiccant, self-reporting of impending battery failures, and ability to upload software and test while containers are stacked. [PHST](#) and Environment, Safety and Occupational Health requirements are important to address early in the [LCSP](#), given their significant [O&S](#) Cost percentage for munitions programs and safety requirements for transporting all-up-rounds, live warheads, propulsion systems, and other sensitive munitions components. Munitions PMs also focus on incorporating sustainment requirements for training assets including captive air training missiles, missile round trainers, missile containers, empty round trainers, and ground/dummy training munitions—all of which require varying levels of maintenance, necessitating similar sustainment planning along with the all-up-rounds.

An additional consideration for munitions PMs is depot maintenance requirements while the system is still in production. If done at a government facility, complying with [IOC](#) plus four-year requirement is challenging, given likely small amounts of workload early in the life cycle. PMs should examine facility and Military Construction costs early in development to ensure legal compliance and adequate sustainment infrastructure. If a contractor facility is used for depot maintenance and the systems are still in production, consider whether the OEM is the vendor and has the capacity to do simultaneous depot maintenance alongside production. If not, maintenance and overhaul requirements may suffer in comparison to new production if using the same tooling and production line.

CH 4–4.7 Information Systems

Information system acquisitions are categorized as either business or non-business systems. Due to the rapid nature of technology changes, the requirements and design of information systems are extremely robust. Sustainment planning focuses on providing support so the system can perform its mission (accessing a variety of information for mission force calculations, compiling medical data for world-wide support between DoD agencies, assembling data for security access for mission support, etc.) and support to maintain the system's hardware and software.

Sustainment planning for information systems includes operating requirements that are usually around the clock 365 days per year, and consist of [COTS](#), [GOTS](#) or COTS-modified, hardware and software. These elements increase the criticality and importance for PMs to ensure a rigorous and disciplined examination of all aspects of the system support strategy, including the requirement and planning for organic depot support and determination of the minimum essential IP and data rights for sustainment. PMs should put in place processes and procedures to monitor vendor products for enhanced or increased processing capability, capacity, and storage, as well as properly assessing risk management to the systems, such as DMSMS. PMs should also maintain good configuration control across a system's life cycle and assess impacts to any information system with interdependency and interoperability requirements. Due to the nature of information systems rapid technology changes, most technology refresh cycles occur every 3-4 years and affect both the system security certification and accreditation, and the system's operation and support costs.

Finally, information systems are completely net-centric and have more robust program protection, cybersecurity, and computer network monitoring requirements. PMs should ensure the processes and procedures put in place to gain and maintain a system's authority to operate are continued across the life cycle of the system. This may require both Red Team and Blue Team testing for major software releases and hardware interfacing with the Global Information Grid and the Defense Information Systems Network.

It is imperative that costs associated with the preceding activities are included in the system's Life Cycle Cost Estimate, affordability goals and caps, and the planning, programming, and budgeting process. The oversight, management, and updating of these costs are required across the system's life cycle until disposal.

CH 4–4.8 Modification Programs

During the [O&S](#) phase, a program may require modifications to meet emerging requirements, improve performance, address safety issues, reduce operating costs, or extend operational life. Additionally, modern acquisition programs are dependent on technology and thus may require technology refresh and insertion at a higher rate than legacy systems. Across DoD, the definition of modification varies from the replacement of a component to an [MDAP](#)-sized investment.

During the development of program modifications, the PM develops an acquisition strategy that considers whether a change will be implemented in remaining production units only, retrofitted into fielded units, or implemented on an attrition basis as supply is replenished. If the program is implemented in production without retrofit, the PM should analyze the potential impacts to readiness and cost of maintaining multiple configurations. In planning for the retrofit of modifications, the PM should consider urgency of the modification; impact to ongoing operations; manufacturing lead times, production rates, skill levels, and training and tooling required; and level of maintenance at which the change can be incorporated (i.e., organizational level, depot level, or return to the manufacturer).

The PM develops the product support package required to implement the change (e.g., installation instructions, training) and plans for changes needed to the original system's product support package to support the change once implemented. Depending on the scope of the modification, the PSM may need to update the [LCSP](#) depending on the impact to the product support elements. Examples of product support changes that drive an update to the [LCSP](#) include changes in reliability, significant increases or decreases in funding required to support the change, changes in level of repair, or major changes in [CONOPS](#).

CH 4–Version and Revision History

The table below tracks chapter changes. It indicates the current version number and date published, and provides a brief description of the content.

Version #	Revision Date	Reason
0	2/1/2017	Chapter 4 initial upload
1	3/24/2017	Acquisition Timeline Figure Update: updated all Chapter 4 figures to reflect Technology Maturation and Risk Reduction (TMRR) vs. Technology Development.
2	8/28/2017	ACC Broken Links: revised all links to DAU's ACC with new links to accommodate ACC going away.
3	DoDI 5000.02 , Ch4 pending publication	CH 4–3.5.2.4 Sustainment Review references new DoDI 5000.02 , Encl 6, Para. 6 (Sustainment Reviews).
4	DoDI 5000.02 , Ch4 pending publication	CH 4–3.5.2.5 Independent Logistics Assessment (ILA): updates ILA requirement changes per revision of DoDI 5000.02 , Encl 6, Para. 5.
5	DoDI 5000.02 , Ch4 pending publication	DAG CH 4–3.2.4.1.2 Cost Estimating: annotates OUSD(AT&L) reorganization and name change to OUSD(A&S).
6	9/25/2018	Update to include Satellite Storage requirements.
7	2/27/2019	Revised all broken links.