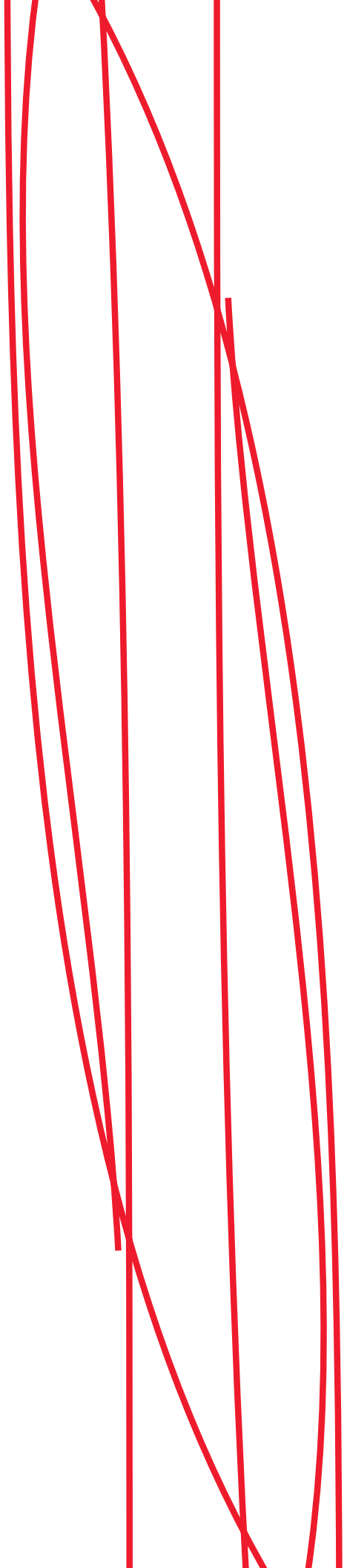

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by

Dick Lohrmann
lohrmann_dick@bah.com

Tony Kime
kime_anthony@bah.com

Mike Jones
jones_mike@bah.com

Product Support Planning

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Regardless of organization type—government or commercial—managers are responsible for mission accomplishment. Effective allocation of scarce resources is a key factor in achieving mission accomplishment. Major resource investments, such as capital equipment, require in-depth cost/benefit analysis and management. Well thought-out acquisition and supportability strategies are essential to optimizing total ownership costs (TOC) (acquisition cost and life-cycle operating cost) and operational availability (Ao).

Capital equipment requires support over the product life cycle. Effective support does not just happen. Planning for support is essential to ensure equipment availability and control of operating costs. A Product Support Plan (PSP) delineates how the organization intends to support and sustain the product over its life cycle. Effective Product Support Planning enables managers to optimize equipment availability to attain equipment performance capabilities and control operating costs.

The Product Support Plan:
A Roadmap for Success

The PSP is an integrated life-cycle plan that addresses customer performance requirements, product attributes, support processes, performance measurement, and resource requirements. The PSP explains how managers will meet customer-defined operational availability, supportability, and affordability objectives. A PSP is a roadmap identifying product life-cycle milestones, performance metrics, and plans of action to ensure equipment is available to fulfill the mission.

Product Support Planning: Adding Value

Booz Allen Hamilton adds value to the PSP development process by applying a disciplined approach, as well as the knowledge and skill of subject matter experts (SME) in acquisition and operational logistics, systems engineering, performance-based supportability planning, and cost analysis. These SMEs leverage lessons learned on major acquisitions, modifications and upgrades, and sustainment programs across government and commercial projects when developing a PSP. Exhibit 1 (see page 2) shows examples of these lessons learned.

Product Support Planning:
Optimizing Availability and Cost

Having equipment available when needed, attaining the required return on investment (ROI), and controlling operating costs are key management objectives. Equipment does not last forever. All durable equipment has a useful life. Effective

preventive and corrective maintenance, as well as product improvements, can prolong equipment useful life. To achieve maximum effectiveness, organizations must plan maintenance and product improvements in advance to ensure resources are available. Ninety percent of total life-cycle costs are determined in the design and development phase, highlighting the criticality of developing a PSP early in the project life cycle.

Exhibit 1
Lessons Learned

Designing for Availability: Define RMA key performance parameters to achieve operational needs. An aircraft acquisition program defined only one measure, operational availability (Ao), leaving individual component RMA and other measures undefined. Allocate RMA at the individual product level (down to configuration items) and include support processes. Translate these measures into performance specifications and contract requirements using detailed descriptions of deliverables and test requirements.

Right-sizing Logistics: Spiral or Evolutionary development programs require tailored logistics support to fit the scale, cost, and timing of the program. Technology turnover, production lead times and program schedules must drive spares, support equipment, and technical data requirements to fit scale and timing of changing product baselines. Using contractor maintenance/logistics until reaching an end state is a best practice.

Integrating Commercial Off the Shelf Products: An avionics program missed schedule milestones and was unsupportable because the team failed to manage interface control between COTS systems and the legacy ship. Interface control must be defined up-front, and diligently managed. Define commonality and modularity for integration and to minimize logistics needs. Ensure built-in test has the reliability needed to support the maintenance plan. Clearly define technical data use rights, form/format, and means for updates. Use best-value performance based contracting for long term out-sourced support.

Supporting Software Intensive C4 Products: Failure to define change management processes & responsibilities, engineering authority, and data rights will prevent timely, effective support. Define life cycle CM up-front. Define how, when, and by whom patches, updates, and certification/accreditation will be supported to integrate into the common operating picture network. Use open systems architecture to facilitate future product upgrades.

Source: Booz Allen Hamilton

Product Support Planning enables managers to influence design during product development by integrating logistics performance measures and requirements into engineering design analysis and reviews. Defining logistics requirements, such as technical data, spare parts strategy, and support equipment needs, ensures sufficient lead time to acquire these items, takes advantage of economy of scale (e.g., spares can be acquired in conjunction with production), and allows for concurrent development, which mitigates the risks of late delivery of logistics support. Integrating logistics into design enables managers to make informed design trade-off decisions with respect to their impact on life-cycle support.

During the operations and support (O&S) phase, Product Support Planning helps managers sustain operations, increase equipment availability, and deliver operational effectiveness at an acceptable cost. The PSP is developed with two generally accepted facts in mind: more than 60 percent of product life-cycle cost is incurred during O&S, and more than 80 percent of federal government agencies' (e.g., Department of Defense [DoD], Department of Homeland Security [DHS]) budgets are allocated to O&S. Therefore, managing cost is a primary purpose and benefit of Product Support Planning. By defining measures that identify negative trends in equipment performance, integrated logistics support (ILS)[1] analysis and a well-developed PSP can help product managers anticipate, control, and resolve diminishing manufacturing source/material shortage (DMSMS), obsolescence problems, and product material failures caused by product reliability erosion. Using equipment performance trend information and understanding technology cycles enables managers to be proactive by planning product improvements and budgeting to execute these efforts. Effective Product Support Planning arms managers with knowledge of when to insert new technology or redesign low-reliability parts before these items adversely affect equipment availability and operating costs. Exhibit 2 shows how effective Product Support Planning can improve a notional product life-cycle total cost growth line

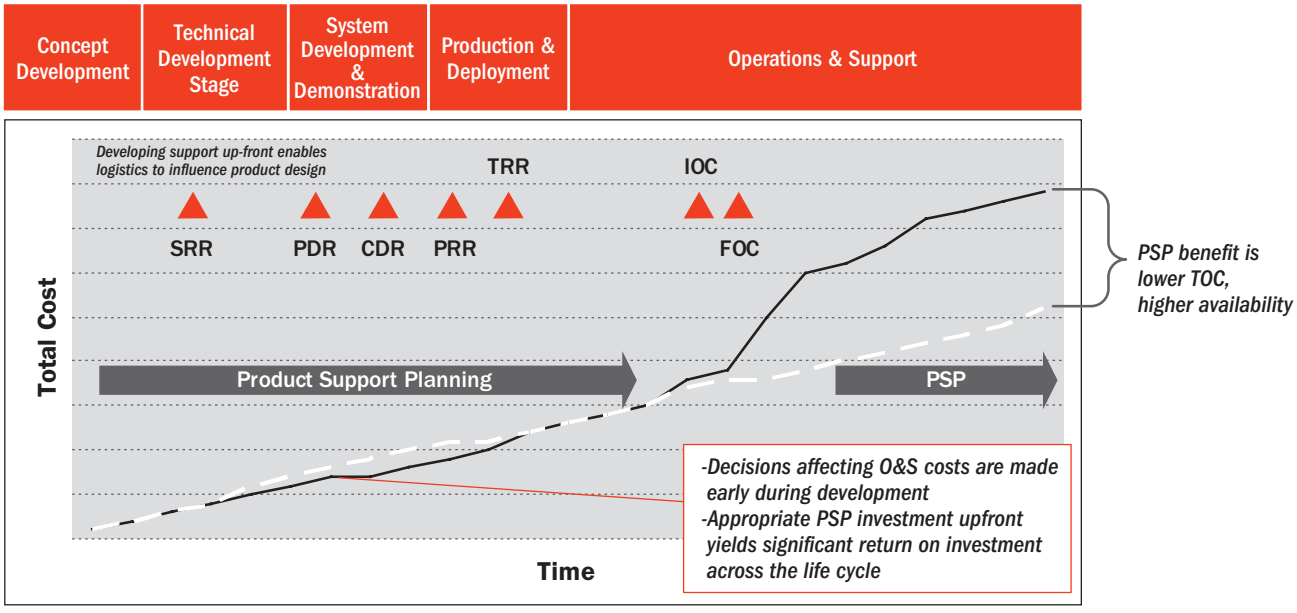
[1] ILS focuses on 10 elements of support: maintenance planning, supply support, technical data, training and training equipment, support equipment, facilities, computer resources, manpower and personnel, packaging/ handling/storage/transportation, and design interface.

(see the solid black line). Product managers can control availability and cost using metrics and action plans created from analysis and PSP development. The objective is to enable managers to anticipate the need for product improvements and implement change before product availability or cost problems affect mission readiness. Prompt management actions taken when trigger points are reached (such as a steep increase in operating costs or a significant decline in equipment availability or logistics response times) will lower total life-cycle operating costs and increase equipment availability. PSP-generated improvements will lower TOC (see the dotted white line in Exhibit 2). It is important to note that the dotted line has a higher total upfront cost during the development and production phases as a result of the acquisition of detailed technical data to facilitate competitive component manufacturing and greater reliability, maintainability, availability (RMA) analysis. These upfront investments enable the development of robust repair capabilities, such as highly reliable diagnostics, and yield long-term returns, such as lower TOC and higher ROI.

Product Support Planning: Delivering Product Availability

The influence of Product Support Planning on supportability, availability, and total costs is not limited to the design, development, and production phases of a project. The analysis and planning for logistics support involved in PSP development lays out a roadmap for life-cycle support. Integration of logistics engineering and performance-based logistics (PBL) into Product Support Planning is essential to achieving product performance and cost goals. Understanding performance trends and having a plan to eliminate/mitigate adverse impacts are goals of Product Support Planning. Establishing triggers to prompt action, such as a 10-percent decline

Exhibit 2
Life-Cycle Product Support Planning

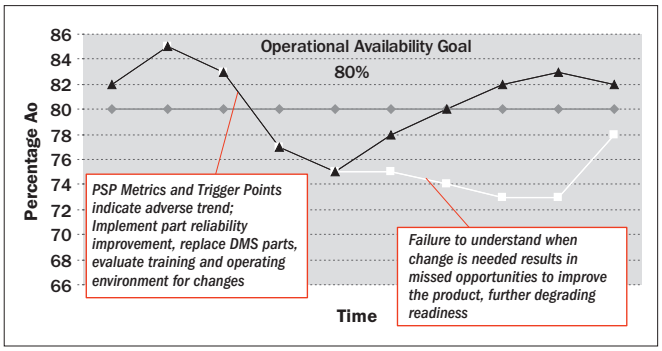


LEGEND
SRR = System Requirements Review; PDR = Preliminary Design Review; CDR = Critical Design Review; TRR = Test Readiness Review; IOC = Initial Operational Capability; FOC = Full Operational Capability; TOC = Total Ownership Cost; PSP = Product Support Planning

Source: Booz Allen Hamilton

in equipment availability over a prescribed time period, drives a root cause investigation to identify a way to reverse the trend. Root cause analysis may lead to possible product design improvement, changes in maintenance, or changes in operation to reverse negative performance trends. Exhibit 3 shows a notional example of the positive impact of a PSP. The horizontal line (with diamonds) shows a notional 80 percent availability requirement, the black line (with triangles) indicates achieved equipment availability with the positive impact of improvement actions resulting from Product Support Planning, and the white line (with squares) indicates notional equipment availability without the benefit of product and process improvements resulting from a PSP.

Exhibit 3
Notional Availability Impacts



Source: Booz Allen Hamilton

Product Support Planning is Life-Cycle Planning

A PSP is a living document initiated for the acquisition of new capital equipment as soon as an acquisition project starts. Planned product design attributes and support processes are key elements that influence PSP development. In a PSP, managers should assess the impact that changes in user requirements, operating environment, technology, and resource availability have on equipment availability and TOC. More importantly, the PSP should delineate the risk mitigation associated with these changes in actionable plans.

Linking PSP development and updates to major project milestone activities, such as design reviews or contract events, enhances the relevance of the PSP and infuses discipline into the Product Support Planning process. For example, an initial PSP is developed around System Requirements Review (SRR), and updates to the PSP occur around Preliminary Design Review (PDR) and Critical Design Review (CDR) (depending on the complexity and the degree of design change between reviews). The PSP is baselined around Production Readiness Review (PRR) and updated iteratively as changes occur. Exhibit 2 (page 3) depicts this type of event-driven PSP development.

Product Support Planning is Performance Based

The PSP is the product of integrated planning involving the coordination of equipment users, project managers, engineering, ILS analysts, financial managers, other managers, and SMEs across acquisition and sustainment organizations. Product Support Planning is inherently performance based and focuses on key product and support process attributes to achieve operational effectiveness. The PSP defines operational availability in measurable terms for test, verification/validation, and operational logistics assessment. Ensuring design performance specifications and operational performance measures are complementary is a critical step to ensuring traceability to customer-defined requirements throughout the product life cycle. Defining the “right” performance metrics to trigger product manager action is essential to PSP development. Metrics must be tailored to the customer’s mission and organization, logistics processes, and product attributes. Metrics identify trends and trigger points, telling managers to implement product improvements or change support processes to deliver needed product availability at an affordable cost. Exhibit 4 contains an example of commonly used logistics metrics (listed in no specific order).

Exhibit 4
Examples of Logistics Metrics

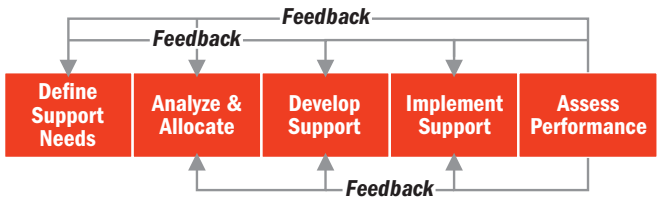
Operational Availability (Ao)	Cost per Operating Hour
Maintenance Man-Hours Per Operating Hour	Parts Repair Turnaround Time
Mean Time Between Maintenance	Customer Wait Time
Mean Time to Repair	Supply Effectiveness (order fill rates)
Built-In Test Reliability	Warranty Parts Return Time

Source: Booz Allen Hamilton

The Product Support Planning Process

No two PSPs and planning efforts are the same. A disciplined, repeatable process is needed to accommodate differences in product attributes and support infrastructure to deliver an executable PSP. The process follows a systems engineering approach that involves five basic steps: identify, analyze and allocate, develop, implement, and assess. Feedback is an essential function in the process. It provides information on verification/validation of customer-defined requirements throughout the product life cycle. Exhibit 5 depicts the Booz Allen Product Support Planning process.

Exhibit 5
PSP Process



Source: Booz Allen Hamilton

The value of this process is in translating customer operational performance needs into meaningful, measurable, and achievable metrics for use during product development, manufacture, and operations.

Product Support Planning: Integrating Engineering and Logistics

Understanding the measures of operational performance that affect supportability (e.g., equipment availability and life-cycle costs) enables program managers to make informed trade-off decisions. A PSP leverages the inherent interdependence of engineering and logistics, regardless of whether the product is a major weapons system or an upgrade or modification project, or whether the product is hardware, software, developmental, commercial off-the-shelf (COTS), or a non-developmental item (NDI). Integrating supportability into the design and engineering processes allows key product support considerations to influence engineering decision making. ILS analysis forms much of the input used in Product Support Planning. To influence design, organizations must define product support and complete key analysis before major technical reviews. Integrating Product Support Planning and ILS into technical reviews is essential to delivering supportable equipment. Exhibit 6 (see page 6) identifies key ILS and PSP activities related to project design reviews.

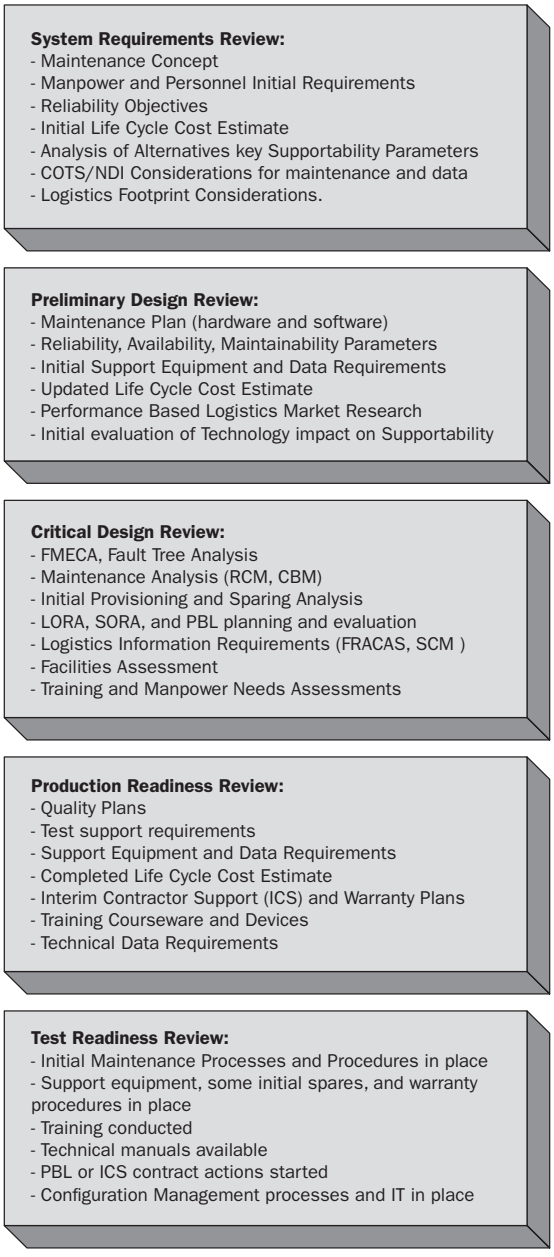
Product Support Plan Elements

PSPs are tailored to customer needs, product attributes, and support processes. A comprehensive PSP addresses a variety of topics, including ILS; supportability and logistics engineering concerns, such as reliability, maintainability, and availability; configuration control; PBL; equipment deployment and outfitting plans; product life-cycle sustainment and modernization; technology refreshment; and product management transition, from development and acquisition offices to life-cycle logistics support offices.

An Integrated Logistics Support Plan (ILSP) defines the foundation of product support in addressing how the 10 ILS elements will be applied for a product. The maintenance concept

determines, at a high level, most of the other 10 elements, including technical data, training, supply support, support equipment, facilities,

Exhibit 6
PSP in Design Reviews



Source: Booz Allen Hamilton

manpower, computer resources support, packaging, handling, storage, and transportation requirements. The product design influences these ILS elements, which in turn influences the engineering process in RMA performance measure development and analysis. The ILSP plans the support in the acquisition phase and ensures the plan's support in the sustainment phase.

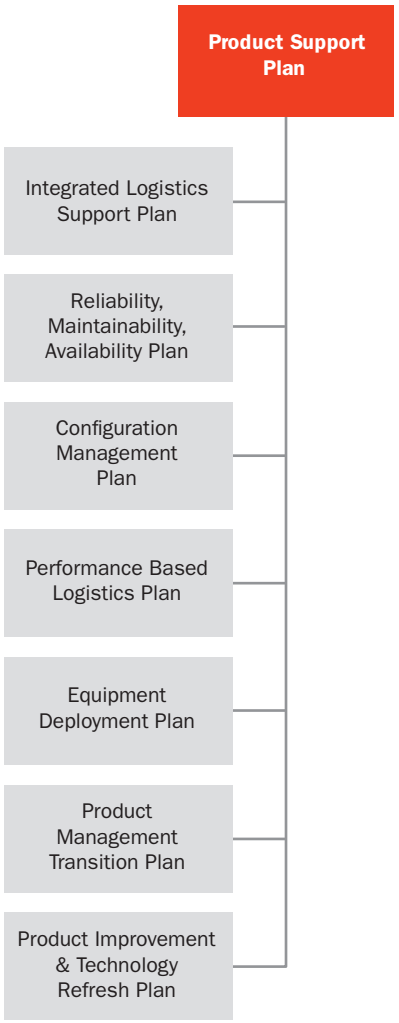
RMA measures are performance requirements documented in equipment performance specifications. These measures enable supportability concerns to influence design and to allow project managers to make informed trade-off decisions with knowledge of possible impacts on equipment availability and operating costs. Maintainability considerations and approaches, such as reliability-centered maintenance and condition-based maintenance, affect equipment performance by either extending equipment availability or lowering operating costs. To support operational use, logistics engineers translate product design parameters into operational performance measures that failure reporting and corrective action system (FRACAS) tools collect during equipment operations and support. FRACAS provides the data that identifies the need for product improvements and allows managers to sustain product availability and manage operating costs in a timely manner.

An effective PSP is much more than an ILSP. An effective PSP integrates these various elements by linking engineering and logistics analysis, planning, and implementation into a seamless life-cycle process. Exhibit 7 shows the possible elements of a PSP.

Configuration management (CM) of the hardware and software components of equipment or systems is also based on the maintenance concept. To be effective, a PSP must identify who will have authority over functional and product baselines, how and when audits will be conducted, how configuration items will be identified, and what process and information technology (IT) tools will be used to track configuration status accounting

and engineering changes. CM applies not only to hardware and software items but also to technical data. Change authority, distribution rights, and use of technical data are critical issues affecting every major system product support effort.

Exhibit 7
PSP Elements



Source: Booz Allen Hamilton

PBL is a sustainment outsourcing methodology intended to deliver the best value support. PBL analysis is mandated for DoD major acquisition programs. PBL strategies are related to ILS factors, product design, and life-cycle cost constraints. These strategies and plans drive requirements for ILS, such as technical data, sparing levels, configuration management, and life-cycle costs. The PSP includes PBL plans.

Product deployment plans define the distribution of equipment to operating locations. Deployment affects and is influenced by key ILS elements. For example, safety, security, environmental, and support infrastructure are key issues affecting deployment. The availability of support equipment, facilities, spare parts, trained personnel, and other ILS elements affects the deployment plan. As a result, the PSP must address these elements.

In many organizations, one office manages equipment development and initial production, and a different office manages the operation and support of that equipment. A transition plan delineating product management responsibilities of the acquiring and sustaining offices is needed to avoid confusion over roles and responsibilities, CM and engineering authority, contract management, and support responsibilities. The transition plan is an integral component of the overall PSP. Effectively managing the project management hand-off from acquisition to sustainment precludes organization change impacts from degrading equipment readiness and availability.

Planning for technology refresh and product improvements is an essential element of a PSP. In 21st-century equipment systems, new capital equipment uses COTS/NDI components and electronics extensively. The rapid technology turnover rate for electronics and IT in end items and support equipment, as well as DMSMS and obsolescence issues, requires advance planning to mitigate adverse impacts of equipment availability and life-cycle cost. Planning for technology refresh from the start of equipment design facilitates the integration of commonality and modularity, allowing for ease of product changes later.

In addition, planning can significantly influence ILS elements, such as supply support, technical data, and support equipment.

Product Support Planning: Summary

Product Support Planning addresses supportability throughout the product's life cycle, from initiation to disposal. The PSP integrates planning for acquisition and sustainment processes, statutory and policy requirements, and systems engineering and logistics support functions into a comprehensive plan of action and milestones. It focuses on achieving needed levels of operational effectiveness at affordable costs. PSPs help managers identify key product and process supportability metrics, which are traceable to needed capabilities, and manage acquisition and sustainment activities to achieve those metrics throughout the product life cycle. PSP development requires a disciplined, systems-focused process that supports planning for complex major acquisition programs or can be tailored to support smaller upgrade or modification projects. PSP development, maintenance, and implementation are not trivial tasks. They require management commitment to allocate sufficient resources, often taking those resources away from demanding daily tasks. Booz Allen's logistics experts' knowledge, experience, responsiveness, adaptability, and scalability provide an effective tool to meet client product support needs.

The Booz Allen Product Support Planning Advantage

Booz Allen has the people, skills, and PSP process to add value to program management organizations. Booz Allen's logistics professionals include acquisition and operational logisticians, program managers, and supportability SMEs with experience developing, analyzing, planning, managing, and implementing PSPs.

Complementing the PSP team, Booz Allen has extensive reachback to commercial and government experts in supply chain management, modeling and simulation, economic business analysis, systems engineering, configuration management, IT, logistics process design, PBL, and logistics engineering.

List of Acronyms Used

Ao	Operational Availability
CBM	Condition-Based Maintenance
CDR	Critical Design Review
CM	Configuration Management
COTS	Commercial Off-the-Shelf
DHS	Department of Homeland Security
DMSMS	Diminishing Manufacturing Sources Material Shortages
DoD	Department of Defense
FMECA	Failure Modes, Effects, Criticality Analysis
FOC	Full Operational Capability
FRACAS	Failure Reporting and Corrective Action System
ICS	Interim Contractor Support
ILS	Integrated Logistics Support
ILSP	Integrated Logistics Support Plan
IOC	Initial Operational Capability
IT	Information Technology
LORA	Level of Repair Analysis
NDI	Non-Developmental Item
O&S	Operation and Support Phase
PBL	Performance-Based Logistics
PDR	Preliminary Design Review
PRR	Production Readiness Review
PSP	Product Support Plan
RCM	Reliability Centered Maintenance
RMA	Reliability, Maintainability, Availability
ROI	Return on Investment
SCM	Supply Chain Management
SME	Subject Matter Expert
SORA	Source of Repair Analysis
SRR	System Requirements Review
TOC	Total Ownership Cost
TRR	Test Readiness Review

What Booz Allen Brings

Booz Allen Hamilton has been at the forefront of management consulting for businesses and governments for more than 90 years. Providing consulting services in strategy, operations, organization and change, and information technology, Booz Allen is the one firm that helps clients solve their toughest problems, working by their side to help them achieve their missions. Booz Allen is committed to delivering results that endure.

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Contact Information:

ATLANTA

Kirk Waldrop
Sr. Associate
404-589-4127
waldrop_kirk@bah.com

ARLINGTON

Dick Lohrmann
Sr. Associate
703-526-2420
lohrmann_dick@bah.com

Timothy Surabian
Associate
703-526-2468
surabian_timothy@bah.com

MCLEAN

Mike Jones
Vice President
703-902-3833
jones_mike@bah.com

Tony Kime
Principal
703-377-6599
kime_anthony@bah.com

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