Welcome

Learning Objectives

Upon completion of this lesson, you will be able to:

- Describe the difference between life cycle cost and Operating and Support cost
- Describe the Operating and Support Cost Key System Attribute
- Describe the role of Operating and Support cost in affordability
- Describe the major influences and cost drivers that affect Operating and Support costs

Closed Captioning

Upon completion of this lesson, you will be able to:

- Describe the difference between life cycle cost and Operating and Support cost,
- Describe the Operating and Support Cost Key System Attribute,
- Describe the role of Operating and Support cost in affordability and,
- Describe the major influences and cost drivers that affect Operating and Support costs.

Introduction to the PSM and Affordability

The majority of the costs incurred over the life of a typical weapon system occur after the system is fielded.

The vast majority of those costs are associated with operating and supporting (O&S) of that weapon system.

The Product Support Manager (PSM) plays a key role in defining the infrastructure that will drive those costs and in operating that infrastructure once the weapon system is delivered to the warfighter.

In short, the PSM is a major player in achieving affordability.

What is Affordability?

Affordability has many definitions. As it applies to the PSM and Operating and Support (O&S) cost estimating, it is defined as the following:

14 Sep 2010 USD(AT&L) memo:

- *"Affordability means conducting a program at a cost constrained by the maximum resources the Department can allocate for that capability."*
- *". . . this guidance will apply to both elements of a program's* ***life cycle cost*** *– the acquisition cost (typically 30 percent) and the operating and support cost (typically 70 percent)."*

3 Nov 2010 USD(AT&L) memo:

- *"As a basis for affordability analysis, you will use standard budget categories to the extent possible. Representative examples include: tactical wheeled vehicles, tactical aircraft, surface combatants, and communications satellites."*

Operating and Support (O&S): A Closer Look

As we move through this lesson, we will take a top-down view of how Operating and Support (O&S) costs impact other areas of cost estimating such as Life Cycle Cost and Key System Attributes.

As well, we will review how O&S ultimately impacts affordability.

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Long Description

Balance scale with man in suit on one arm and a piggy bank with money on the other arm.

Life Cycle Cost Definition: A Broad Scope

The definition of Life Cycle Cost is quite broad and is represented in the ***DoD 5000.4-M Department of Defense Manual Cost Analysis Guidance and Procedures*** as the following:

- The Total Cost To The Government For A Program Over Its Full Life, and Includes The Costs Of:
  - Research and development
  - Investment in mission and support equipment (hardware and software) and initial inventories, training, data, facilities, etc.
  - Operating and support
  - Demilitarization, detoxification, or long term waste storage (where applicable)
- Life Cycle Cost Includes:
  - ALL Work Breakdown Structure (WBS) element
  - ALL affected appropriations
  - Contractor and in house effort
  - Costs to use existing assets

Life Cycle Cost (LCC) and Operating and Support (O&S) Cost

Why make the distinction between LCC and O&S? The distinction is made here because of a mandatory Key System Attribute (KSA) called "Operating and Support Cost." It is important to understand what is and is not included in that KSA.

Life Cycle costs are made up of several KSAs. These include Research and Development Cost, Operating and Support (O&S) Cost, Production/ Deployment Cost, and Disposal Cost. This is represented by the following formula:

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Long Description

Animated graphic image depicting how Life Cycle Costs are made up of several Key System Attributes (KSAs) including:

- Research and Development Cost,
- Production/Deployment Cost,
    - These first two costs are considered Acquisition Costs
- Disposal Cost, and
- **Operating and Support (O&S) Cost**

Operating and Support (O&S) Cost

In the new JCIDS Manual of 19 January 2012, the KSA formerly called "Ownership Cost" was changed to "Operation and Support Cost."

It is important to note that while O&S refers to "Operation," this KSA is synonymous with "OPERATING" and Support Costs.

So what changed?

The previous KSA excluded certain costs that ultimately were determined to be appropriately included, hence the change.

Previously, the KSA did not include any system-specific training or indirect costs. Now, it does.

Operating and Support (O&S) Cost, Cont.

As of 2012, Operating and Support Cost includes:

- All O&S categories as defined by the Cost Assessment and Program Evaluation Office (CAPE)
- Unit Operations such as energy (i.e. fuel, petroleum, oil, lubricants, electricity)
- All maintenance
- Sustaining support (with the exception of System Specific Training)
- All continuing system improvements

Difference between LCC and O&S

Remember the difference between Operating and Support (O&S) cost and Life Cycle Cost.

Life cycle cost consists of research and development costs, investment costs, operating and support costs, and disposal costs over the entire life cycle. The new Operation and Support Cost KSA is one of the mandatory Sustainment KSAs.

Looking at what is included in this KSA, the PSM will obviously play a significant role in determining what these costs will be and in managing them once the system is fielded.

For further clarification of these definitions, review Chapter 3 of the Defense Acquisition Guidebook.

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Long Description

Apple and orange representing life cycle cost and operating and support cost.

Knowledge Review

You are the PSM in an initial O&S cost estimating meeting with your logistics team. One of the team members says, "I'm confused by the terms life cycle cost and O&S cost. What's the relationship?" You reply, "_____"

- [x] O&S cost is a subset of LCC costs.
- [ ] LCC is independent of O&S cost.
- [ ] O&S cost only applies to maintenance.
- [ ] LCC plays a key role in defining infrastructure that will drive cost.

Check Answer

O&S cost is a subset of LCC costs. Life cycle cost (LCC) consists of research and development costs, investment costs, operating and support (O&S) costs, and disposal costs over the entire life cycle.

Knowledge Review

One of your IPT members comes to you and says, "I was reading that one of the Sustainment Key System Attributes is Ownership Cost. I seem to recall that the terminology may have changed. Which is correct?"

- [ ] Total Ownership Cost
- [x] O&S Cost
- [ ] Life Cycle Cost

Check Answer

The **O&S Cost** Key System Attribute is one of the mandatory Sustainment Key System Attributes.

The PSM and Acquisition Program Reviews

On April 5, 2010, Undersecretary of Defense for Acquisition, Technology and Logistics (USD AT&L) issued a memorandum entitled "Strengthened Sustainment Governance for Acquisition Program Reviews."

This important document provides essential guidance to help the PSM and the respective program manager prepare for these reviews.

According to the memo,

> *"... as part of the Department's continuing effort* ***to improve program life cycle management****, (DoD is committed to) strengthen sustainment governance by conducting detailed reviews of key elements of sustainment planning for all ACAT ID weapons system programs at decision and other review points in the acquisition process. Increasing visibility of sustainment factors is vital to ensuring we deliver a program that meets Warfighter materiel readiness objectives with long-term affordability consideration.* ***To facilitate a comprehensive review and provide the required information in a standardized format, program managers are to use the sustainment quad chart (contained in the memo) to report the status of sustainment planning at OIPT and Defense Acquisition Board reviews.*** *Reporting begins at program initiation and continues through each subsequent milestone, the production decision, and at other reviews when directed."*

The Sustainment Quad Chart

This is an example of a Quad Chart and the sample program under review is labeled "ABC." Let's review the information in the O&S lower right quadrant of the chart.

Select the highlighted section to enlarge and review the data.

SAMPLE PROGRAM: "ABC"

Product Support Strategy

Sustainment Approach
- Current (initial CLS covering total system)
- Future (sub-system based PBL contracts)

Issues
- Shortfall in O&M funding in FYDP
- Reliability and availability estimates are below goals
- LCSP requires update before DAB

Resolution
- POM request for O&M restoration submitted
- Reliability improvement plan with clear RAM goals up for final signature
- LCSP in draft

Sustainment Schedule

Metrics Data

Metric	Antecedent Actual	Original Goal	Current Goal	Current Estimate/ Actual
Materiel Availability	76%	80%	77%	71%
Materiel Reliability	37 hrs	50 hrs	50.5 hrs	48 hrs
Ownership Cost	245.6B	385.5B	395.0B	395.1B
Mean Down Time	12 hrs	20hrs	18 hrs	15 hrs

O & S Data

Cost Element	Antecedent Cost	ABC Original Baseline	ABC Curren Cost
1.0 Unit-Level Manpower	3.952	5.144	5.750
2.0 Unit Operations	6.052	6.851	6.852
3.0 Maintenance	0.739	0.605	0.688
4.0 Sustaining Support	2.298	2.401	2.401
5.0 Continuing System Improvements	0.129	0.025	0.035
6.0 Indirect Support	1.848	1.925	1.956
Total	15.046	16.951	17.682

Cost based on average annual cost per squadron

Total O&S	Antecedent	ABC
Base Year $M	102,995.2	184,011.9
Then year $M	245,665.2	395,147.2

Source: USD AT&L Policy Memo "Strengthened Sustainment Governance for Acquisition Program Reviews", DTD 5 Apr 10.

The Sustainment Quad Chart, Cont.

It is important for the PSM to ensure that definitions are consistent and that the quad chart correctly reflects the program's O&S data. This data includes the following elements: **(select each element to learn more)**

Cost Element

Antecedent Cost

ABC Original Baseline

ABC Current Cost

Total O&S Cost

O & S Data

Cost Element	Antecedent Cost	ABC Original Baseline	ABC Current Cost
1.0 Unit-Level Manpower	3.952	5.144	5.750
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Cost based on average annual cost per squadron

Total O&S	Antecedent	ABC
Base Year $M	102,995.2	184,011.9
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Popup Text

Cost Element

- Refer to 2007 CAIG (now CAPE) Cost Estimating Guide for definitions of individual cost elements
- These definitions should be consistent with what is submitted in the program's Selected Acquisition Report or SAR ("SAHR") O&S cost section (which should be based on identical definitions)

Antecedent Cost

- O&S cost of the existing program reported using the CAPE cost elements
- O&S costs are based on average annual cost per hull, squadron, brigade, etc.
    - Use the SAR as the basis for determining the unit level and cite beneath first box what costs are based on

New Program ABC Original Baseline

- New program O&S cost broken out over the CAPE cost elements, according to their original SAR submission.
- Costs are based on average annual cost per hull, squadron, brigade, etc.

New Program ABC Current Cost

- Current program cost broken out over the CAPE cost elements according to the most recent projections, not last SAR submission
- Costs are based on average annual cost per hull, squadron, brigade, etc.
- Color rating assigned by PM, based on increase since original baseline
    - Green – At or below original baseline or < 10% increase
    - Yellow – Increase > 10% but < 20% vs. original baseline
    - Red – Increase > 20%

Total O&S Cost

- Comparison of antecedent program cost vs. the new program's current cost presented in totals in both Then Year dollars and Base Year dollars.
    - For the new program "ABC," use the most recent estimate, not the most recent SAR values
    - O&S cost totals should be consistent with the CAPE estimate

O&S Cost and Affordability

Dealing with O&S cost in an affordability context presents real challenges to the PSM and the program manager. The affordability dilemma is short term pain vs. long term gain. The department places great emphasis on affordability of weapon systems. But expending funds now to realize a long term gain in the sometime distant future can often be a very hard sell. The funds are bounded by the budgetary process and the gains will consist largely of O&M dollars, so it may be tough to defend this approach.

Short Term and Long Term Affordability may be seen as the following:

- **Short term**: Bounded by the budgetary cycle. This is often related to relatively near-term procurement of goods and services.
- **Long term**: Bounded by the life of the system. Focuses on matching capabilities with requirements at a cost the taxpayer is willing to meet.

Affordability As A Requirement

The PSM will play a part in all these initiatives and probably most effectively in "Affordability."

The Under Secretary of Defense for Acquisition, Technology, and Logistics (USD AT&L's) directive memo of November 3rd, 2010 provided "Better Buying Power" initiatives implementing instructions.

These instructions specifically emphasized that affordability is to be considered on par with operational and sustainment (O&S) Key Performance Parameters (KPPs).

Under "Better Buying Power" there are five broad areas of concentration:

1. Target Affordability
2. Incentivize Affordability
3. Promote Competition
4. Improve Tradecraft
5. Reduce Bureaucracy

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Popup Text

"Better Buying Power" initiatives from the USA AT&L's Directive Memo

"At Milestone B...You will recommend for my approval to establish and document, in the Acquisition Decision Memorandum (ADM) and in the program baseline, an 'Affordability Requirement' for acquisition cost and for operating and support cost. this requirement will be the functional equivalent of Key Performance Parameters (KPPs) for baseline establishment and monitoring. You will provide cost tradeoff curves or trade space around major affordability drivers (including KPPs when they are major cost drivers) to show how the program has established a cost-effective design point for these affordability drivers."

Long Description

Five broad areas of concentration under "Better Buying Power":

- Target Affordability
- Incentivize Productivity
- Promote Competition
- Improve Tradecraft
- Reduce Bureaucracy

Affordability Concepts

One of the principal focus areas of Better Buying Power is "Should Cost/Will Cost." The program manager will look to the PSM to be a major factor in developing "Should Cost" initiatives. The PSM will play a role in both "Should Cost" design-related initiatives and in process-related initiatives both centered around the Integrated Product Support elements.

"Will Cost"

The AT&L definition of "Will Cost" is "reasonable extrapolations from historical experience." Simply put, Will Cost estimates are independent cost estimates created by CAPE or other independent cost analysis agencies.

"Should Cost"

Should Cost is a management plan for a program that is developed by the PM and the program's complete team of technical experts that identifies, documents, measures, and realizes optimization opportunities within the program that reduce costs without sacrificing performance requirements.

Knowledge Review

You are discussing the affordability of the weapon system your program is acquiring with your Program Manager and System Engineer. You are advocating spending some procurement money to achieve some reliability improvements. The point you are trying to make regarding this decision and the relationship of future O&S cost to affordability is_____.

- [ ] O&S costs do not impact affordability.
- [x] Near-term "pain" in expending procurement dollars can lead to long-term "gain" in reducing O&S costs over the life of the program.
- [ ] O&S cost sustains affordability drivers and key performance parameters (KPPs).
- [ ] O&S cost only provide short term gain.

Check Answer

O&S impacts affordability in that it provides short term pain for long term gain.

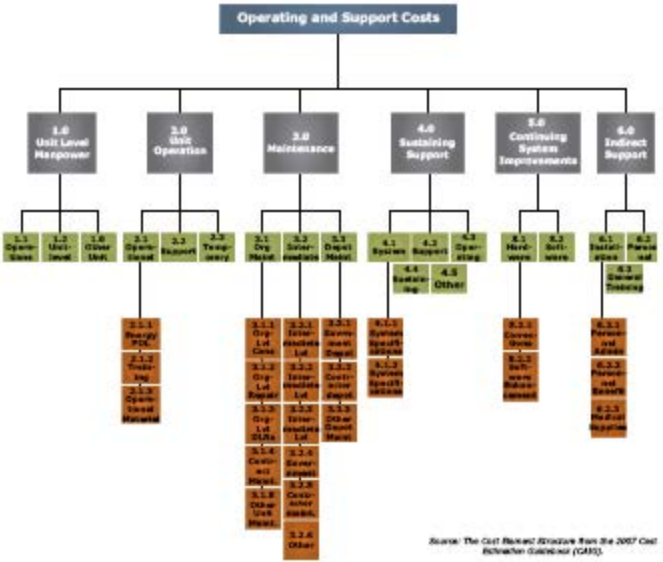
The PSM and O&S Cost

The most basic question we have to answer when focusing on reducing O&S cost is, "What's in and what's out?" Usually, the cost estimators will provide the estimates in this structure. However, the PSM will be tasked to evaluate these estimates. They must understand the estimates and, when necessary, challenge them. In order to do that effectively, the PSM must understand where the cost drivers are.

What Comprises O&S Cost?: Drivers

It is important to understand that the cost drivers have two different applications. One is from the **gross side where big chunks of cost are considered causal** cost drivers. For example, a personnel cost is a cost driver. The second, from the statistical/estimator side, cost driver usually means a **physical or performance parameter which either causes cost to change**, or is highly related to something that causes cost to change. For example, increasing the weight of a proposed aircraft will increase its estimated cost. The items on the following chart include **causal type cost drivers**.

Select the image to enlarge.



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Long Description

Operating and Support Cost chart that includes causal cost drivers.

Six high level divisions include:

1. Unit Level Manpower
2. Unit Operation
3. Maintenance
4. Sustaining support
5. Continuing System Improvements
6. Indirect Support

Know Your Cost Drivers

It is absolutely essential that the PSM thoroughly understand his or her program, from the concept of operations (CONOPS), to the design, to the potential trade-off analyses.

All of these will drive O&S costs. As a PSM, the following should be kept in mind when reviewing and assessing O&S cost drivers:

- Cost drivers vary from system type to system type to system type
- Know the cost drivers for the type of system(s) that you support
- Put the most effort into those areas that represent the largest share of the costs

Causative Cost Drivers

Knowing your system will give you insight into the kinds of questions raised below, all of which directly impact O&S costs.

- **Personnel Costs?**
  - Crew ratios
  - Maintenance workload (System Reliability and Maintainability)
  - Organization support functions (Security, Mission Planning, command and control)
- **Operating Costs?**
  - Inventory
  - Operating Tempo (OPTEMPO)
  - Mission Profiles
  - System Weight Growth (Fuel Costs)
- **Maintenance Costs?**
  - System Reliability and Maintainability
  - Support Concept (Level of Repair)
  - Overhaul/Inspection Standards
- **Sustaining Support?**
  - Amount of Support Equipment
  - Skill Levels (Operators and Maintainers)
- **Continuing Support?**
  - Size of Software Suite and Growth Over Time

The Four Pervasive Influences that Drive O&S

The system's characteristics, operating environment, support environment and age all directly influence O&S cost. The PSM must be intimately familiar with how these four influences affect cost on his or her particular program. Select each influence to learn more.

System Characteristics	Operating Environment	Support Environment	Age

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Long Description

System Characteristics
Reliability and maintainability
Technology density (procurement cost)
Evolution of cost drivers over life cycle
(shows image of computers and data flowing)

Operating Environment
Inventory size, OPTEMPO, operating stress
Deployment/CONOPS
(shows image of soldiers marching in formation)

Support Environment
Maintenance levels/Level of Repair
(military person performing repair inside airplane)

Age
Older systems being kept in inventory longer (e.g. B-52)
Older systems present more support challenges that are often more costly
(two old airplane engines sitting on ground)

Cost Drivers and Credible Estimates

Figuring out what are the cost drivers, and determining credible estimates, definitely fall into the "easier said than done" category.

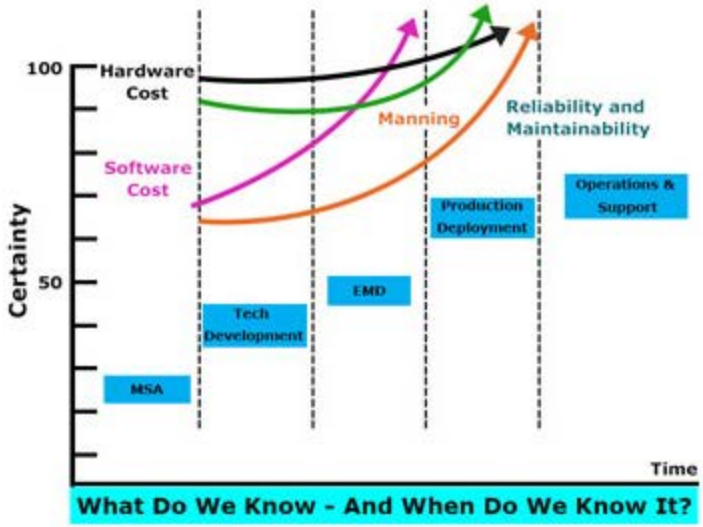
As with many other aspects of system acquisition, there are many uncertainties early in a program.

However, as more information becomes available over time, we gain more knowledge and insight.

Life Cycle Cost: Uncertainty Evolution

This chart represents a notional example of the improving certainty of cost estimates over time from the start of technology development through the life cycle. As you review this information, you will be able to gain a better perspective for hardware costs and manning. The manpower estimates usually get solidified when the users get involved at the initial systems employment and once the population of users have been produced/procured to provide an operating capability. You will also see that we have a lower level in the software cost estimate and the Reliability and Maintainability (R&M) numbers. The actual R&M values are often not known until we get into operation and support.

Select image to enlarge.



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Long Description

Graph demonstrating how certainty in estimating costs improves over the life cycle of technology development. Hardware costs are more standard and so the graph shows that the certainty starts out fairly high at the beginning and does not increase drastically. But software use and development can change and so the certainty increases only as the software development life cycle increases.

O&S Relative Cost Drivers

The chart below looks at uncertainty in a different way. At a Cost Research Symposium, participants were surveyed as to their level of confidence in how well the cost elements could be estimated. For example, 44% of the O&S cost of ships, in general, is personnel costs, while 30% is depot maintenance, and 16% unit consumption. Note that the percentages for personnel differ greatly among the categories of systems shown. The color coding relates to how well the participants felt the cost elements could be estimated. Note that Personnel Costs were highest rated, while Sustaining Support and Indirect Support were lowest rated. The arrows reflect whether the participants felt their ability to estimate that cost element was getting better or getting worse. While this survey is now somewhat dated, it does provide a general depiction of uncertainty in estimating O&S costs.

	Ships	Fixed Wing Aircraft	Rotary Wing Aircraft	Land Vehicles	Tactical Missiles	Electronics	Space Systems
Mission Personnel	44%	22%	48%	58%	8%	29%	↓ 14%
Unit Consumption	16%	15%	38%	24%	↓ 21%	13%	↑ 12%
Inter Maintenance	<1%	8%	0%	0%	12%	<1%	0%
Depot Maintenance	30%	↑ 13%	1%	1%	11%	7%	↓ 3%
Contractor Support		8%	1%	0%	4%		↓ 2%
Sustaining Support	7%	26%	11%	10%	29%	41%	↓ 66%
Indirect Support	3%	8%	1%	6%	15%	10%	↓ 3%

Legend: *Current State* — *Good* … *Poor*; *Trend* — *Better*, *Worse*

Source: Service Cost Agencies at IDA 2001 Cost Research Symposium

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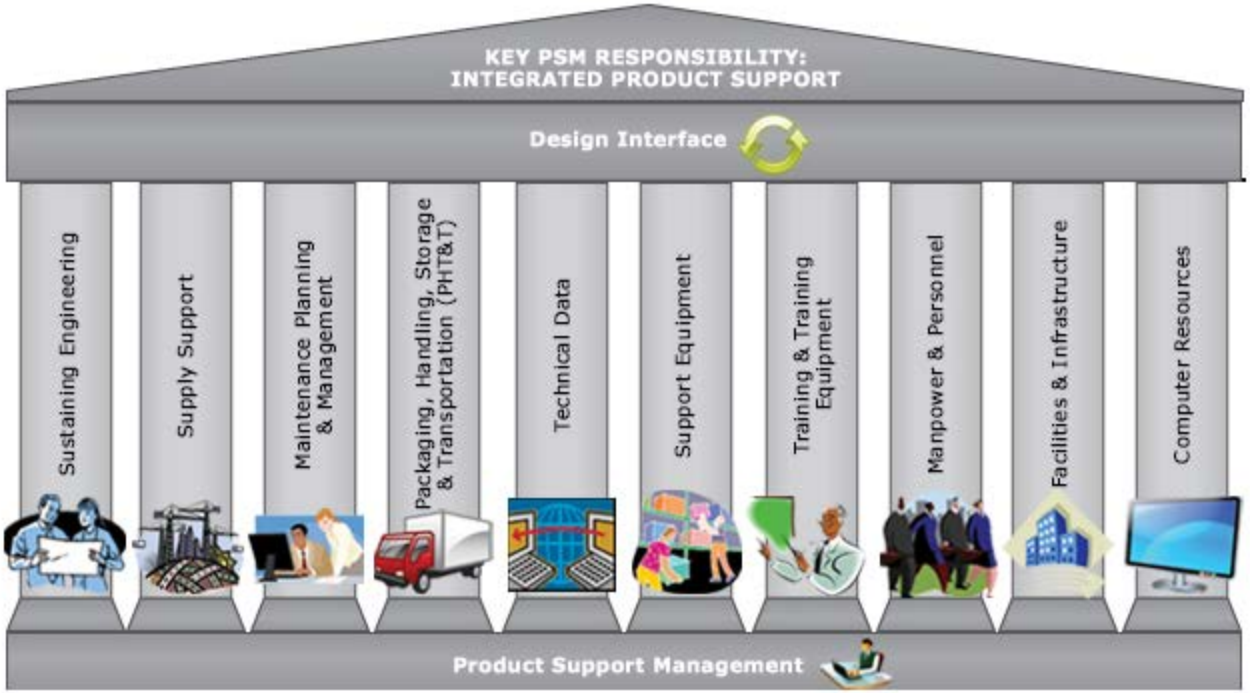
Long Description

Table showing how well some participants at conference thought specific costs could be estimated. The items they were questioned about were Ships, Fixed Wing Aircraft, Rotary Wing Aircraft, Land Vehicles, Tactical Missiles, Electronics and Space Systems while theO&S costs were specific to Mission Personnel, Unit Consumption, Inter Maintenance, Depot Maintenance, Contractor Support, Sustaining Support and Indirect Support. With regard to Personnel, the estimated costs according to the chart are as follows: Ships 44%, Fixed Wing 22%, Rotary Wing 48%, Land Vehicles 58%, Tactical Missiles 8%, Electronics 29% and Space Systems 14%.

Integrated Product Support and O&S Costs

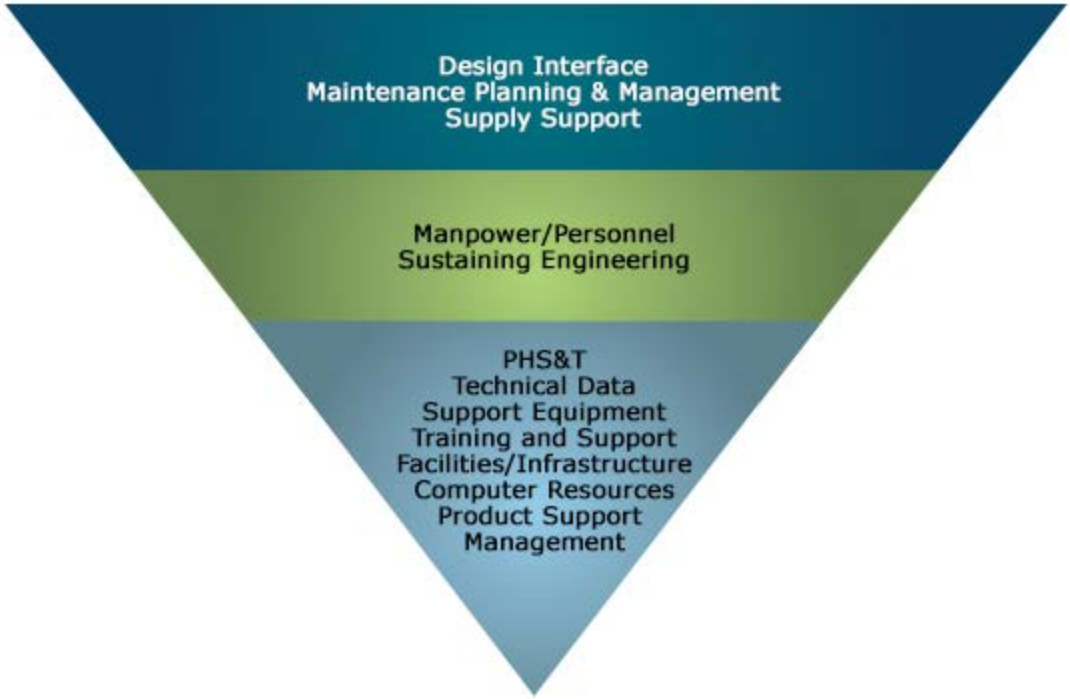
The Integrated Product Support (IPS) elements have, for many years, provided a framework and structure for life cycle logisticians in planning for life cycle product support. Similarly, each one of the IPS elements has associated Operating and Support (O&S) costs.

Select image to enlarge.



The Hierarchy of Cost Drivers

All IPS Elements are not created equal in terms of their impacts on O&S Cost. In the context of determining cost drivers, the PSM need only reflect on what IPS elements are the principal drivers in determining what our product support strategy will be. We know that Design Interface, Maintenance, and Supply Support will be the principal focus, with the remaining IPS elements falling in behind.



Knowledge Review

You've inherited an experienced logistics team and are conducting a "Brown Bag" lunch on affordability. You make the point that there are several major influences and cost drivers that affect O&S costs, which are a major factor in affordability. When asked what some of them are, you respond_____.

- [ ] System's characteristics, operating support, 3 IPS elements, and age
- [ ] System's characteristics, CAPE, operating environment, and operational support
- [x] System's characteristics, operating environment, support environment, and age
- [ ] System's characteristics, life cycle costs, and age

Check Answer

The major influences and cost drivers that affect O&S include **system's characteristics, operating environment, support environment, and age.**

Lesson Summary

To summarize, in this lesson you learned the following:

- The program manager and the PSM play a major part in determining and achieving affordability in that he or she defines the infrastructure that will drive the Operating and Support (O&S) costs and in operating that infrastructure once the system is delivered to the warfighter.
- Life Cycle costs are made up of several KSAs that include Research and Development Cost, Operating and Support (O&S) Cost, Production/ Deployment Cost, and Disposal Cost.
    - The O&S cost are those resources required to operate and support a system, subsystem, or a major component during its useful life in the operational inventory.

Lesson Summary, Cont.

To summarize, in this lesson you learned the following, (cont.):

- PSMs can measure affordability and, more specifically, O&S cost to provide short term pain for long term gain, through Acquisition Program reviews using tools such as the Sustainment Quad chart and understanding the "Better Buying Power" initiatives.
- The PSM will be tasked to evaluate cost estimates and must understand, and when necessary, challenge them. In order to do that effectively, the PSM must understand what are the cost drivers. For example, caustic cost drivers, pervasive influences that drive O&S, and relative cost drivers.
- Each of the IPS elements has associated Operating and Support (O&S) costs but the principal drivers of O&S include Design Interface, Maintenance, and Supply Support.

Lesson Summary, Cont.

Congratulations! Now that you have completed the PSM and Affordability lesson, you should be able to:

1. Describe the difference between life cycle cost and Operating and Support (O&S) cost.
2. Describe the O&S Cost Key System Attribute (KSA).
3. Describe the role of O&S cost in affordability.
4. Describe the major influences and cost drivers that affect O&S costs.

Lesson Completion

You have completed the content for this lesson.

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