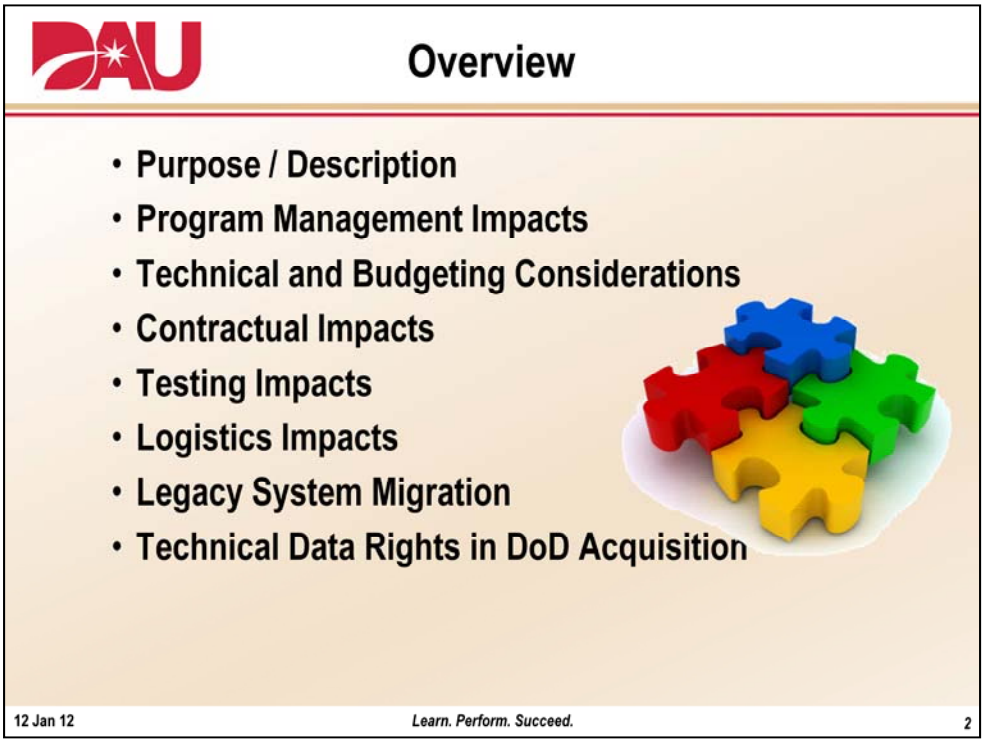
Defense Acquisition University

Open Systems Architecture and Technical Data Rights…Management Approaches

Keeping up with the changing world... by designing and building weapon systems using an open systems approach.

Better Buying Power Gateway: https://dap.dau.mil/leadership/Pages/bbp.aspx
Better Buying Power Community of Practice: https://acc.dau.mil/CommunityBrowser.aspx?id=432727

MA Brief 8-25-2011



Overview of what we are going to discuss.

NOTE: Many years before the recent BBPi emphasis on Open Systems, the DoD established a Joint Task Force for "Modular Open Systems Approach (MOSA)". The MOSA effort grew out of a less-than successful emphasis by DoD and the Federal government during the early 1990's on "purely" open systems, to the extent that there was a Congressionally-level mandate on open systems. However, it was found that the emphasis was misplaced in that open systems were not cost-effective in all cases. The MOSA task force developed an open system approach in 2004 that first incorporated the identification of "key interfaces" as potential open system targets and then factored in business case trade-off analyses to determine their viability.

Many programs continue to use MOSA legacy materials and their checklists which are available at: http://www.acq.osd.mil/osjtf/

Open Systems are still emphasized in DoD policies outlined in DoDI 5000.02 [Enclosure 12: Systems Engineering]; however a pending change to Enclosure 12, paragraph E12.8 states: " The term "open system architectures" will be applied to the concept formerly referred to as the "modular opens systems approach…"

Purpose / Description
USD(AT&L) Memo

- On 3 November 2010, Dr. Ashton Carter, Under Secretary of Defense for Acquisition, Technology and Logistics, signed a memorandum to Secretaries of the Military Departments and Directors of Defense Agencies outlining specific actions needed to implement his September 14 Guidance on obtaining greater efficiency and productivity in defense spending. All applicable DoD Directives and other related issuances will be updated to implement this direction and guidance within 180 days.
- Dr. Carter's September 14th memo promulgated sweeping acquisition Guidance through a "Memorandum for Acquisition Professionals" and signed out directive memoranda to his key staff elements.
- Dr. Carter's June 28th memo describing a mandate to deliver better value to the taxpayer and warfighter by improving the way the Department does business; and contains specific guidance for achieving the June 28 mandate.

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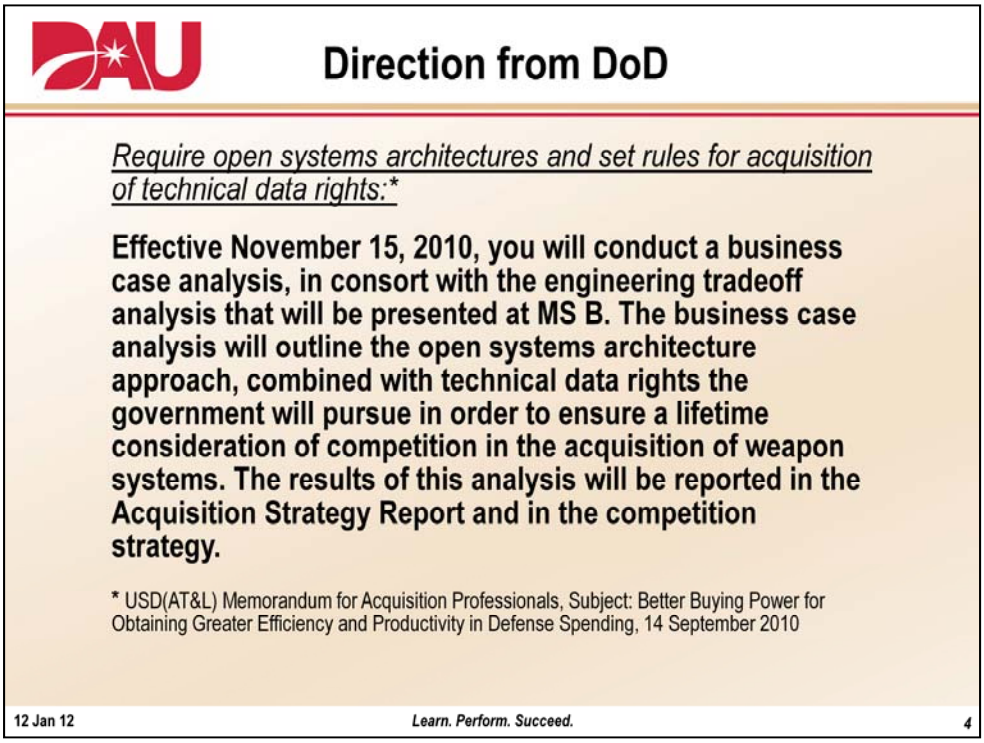
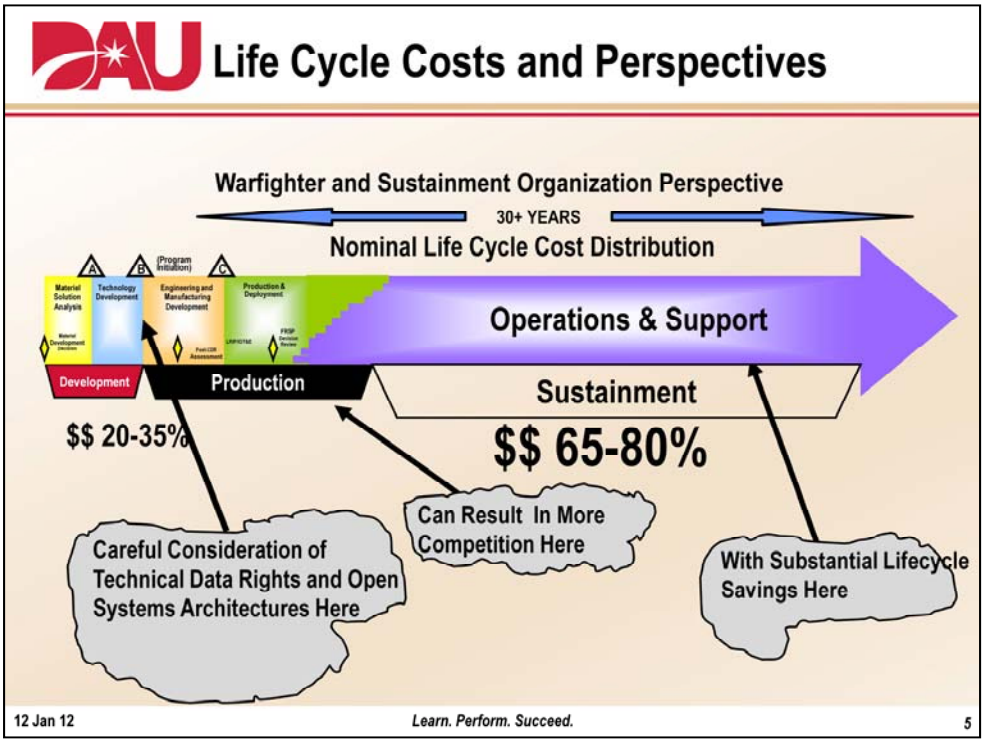
This is to remind the students that the BBPi has the backing at the highest levels and that these slides following reflect their desires for solving the continuing problems associated with increased costs of our weapons systems.

Open Systems Architectures and the associated Technical Data Rights , properly implemented, can play a key role in supporting these initiatives

These summaries of but a few of the many memos released on the subject.



This language is self -explanatory. Note that there is an engineering trade-off analysis required at Milestone B that will outline the open systems architecture approach, combined with technical data rights the government will pursue in order to ensure a lifetime consideration of competition in the acquisition of weapon systems.



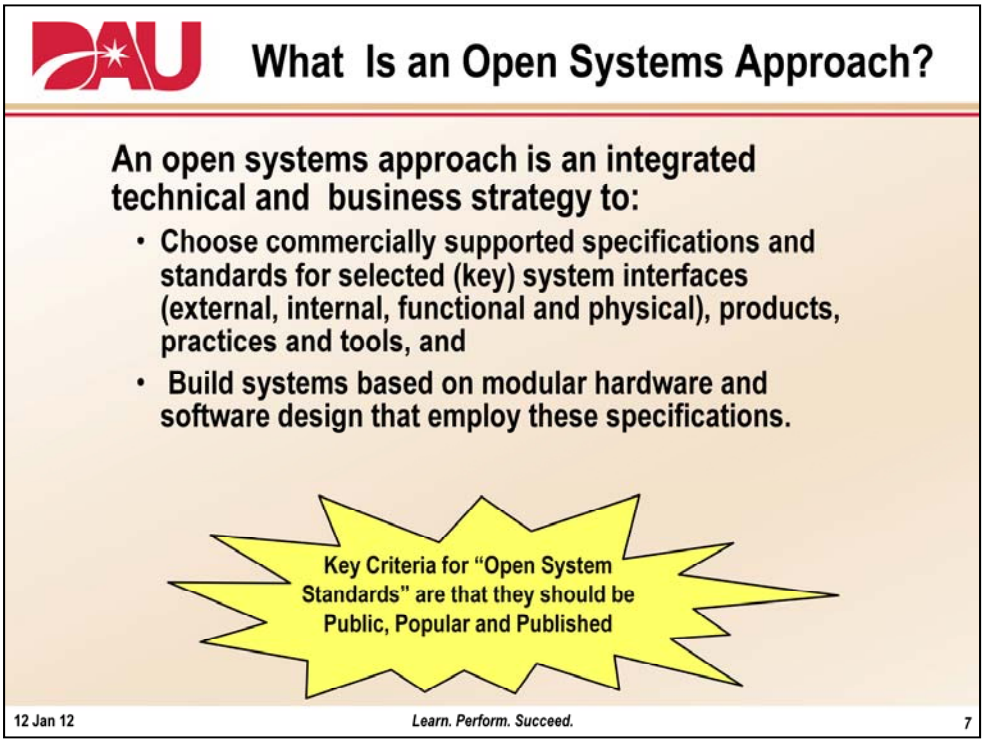
This is a well known chart of typical costs associated with the life-cycle of a major weapons system. Early development design trades and approaches with careful consideration of technical data rights and Open Systems Architectures can have a profound effect on the total costs of a programs' life-cycle that follows.

Because a system that uses open system architectures for key interfaces for it subsystems and products potentially allows a broader range of non-proprietary products to be employed, the potential for increased competition with multiple vendors in the Production Phase can provide the opportunity for substantial life-cycle savings.

The current Acquisition environment needs to be changed, the question is how?

Better Business practices can help a great amount , but there are some things that can be done technically that will also help. The pressure is on to develop and field weapons systems faster and more affordable.

OSAs can help mitigate some of the items on this slide as we will show in the slides following.



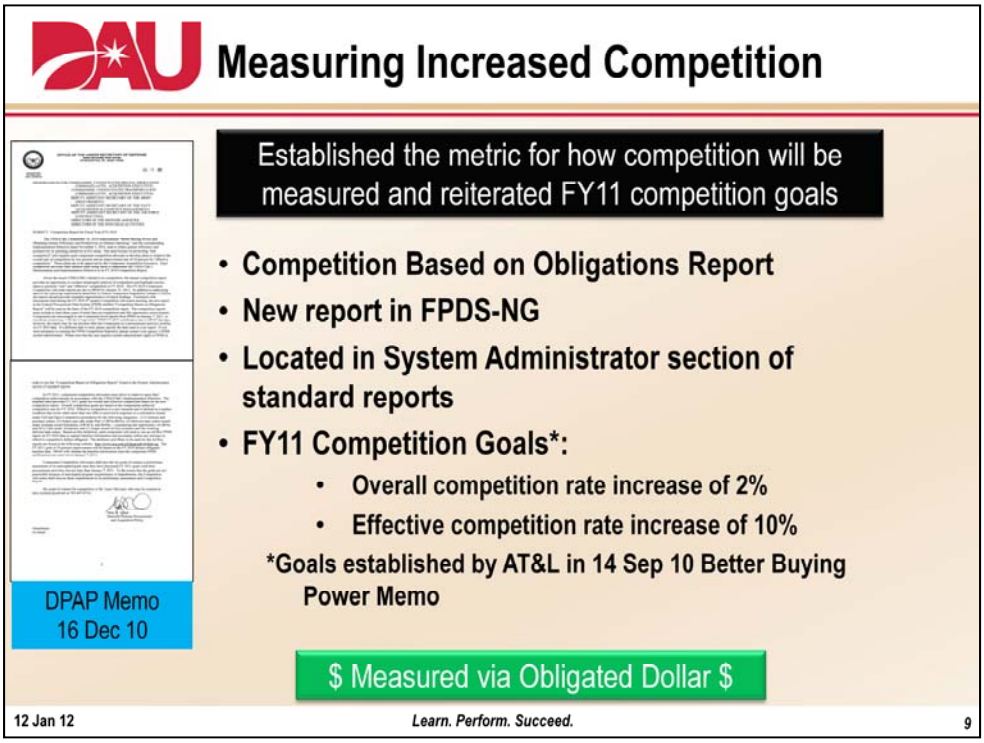
Conceptually the OSA approach is simple. However, actual implementation must be carefully controlled and all risks considered. One key attribute for open systems is that the interface standards around which the open system architecture ideally be non-proprietary or have such significant market penetration that they can be considered are *de facto* open systems.

The identification of key interfaces is important. These are typically defined as: "a common boundary shared between system modules that provides access to critical data, information, materiel or services; and/or is of high interest due to rapid technological change, a high rate of failure, or costliness of connected modules; or is important from an interoperability or net-centric standpoint."

Be prepared to get questions about the single competitive offer policy and politely defer them to later in the session.

Emphasize that real competition and effective competition are the same thing.

Caveat that for purposes of this brief:



This new reporting within FDS-NG includes competitive classification of individual TOs/DOs. Applying2% declination in competition. The delta is caused by MACs that only got one offer where changed to non-competitive.

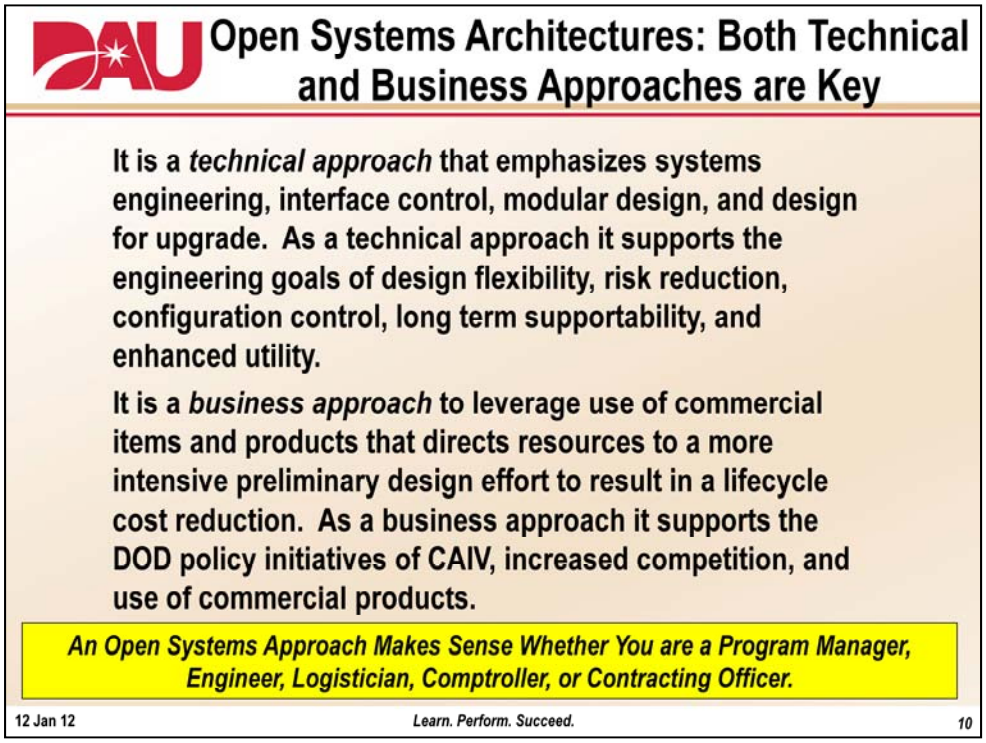
Note to audience the difference between the two FY11 competition goals. There is a much larger percentage increase goal of 10% for effective competition vice 2% for overall competition. Thus, the goal is not more competition for competition sake. Each agency must analyze its "ineffective" competition data in FY10 and each year thereafter, which areas the "ineffective competition" are occurring in, and the circumstances of such "ineffective competition.

Why DoD is being measured by dollars obligated, it is important to note that the various smaller dollar actions are a vital part of that measurement, not just the significant dollar amounts in the largest fair opportunities (e.g., LOGCAP) or stand-alone contractors. Should we provide metrics on SAP vs. non-SAP dollars obligated in previous years?

The 14 Sept 10 AT&L Memorandum stated the each agency's competition advocate must develop a plan to improve, at a minimum

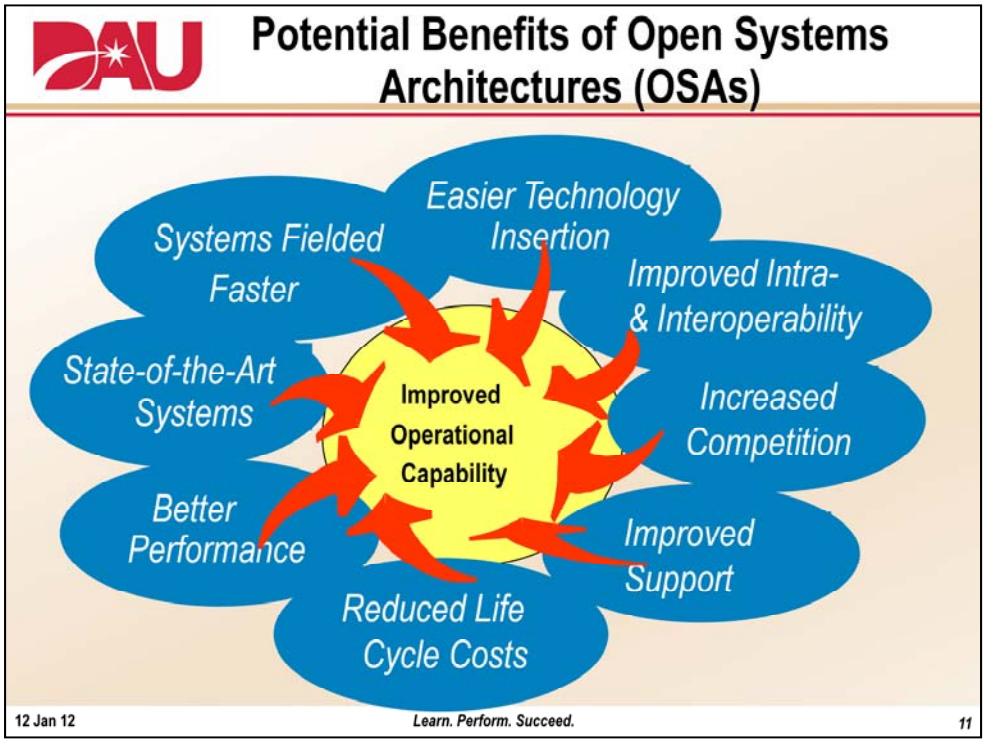
-the overall competition rate by 2% each year

-the effective competition by 10% each year, thus reducing the number of single offer competitions.



As a *technical approach an* OSA supports the engineering goals of design flexibility, risk reduction, configuration control, long term supportability, and enhanced utility.

Most important is the business aspect of OSAs as this is where the cost-savings can accrue during the long support and sustainment phases typical of DoD systems.



1.Easier Technology Insertion - Identified standard interfaces provide a path for new technology developers to assure that the migration of the technology will have a stable path for future upgrades.

2. Improved Interoperability - will be provided between systems with Open Architectures based upon common interfaces.

3. Increased Competition – Open interface standards at the parts level can lead to more competition between vendors supplying parts.

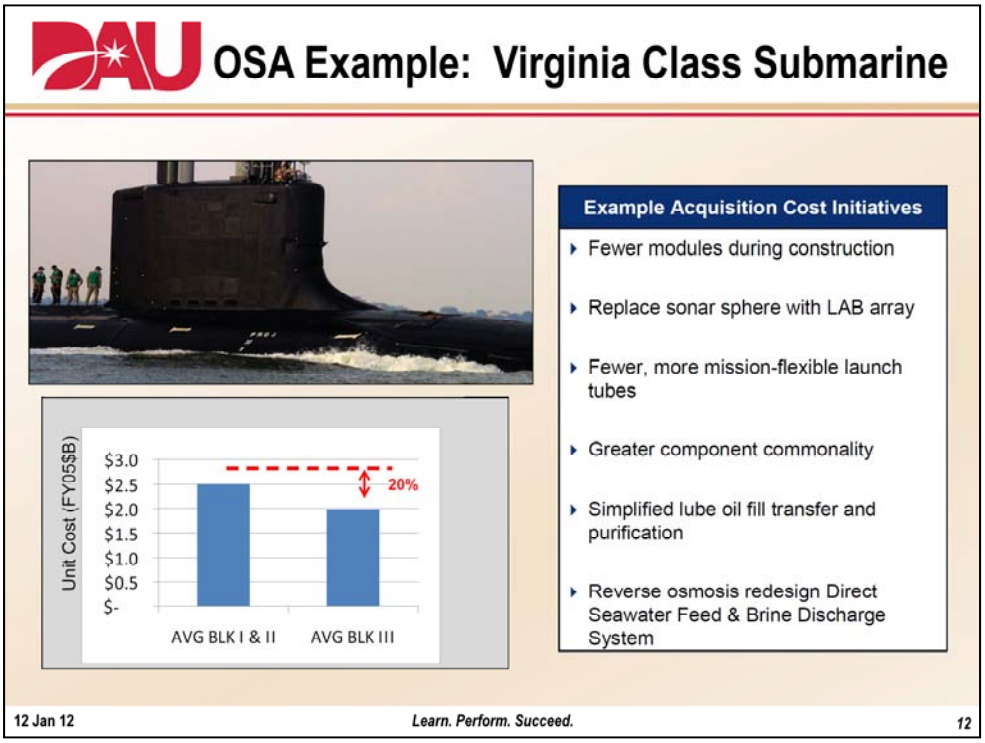
4. Improved Support –Maximum allowable technical data/licensing rights allows Government to leverage open architecture/standard interfaces leading to improved organic depot capabilities

5. Reduced Life-Cycle Support –Reduction in non-standard parts for commercial parts.

6. Better Performance – Potential avoidance of data transfer problems by using standard OSA approach

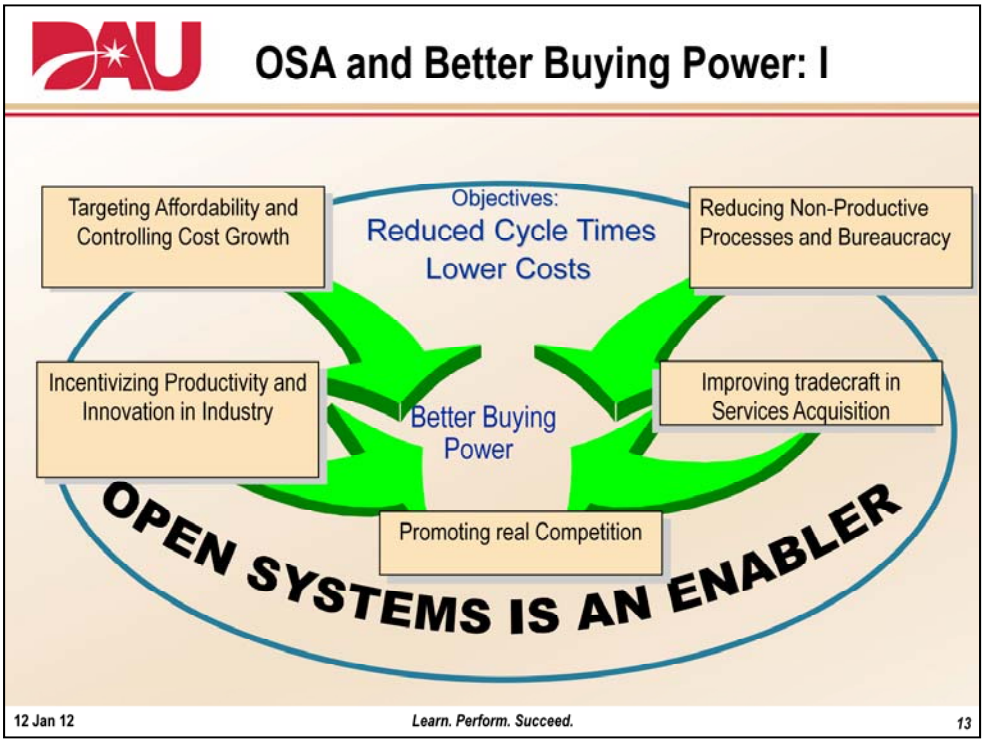
7. State-of-the-art-systems – Can enhance upgrades if using same OSA

8. Systems Fielded Faster – Using approved standards and processes in an open systems environment can lead to faster fielding of systems.



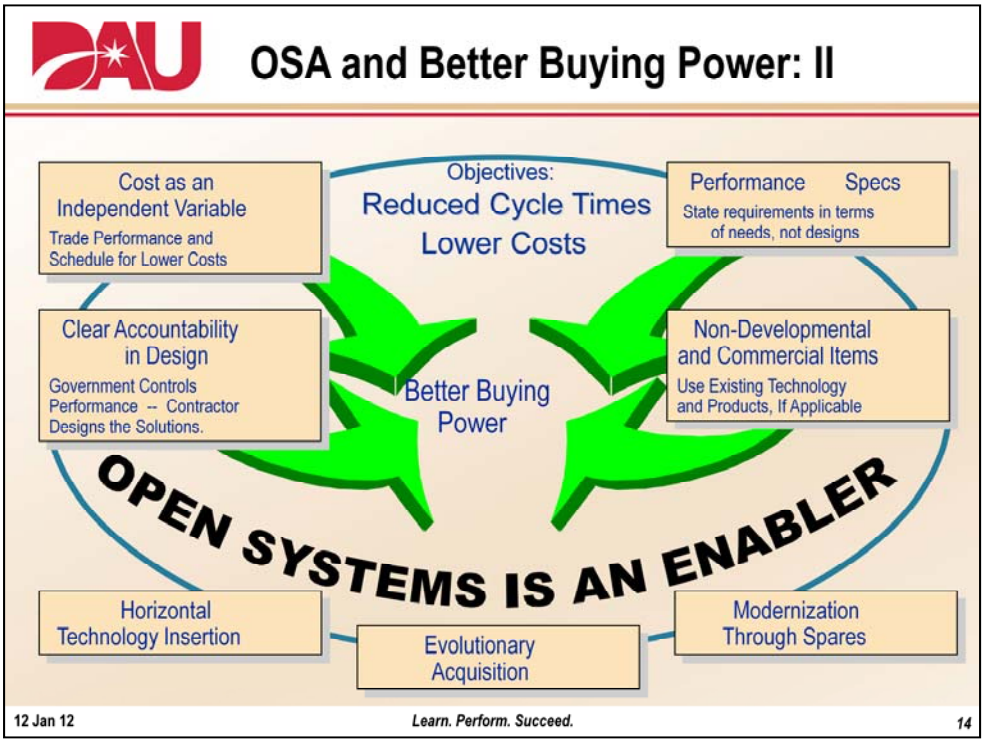
The Virginia Class Submarine benefited from the use of standard size modules and physical parts.

NOTE: The Navy's approach to OSAs is instructive and is outlined in a DAU CLM, CLE 012: Naval Open Architecture



From OSD AT&L14 September 2010 Memo " Implementation Directive for Better Buying Power – Restoring Affordability and Productivity in Defense Spending".

While not all of these will be achieved solely thru use of Open Systems, OSAs are a key enabler.



These are some of the technical ways we can accomplish the goals outlined on the previous chart

This section outlines some of the Program Management Impacts and Considerations relevant to OSAs.

Program Management Considerations

- Planning
- Risk Management
- OSA Program Metrics
- Configuration Management

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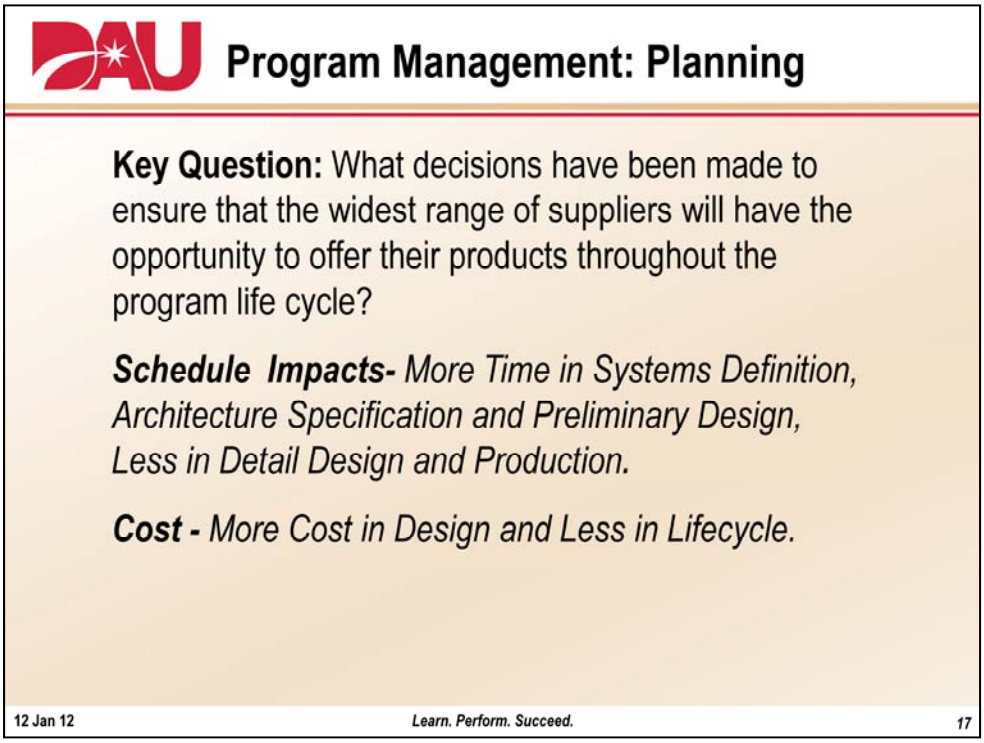
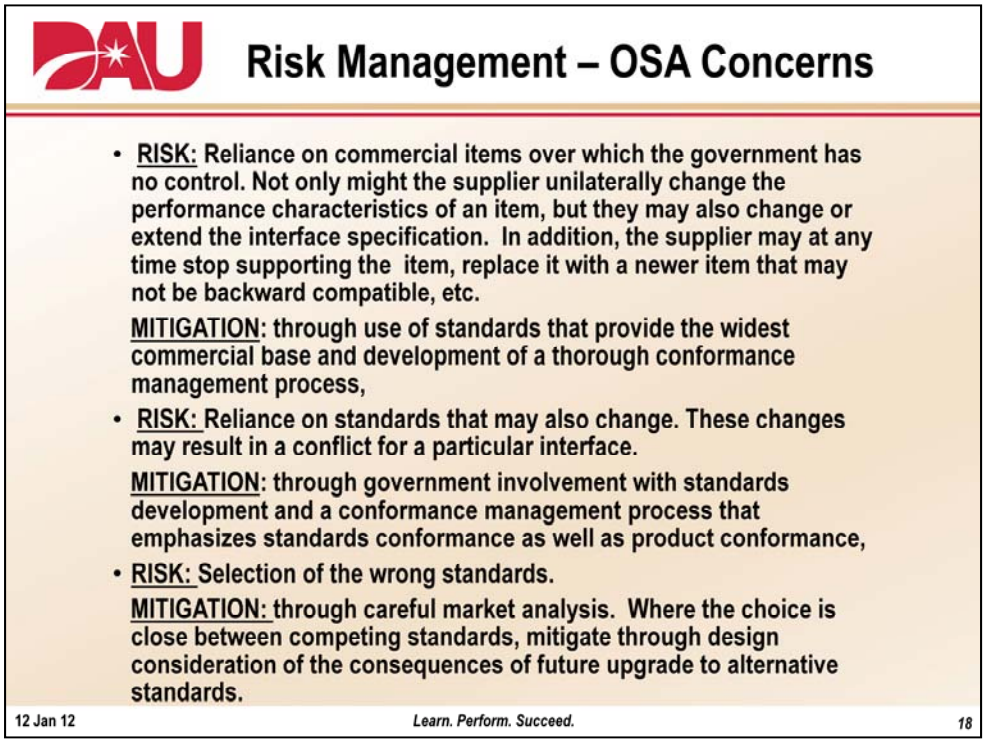
Outline of what is to follow



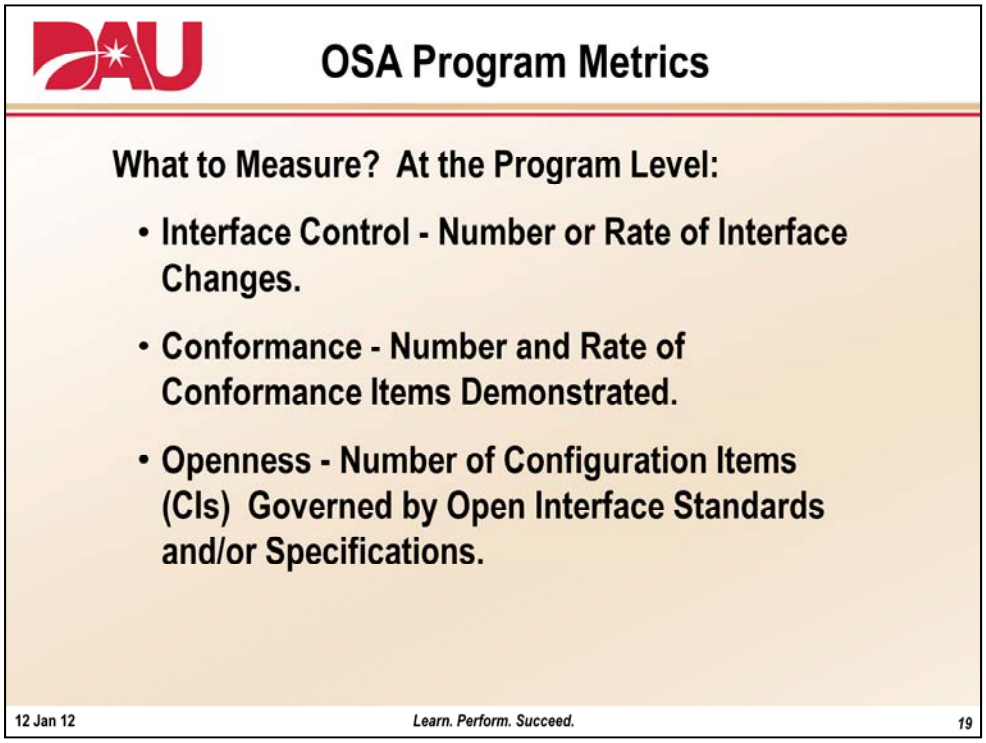
Typically more emphasis is needed "up front" to establish the technical pre-conditions to make later adoptions of an OSA successful



- Reliance on commercial items over which the government has no control. Not only might the supplier unilaterally change the performance characteristics of an item, but they may also change or extend the interface specification. In addition, the supplier may at any time stop supporting the item, replace it with a newer item that may not be backward compatible, etc. Mitigate through use of standards that provide the widest commercial base and development of a thorough conformance management process,

- Reliance on standards that may also change. These changes may result in a conflict for a particular interface. Mitigate through government involvement with standards development and a conformance management process that emphasizes standards conformance as well as product conformance.

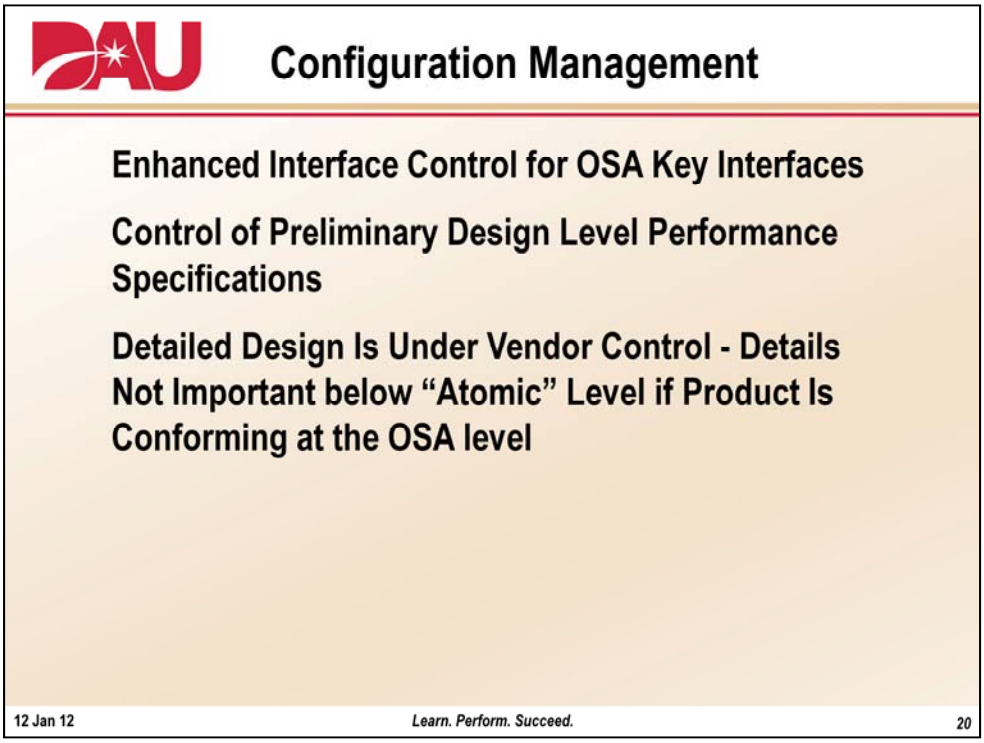
- Selection of the wrong technical interface standards. Mitigate through careful market analysis. Where the choice is close between competing standards, mitigate through design consideration of the consequences of future upgrade to alternative standards.



This is a listing of descriptive measures that might be used. These types of measures should be part of an overall integrated measurement program.

Such an integrated measurement program is outlined at the DoD's Practical Software and System Measures (PSM) web site provides a variety of such measures that are useful from a program management and technical control standpoint.

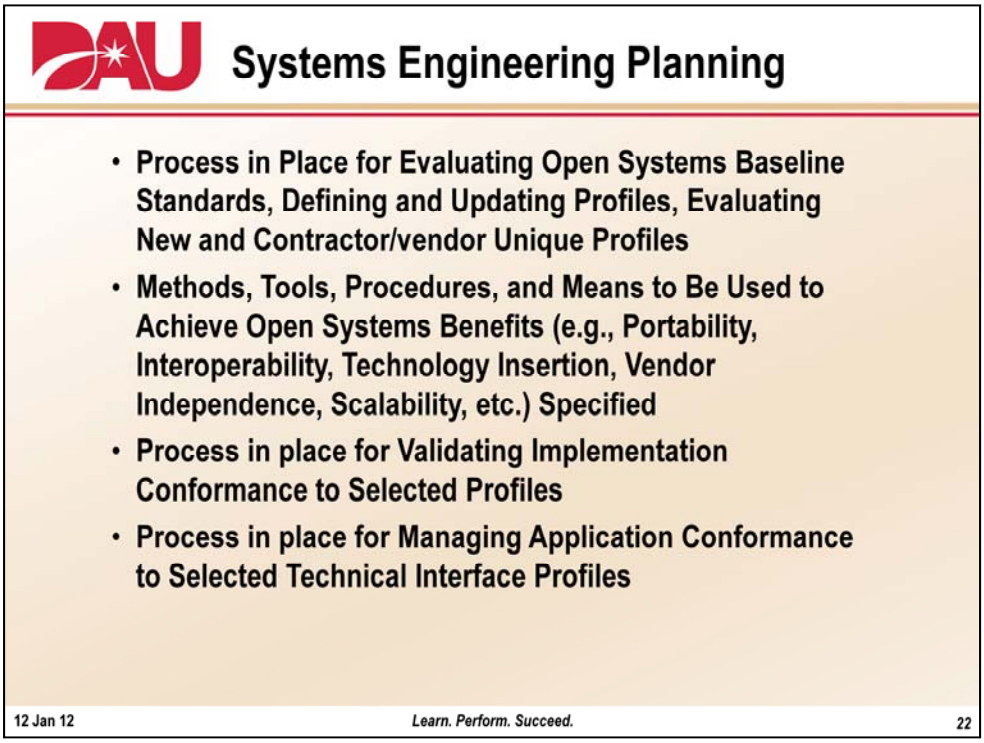
The PSM website is at: http://www.psmsc.com/Default.asp and there is a DAU CLM CLE 060 (Practical Software Measurement) is available as well



Configuration Management (CM) is the act of planning for the execution of the identification, assessment and control of the approved technical configuration baselines and other designated Configuration Items and the changes thereto.

One of the Systems Engineering Technical Control Processes CM is a vital supporting discipline for OSAs and PM emphasis of CM is essential.

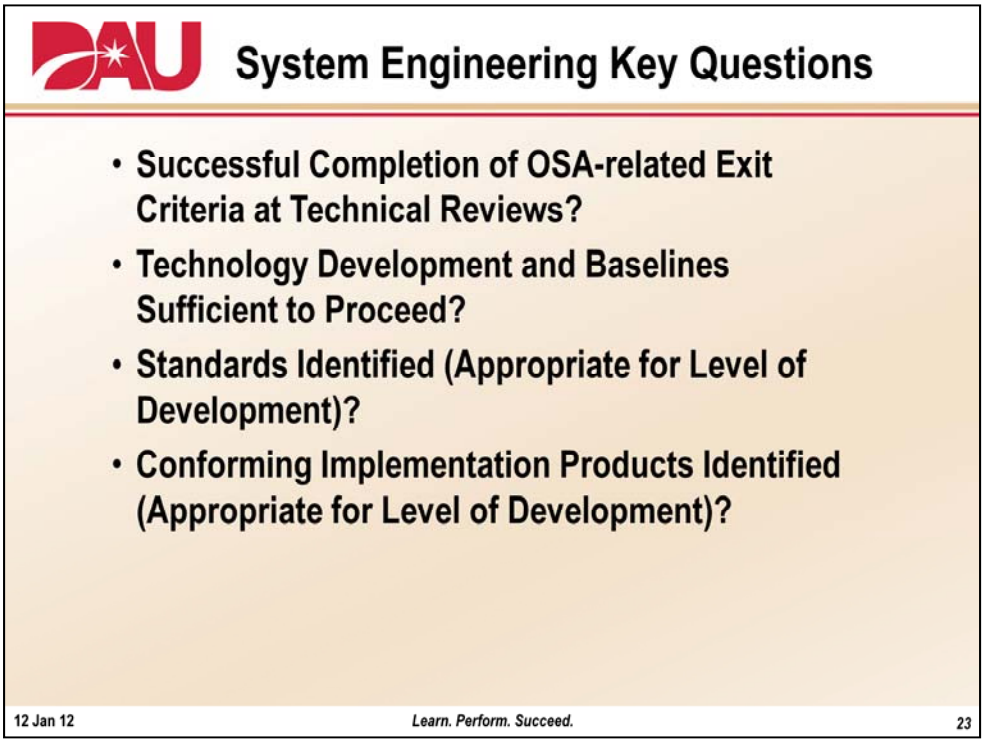
This section outlines some of the Technical and Budgeting Impacts and Considerations relevant to OSAs.



This outlines a typical OSA planning process.

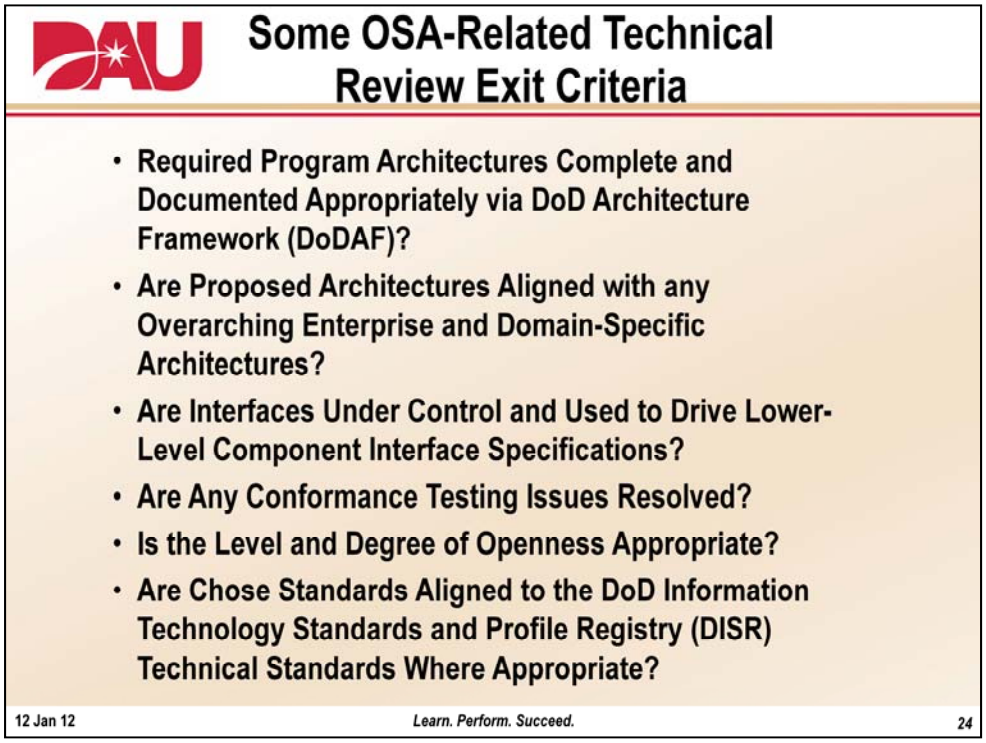
Many of the Technical Interface Profiles suitable for software interfaces have been analyzed and determined suitable for possible DoD use as part of the DoD Information Technology Standards and Profile Registry (DISR).

The DISR (closed site requiring registration) is available at: https://disronline.csd.disa.mil/



Here are some key questions related to OSAs that should be addressed as part of the System Engineering process.

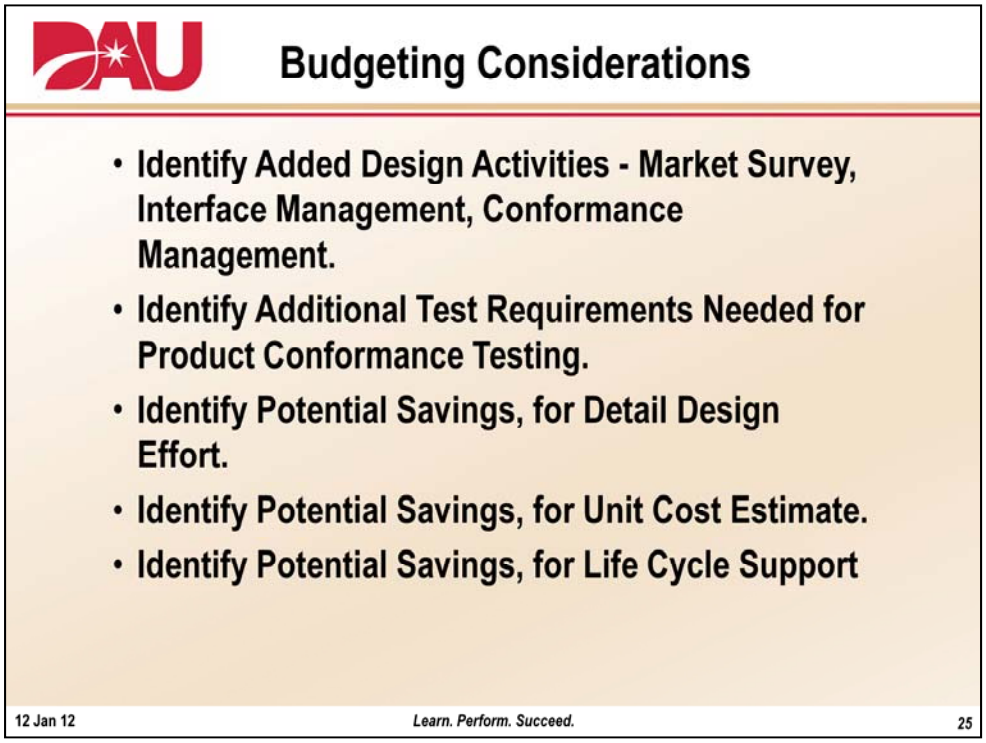
Technical Review are key to getting early insight into potential problems. More information on Technical Review questions regarding OSAs follows.



More questions to ask for Tech Review Exit criteria. These have been tailored to address OSA potential issues.

A variety of detailed DoD-approved checklists for technical reviews have been developed by AT&L. They can be found at: https://acc.dau.mil/TechRevChklst

The DoDAF is a comprehensive mandatory DoD methodology for documenting the complete architecture of a system in a standardize way via a number of “viewpoints” . Among these “viewpoints”, the Technical Viewpoint is key for documenting the interface standards being used on a system. More information on the DoDAF is available at: http://cio-nii.defense.gov/sites/dodaf20/



If the needed Systems Engineering OSA considerations are to be properly performed, they must be funded. This is a listing of some budgetary considerations that should be addressed to support and OSA effort

Summary of Program Impacts

In Terms of Effort Allocation, Implementation of Open System Architectures Will Require:

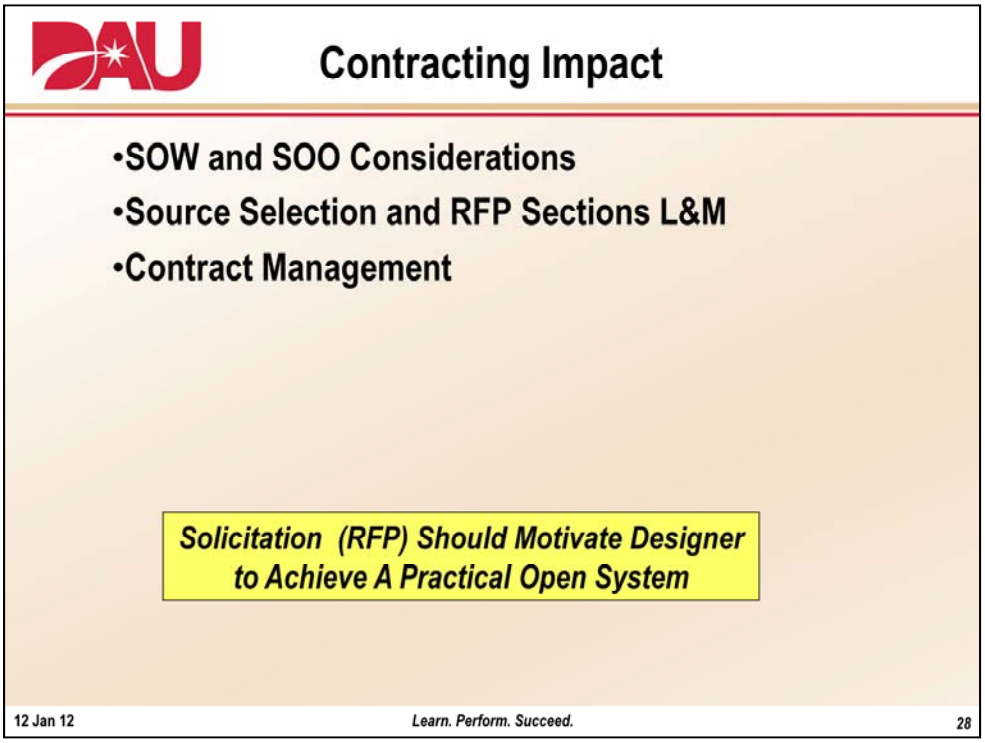
- More Time in Systems Definition and Preliminary Design, Less in Detail Design and Production.
- More Cost in Design and Less in Lifecycle.

Open Systems Architectures Can Help Control Risk and Cost

Open Systems Architectures Can Accommodate System Upgrade and Technology Refreshment

This sums up previous slides

This section outlines some of the Contracting Impacts and Considerations relevant to OSAs.



Discussion topics: if it ain't on contract, it won't get done! This section discusses some key contracting considerations for OSAs.

As always, a Contracting Officer and the contracting command's Data Right Attorney should be consulted to get specific details beyond the general guidance summarized in this section

Tasking The Contractor - SOW

Statement of Work (SOW): a Task Statement Derived From the Program WBS that forms Section C of the Contract.

Example Basic Requirement: "The contractor shall make maximum use of the open systems design approach to provide flexible interfaces and maximum interoperability, optimum use of commercial competitive products, and enhanced system capacity for future upgrade."

Detailed Specific Example: New Attack Submarine SOW

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Example of SOW wording….SOW is important if OS As are going to be implemented.

We will use actual SOW examples from the Navy New Attack Submarine SOW.

This system was cited as an exemplar for the DoD in the BBPi September 2010 tasking memo

New Attack Submarine SOW Open Systems Example

3.1.5 Open Systems Standards.

3.3.1.5.1 Baseline Standards. The Contractor shall use the baseline standards identified in the System Specification for all newly developed hardware and software and for Commercial Items, Commercially Available Off-the-Shelf (COTS and other Non-developmental Items (NDI) where possible. For NDI which will not conform to the baseline standards, the Contractor shall document the method by which the item will migrate to the open system baseline standards in the SEMP.

The Contractor shall document the process for evaluating baseline standards for use, defining profiles, evaluating new and Contractor unique profiles, and updating profiles in the SEMP. The contractor shall develop profiles [ELIN E004] which identify a complete and coherent subset of these baseline standards that support portability, interoperability, maintainability, vendor independence, technology insertion, compatibility with other products, reusability, scalability, and improved user productivity.

It is specifically required that all selected technical standards profiles support vendor independent implementations of the components. The contractor shall provide evidence that all profiles proposed are not proprietary, and support vendor independent solutions, as well as support the requirements identified above.

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Great example

This system was cited as an exemplar for the DoD in the BBPi September 2010 tasking memo

New Attack Submarine SOW Open Systems Example (continued)

3.3.1.5.2 Open System Performance Evaluation. The Contractor shall document the criteria for evaluating open system performance in the System Engineering Plan. The Contractor shall address, as a minimum, portability, interoperability, maintainability, vendor independence, technology insertion, compatibility with other products, reusability, scalability, and improved user productivity as candidate criteria. The Contractor shall continually evaluate products through market analyses and trade-off studies in accordance with the approved System Engineering Plan .

3.3.1.5.3 Implementation Conformance. The Contractor shall validate implementation conformance for all products proposed as meeting the selected profiles by providing documented proof of conformance. Where no documentation exists to document implementation conformance, e.g., for legacy items or new technologies, the Contractor shall submit the product as a Critical Item.

This system was cited as an exemplar for the DoD in the BBPi September 2010 tasking memo

SOO OSA Example

Statement of Objectives(SOO): is 1-2 Page Statement of Government's Objectives. Presented to Offerors in Solicitation .

The SOO is Usually Supplemented With Draft Specification, JCIDS document, Draft SOW, etc. Contractor Writes SOW As Part of their Proposal.

SOO Example:

"An open system approach to design is desired to provide for flexible interfaces and maximum interoperability, optimum use of commercial competitive products, and enhanced system capacity for future upgrade."

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More general SOO example.

While the JCIDS is cited as a general reference, JCD JCIDS documents do not specifically use the "open system" in the core directive or the manual. However, many of the "ilities" cited as benefits of use of OSAs (e.g., portability, maintainability, etc.) can be cited as essential attributes and capabilities

Source Selection and Section L Example

Section L

The description of the systems engineering management process should describe the methods by which an open systems design approach will be used to provide flexible interfaces and maximize use of commercial competitive products to enhance system capacity for future upgrade.

Example Section L RFP Language

Source Selection and Section M Example

Section M

Application of the Open System Design Approach: The government will evaluate the following in descending order of importance:

- How well the contractor identifies a process that will identify and control interface requirements.
- The continuity between the configuration management and interface management efforts.
- The adequacy of the metrics and feedback system is designed to manage the risk associated with using an open systems concept and retaining flexibility of the system.

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Section M of the RFP calling out Source Selection Criteria for evaluation of OS approach.

Contract Management Considerations

Metrics

- Government or Contractor Generated
- Measure Interface Design and Conformance Issues
- Training, Available Expertise

Incentive Fee

- Use of Incentive Fee Can Allow for Necessary Flexibility
- May Impact IPTs

Integrated Teams (IPTs)

- Joint Government and Contractor Assessment
- Most Effective Way to Assure OSA Is Being Achieved

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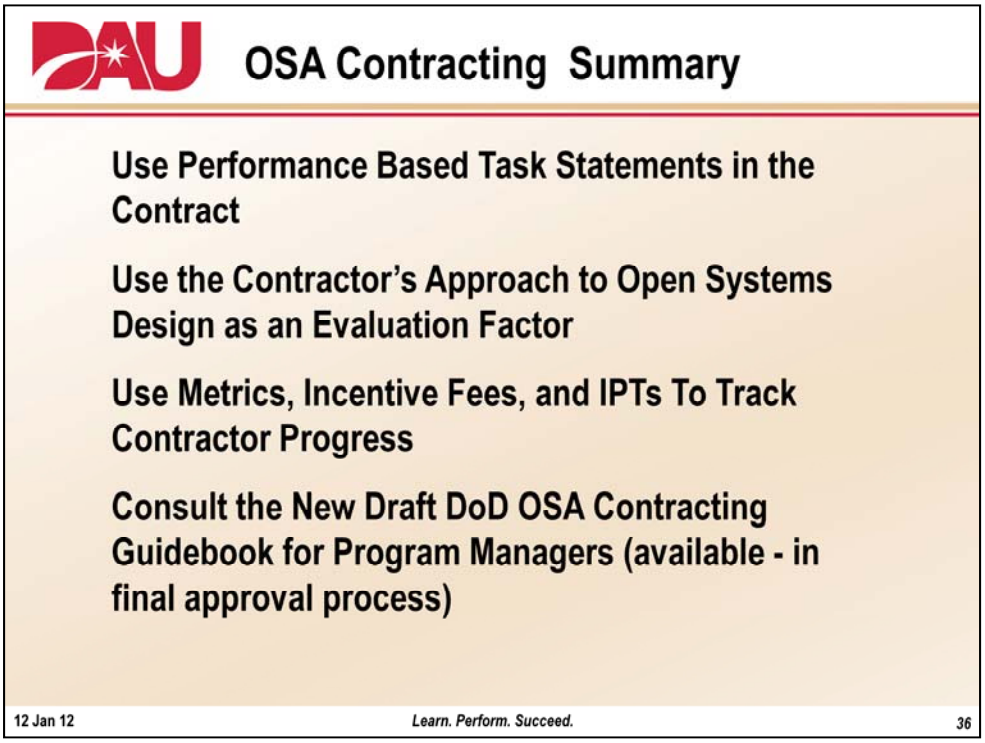
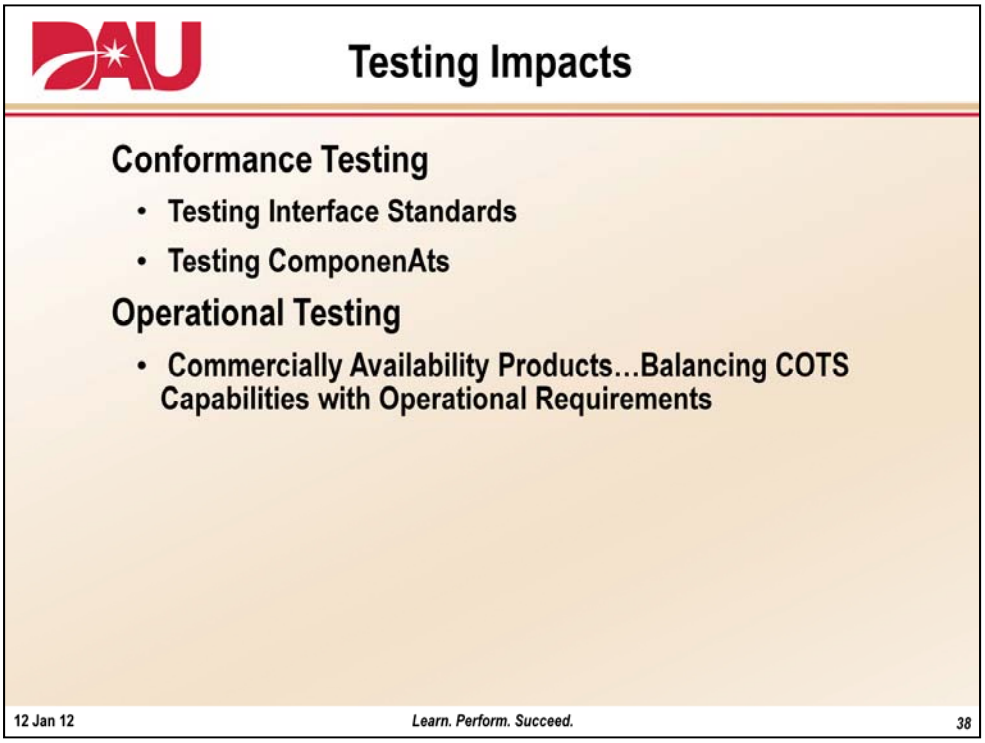
If used, make OS a consideration as part of the overall Incentive Fee structure.



This summarizes OSA contracting considerations.

The Contracting Officer and contracting command's Data Rights Attorney will have the last word in this evolving area…

This section outlines some of the Testing Impacts and Considerations relevant to OSAs.

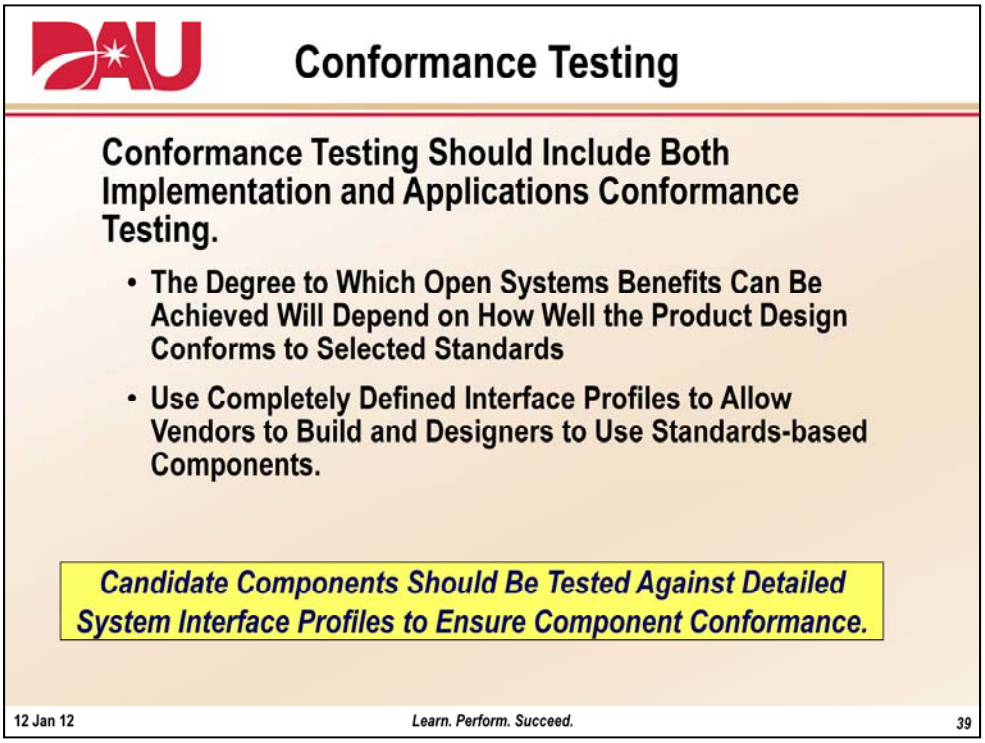


Key T&E aspect is conformance testing of interfaces in general and of the open system interfaces in particular. Conformance testing is also used to refer to the testing of products and standards themselves.

In some cases some of this testing will be accomplished at the PEO or enterprise level, resulting in a set of “approved” conforming products and standards to be used on relevant systems.

For software interfaces, many conforming standards for DoD-wise use by functional domain are found at the DoD Information Technology Standards and Profile Registry (DISR).

The DISR (closed site requiring registration) is available at: https://disronline.csd.disa.mil/



Component conformance testing is important to assure interfaces are as “open” as claimed by the providing vendor.

For software interfaces, many conforming standards for DoD-wise use by functional domain are found at the DoD Information Technology Standards and Profile Registry (DISR).

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Testing Summary

Conformance Testing Requires Both Testing Standards and Components

Operational Testing Requires Balancing Operational Requirements Against Solutions Based on Commercial Availability and Capabilities

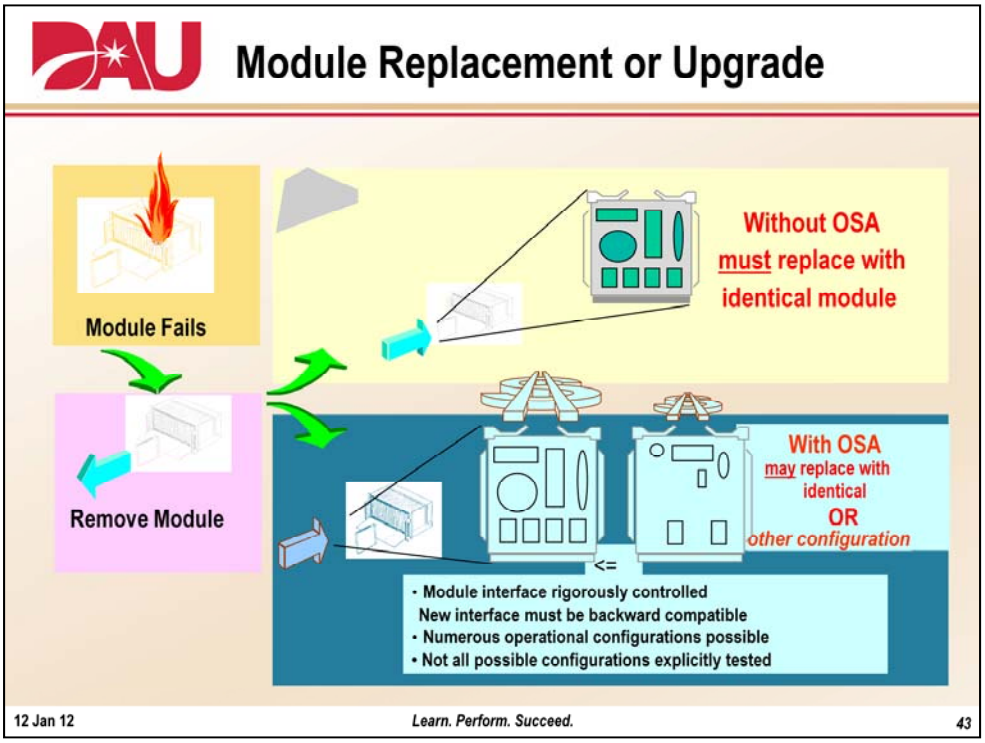
This section outlines some of the Logistics Impacts and Considerations relevant to OSAs.

Logistics Impacts

Time and Cost to Support and Upgrade a System Can Be Reduced…

- Defense systems average 40 year life span
- Upgrades likely due to component obsolescence, threat increase, or technology push.
- Commercial products are designed for shorter life
- Original commercial components will not necessarily be available throughout a military system's lifecycle.
- Open system design can ease the task of replacing the component, reducing upgrade cost and schedule

Self-explanatory.

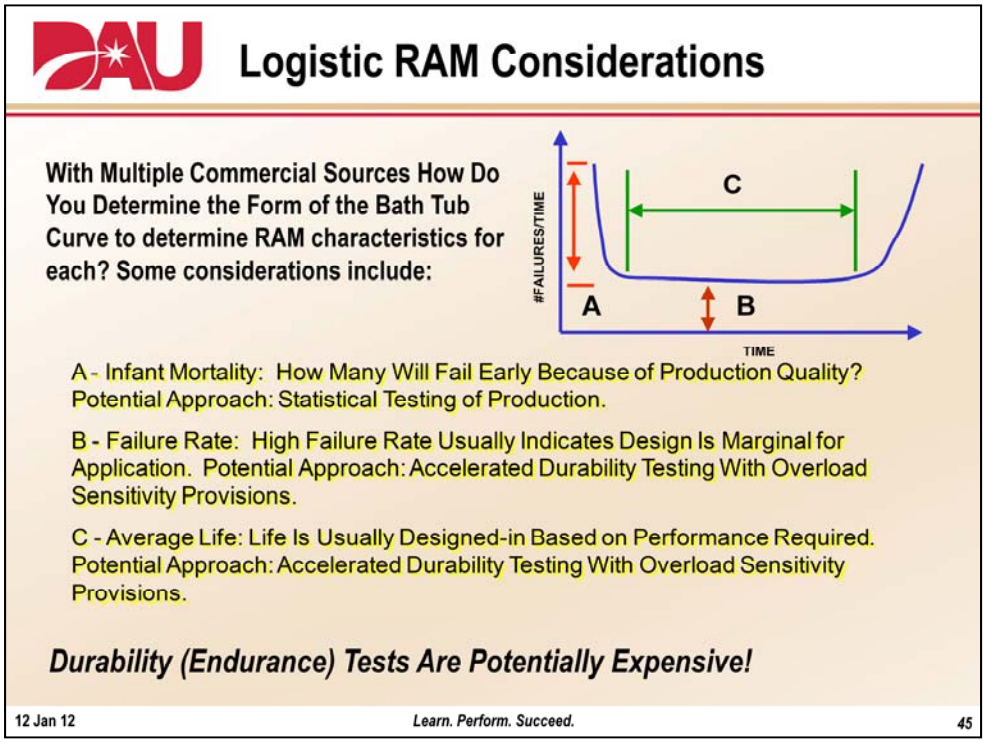


Illustrative diagram contrasting how OSAs vs. “closed” system architectures can impact later lifecycle support efforts

OSA Logistics Benefits

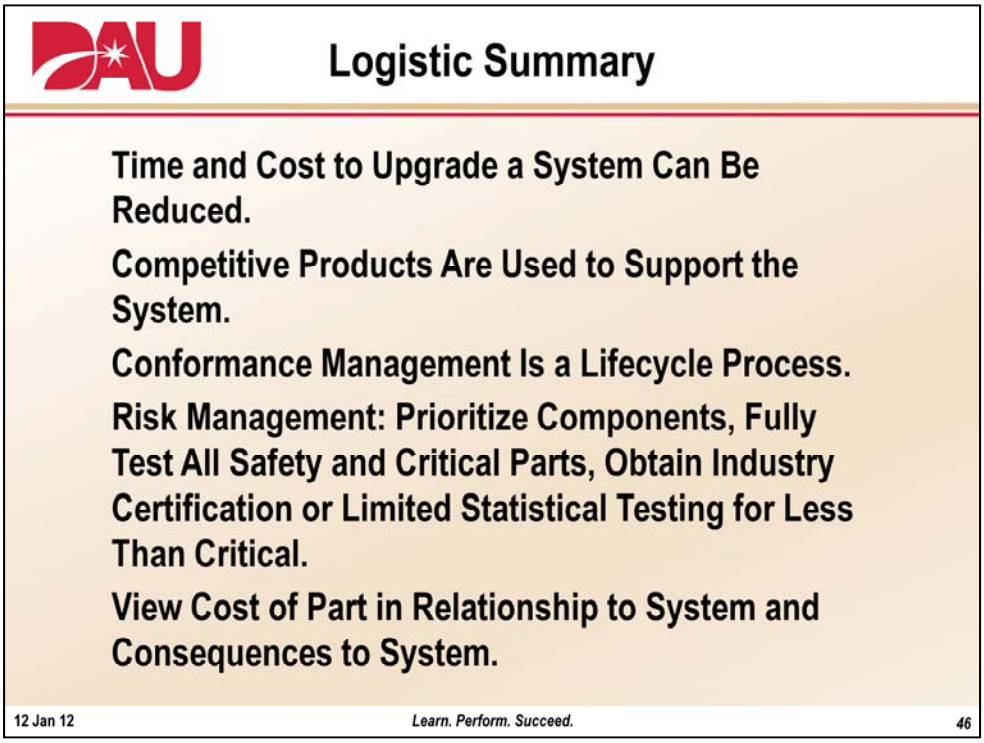
Easier to Repair or Modify Part Replacement-if based on Open Standards…then

- Multiple Sources, Including Commercial Equivalent Products, Likely Available
- Increased Sourcing Can Lead to More Competition, Holding Down Lifecycle Support Costs



A complicating factor is determine RAM characteristics for possible replacement products. It is essential to note that just because a replacement system's interfaces are "open", it does not necessarily mean it automatically will have better RAM characteristics. These must be measured and evaluated consistent with the needs of the program. And because there will likely be more products available, RAM determinations will take more time.

A complicating factors is that since many of these open products are used in the commercial sector [COTS products], baseline reliability data may not be easily obtained from the vendor



Summary of logistics considerations

Many DoD legacy systems use “closed” or proprietary interfaces. Moving them to and OSA framework requires careful planning. It may not be economically feasible in all instances

Migration Process

- Establish metrics for "degree of openness" relevant to program needs via assessment of Key Interfaces
- Categorize legacy components for criticality, modularity, cost of maintaining, performance, etc. with respect to openness metrics
- Evaluate components as to how they will transition and transition risks
- Develop a phased transition plan reflecting operational priorities, key interfaces and areas of projected change

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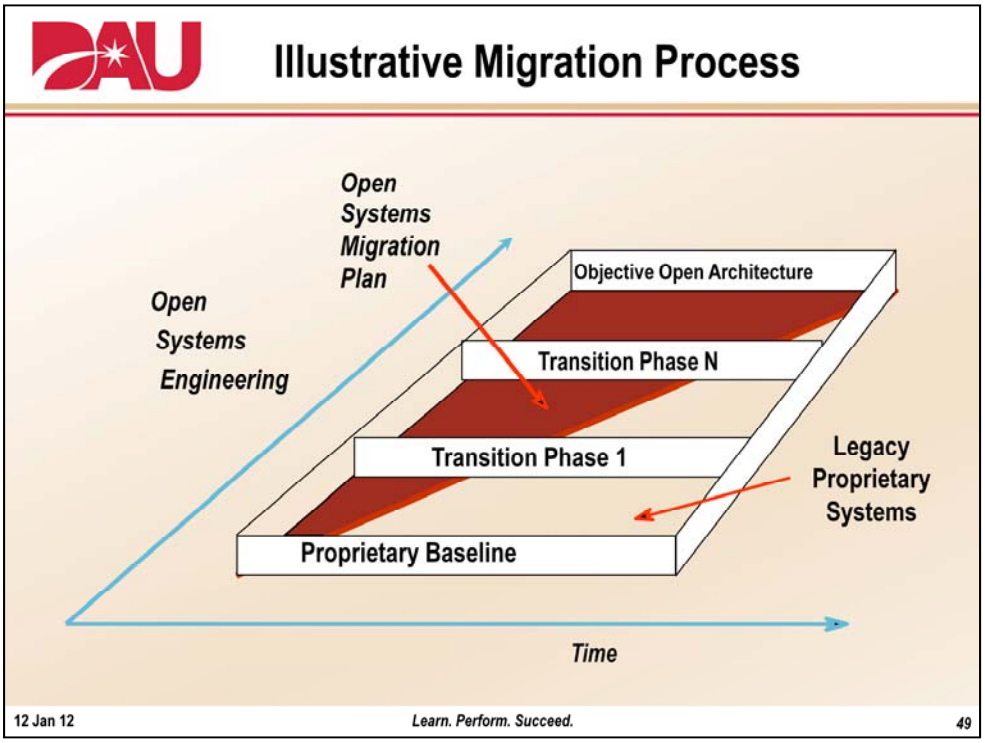
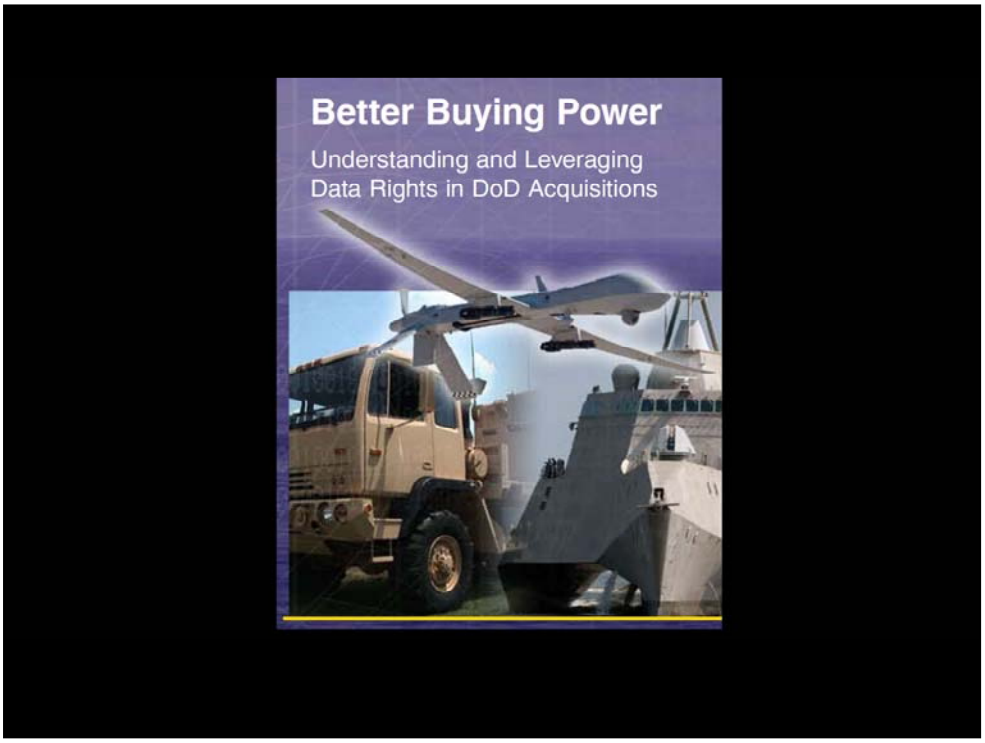
Summary of one example methodology for legacy system migration.



Illustrating that the legacy transition process needs to occur in a phased planned way. The development of open standards and product availability will impact the phasing of the transition points and complicate it.

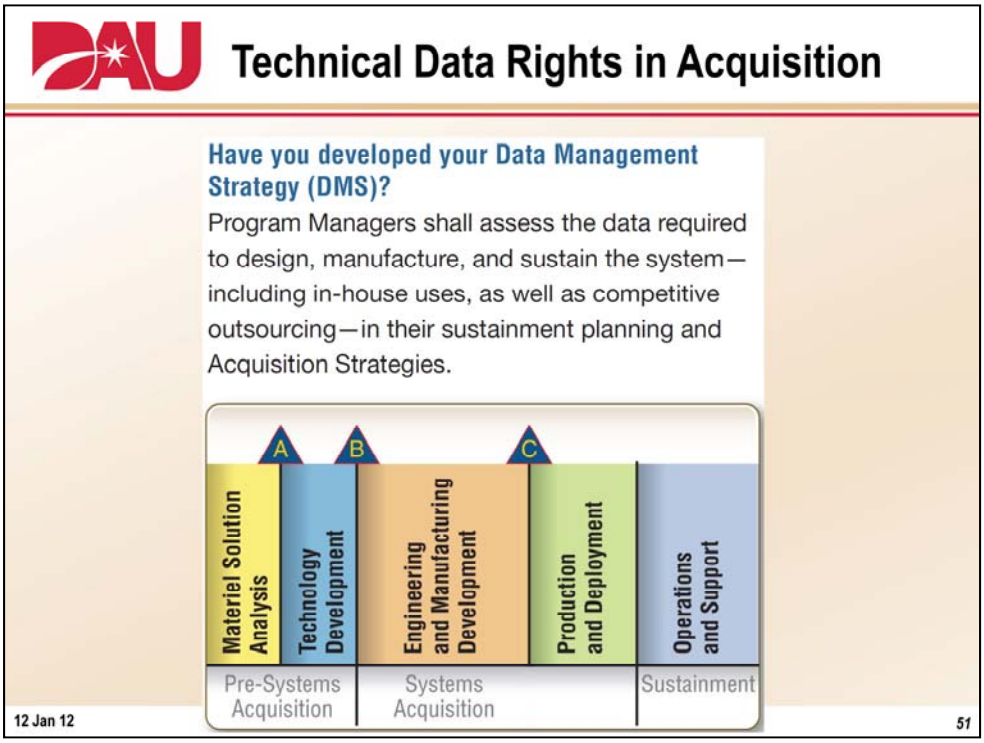
Because of underlying changes in the commercial market place, changes in the originally-planned transition approach are likely. These plans should be revisited frequently and realigned as needed



An introduction to a key companion of the OSA effort…ensuring that needed technical data rights sufficient to support the chose OSA approach are contractually specified.

Some of the slides in this section have been extracted from an Army briefing on this subject. The material has been vetted by an acquisition law attorney specializing in data rights.

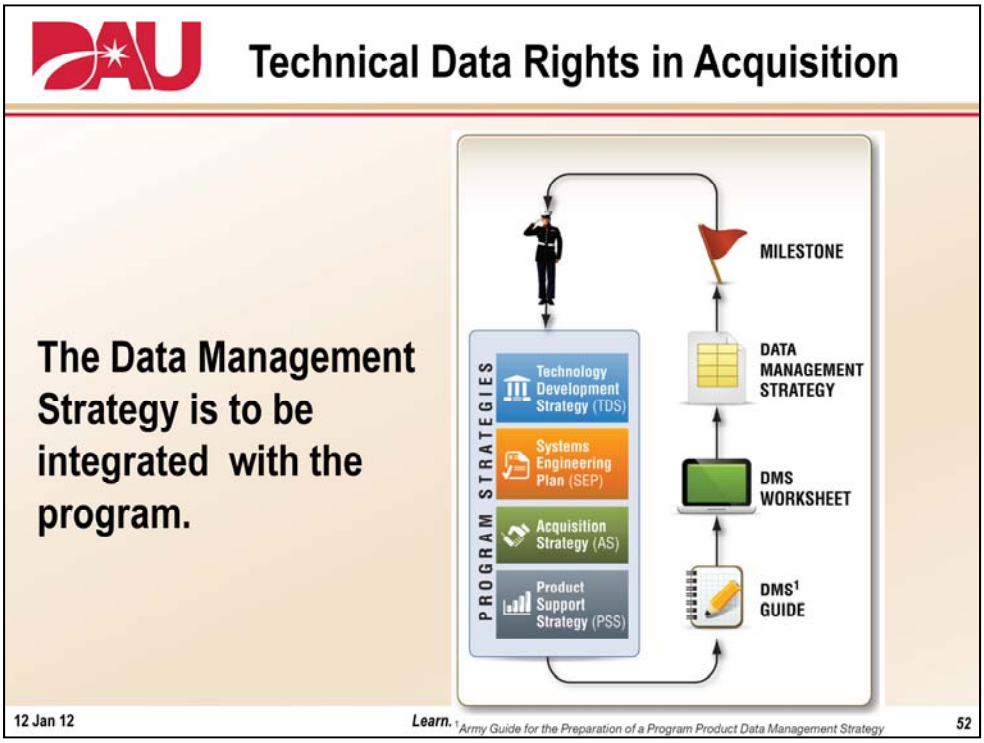
However, this is a complex and evolving legal field and specific instances should be referred to the contracting command's data rights legal office for resolution. In particular, areas relating to government *de facto* ownership of information created under a project funding and reused in other areas is still evolving. The FY11 NDAA provided some guidance which is still working its way through the system…this area is touched on in a later slide



This slide cites the “Data Management Strategy” (DMS).

Pending changes to the 5000-series will rename this as “Technical Data Rights Strategy”, TDRS. However, the principles remain the same.

The term “DMS” will continue to be encountered in older ACAT I programs and in service-level programs



The point here is that the DMS needs to be part of the program's overall approach to the acquisition and management of data. Data costs money and determining the program's true data needs are an important first step

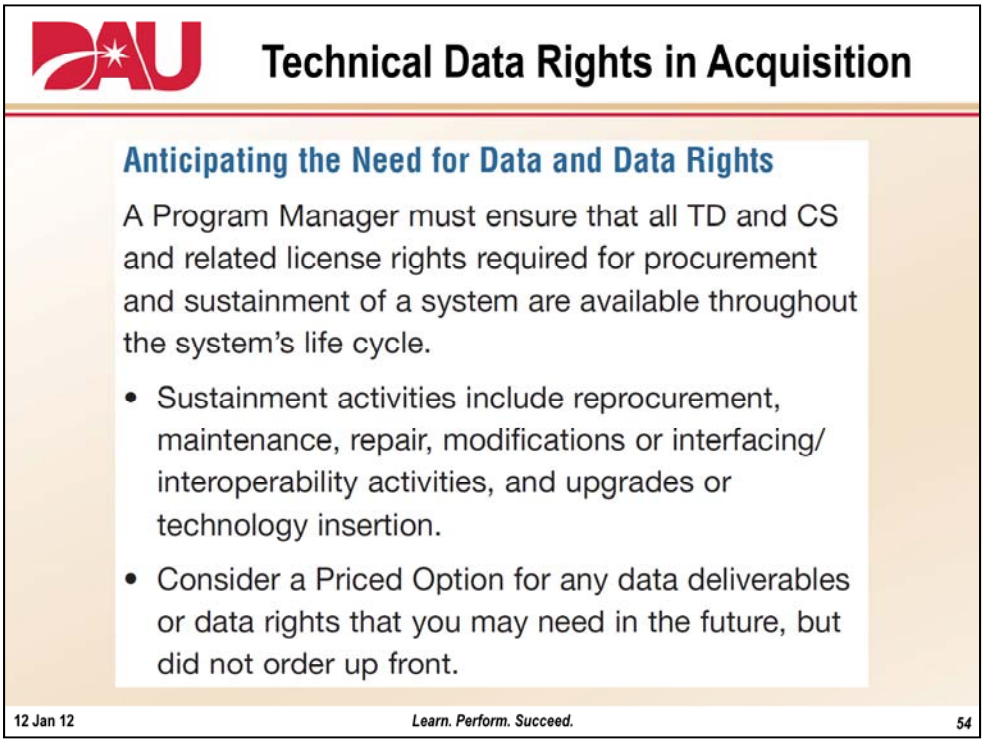
Categories of Intellectual Property

"Data Rights" → Rights in Technical Data (TD) and Computer Software (CS)

"Data Rights" is a shorthand way to refer to the Government's license rights in two major categories of valuable intellectual property:

- Technical Data (TD) includes any recorded information of a scientific or technical nature (e.g., product design or maintenance data, computer databases, and computer software documentation (CSD)).
- Computer software (CS) includes executable code, source code, code listings, design details, processes, flow charts, and related material.

The FAR and DFARS provide a number of definitions in these area which will be cited later on…



An obvious precondition for the PM to adequately address this area is the early determination of the support strategy for the program. This support strategy will drive many of the needs for technical data and licensing provisions.

This is an especially complex area for COTS products that have wide commercial impact and where the DoD is not a big player in the commercial market.

Contracting Considerations

Identify and Resolve Data and Data Rights Issues *Prior to* Contract Award

Identify and resolve data delivery or data rights issues prior to contract award, by:

- Requiring Offerors to assert all restrictions on deliverable TD and CS—both commercial and noncommercial—up front, in their proposals;
- Evaluating the data and data rights packages being offered;
- Negotiating for mutually agreeable specialized license rights whenever the standard license categories do not meet both parties' needs; and
- Challenging asserted restrictions if necessary to account for Government investments.

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Some contracting considerations…these should be developed in concert with companion contracting clauses dealing with OSAs, as described earlier

Data Rights and Government Funding

Data Delivery Requirements

The DFARS clauses do not require delivery of TD or CS—the Government must include specific delivery requirements in each contract. For TD, it is important to distinguish detailed design data from less detailed operation or maintenance data. For CS, it is important to distinguish executable code from source code and other design data. Consider a priced option for contingency-based data delivery or data rights needs.

Data Rights Granted to the Government

The Government's license rights to a contractor's TD and CS generally depend upon the extent to which the Government funded the development of the technology, whether the technology is commercial or noncommercial, and any negotiations for mutually agreeable "special" license agreements. Some types of data qualify for Unlimited Rights regardless of development funding, such as "form, fit, and function data," (FFF) and data necessary for operation, maintenance, installation, and training (OMIT) purposes.

An evolving area subject to disputes

Summary of Data Rights in Acquisition

Rights Category	Applies to These Types of TD or CS	Rights Criteria	Permitted Uses Within the Government	Permitted Uses by Third Parties Outside the Government[1]
Unlimited Rights (UR)	Noncommercial TD and CS	Developed exclusively at Government expense, and certain types of data (e.g., FFF, OMIT, CSD)	All uses; no restrictions	All uses; no restrictions
Government Purpose Rights (GPR)	Noncommercial TD and CS	Developed with mixed funding	All uses; no restrictions	For "Government Purposes" only; no commercial use
Limited Rights (LR)	Noncommercial TD only	Developed exclusively at private expense	Unlimited; except may not be used for manufacture	Emergency repair or overhaul[2]
Restricted Rights (RR)	Noncommercial CS only	Developed exclusively at private expense	Only one computer at a time; minimum backup copies; modification[3]	Emergency repair/overhaul; certain service/maintenance contracts[2]
Negotiated License Rights	Any/all TD and CS– including commercial TD and CS	Mutual agreement of the parties; use whenever the standard categories do not meet both parties' needs	As negotiated by the parties; however, must not be less than LR in TD and must not be less than RR in noncommercial CS (consult with legal counsel as other limits apply)	
SBIR Data Rights	Noncommercial TD and CS	All TD or CS generated under an SBIR contract	All uses; no restrictions	Cannot release or disclose except to Government support contractors
Commercial TD License Rights	Commercial TD only	TD related to commercial items (developed at private expense)	Unlimited in FFF and OMIT; other rights as negotiated	
Commercial CS Licenses	Commercial CS only	Any commercial CS or CS documentation	As specified in the commercial license customarily offered to the public[4]	

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Extracts from the DFARS and FAR

Data Rights in Acquisition

Additional Guidance

- Army Guide for the Preparation of a Program Product Data Management Strategy
- Naval Open Architecture Contract Guidebook for Program Managers
- Acquiring and Enforcing the Government's Rights in Technical Data and Computer Software Under Department of Defense Contracts, Air Force Space and Missile Systems Center

Please visit https://acc.dau.mil/oa for additional information and resources

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Places to get more information.

These are available via the ACC

Technical Data Rights Strategy portion of the new AS/TDS Strategy Document (20 April 2011)

7.6 Technical Data Rights Strategy (formerly the Data Management Strategy). Summarize the Technical Data Rights strategy for meeting product life-cycle data rights requirements and to support the overall competition strategy. Include:

7.6.1 Analysis of the data required to design, manufacture, and sustain the system as well as to support re-competition for production, sustainment, or upgrade. The strategy should consider, but is not limited to, baseline documentation data, analysis data, cost data, test data, results of reviews, engineering data, drawings, models, and Bills of Materials (BOM);

7.6.2 How the program will provide for rights, access, or delivery of technical data the government requires for the system's total life cycle sustainment. Include analysis of data needs to implement the product support life cycle strategy including such areas as materiel management, training, Information Assurance protection, cataloging, open architecture, configuration management, engineering, technology refreshment, maintenance/repair within the technical order (TO) limits and specifically engineered outside of TO limits, and reliability management;

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This is an extract of the new Acquisition Strategy/Technology Development Strategy Document. template

This template, which came out in April 2011, is part of the DoD's overall document streamlining initiative

Technical Data is required to be explicitly addressed. Note that the term "TDRS" is replacing "DMS" which was historically used to refer to this area.

Technical Data Rights Strategy portion of the AS/TDS Strategy Document (20 April 2011)

7.6 Technical Data Rights Strategy (formerly the Data Management Strategy). Summarize the Technical Data Rights strategy for meeting product life-cycle data rights requirements and to support the overall competition strategy. Include:

7.6.3 The business case analysis calculation, conducted in concert with the engineering tradeoff analysis, that outlines the approach for using open systems architectures and acquiring technical data rights;

7.6.4 The cost benefit analysis of including a priced contract option for the future delivery of technical data and intellectual property rights not acquired upon initial contract award; and

7.6.5 Analysis of the risk that the contractor may assert limitations on the government's use and release of data, including Independent Research and Development (IRAD)-funded data (e.g., require the contractor to declare IRAD up front and establish a review process for proprietary data).

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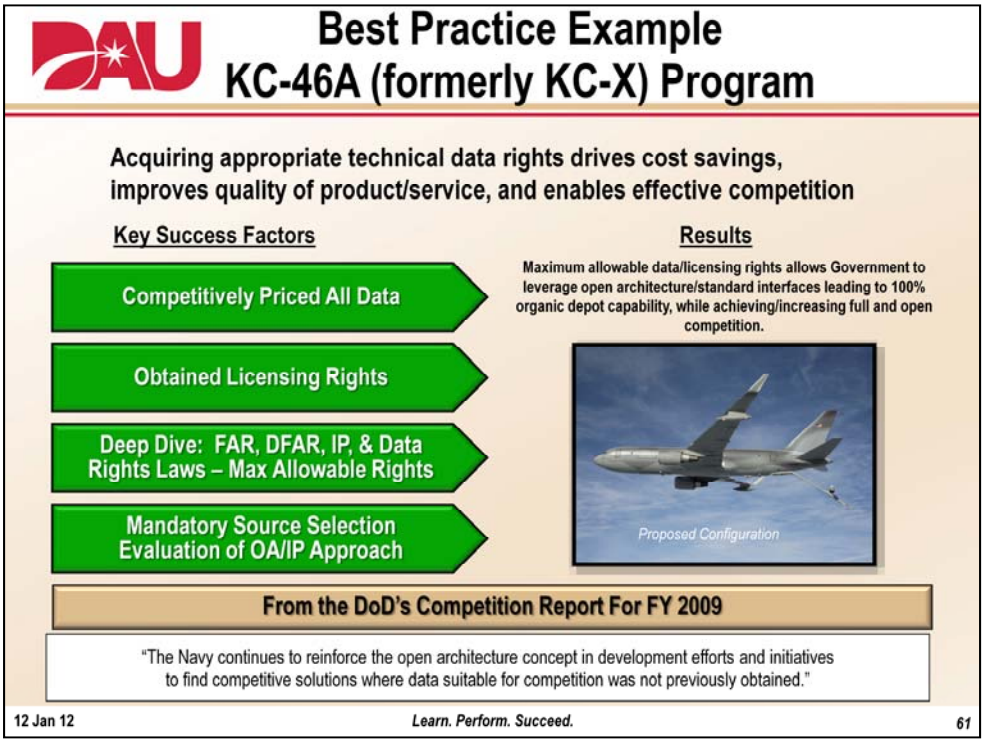

Exemplar program