



Making Affordability Work

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The evolving defense acquisition policy requires more affordable solutions delivered faster and on cost and schedule. To achieve an affordable product, acquisition professionals must clearly understand their desired end-state and develop innovative solutions to close the gap between where they are today and where they want to be in the future. The Department of Defense's current mindset is to avoid new ideas and settle for a solution it is comfortable with, thereby driving the department toward designs similar to those created in the past.

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As a result, there is currently a silo approach to product development that focuses on getting the item to work and then making it producible. Historically, we have seen that dollars spent upfront on producibility have a much greater return than those spent later in the development cycle. Unfortunately, focusing on producibility has not been enough. Producibility pertains to optimizing the efficiency of the manufacturing processes and the associated inspection and test procedures. Affordability expands the sphere of influence and focuses on the ability to meet the user's desired number of production units at the intended cost.

The Affordability Manager

A new structure and way of thinking is necessary in order to break the current paradigm and realize the full affordability potential. The program infrastructure must be aligned to ensure affordability oversight at the level of the program management office. We propose an affordability manager at the program management office level be created. Such a role aligns well with the role of the deputy director for cost assessment, as defined in the newly approved Weapon

- Operations
- Supply chain
- Life cycle engineering
- Program office
- Knowledge management
- Cost estimation.

The affordability manager will ensure that affordability processes are applied across the program (system, subsystem, and module level) to the design, manufacture, and assembly efforts in order to achieve affordability targets.

Affordability Approach

The affordability approach is based on the simple foundation that the system architecture defines the system cost, and it requires systems engineering to own the cost requirement. The approach calls for systems engineering to allocate cost targets across functions that include the supply base, which is a departure from simply giving the designer a cost target and expecting that the target will be met. The Affordability Innovation Funnel (Figure 2) defines the path to a system definition that supports the cost requirement and identifies cost contributions across engineering disciplines. The Affordability Innovation Funnel approach flows cost elements to the function that can most influence the cost driver. For example, a design engineer can influence the material cost of his design but may have little insight or influence on manufacturing transportation costs. A systems-level approach to cost uses the entire value stream working together to ensure a cross-discipline approach to cost reduction.

The funnel consists of four decision gates supporting projects that are more likely to succeed and sacrificing projects that are likely to fail. At a gate, a decision is made to continue working on the project, moving it along to the next stage in the funnel; to stop working on the project, shelving it for later technology maturation; or to get additional information and reconsider the project for passage through the same gate once that information becomes available. Such a structured approach enables the affordability manager to measure the progress across disciplines to ensure full potential is realized.

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Systems Acquisition Reform Act of 2009. The addition of an affordability manager equivalent to the chief engineer provides the necessary balance between performance and cost (see Figure 1).

The affordability manager should have responsibility for the following tasks:

- Identifying potential affordability initiatives and the time-phasing of items to be implemented by the integrated product team leads
- Supervising and coordinating activities that drive the cost
- Determining the total ownership cost of the system
- Overseeing program-wide affordability initiatives
- Integrating traditionally silo activities such as:
 - Systems design
 - Design engineering
 - Systems test

Figure 1. **Program Infrastructure**

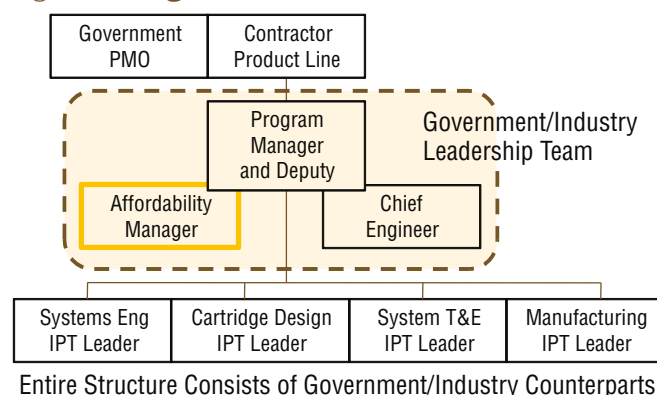
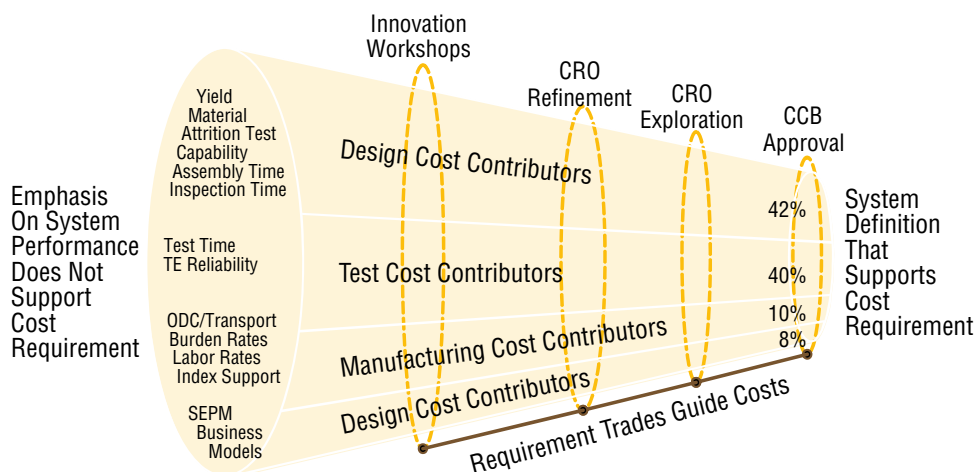


Figure 2. **Affordability Innovation Funnel**



Implementation Enablers

The ability to meet the end-user's desired number of production units is realized through optimization of product attributes and the cost requirements, requiring input from the entire team from the beginning of the program. Trades in schedule, performance, and requirements against an established cost target provide the design team visibility into cost drivers that typically get ignored until later. To help avoid the trap of the "make it work first" and "make it producible after it works," you should:

- Know your cost requirements and understand your cost drivers
- Aggressively identify cost reduction opportunities
- Identify requirements that drive cost and flow it back to systems engineering
- Incorporate critical parameter management to match manufacturing process capability
- Make affordability part of individual development goals
- Co-develop an affordability incentive program with the stakeholders.

Identifying Cost Drivers

An effective affordability management model will define the cost requirements and document the cost components of the product assemblies and sub assemblies. It will review the baseline cost, what the cost is at the moment, the best cost, and the requirement cost. The affordability manager shall initially populate the affordability model with estimated/projected values for quantities, labor, and material prices. In order to improve cost projection accuracy, the model shall calculate cost projections based upon detailed indented parts lists, part quantities needed, purchase options, price estimates, supplier price quotes, or actual price.

Components of cost should include labor standards and realization factors, rates and factors, support pools, and burdens. Cost should be based on Six Sigma worksheets, assembly process flows, assembly and test yields, rework attrition and scrap, batch sizes, amortized set-up costs, material allowances, and negotiation allowances. Further

accuracy is ensured if the model permits the user to scale the data by applying appropriate learning curve and process yield data.

Predicted cost output data should be adjusted for fixed-year dollars based on the initiation of the pre-production test build by considering inflation and rate variations. In order to preserve the integrity of cost model comparisons, the fixed-year dollars should remain constant throughout the life of the program. As the fidelity of the model improves, estimates are replaced by quotes, and then

actual costs. The model shall be updated monthly, as a minimum, to reflect the most current information. Using an affordability management model allows for the identification of the key cost drivers and leads to understanding the gaps between the current and future states.

Identifying Cost Reduction Opportunities

Innovation workshops can be used to capture ideas from a broad, cross-functional, multi-stakeholder team. The criteria used to consider ideas are that they close the gap between the current state and the desired end state. Such workshops can help develop tactics that will potentially eliminate, reduce, substitute, separate, integrate, re-use, standardize, or add to design techniques. Acquisition professionals can consider how the tactics will target the functions, sub-assemblies, life-cycle processes, materials, and people who use the end product. Populating the Innovation Matrix (Figure 3) with answers to the "can we?" questions helps to generate ideas. The resulting insight and idea matrix can capture ideas and consolidate them, thereby providing one with a starting point to focus his or her evaluation and maximize return on that evaluation. Evaluating the ideas against the cost drivers allows for the prioritization of their implementation as well as identification of those to be set aside, demonstrating the breadth and depth of the ideas that will eliminate waste and increase value.

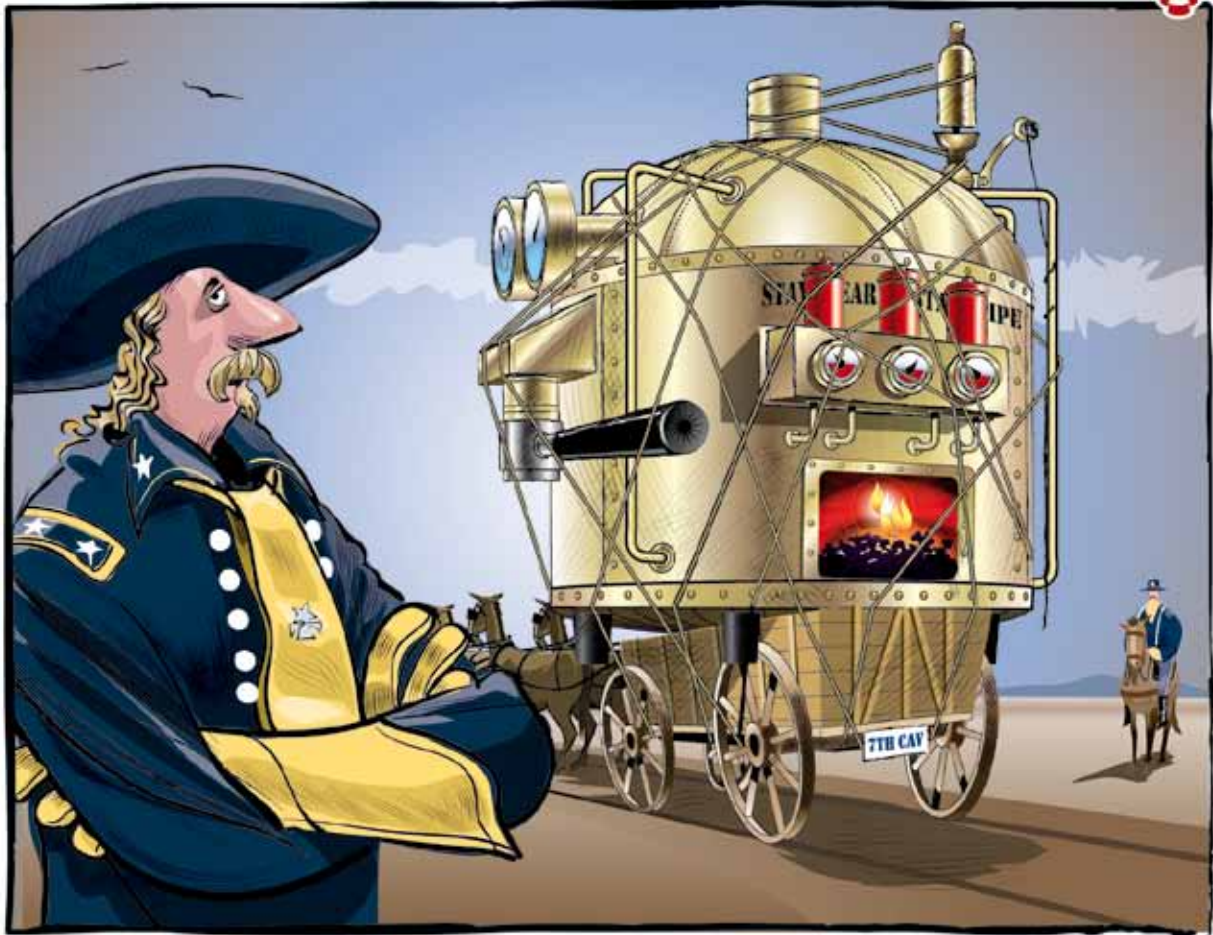
Figure 3. **Innovation Matrix**

		5 Product "Targets" of Opportunity				
		Functions	Parts	Processes	Materials	People
8 Design Tactics	Eliminate?					
	Reduce?					
	Substitute?					
	Separate?					
	Integrate?					
	Integrate?					
	Reuse?					
	Standardize?					
		Add?				

Can We Eliminate Processes?

Can We Standardize Parts?

GREAT MOMENTS IN ACQUISITION HISTORY



General Custer takes receipt of the Army's first steam-powered espresso machine.

Opportunity Management

In DoD acquisitions, opportunities are pursued using a fixed budget. Funds are allocated to reduction activities based on their feasibility as determined by its benefit ratio. Progress is measured using benefit thresholds. Funding applied in this tiered approach historically leads to maximized return on investment.

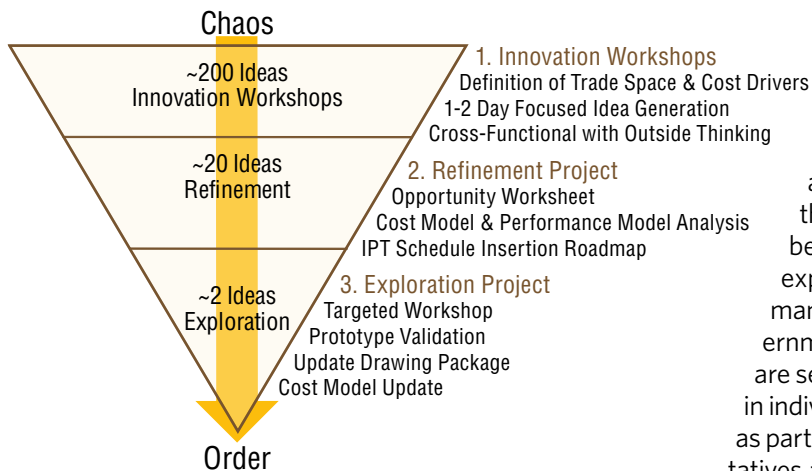
Cost-reduction opportunities can be managed in the structured framework of the Opportunity Pyramid (Figure 4) and tracked in an opportunity register. They are prioritized based on their feasibility of implementation and cost benefit to the unit cost. Ideas that meet the opportunity threshold will progress to the refinement project phase upon the approval by the opportunity review board. This phase allows for the refinement of the idea to quantify the cost and performance impact and to develop a plan to insert the improve-

ment into the design. Results from the refinement phase should be presented to the opportunity review board for approval to progress to the exploration phase. This phase includes targeted workshops using Six Sigma tools and Lean design workshops. The development of prototypes should be encouraged as part of the project verification. In addition, cost and performance models will be updated and a drawing package developed or updated. The final gate is to present the results to the change review board for incorporation into the baseline design.

Critical Parameter Management

A robust critical parameter management process will ensure that the design has sufficient margin to be built using the factory's manufacturing processes. Such a process combines the design requirements with the process capability to minimize variation on the production floor. The early collec-

Figure 4. **Opportunity Pyramid**



and why. A significant percentage of the yearly award fee is based on meeting unit cost goals.

tion of manufacturing variation data provides a quantitative way to focus on design and process capability interaction. The approach provides an understanding of the effects of the manufacturing process on the design and provides confidence that production processes are in control prior to a Milestone C decision.

The Price of Success

Historical data shows that the earlier in a program one applies budget to cost reduction opportunities, the more impact that budget has on final unit price. It requires setting aside program funds to ensure the budget is available to implement an affordability vision. For example, some of the successes to date of the affordability implementation on the Mid-Range Munition program include:

- First-year overall cost reduction of 40 percent
- A 35-percent reduction in the automated seeker test time
- A 14-percent cost reduction identified for seeker design
- A 30-percent material cost reduction in the Control Actuator System
- Relaxation of secondary mirror requirements due to design margin trades
- Design, tolerance, or manufacturing process parameter modifications resulting in significant improvement in manufacturing process capability.

As the reductions in the Mid-Range Munition program demonstrate, for every dollar you invest upfront, you will benefit by delivering an affordable capability to the warfighter and profitable program to the contractor.

Affordability Incentive

Government expectations are established in the statement of work, which include requirements to provide data and models to assess life cycle cost, continuous assessment of each component to identify and reduce cost drivers without compromising key performance parameters, identifying producibility ideas incorporated and the estimate savings, and summarizing ideas investigated but not incorporated

Understanding what motivates people to take the risk and work outside their comfort zone is the key to achieving success. We believe the acquisition professional's incentive for success is the challenge of doing something no one has done before along with the pride of meeting or exceeding expectations; however, recognition of that performance is still a key enabler. There needs to be a government recognition program. Industry expectations are set by requiring the inclusion of affordability goals in individual personal development goals and evaluated as part of the merit review cycle, and industry representatives are recognized with peer awards and gift certificates (for example). In addition, a government-industry incentive program could be developed to foster a culture uniquely aligned on affordability.

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There is a continuous balancing act between key performance parameters (customer), delivery schedule (supply base), overall development cost (design), and unit cost of the final product (operations). Changing one factor can adversely impact the others. An affordability instruction provides a structured approach to affordability based on the simple foundation that the system architecture defines the system cost. The innovative approach is for systems engineering to conduct trade studies that allow the allocation of cost targets across functions that include the supply base, which is a departure from simply giving the designer a cost target and expecting that the target will be met. The approach channels cost elements to the function that can most influence the cost driver. It uses the entire value stream and fosters a culture uniquely aligned on affordability.

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