

# Controlling Cost and Schedule — A Contractor's Perspective

## Why Control of Requirements Driving Cost and Schedule Makes Sense for Government-Industry

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**A**s a former Air Force officer who conducted developmental and operational testing on defense systems, and as a program manager who now oversees contractor projects, I have long been interested in why developmental defense programs routinely overrun cost and schedule.

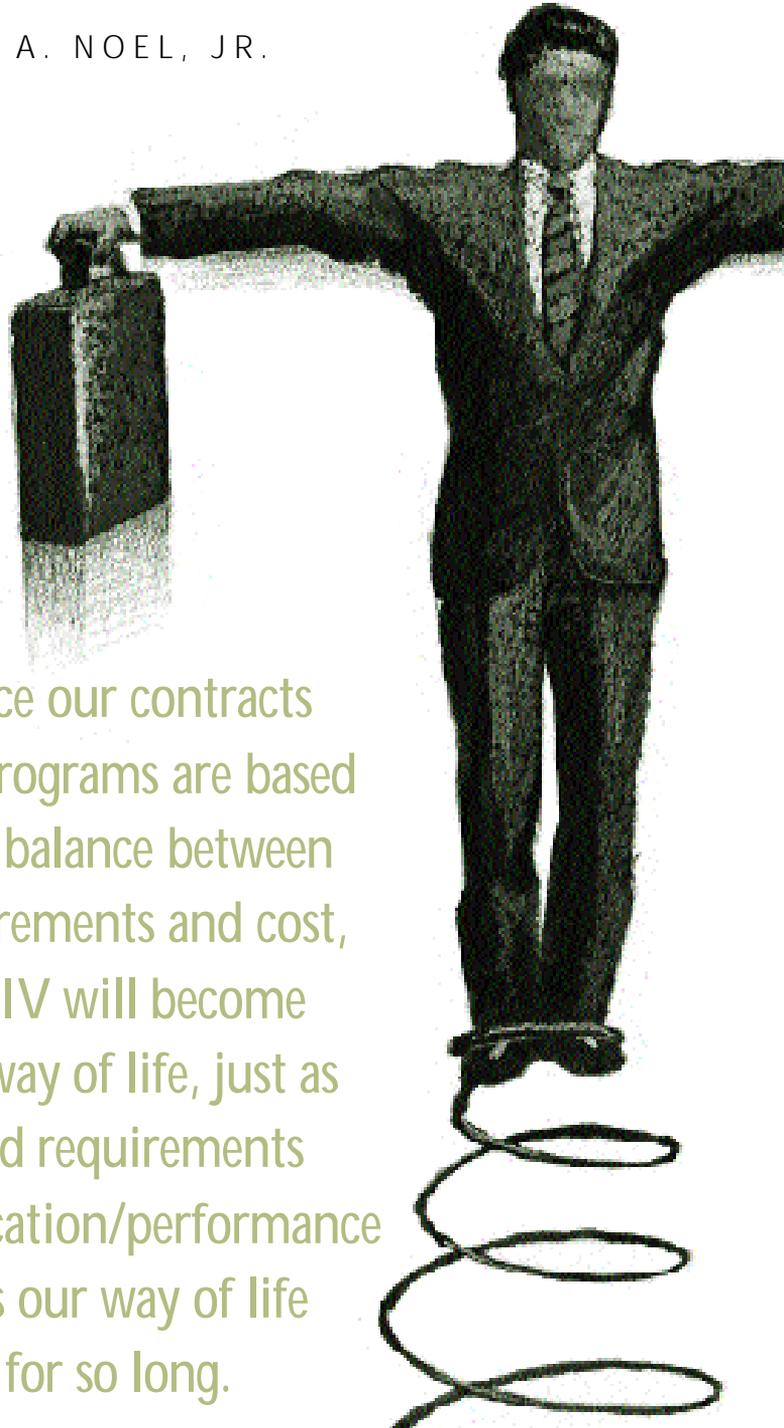
Two excellent articles addressing the relationship between system requirements/performance and cost on developmental defense procurements appeared in the November-December 1996 issue of *Program Manager*. I'd like to comment about several of the concepts and observations presented by the authors.

The first article, "Controlling Costs—A Historical Perspective" by B.A. "Tony" Kausal IV, discusses the successes and failures of Design to Cost (DTC) as an acquisition strategy.<sup>1</sup> The second, "Some Potential Benefits of Using Cost as an Independent Variable (CAIV) in Defense Programs" by Dr. Edmund H. Conrow, advocates breaking away from the historical practice of performance specification in favor of specifying a tradable range of operational capabilities, as defined by the end user of the system.<sup>2</sup>

### The Trade-off Between Compliance and Cost

Kausal observes that industry contractors can "treat cost as a critical variable where they make trade-offs." From the vantage point of the contractor side of the desk for 13 years now, I can say that

Once our contracts and programs are based on a balance between requirements and cost, CAIV will become our way of life, just as hard requirements specification/performance was our way of life for so long.



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we in industry know the government customer expects us to do cost/performance trades. However, when compliance with a specification is a major evaluation factor in winning a competition, we naturally put our engineering energy into design and try to find other ways to cope with the cost of the program.

During the Cold War, when technological advances significantly determined combat capability, specification compliance drove cost in acquisition. Larger defense budgets permitted cost-plus contracting, which motivated contractors to design and produce to the specified level of performance. The government and the contractor were then forced to find ways – some painful – to deal with increases in cost and schedule.



## Market Pull Controls Defense Industries

After years of sharing decreased defense budgets and absorbing project cost increases, aerospace/defense contractors developed a "stimulus-response" behavior pattern, basically reacting to requests from the defense market rather than developing and marketing our products. Defense contractors rarely practice any of the proactive or "push" marketing principles found in college textbooks and practiced by commercial leaders, such as McDonalds, Nike, and Honda. Rather, "market pull" dominates our marketing strategy.

Why? Because the significant cost of investment in defense technologies, the high unit price/low-volume production of our specialized products, and our unitary customer radically separate us from standard commercial practices and processes. Contractors do not have the money, individually or collectively, to "push" operational military systems into the marketplace: we normally have to settle for small advances in specialized areas of technology with our own money.

An example: It is unlikely we will ever see the equivalent of Northrop's internally funded F-20 development where they built three fully operational aircraft

to military standards and specifications, and actually flew two of them. In this case, the contractor paid for the entire program.

Current contractual practices and processes of the military/government customer significantly affect nearly all of the operations and business practices of defense contractors today. In his discussion of why DTC was not successful on the F/A-18 Program, Kausal says, "There appeared to be little interest in the Navy in trading off systems requirements for cost...the DTC goal was dropped or faded away in program FSD [Full Scale Development]."

Kausal demonstrates his understanding of the "following" nature of defense contractors when he writes, "What was the contractor's response to DTC?" The answer is revealing: Because the Navy did not pressure the contractor to adhere to DTC practices rigorously, the contractor followed his customer's lead. *End of story.*

Whether the same fate now will plague the CAIV strategy is a subject of much debate in government acquisition circles. The contractor's most difficult problems with the CAIV strategy are developing estimates:

- With precision, how long and how costly will it be to design, build, test, and support a complex system?
- Once a system that exists only as concept has been built, how well will it work?

The more challenging the performance specification of a developmental military product, the more costly it will be, the longer the developmental cycle will be, and the greater the error will be in estimating project variables, such as cost and schedule. Setting a cost ceiling for a program and accepting what technology and contracted effort can deliver is a new paradigm for us all.

Historically, DoD asks the aerospace/defense industry to produce complex, long-developmental-cycle, highly specified

weapons systems that push the boundaries of technology (sometimes more than one technology) – systems expected to be in the field for decades to come. This is a significant challenge, exclusive of cost or schedule. Many government employees do not understand this: I didn't until I crossed over to the contractor side of the table.

## Industry Challenges

As the government pushes the line on requirements, competitive contractors typically commit the following errors:

- Underestimate the difficulty, risk, or both of meeting specifications.
- Accept the risk of performing to the contract in order to beat the competition.

These errors, when compounded, manifest themselves in cost and schedule overruns. Other factors challenging contractors are the highly technical and programmatic complexity of projects, the annual and sometimes unpredictable nature of government funding, and the possibility for change as a product or program develops.

Change control, that is, requirements containment and configuration management, and the impact on cost and schedule are other major challenges in this industry. A direct correlation exists between the length of development and cost and schedule growth; the longer a program runs, the greater the growth of requirements and the number of government and contractor-initiated changes.

## Making Trade-offs

We contractors are competition-driven and profit-motivated; we are reluctant to do something that does not produce increased sales or profit, or make us more efficient or competitive. Kausal is on target when he says, "To make CAIV work, it is critical that the contractor's engineering personnel see this as part of their job." However, unless the force for change is powerful, our engineers, conditioned for so long, will not alter their cultural views or behavior. The government must therefore find the incentives to convince

our engineers and our program managers that trading off performance against cost is a desirable behavior.

I suggest that the government look for ways to facilitate and promote design and cost trade-offs. As Kausal notes, these trades must be made evident upfront, that is, when they can produce the changes in system definition and design that will result in more realistic cost and schedule estimates.

For CAIV to work, the government must demonstrate what requirements, specifications, and performance are up for trade in a *clear* order of priority. Contractors know very well how difficult it is to be clear when the discussion is technical and the programmatics are complex; we face this every time we write a proposal.

The contractor engineer and program manager must know *how much is enough*, in the form of a clear statement of performance objectives. The government program manager should structure the Request for Proposal (RFP) in a way that draws the best possible line at *where* to stop. If the government RFP hints at requirements hedging (upward, of course), you can be assured that the contractor will follow.

Engineers are trained and expected to make their products as good as they can possibly be; in fact, they are rewarded when they improve their company's products. When *good enough* is not clearly defined, they will naturally continue to make their product better, bigger, faster, more capable, etc. Setting the threshold of operational capability too high will define the minimum program cost by default. Restricting trades in any way potentially defeats the concept of CAIV.

### A Lesson Learned Too Many Times

About 10 years ago, I was the deputy program manager on a large government proposal on which the requirements were clearly out of line with the amount budgeted for the project. After pricing the draft RFP three different ways, my

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company notified the government program manager of the large gap between the proposal requirements and our estimated program costs. Competing contractors apparently advised the government of a similar problem because a team was formed to downscope the requirements and specifications.

Between the time the government issued the draft and finalized RFP, my program manager had numerous conversations with his government counterpart over the issue of requirements. Three months later, we received what supposedly was a downscoped RFP; however, it contained no meaningful reduction in requirements or statement of work. Disappointed, we submitted our proposal.

Although my company lost this competition, the government ultimately was the big loser. After lawsuit and counter-suit with the contractor who was awarded the contract, the government received a product that was delivered considerably late after a troublesome test program. Moreover, the program had a significant cost overrun.

On this project, informed contractor program managers knew how difficult it would be for the government program manager to control requirements, but the government program manager did not/could not [this was prior to Acquisition Reform] heed their advice. By not controlling requirements, the government program manager left the contractors with no choice but to try and meet unrealistic objectives.

Last year, I managed a foreign proposal that was, again, a virtual repeat of this experience. This is a lesson that we've learned too many times.

### Changing the Paradigm

The old Department of Defense (DoD) paradigm was *control cost and schedule*; the CAIV attitude is *control the requirements that drive cost and schedule*. In his article, Conrow correctly observes that the CAIV tenet "has the potential to reduce over-optimism in setting the design, which can eventually lead to decreased program cost and schedule by requiring that risks be recognized, administered through a proactive risk management process, and requiring viable risk mitigation activity."

About two years ago, I worked on an Advanced Concept Technology Demonstration (ACTD) proposal employing the CAIV strategy. The government program manager structured the RFP well. Our company received a list of bounded operational capabilities rather than a performance specification, and I thought the trade space was clear. However, my engineering peers were not comfortable with the CAIV methodology. They did not like the idea of reducing component, subsystem, or system performance to trade off cost.

Even after our company spent considerable money training them in DTC strategy, they still were hesitant to vary from the old familiar way of doing business. They wanted someone to provide them with concrete requirements and a specification.

What this case illustrates is the natural inertia, accumulated in our industry over

years and years of driving acquisition with requirements and subordinating cost, can only be overcome by rigorously using government CAIV methodology. Because we are shaped by our contracts, the government program manager must lead the effort to change the paradigm. Once our contracts and programs are based on a balance between requirements and cost, CAIV will become our way of life, just as hard requirements specification/performance was our way of life for so long.

Although CAIV is now a recognized term, I think the methodology might better be called "Clear and Controlled Requirements" or "Cost as a Function of Requirements." I believe that system performance, cost, and schedule are inextricably tied and cannot be independent of one another. Although I don't agree with the name, the concept is a good one.

### CAIV Can Work

Because of the complexity of the process, the creation of weapons system definition through systems engineering is neither simple nor quick. Therefore,

bounded operational capability and trade space must be defined well before beginning the system definition/design process.

Government program managers should work closely with their users and contractors to define/refine what is possible before issuing an RFP. If I seem to be suggesting more contractor involvement in pre-RFP activity and more teamwork while on contract, you are right. Today's defense marketplace suggests this to us all.

Just as tactics derive from strategy, detailed design derives from requirements; the more flexible these requirements are to trade-off, the more trades there will be.

At times, conducting more studies and analyses might be useful before initiating an acquisition; possibly adding requirements review milestones to the acquisition cycle could help in some cases; and certainly using Integrated Product Teams (IPT) could reduce the time it takes to finalize requirements. In recent years, the government has done an excellent job of instilling concepts like *stakeholder* and *ownership* through rigorous promotion of IPTs. I suggest

that government acquisition managers apply this same rigor to CAIV.

Since 1994, industry, the government acquisition workforce, and the military end user have coalesced as teams to manage several successful defense programs that resulted in products with the capabilities desired, at accurately predicted costs. On such programs, the secrets to success were readily apparent: clearly stated and bounded requirements that were tied to realistic cost and schedule; and a very smart government program manager in charge, working with a *dedicated* contractor program manager who clearly understood the stated requirements.

In addition to being a practitioner of contracts, cost, and schedule, I suggest that the articles discussed here prove that the program manager, whether government or contractor, needs to have a very close working relationship with a competent systems engineer or, even better, should be a competent systems engineer. Why? Because systems engineers are specifically trained to look for trade-offs – the very foundation on which CAIV is based.

## Inside DSMC

Air Force Col. Legand L. Burge, Jr., was assigned as Dean, Academic Programs Division, effective June 15, 1998. He is the former Vice Commander, Air Force ROTC, Maxwell AFB, Ala. Burge holds a Bachelor of Science in Electrical Engineering, a Master of Science in Electrical Engineering, and a Doctor of Philosophy from Oklahoma State University. In addition to several Service schools in-residence, Burge is a 1990 graduate of DSMC's Program Managers Course (PMC), now renamed the Advanced Program Managers Course (APMC).



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Langston earned a Bachelor of Applied Mathematics from the College of New Rochelle, and a Doctor of Jurisprudence from the University of Maryland. In addition, she was a student in the Institute of Public Policy at George Mason University. A Fellow of the National Contract Management Association and the Washington Academy of Sciences, Langston is a former elected director of the Washington Operations Research Council (now WORMSC), of the Operations Research Society of America (now INFORMS); and the Military Operations Research Society. She is a member of the Maryland and American Bar Associations, where she is active in the Public Contract Law section.



Joann H. Langston returned to DSMC as Holder of the Army Chair, DSMC Executive Institute, effective July 6, 1998. Langston previously served as DSMC's Army Chair from December 1987 to December 1989. She is the immediate former Director, U.S. Army Model Improvement and Study