

Are we Tending a Dinosaur Farm?

or

The Insertion of New Technology into Defense Systems...

Why is it Taking so Long?

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Introduction

There is a concern that it may now be taking longer to get new technologies into fielded defense systems than it did in the fairly recent (15-20 years ago) past. Advances in technology continue at a rapid pace, both procurement and RDT&E budgets are at significant levels. What is the problem? What are the causes?

First, is there really a problem? Yes, based on experience in both government and industry, I believe that there is a significant and growing problem. It is very clear that technology is available today which offers significant potential for operational or performance improvement, yet that technology may be 7 years or more from application. There is every reason to believe that the operational and performance improvements are needed. The basic complexity of the system requirements is steadily increasing. In fact, technology insertion is absolutely necessary if we are to meet these requirements.

Some Causes

The problem is complex and has a number of causes. Major causes are:

1. Significant system capabilities are presently in place
2. Some portions of a given "total system" have evolved to a point where large-scale replacements now require large expenditures
3. The process for developing operational requirements is severely flawed
4. There is a poorly-motivated government customer-set
5. Decision-making on procurements is diluted and imprecise
6. Industry is financially pressed and is reluctant to push advancements/ technical insertions. It is moving toward a low price mentality.

By briefly exploring each of these areas we may be able to capture the nature of the underlying situation and then propose actions which could improve it. This short paper will not address detailed actions for improvement since the specifics vary by system, Service or Agency. However, some thoughts are presented on the general nature of an improvement process.

Significant Capability Exists

Today's advocate of advances in capability must work in an environment where the major systems seem to be performing well. This is good news. However, since expenditures are at appreciable levels, a simple "more is better" argument is inappropriate. It is difficult and time-consuming to create the authoritative and logical resource requirement.

In the late 1960's and on through the 70's, events worked together to pull modern technology into advanced defense systems. The availability of technology actually permitted some missions to be performed which up to that point in time had been truly impossible. The needs were met with experimental programs which were, in large measure, successful. Although there were uncertainties at the start of some of the more significant programs, they rapidly gained support. In addition, the technologies used were even more successful than anticipated. System lifetimes almost always exceeded predictions. The new capabilities revealed new requirements and needs. The process was "on a roll".

Although many people today are apparently not aware of it, the vestiges of overall system (ground and space segments/collection processing, analyses, etc.) architecture existed in the minds of the program participants. This architecture was loosely coordinated and not mindlessly adhered to, but it did exist. The success of today's deployed capability is evidence that the architecture did not have major flaws. Today's continuing focus on organizational and operational shortcomings is also evidence that the architecture was far from being either completely thought out or perfectly executed.

The result of the energy and resources placed in this expanding area is the remarkable set of deployed resources which we have today. We have more systems, more inputs, more people involved, and more money than ever before. This, along with the extreme increase in "oversight", "management", and organizational "conflict" make it increasingly difficult to create new starts. Yes, it was somewhat easier to create a new system concept in the late 1960's, early '70's time frame. Yes, the new systems took proportionally smaller portions of the total budgets. Yes, the needs were relatively unaddressed. But it was still hard. The money was hard to get. There were other options. There were a lot of unbelievers. But it did happen. There must be other factors.

Large Scale Replacements Require Large Expenditures

Quests for commonality and for multiple-use systems are usually the tools of the review authorities for reducing resource requirements. These are not always appropriate and their use introduces confusion into the long term improvement process.

There are several existing systems which have similar basic mission statements (this surely applies in my area of specialty, but also seems to be true in other areas such as strategic and tactical weapon systems). These systems are basically sound, but they do not totally cover all requirements. They were usually evolved in an era where technological limitations did not permit covering "all" requirements. In some cases, the requirements are a strong function of time. In any event, there are often people in the current review cycle which, for whatever reason, ask sets of questions which can be reduced to a version of "can't one of these be modified to do the entire job?" Technologically, the answer may be "yes". For today. What of tomorrow?

If a "yes" answer to the consolidation questions were to be implemented, a wide variety of non-technical things might have to be changed. These changes could include:

1. acquisition authority
2. balances in industrial base, and
3. fundamental design of some aspects of the system

So far, when viewed in aggregate, the net delta expenditure for these changes has been very large. The total bill has then been judged to be too large in one or more of the repetitive review cycles and the original "decision" has been reversed. One recent example in my own experience is almost classic. People tried to solve all issues related to one problem set with one consolidation program. While it was technically possible to do this, the effort failed...at great expense in not only dollars, but human motivation and organizational good will (which are more difficult to recover). Such a situation makes it hard to take "giant steps". Only program advocates with great resolve will now attack a major consolidation program even if it is the correct technical solution to the operational need.

But there must be more to the story. Good will and motivation have never been in good supply.

The Flawed Requirements Process

When advanced program advocates enter the resource justification process they often find that the formal stated requirements do not support the advances. Yet, even a superficial investigation by knowledgeable individuals shows that requirements do exist. The situation is demotivating at a minimum and almost always introduces delays into the system. Why does this happen?

Translating operational needs into technical system requirements is one of the most challenging parts of the defense management process. I was actively engaged in it for about five years. In my experience most people engaged in conducting operations are not equipped with technical vision and they are much too busy to take time to learn. On the other extreme, the technologists have little idea of what is really needed and are often seen as arrogant by the operators. Only a very small percentage of people can effectively work both sides of this particular street. In attempts to work through this situation, many variants of management polling are used. Some are of the "pick-an-option" variety which are likely to be created by engineers and the others are forms of reaching the committee solution. Both are extremely time consuming and usually do not cover all of the points which are necessary for informed decision making.

For example, the "pick-an-option" technique often is created without good associated cost information. The most capable option is usually the most expensive, etc., but the options have been created in an unrealistic budget environment. The committee technique is generally judged to be more effective but only a few players will actually know anything relevant. Others present may simply represent staffed "positions". It is not an environment for creative work.

There is also a very serious problem associated with projecting future requirements in an environment where current needs are not being met. Almost without fail, the people responsible for conducting current operations will focus on short-term solutions. Perhaps we should be grateful for this because it does account for much of the piece-wise progress which is made. The larger problem is that the piece-wise approach usually becomes ineffective sooner than expected and the replacement may then be too expensive. It is my experience that actual needs almost always move faster than projected requirements. Yet the major long term solutions (which were once available) are avoided because of the perceived problem of doing them exclusive of quick-fixes. We need both. If we can make the decisions at the right time, the overall bill can be "afforded".

Perhaps individuals will press on through all of this?

Poorly Motivated Government Customer-Set

Getting something done in any large management system requires energy. The risk of not doing the operational job seems less than the risk of possible causing a problem by inserting new technology. Fewer people are effectively and aggressively working their management systems. It is my distinct past experience and current impression, that the government customer-set is increasingly adverse to any form of accommodating risk. Hopefully, this is not a National malady although there is also ample evidence that many other portions of industry are also seriously affected. It is interesting to note that there is a recognition that the status-quo is not sufficient to meet the basic operational requirements. However, there seems to be an almost total lack of motivation to expend the required amounts of energy (and resources) to make significant changes. Do SES-X's want to become SES-(X+1)'s so much? I really doubt this. Personally, I view it as a serious lack of dynamic leadership. Aggressively working the system has somehow become too personally expensive for middle-level government managers to risk anything. Technology insertion has somehow become seen as the "risk". Drives for the use of various MIL-Standards and procurement standards of various types are used as safety nets and inhibit the use of new technologies and management techniques. Whatever happened to the risk of not being able to do the job!?

I am influenced by current experience with a major program manager who has inherited an "approved program". No systems have yet been deployed. This individual can simply perform his routine duties and retire from government service as a success if he just manages to keep within budgetary guidelines and the existing delivery schedule. It seems that no one above him encourages him to be creative. Non-profit advisors are always available to replay the mistakes of the past and point out the potential problems of change. Because of launch delays beyond his direct control, the systems (which are not yet built or even contracted for) to be launched in the mid-1990's will contain 1970's technology and basic designs. They will last well into the 2000's. Entire new systems of

significant complexity have been built from scratch in the time now thought to be required simply to reproduce one already designed. Reduced to its basics, this is a totally ridiculous situation demanding immediate replanning. The entire government community which is involved seems to have no concern whatsoever for this situation.

To his credit, this specific program manager is trying to make step-wise system improvements, but is meeting with serious opposition. If this is the situation in a major program area which owes its success directly to the ability to insert technologies into advanced capability systems, I can only imagine how difficult it must be for program managers with technological vision to exist in the more mundane parts of DoD (or NASA?).

Diluted and Imprecise Decision Making

Should a program improvement advocate have enough vision and drive to develop a proposal, it will have to be "approved" multiple times. There are so many approval levels that it is extremely unlikely that the "final" approval authority will actually know anything about the subject.

How many "decision makers" does it take to decide anything? In government? In industry? This is often treated as a joke by many managers. Sometimes major panels of serious and experienced experts offer advice such as "use commercial products whenever possible" as a mechanism for avoiding too severe criticism of the existing situation in DoD. While this may be a good short term strategy, it is not a useful solution to the technology issue simply because many of the technological capabilities needed by DoD have, in fact, little or no commercial value. Not in the short-term anyway.

When the available technology was being inserted in relatively short lengths of time, the decision-making was timely even if not crisp. Technology will (hopefully) continue to advance at a healthy rate regardless of what DoD or the Defense industry does. But only some of it will apply to our problems. The general pace of technology base improvements is good (the related expense of these improvements will be mentioned later). If we are to make system insertion (or acquisition) decisions which are based on the availability of technology, we must make them in a timely fashion! Something better is always going to be available...see the latest set of vu-graphs from vendor X! Remember the 60's when we were reduced to saying (in essence) that our specifications were much better than the pictures that the Soviets had from the back side of the moon? We must be able to decide, regularly, without need for psychotic advocates or champions, and then do it!

The layers of decision making which now exist do not promote the solution to our problem. In recent years, decision-making has passed from an authoritative program manager all the way to a set of Congressional Committees (as many as six) and their ubiquitous staffs. We cannot turn the clock back. We can, however, devise ways for system decisions to be made in a timely manner. Unless we want to "fly and fight" with vu-graphs, we must do this!

Well, maybe "industry" will save us...it has before?

Industry Reluctance

There are many ways to say it but three factors weigh in against the defense industry offering a safety net. These factors are

1. perceived poor financial situation (see, for example David Westermann's paper attached)
2. very poor government/industry relationships (partially caused by some atrocious examples of industry abusing the public trust)
3. the resulting poor image of the defense industry by the public in general and the investment community in particular.

Since senior managers in the aerospace industry are faced with business decisions which are relatively short-term (i.e., profits for this quarter), they are not in the mood for approving investments which are alleged to deliver technologies which are promised to bring in system contracts in the not-too-clear future. This is particularly true when they can easily see that most current contract awards are made on the basis of the low-bidder. "High-tech" does not equate to "low-bidder"...at least not in the short-term.

In spite of all this, some senior managers have continued to invest in technology-driven programs. In my experience they have been rewarded by cancellations, delays, and an almost total lack of concern from their major customers. They are very unlikely to promote continued technology investment even if they believe that it is good for the country. They too have become ultra-cautious.

Net Result of Problem Causes

Taken one at a time, this collection of problem-causes could be overcome a large percentage of the time. However, depending on the structure(s) in which a particular problem exists, two or more of these problem-causes become very effective barriers to progress. It seems that we have unconsciously created a "problem-cause" distribution which is seriously inhibiting the application of advanced technology. Most of this has been done in the quest for "good management". The cure for past ills has serious side effects!

Since we live in an era of shared responsibility and decision making we probably cannot realistically expect to structure a process which will "fix" the total problem. We can reasonably expect to make changes which will improve our present position.

What can we build on?

Good News

There is a lot of good news. There are many people who are as good as any who have ever been a part of the aerospace industry. I am reasonably sure that they also exist in other essential parts of the defense industry. The young engineers and managers of today have more technical talent than their predecessors. There are a lot of good ideas. Not only do the new (and younger) people have new ideas, but many of the more stubborn, non-

conformist, older people still hold to good ideas which have yet to be implemented. We are still a profitable industry with the worlds greatest capability. If we act in some reasonably coordinated way we can provide the needed capability in the right time frame.

It is also true that many people are offended by the present condition. They seem to be just below the top levels of management in government and may be well positioned to do something in the near future. I have the impression that they need a flag to rally around.

We should consider it good news that nobody set out to intentionally create the situation that exists today. The sum of all the inter-related causes we have discussed is oppressive, but it is primarily the undesirable result of many actions which, in and of themselves, seemed to be justified at the time. Thus, a revolution is probably not required. Education and organizational evolution could provide the required results.

It is very important to realize that none of the causes which we have discussed are technical in nature. While it may take considerable sums of money to continue the surge of technological improvement in the industrial base, there does not seem to be any real reason to conclude that defense technology is somehow fundamentally leveling out. Technological improvements can be generated at understandable costs and in reasonable time spans. They could also be inserted into operational systems with good results. The problems are primarily with people and procedures. This also is not new. It is probably a natural state in our large bureaucratic management systems of both government and industry. Motivation must be supplied.

Another key to a solution is the fact that not all organizations are equally affected by all of the causes. Some have very well motivated and informed people, others have good requirements processes, etc.

The Challenge and the First Steps

If we do not get our government-industry act together, we will continue to evolve towards a "no-risk", "lowest-cost" defense effort. That will, I believe, be a disaster to the security of our nation. The serious nature of the problem merits us making the effort to promote the change. What are the first steps?

One of the organizational focal points for this sort of problem in the past was DDR&E. A series of reorganizations has diffused the responsibility for the type of objective overview necessary to identify broad-scale problems similar to this one. The individual Agencies and the Services are unlikely to spontaneously conduct the type of reviews which are required. The transition into the new administration offers the opportunity to reestablish competent authority in OSD which could examine this problem. The examination would focus on which problem-cause set is the most responsible as a function of organization and system type. Congressional advocates would be developed and made an appropriate part of a joint review process. Specific suggestions would be made to each of the concerned organizations. Yes, this is yet another review. Nevertheless, it is a practical organizational mechanism to illuminate the problems.

It will be relatively common that this proposed process will provoke negative reactions. Defenses will be created. If my belief that there is actually a widespread "feeling" that a serious deficiency exists is true, then there will also be a broad-based

secondary positive response which will grow and dominate if there is an authoritative, high-level interest shown in the subject. Most organizations like to keep their reviewers happy. In some cases independent review authorities will have to be established outside of the DoD because of the scope of the problem. These reviews would have no directive authority but could function as "red teams".

The time is right, for the transition period offers opportunities for fresh looks...even at old problems. Past studies can receive new attention, interest, and support without the need for indicting past management.

Once the recommendations are created (by full-participation, multi-organizational panels) then it must be the responsibility of the organizational managers to implement the improvements. Will they? Not in all cases. Further studies and follow-up reviews would be required to institutionalize the process.

The sooner we start, the better. Other actions will be required and follow-up assigned. This will lead to other actions.

We should get started with some specifics! Perhaps this paper will serve to illuminate the fact that there is indeed a problem.