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MEASURING PERFORMANCE: DEVELOPING GOOD ACQUISITION METRICS

HEARING

BEFORE THE

PANEL ON DEFENSE ACQUISITION REFORM

OF THE

COMMITTEE ON ARMED SERVICES
HOUSE OF REPRESENTATIVES

ONE HUNDRED ELEVENTH CONGRESS

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PANEL ON DEFENSE ACQUISITION REFORM

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[There were no Questions submitted post hearing.]

MEASURING PERFORMANCE: DEVELOPING GOOD ACQUISITION METRICS

HOUSE OF REPRESENTATIVES,
COMMITTEE ON ARMED SERVICES,
DEFENSE ACQUISITION REFORM PANEL,
Washington, DC, Tuesday, May 19, 2009.

The panel met, pursuant to call, at 8:00 a.m., in room 2212, Rayburn House Office Building, Hon. Robert Andrews (chairman of the panel) presiding.

OPENING STATEMENT OF HON. ROBERT ANDREWS, A REPRESENTATIVE FROM NEW JERSEY, CHAIRMAN, PANEL ON DEFENSE ACQUISITION REFORM

Mr. ANDREWS. Good morning, ladies and gentlemen. The panel will come to order. Appreciate your attendance. I especially want to thank the witnesses for their very diligent preparation. We have had the opportunity to review the testimony ahead of time. It looks like we are going to have a very engaging and meaningful discussion this morning.

This is the last of our series of hearings looking at the first question that we are going to be looking at in our inquiry. The members will recall that we are proceeding on a series of questions, the first of which is, "Can we design a series of metrics that accurately measure the difference, if any, between the price paid by the taxpayers and the value received by the taxpayers and the warfighters for the systems and services that we are buying?"

We are going to proceed after today's hearing with our second category of questions, which is really hypotheses as to what has gone wrong. We are going to have a series of panels talk about their theories and analyses of why we have a difference between the price paid and the value received.

The first of our two panels on this metrics question dealt with the sort of measuring the orthodox algorithms that are used. In the major weapons system side, we had a panel on that, and on the services side, we had a panel on that.

The purpose of today's panel is to bring in some people who we think perhaps look at the whole question through a different prism. They are willing to give us some new perspectives through which we can analyze the difference between the price we pay and the value that we receive.

We have three witnesses with a wealth and breadth of experience in the acquisition field, but also who I think benefit from what I would call a healthy distance from the daily responsibilities for that function, so they can give us a perspective that marries experience with a fresh perspective. And hopefully, we will be able to use

the testimony of these witnesses to go forward, draw some conclusions about the best metrics to use in our work, and then proceed with our work in analyzing the various hypotheses given for why we have suffered these cost overruns.

I also want to take a moment and thank Mr. Conaway, who can't be with us this morning but who is ably represented by Mr. Coffman, and all the members of the panel for their excellent contribution to the work on the Weapons Acquisition System Reform Through Enhancing Technical Knowledge and Oversight (WASTE TKO) bill, which has passed the House. We will be meeting with the Senate in formal conference at 4:30 this afternoon to, I believe, put the finishing touches on that conference report so we will be able to proceed to the floor in short order on that, get the bill on the President's desk. Each member of the panel has made a very significant and welcome contribution to that effort.

Having said that, as the chairman and Mr. McHugh have said, we think that that effort covers about 20 percent of the landscape. It looks at major weapons acquisition, which certainly needed to be examined. But there are so many other areas that fall outside of that that the panel has to pursue, as well as, frankly, reviewing the early stage implementation of the law that we believe the President will sign this week.

So we are by no means at the conclusion of our work. We are really at the outset of it. And one thing we would ask the witnesses to do this morning is to think about the fact that, although the Congress is about to pass major legislation dealing with major weapons systems, we have not yet addressed hardware that doesn't fall into the major weapons system category and the 55 to 60 percent of acquisition that is services that we have to look at on behalf of those who wear the uniform and on behalf of the taxpayers.

We are glad that you are here. And at this time, I want to turn to Mr. Coffman for his opening statement, and we will proceed with the witnesses after that.

[The prepared statement of Mr. Andrews can be found in the Appendix on page 27.]

STATEMENT OF HON. MIKE COFFMAN, A REPRESENTATIVE FROM COLORADO, PANEL ON DEFENSE ACQUISITION REFORM

Mr. COFFMAN. Good morning. Mr. Chairman, ladies and gentlemen, I would like to extend a welcome on behalf of Ranking Member Conaway, as well. He is sorry he could not be with us today. I would like to thank the chairman for allowing me to take a few introductory remarks in Representative Conaway's place.

Today's hearing is an appropriate follow on to the panel's two hearings which focus on how the Department of Defense (DOD) and the Government Accountability Office (GAO) currently assess performance on major weapons systems and service contracts. The purpose of this hearing is to think outside the box on how we should measure performance and about what we should be measuring and less about the how we are doing it today.

Our previous hearings revealed that current measures of performance tend to break down if the program baseline is unrealistic. We want to know if the program can be corrected—if the problem

can be corrected. Furthermore, are there metrics beyond cost and schedule performance that are of value, such as how closely does the delivery system meet actual warfighter needs. Does the time of delivery of operational capabilities satisfy warfighter needs? How do we determine whether optional or tradable capabilities requested by the warfighter are affordable?

Mr. Chairman, we have a distinguished panel of witnesses in front of us today. I have looked at their written testimony, and I look forward to their testimony. There are a couple of points I would like to highlight. Although Mr. Dillard is not testifying today, he did submit a written statement that I would like to briefly comment on.

[The prepared statement of Mr. Dillard can be found in the Appendix on page 77.]

Mr. COFFMAN. He states that, "The proliferation of autonomous fiefdoms within the department continues to increase, with each being a stovepipe of oversight expertise, imposing unique reporting requirements, assessments and reviews."

He goes on to state that, in regards to adding additional acquisition workforce professionals, that, "These new people should not be housed in the Pentagon, but instead where the execution of programs occur." Mr. Chairman, I think this is an important point that I believe we need to follow closely.

Another point of observation I would like to make is in regards to requirements in joint programs. We have many programs out there that have the word "joint" in front of them, but they are joint in name only. I understand that the current requirements generation process is called the Joint Capabilities Integration and Development System, or JCIDS.

It seems to me that, in order to have a truly joint program that the requirements for that program must be borne jointly. Yet, I do not believe our current system, or as Mr. Dillard describes, current fiefdoms, foster such an environment. So I would be interested in hearing from our witnesses in this regard.

I also encourage our witnesses to share their views on existing laws and regulations that are particularly helpful or not helpful to the Department's efforts to obtain the best value and capability for our warfighters. We have heard from the Department in two separate hearings about how they currently measure performance and value on contracts. What we haven't heard enough about is how they should be measuring value. Consequently, your input will be greatly appreciated.

With that, I conclude. And again, thank you, fellow members, and thank you, Mr. Chairman. I look forward to the witnesses' testimony.

Mr. ANDREWS. Mr. Coffman, thank you.

Without objection, the statement of any other member of the panel will be included in the record. And without objection, the statement of each of the three witnesses, plus the supplemental floor statement, will be included in the record of the hearing.

[The prepared statement of Mr. Coffman can be found in the Appendix on page 28.]

Mr. ANDREWS. I think each of you are veterans at this process. You know that we generally have a five-minute rule where we ask

for succinct summaries of your written testimony. We are going to be a little bit more liberal with that this morning, but then we are going to turn as quickly as we can to the questions from the panel and get into the give-and-take.

I am going to read a brief biography of each witness, and then, Mr. Patterson, we are going to begin with you.

Mr. Dave Patterson is the Executive Director of the National Defense Business Institute, which he is establishing at the University of Tennessee in the College of Business Administration. It is an institution inspiring business innovation for both government and industry by providing practical, sound assistance and creating economically efficient and effective defense business and acquisition programs.

Prior to taking his current duties, he was the Principal Deputy Under Secretary of Defense Comptroller. As the Principal Deputy, he was directly responsible for advising and assisting the Under Secretary of Defense with development, execution and oversight of the DOD budget exceeding $515 billion, with annual supplemental requests of more than $160 billion.

From August 2003 to June 2005, Mr. Patterson held duties as the Special Assistant to the Deputy Secretary of Defense. In that capacity, he was responsible for managing the Deputy Secretary of Defense's personal staff, as well as providing direction and advice to the Office of the Secretary of Defense staff on a wide range of national security operations and policy subjects.

He served in the Air Force from 1970 to 1993, retiring in the rank of colonel. During that time, he held responsible leadership and management positions, with assignments at the air wing level as the C5–A aircraft Commander and Deputy Operations Group Commander at Major Command Headquarters, U.S. Air Force, the Office of the Chairman, Joint Chiefs of Staff, the Office of the Secretary of Defense and Inspector General. In 1986, he was the Air Force Fellow at the American Enterprise Institute and served in Vietnam, flying 02–As as forward air controller.

Thank you for your service to our country, Mr. Patterson. Glad to have you with us.

Mr. Fitch, Mr. David P. Fitch enlisted in the Navy in 1966. He was commissioned in 1968 after graduation from San Jose State College and Aviation Officer Candidate School in Pensacola, Florida.

In 1969, after fixed and rotary wing flight training, he was designated a naval aviator and a distinguished naval graduate. He retired from the Navy in 1998 as a captain, following a career that included three operational and major acquisition command assignments.

Mr. Fitch culminated his tour in the Navy as the major program manager for the international and joint multi-functional information distribution system. He was a 1997 recipient of both the David Packard Excellence in Acquisition Award and the Department of Defense Value Engineering Award.

In 2001, after nearly three years in the defense industry, Mr. Fitch joined the faculty of the Defense Acquisition University, teaching and consulting acquisition executives and program management and other acquisition disciplines.

In 2006, he led a major independent study of the Coast Guard Deep Water program. In July of 2008, he assumed the position of Director, Acquisition, Technology and Logistics (AT&L) Leadership Learning Center of Excellence after nearly seven years as the Dean of the Defense Systems Management College.

Mr. Fitch holds degrees in business and industrial management from San Jose State college, an M.S. in education from the University of Southern California, and he is a graduate with highest distinction from the Naval War College in Newport, Rhode Island. Thank you, Mr. Fitch, for your service to our country, and we are glad you are with us this morning.

Dr. Daniel Nussbaum, from 2004 to the present, has been a visiting professor at the Naval Postgraduate School operations research department. From 1999 to 2004, he was a principal at Booz Allen Hamilton, responsible for a broad range of costs, financial and economic analyses with clients across the government and commercial spectrum.

From 1996 to 1999, he was the director of the Naval Center for Cost Analysis at the Office of the Assistant Secretary of the Navy for Financial Management and Comptroller here in D.C. From 1987 to 1996, he was division head of the Naval Center for Cost Analysis. From 1982 to 1986, he was Deputy Director and Acting Director for operations research and cost analysis divisions of the Naval Air Systems Command in Washington, D.C.

Again, a very distinguished servant of our country, three excellent people with experience and fresh insight. We are happy to have you with us.

Mr. Patterson, we would like you to begin with your testimony.

STATEMENT OF J. DAVID PATTERSON, USAF (RETIRED), EXECUTIVE DIRECTOR, NATIONAL DEFENSE BUSINESS INSTITUTE, UNIVERSITY OF TENNESSEE

Mr. PATTERSON. Thank you, Mr. Chairman, members of the Defense Acquisition Reform Panel. I am very pleased to be here this morning to participate in a discussion of a question that has clearly captured the attention of the current Administration and Congress: How should Congress assist the Department of Defense in improving its acquisition of weapons and services so that it can meet the needs of the warfighter in the field while still being a good steward of the taxpayer's dollars?

The first consideration for judging the success of an acquisition program is whether it fielded a weapons system or information system or service in time to make a positive impact for the warfighter. A system or service fielded too late to need may as well not have been bought at all. The phrase, "too little, too late," can mean lost lives.

But before we look at the measures of the acquisition system merit, there is another consideration central to this discussion. When Secretary Gates made his budget announcement on April 6th, 2009, I believe he was speaking from frustration that was as much about what has been the persistent problem with the acquisition system that we depend on that is simply not responsive to the immediate warfighter needs, as it was about winnowing bloated, failed and unnecessary programs.

Implicit in that expression of frustration is a clear lack of confidence in a system that actually produces programs with uncertainty and instability. The most dramatic improvement metric will be when the senior leadership in the Administration, Congress and the Department of Defense have seen such improvements, results, not words, that they can say they have renewed confidence in the stability, predictability and effectiveness of the defense acquisition system.

The Defense Acquisition Performance Assessment's Report contended that program stability and predictability were singularly and uniquely crucial to managing programs that were on cost, on schedule and performing. To that end, in the time I have, allow me to describe two areas of improvement for measuring program effectiveness worthy of attention.

First, Major Defense Acquisition Programs, or MDAPs, often start at milestone B, the beginning of engineering and manufacturing development, with critical staff positions vacant. Percentage of critical staff positions filled at milestone B is an easy and important metric to be observed. It makes little difference to implement programs to raise the level of skills of the program staff if they are missing in action.

Second, the acquisition strategy document, that is to lay out how the weapon system is to be acquired, the initial roadmap, if you will, is often flawed in that it focuses more on presenting a case for required capabilities and quantities than on laying out the reasoning for acquisition competition methodologies.

For example, how the prime contractor participants in an MDAP competition will select subcontractors and how the winner of the competition will manage the subcontractors to gain improved efficiencies and effectiveness are generally given little consideration. Creation of the acquisition strategy document is one of, if not the most, important tasks the government acquisition program management can undertake.

The strategy should establish the template for all the activities that will take place throughout the source selection process, engineering manufacturing development, and follow-on production and fielding. More important, it establishes how the program management team is thinking about the numerous events and activities that a program will encounter.

The defense acquisition executive should establish a common set of strategy elements that all the military department service acquisition executives must include in MDAP acquisition strategy documents. Additionally, a set of standards or metrics by which the strategy elements can be evaluated as effective must be part of that process.

In closing, I would be remiss if I didn't acknowledge the progress that has been made by the Department in improving the acquisition system over the last four years. Though it is the General Accountability Office's headline that the 96 major acquisition programs have grown in cost by $296 billion that gets attention, those numbers belie an equally worthy but overlooked statistic published in the very same report.

The average increase in unit cost of the 28 MDAP programs with less than 5 years since development started is only 1 percent. Com-

pared with an average of 55 percent increase in acquisition unit cost of 25 programs in the group with 5 to 9 years since program development start, there has been important improvement that should be recognized.

With that, it is my privilege to be here. Thank you very much, and I would be happy to take any questions that you have.

[The prepared statement of Mr. Patterson can be found in the Appendix on page 32.]

Mr. ANDREWS. Thank you, Mr. Patterson.

Mr. Fitch.

STATEMENT OF DAVID P. FITCH, USN (RETIRED), DIRECTOR, AT&L LEADERSHIP LEARNING CENTER OF EXCELLENCE, DEFENSE ACQUISITION UNIVERSITY

Mr. FITCH. Chairman Andrews, Congressman Coffman, members of the panel, thank you for the opportunity to appear here today. I will address the subject of acquisition performance metrics and your questions about how to increase the realism of program baselines, making trades between affordability and performance and how to assess the value of systems that do not necessarily—please recognize that my opinions do not necessarily reflect the views of the Defense Acquisition University (DAU), the Department of Defense or the Administration.

Mr. ANDREWS. That is why we are interested.

Mr. FITCH. I suspected as much.

Measurement of acquisition performance must encompass both strategic and tactical elements. As emphasized in a recent Defense Science Board report titled, "Creating a DOD Strategic Acquisition Platform," the management, execution and oversight of acquisition programs is moot if we aren't spending taxpayer dollars to buy the right capabilities if we aren't demonstrating strategic choice. It is as important to decide what capabilities we won't buy as well as what we will buy.

I believe one of the root causes of funding instability is what I described as too many programs chasing too few dollars. Too many programs chasing too few dollars is one of the root causes, I believe, of overly optimistic cost estimates. The recently implemented Materiel Development Decision (MDD) process provides a framework for making strategic investment decisions.

The MDD is the formal point of inquiry into the acquisition process. MDD will increase integration of the three major acquisition support systems, requirements, resources, and acquisition.

Improving requirements management, an initiative supported by the Congress, includes providing training to requirements writers and managers to ensure that they have a sufficient understanding of the critical elements of acquisition, such as systems engineering and testing. The goal is to improve collaboration between acquisition and requirements communities to exploit cost and performance trades and improve acquisition outcomes.

Having a formal requirements and acquisition process is not unique to the DOD. We can learn important lessons from commercial industry. If you compare the DOD acquisition system with the process to develop electronic games, there are marked similarities and differences.

Notably, the process to get games on the shelves for the December holiday season starts with a precise clarity of what will be developed by when, and includes a corporate commitment to the resources required for the project. Precise clarity is a result of intense interaction between the people that divine the capabilities of the game and the people that will design and test the software.

Turning to the subject of tactical acquisition metrics, the most effective tools and templates incorporate metrics, both quantitative and qualitative. The question was raised, "Are there metrics beyond cost and schedule performance that are of value?" The answer is yes, and an ongoing example is a probability of program success metrics, POPS, that are currently being developed and deployed across the services and other federal agencies, such as the Department of Homeland Security.

Starting with a blank sheet of paper, a group of DAU faculty comprised of experienced program managers and other functional experts ask themselves questions, including, "What conditions facilitate the success of programs? What metrics are leading indicators of derailment?"

The resulting tool, POPS, uses a structured process to continually assess and display key elements of planning, resourcing, execution and external influences that promote or negatively impact program success. Still evolving, POPS is being used in the Army, Air Force, Navy, Marine Corps and Coast Guard. Timely, accurate and transparent metrics integrated in a management and oversight process, will produce better program outcomes.

Another question that has been asked, "Can we ensure improved realistic baselines." Again, I believe the answer is yes, and there are ongoing initiatives that will yield more realistic baselines. These include increased emphasis on technology readiness before starting major development, emphasis on improved cost estimating, which I am sure that we will talk about today, and competitive prototyping, which is included in the new DOD 5000.2 and pending legislation.

Prototyping increases the opportunity to identify and assess affordability and capability traits. Competitive prototyping also allows the government to observe the performance of competing industry teams before making a down-select for engineering and manufacturing development. No matter how thoughtfully we plan and discipline source selection, a paper-only source selection process is never as good as demonstrated performance.

The ultimate assessment of whether we have delivered value and needed capability to the warfighter is feedback from the field from the warfighter. At various times, I have seen photos of messages written with felt-tip pens on trucks and personnel carriers that have been returned to the government or industry depots. One of those signed messages—a picture is in my written testimony—reads, "This truck saved my life, as well as five others, 2–April–2008 at 2300 Lima, Basra, Iraq." Those kinds of testimonies, those kinds of results, are what those of us that are in the acquisition aim to achieve on a daily basis by our efforts and commitment.

Before equipment is fielded, it undergoes rigorous levels of development and operational testing, and the new DOD 5000 has increased emphasis on earlier testing.

Mr. Chairman, thank you very much for the opportunity to participate in today's discussion. As the Secretary of Defense has said, there is no silver bullet. It will be a combination of initiatives and collaboration amongst all the stakeholders to create an acquisition system that consistently produces successful acquisition programs.

I look forward to your questions.

[The prepared statement of Mr. Fitch can be found in the Appendix on page 57.]

Mr. ANDREWS. Mr. Fitch, thank you very much for your testimony.

Dr. Nussbaum.

STATEMENT OF DR. DANIEL A. NUSSBAUM, VISITING PROFESSOR, DEPARTMENT OF OPERATIONS RESEARCH, NAVAL POSTGRADUATE SCHOOL

Mr. NUSSBAUM. Mr. Chairman, distinguished members of the panel, I would like to thank you for this opportunity to discuss my thoughts on how to improve acquisition and cost estimating processes in the Department of Defense. These ideas are mine alone.

As the chairman said, I am a member of the faculty at the Naval Postgraduate School in Monterey, California. And I have spent the last 30 years mainly doing, and more recently, teaching and researching in the defense acquisition management system with a focus on cost estimating. I was a previous director of the Naval Center for Cost Analysis and past president of the Society of Cost Estimating and Analysis.

All my experiences in cost estimating confirm that three things are necessary for sound cost estimating: Acceptance of the underlying uncertainties in predicting the future, accurate and plentiful historical data, and professionally trained and certified personnel.

On uncertainty, there is intrinsic uncertainty in all estimates. It derives from several sources, mainly that we are usually designing or building or operating something that is substantively different from what we did before. The difference could be in the product or in the economic conditions or the programmatic conditions.

An estimate reflects our knowledge at a point in time when we freeze the problem and base the cost on the configuration and programmatics as they are understood at that time. From that baseline, many things can change that can also change the cost estimate, including labor rates, overhead rates, schedules, enhancements of the capabilities or quantities, changes when a particular technical solution to a problem doesn't work as planned. And we need an alternative technical solution.

On data, a hallmark, a necessary characteristic of a sound cost estimate, is that it is based on historical program performance from similar or related ongoing or past programs. Historical data is variable. Not every aircraft costs the same as every other aircraft.

And the measurement of this variability is accomplished through statistical constructs, things like standard error of the estimate, things like confidence intervals. We assume in our community of cost estimating that the patterns of the past will repeat in the future. But these patterns are almost always statistically grounded patterns modeled with the powerful and subtle techniques known collectively as regression. Further, we know of no alternative ap-

proach to using the past as a guide to the future if we want a scientific that is a reproducible and auditable approach.

Not all estimating is done by government employees. There really are three sub-communities. One is the government in-house estimators. One is employees of the large vendors who also design, develop and build what we buy—Boeing, Northrop, Lockheed Martin, for example. And thirdly, there are support contractors or consultants to the government. Those are the three communities.

And surely, we need to increase the capacity and the quality, the numbers and the training of the government estimators, but so do we need to enhance the professionalism of the other two communities.

There are currently no undergraduate curricula in cost estimating, and there are only four educational institutions that I am aware of that teach at least one course in cost estimating, and those are the Naval Postgraduate School in Monterey, where I am; the Air Force Institute of Technology at Wright-Patterson in Ohio; Defense Acquisition University, diverse locations with a capital campus at Fort Belvoir; and the Massachusetts Institute of Technology, which offers one elective course in cost estimating within its engineering curriculum.

The recent separation of the business cost estimating and financial management career field into two separate cost estimating and financial management tracks is a very welcome development and should be supported, but note that DAU support is largely limited to military and DOD, not the other two communities.

The Society of Cost Estimating and Analysis—we say SCEA—whose membership includes approximately one-third of all cost estimators supporting DOD, is a central and indispensable player in the training, initial certification and periodic recertification of cost estimators. I note with pleasure that the executive director of SCEA, Mr. Elmer Clegg, is in the room.

SCEA has collected a body of cost estimating knowledge, and it provides the members of the cost estimating community, provides training in cost estimating, has developed and offers an examination and experience-based certification program. Lockheed Martin, Boeing, Northrop Grumman, other vendors use SCEA's training and certification as their standard.

I appreciate very much what this committee seeks to accomplish, Mr. Chairman. This concludes my prepared statement, and I would be pleased to answer your questions.

[The prepared statement of Dr. Nussbaum can be found in the Appendix on page 66.]

Mr. ANDREWS. Well, thank you, Dr. Nussbaum, and I thank each of the three witnesses for their testimony. As I say, we have had the chance to review the written testimony. We are now going to get to the questioning phase.

Mr. Patterson, I was intrigued by your reference in your written testimony to two kinds of requirements costs, which you express as customer requirements and derived requirements. What is the difference between the two?

Mr. PATTERSON. Customer requirements are established in key performance parameters, which are requirements that are established for a particular weapons system that the weapons system

then must perform against. Derived requirements are those requirements that the customer did not ask for but that, as the name would suggest, derive as a consequence of the design process. "Oh, look, we could do this better if only we"—and of course, that is taken to the program manager.

The program manager will say, "Okay, we can do that. Just bring money." And they do.

Mr. ANDREWS. Now, I notice on page seven of your testimony that you say that a recent study prepared by the Monitor Company Group was based on selected acquisition report data, estimates that approximately 33 percent of the cost growth from 2000, 2007—I think I read this—is attributable to this second category of requirements that you are talking about, right, the derived?

Mr. PATTERSON. That is correct. Yes, sir.

Mr. ANDREWS. Now, how is that number reached? Where did that 33 percent come from?

Mr. PATTERSON. That comes from the selected acquisition reports (SARs). In fact, they lay that out in the SARs and explain in each of the SARs where the——

Mr. ANDREWS. Well, one of the things that we want to do is to make sure that we discriminate between derived changes that are beneficial and those that may be superfluous. How would you suggest that we might do that? In other words, I don't want to leave the impression that we are saying, or the report is saying, that "Oh, that 33 percent was waste."

Mr. PATTERSON. Oh, absolutely not.

Mr. ANDREWS. And how do we draw the line between beneficial, cost-effective derived requirements and not-so-beneficial derived requirements?

Mr. PATTERSON. Well, let me give you a real-life example. In 1993, I came to the C–17 program. It was a troubled, problem-plagued program.

The two program managers decided that much of the problem was that requirements were growing in an airplane. They established a set of rules. The set of rules was very simple: If you have a requirement or an engineering change, which is effectively a derived requirement, then it must go to an engineering change board.

The engineering change board will evaluate the change for its intrinsic merit. But if it doesn't meet the safety of flight or other driven requirements, then it has to have a three-to-one payback in savings and not perturbate the schedule.

Mr. ANDREWS. Interesting.

Mr. PATTERSON. Real simple.

Mr. ANDREWS. Now, in terms of the scope of that C–17 program, how much were the derived requirements overrun? In other words, how much was attributable to derived requirements?

Mr. PATTERSON. I would only be guessing. I can certainly get that for the record.

[The information referred to can be found in the Appendix on page 83.]

Mr. ANDREWS. And with this method that you just described, in your judgment, what percent of the derived requirements were beneficial, and which failed to make that three-to-one cut and didn't happen?

Mr. PATTERSON. Again, let me give you an example.

At Edwards Air Force Base, they were testing the airplane. One of the requirements was that one airplane needed to start another airplane, but it started it with two hoses from the pneumatic system. Somebody said, "I wonder if it will start with one hose." It didn't. "Oh, my gosh. Well, now we have to go and figure out why that is the case."

And so, that took a considerable amount of test time and money, and as it turned out, they really wanted to have it start with one hose. I am sorry, that would have taken——

Mr. ANDREWS. Who was the someone who said that? Not the person's name, but where were they in——

Mr. PATTERSON. That was the test community out on the ramp at Edwards.

Mr. ANDREWS. Right.

I am going to go back for a second round, but Mr. Fitch mentioned this probability of success metrics program. Has there been built into that a litmus test for a probability, if you would fall below it, things stop? In other words, does that program have in it a built-in go or no-go line?

Mr. FITCH. It does not have a go or no-go line. It is information that is updated and provided——

Mr. ANDREWS. Do you think it should?

Mr. FITCH. I think that there needs to be an informed review and decisions that look at each of the things that occur that is negative, because some of the things that are in the probability of success metrics and reporting are positive.

So I think that it needs to have the program manager, when that information is put together on a monthly basis, needs to look at that. It needs to be reviewed by someone in his Program Executive Office (PEO), okay, and potentially even at higher authority when there are negative occurrences.

Could I add something about—reporting?

Mr. ANDREWS. Sure, and then we are going to go to Mr. Coffman. Sure.

Mr. FITCH. Yes.

I just wanted to explain that the derived requirement process is actually part of the systems engineering process so that if, for instance, the warfighter says in an aircraft, "I need a display that has color, I need a display that has this amount of resolution," et cetera, the first pass, even by the warfighter or the cost estimators, may say, "This amount of processing may be sufficient for that."

When you get into, "Well, by the way, you are going to have these other software capabilities." You put those together, and they start to build on one another, you can find all of a sudden that the processor that was planned may be a commercial off-the-shelf item with X amount of memory, throughput, et cetera, is insufficient.

At that point is the point where it would be very useful to have the requirements community have a real dialogue with the acquisition community to say do I now take away some of the requirements so I can continue to use that commercial off-the-shelf processor that is less expensive, or are those requirements really important now that we have figured out what they are. So the point is the derived requirements is a very important process, and it is ac-

tually the process where you allocate where features will go to hardware or software.

Mr. ANDREWS. Thank you very much.

Mr. Coffman.

Mr. COFFMAN. Thank you, Mr. Chairman.

This is to all of you. It seems like part of the problem is sometimes we are dealing with immature technologies, and I think we have had previous testimony to that effect, that sometimes we are asking the contractors to develop something.

Should we bifurcate the process? In other words, that you are contracting with one entity to develop the technology, to develop the—I don't know if you would go as far as a prototype, and then where you can go into fixed cost production with another—maybe that entity would be allowed to bid on it as well. But is it better to bifurcate the process?

Mr. NUSSBAUM. You know, I would say we would do that now. If we have open competition, we certainly have a research and development (R&D) contract followed by an acquisition contract with—there is certainly no guarantee that the R&D contractor will have a follow on.

So in some sense, we do that, but in another sense, the Department has now mandated technology readiness levels, TRLs of certain levels before a program can get beyond a milestone. They have narrowed that cone of uncertainty by saying you have to have a TRL level six. They would prefer seven, and GAO prefers seven, but you have to pass a TRL level of six before you go into the next milestone.

Mr. FITCH. As a part of the analysis of alternatives, that process that immediately follows it, the technologies that would be appropriate for that system, that capability, are assessed for technology readiness, when you get to the point of saying who should develop it, I prefer the concept of the competitive prototyping, because you are going to get proposals from industry.

They are not going to all have the same strengths. Some are going to view that I want to do this more in a hardware function. Others may be more software intensive. There are different technologies involved.

Their proposal, and then watching them deliver on what they promise and they say is possible in competitive prototyping, is key to then being able to transition and make an award to that contractor who has proven that they did what they say they could do. So having a different contractor, if I understood your premise correctly, to develop technology and then award it to somebody differently to develop the system, I think that is not the intent of the competitive prototyping system.

Mr. PATTERSON. I think, too, there is a problem that arises when we talk about spiral development. Originally, spiral development, evolutionary development, were designed to have a weapons system that effectively was fielded and then have block upgrades to improve the weapons system.

In many cases, that is not how that works, because you do have a parallel R&D program that is working on improvements. And before the weapon is actually fielded, you have the attempt to integrate improvements.

Well, the consequence of that often is that you have a stretched-out program. Costs escalate. And in the end, performance is degraded, and it takes a while for the—much longer than had been anticipated for that weapons system to be fielded. So I think we need to have very specific and clear understood standards by which we will integrate or put in upgrades or technology advances into weapons system. It certainly can't be during engineering, manufacturing, development.

Mr. COFFMAN. I think it was mentioned, and it has been mentioned repeatedly, that the changes drive a lot of the cost as they go forward. Where did the changes emanate from? I mean, are some of the changes sort of broader in scope where the affected branch who will receive and utilize the weapons system, is it changes in evolving doctrine, or is it mostly at a very technical level with this engineering requirements?

Mr. NUSSBAUM. You know, I think that changes come from all sorts of places, including changes in labor, overhead rates, schedules, requirements, quantity, absolutely everything, just like building a house. Everything that changes has the contractor saying, "Cement has gone up. Brick has gone up. My subs have gone up"—or down, but they are always changing.

And so there is a great churn. Some of it is part of life, and some of it we try to control by saying, "Tell us what you are building, and we will cost that program." But I think it is just intrinsic in the cost estimating process.

Mr. COFFMAN. Is there any way to just have more—I mean, what would be some of the methods for having more discipline over the—and I take it some of it would—having a change board?

Mr. NUSSBAUM. There is something called a CARD, a Cost Analysis Requirement Document, which is, to the chagrin of all program managers, we say three or six months before we are going to a milestone, you tell us what you are building, how many, what the technologies are, and we will cost that program. It may be that things change after that, but that is the program we are going to cost, because otherwise we are chasing our tail, and we don't know until the very last moment what we are costing.

And in fact, it takes time to do a cost estimate. It is a part of the discipline at the Office of the Secretary of Defense (OSD) is a Cost Analysis Requirements Document will be prepared six months before the milestone, and the lack of availability of that CARD results in a day-to-day slip in the milestone. So that is real discipline, but it has its obvious down side, too.

Mr. PATTERSON. I think, too, that in dealing with the discipline and structure, that I must tell you, I submit that it requires rules. And the rules simply have to say that, after milestone B, you don't have any more requirements. And, I mean, it is somewhat draconian, but nonetheless, if it—unless of course it is a safety of flight or it is an obvious design failure that needs to be corrected.

But those kinds of things are few and far between, quite frankly. And then, this idea that a requirement or a change would give you a three to one or four to one payback in savings while not perturbing the schedule is not a bad idea, either. And as technology moves forward, that is entirely possible over the course of a program.

Mr. FITCH. There are times with the requirements—I recall when I was developing a black box that was going to go in 17 different platforms. I would have this platform coming to me and say, "It would really be easier if you changed it this way. It will make me less expensive for my integration, save my costs and schedule."

What I came to understand is the program manager has to be prepared to say no during the development phase. Now, the configuration steering boards we have in place anticipates that there may be compelling reasons to change a requirement, moderate a requirement during development, but that is the process of the configuration steering board, is to raise that, if you would, visibility to the pressures of changing requirements to have a senior level decision made about the requirement once the milestone has been approved.

Mr. ANDREWS. Thank you.

Mr. Cooper.

Mr. COOPER. Thank you, Mr. Chairman.

And I would especially like to welcome a fellow Tennessean, David Patterson, and congratulate him on starting Defense Business Institute at the great University of Tennessee in Knoxville. Thank you not only for your past service, but what you are doing right now.

Can anyone provide me with enough historical perspective to help me understand how, during World War II, men like Henry Kaiser were able to produce destroyers and—I forget exactly who produced airplanes, but it was an amazingly productive period. And I don't know how—was there less bureaucracy then? How was so much able to be accomplished so quickly? Anybody know?

Mr. NUSSBAUM. My reading of history is that there were a lot of failures, and then we tend to remember the successes, which were terrific. But in fact, there were false starts.

The P–51 was wonderfully successful, but because it had a bigger gas tank so it could keep up with the other aircraft, it gave us greater range, but we didn't build it for that reason. Just we sort of lucked into that, if you will.

I think that things were much simpler. We were able to turn technology generations around much faster and, therefore, absorb the failures. Today's systems are very complex. They take a long time, and we just won't accept failure.

Mr. FITCH. I think that what we remember a lot is those ships going down the ways, okay, daily, okay? That was in the production phase.

Even the P–51 that was just mentioned by Mr. Nussbaum, when it was first fielded, it didn't have the engine that ended up being what everybody remembers about the performance of that aircraft. There were various modifications made after it was fielded. It was in the field and found that it was not exactly was needed.

Mr. PATTERSON. I think, too, you had a tremendous industrial base that was able to accommodate to the level of technology that it was asked to accommodate to. Today, I am not sure that we would be able to do that again in that amount of time.

Dr. Ron Sega did a study not long ago when he was at DDR&E, Director of Defense Research and Engineering, in which he looked at the industrial base and what it could do, and found that 62 per-

cent of all of the Ph.D candidates that are enrolled in disciplines critical to national security have temporary visas. And that tends to put us at a disadvantage, because they generally don't stay around and work for Lockheed or Northrop or Boeing, and Skunk Works, particularly, or Phantom Works.

And if you will look at the Aerospace Industries Association data, you will find that in the 1990, 1991, you had 1.3 million touch labor workers, highly skilled workers. Today, we have something less than 700,000. Those are statistics that should give us pause to consider what we are going to do in the future.

Mr. COOPER. Help me understand. I know that we have had failures in acquisition throughout our history, and Mr. Fitch mentioned a success when he posted the note that was on the vehicle that saved lives.

But on the front page of the Washington Post recently was a statement by Secretary of Defense Gates when he attended the return of the remains of some of our troops. He asked how they died, and he was told they were in an inadequate vehicle. And he cursed because that was symbolic of the fact that we have had difficulty fielding relatively simple platforms like Mine Resistant Ambush Protected vehicles (MRAPs) or up-armored Humvees.

And at least for some period of time there was only one manufacturer of up-armored Humvees in America, and yet, at the same time, we have automobile companies going bankrupt and looking for vehicles to build. So there seems to be a mismatch somehow between pretty basic demands for troops and our ability to field and source those even when we have able and willing automobile companies who are looking for ways to keep their plants busy. Why the mismatch?

Mr. PATTERSON. Oh, I think it is a very fundamental problem in that you have a Department of Defense that understands fully that we are at war with terrorists, and you have a country that doesn't.

Mr. COOPER. So Chrysler or General Motors (GM) or Ford didn't want to bid on the up-armored Humvee, or we couldn't——

Mr. PATTERSON. Well, actually, the subsidiaries of those folks did, but they really were not in the business of putting out those kinds of vehicles. The people who were, International Harvester, obviously, and—but the design, fortunately or unfortunately for us, that was available were foreign designs of up-armored vehicles that were designed to sustain the kinds of things that an MRAP would have to sustain.

Mr. FITCH. And the number of companies that have as a core competency in the technologies for armor, okay, is not the same as we have for the auto industry. In fact, we are doing a lot of investment in the Department of Defense today to try to find better armor, cheaper armor, especially lighter armor, whether that be for the vehicles because, when you put the armor on it, it puts a demand on the engine. It puts a demand on the drivetrain. If you double the weight of the vehicle, whatever the percentage is, okay, it has additional tolls upon the reliability of the vehicle.

So we don't have the same industrial base. In other words, the auto industry isn't the industrial base for our Army, either.

Mr. NUSSBAUM. In a sense, the Humvee is the wrong vehicle to up-armor, but it is the only vehicle to up-armor. But it was built as a replacement for the Jeep, which didn't go in harm's way.

So it was designed to optimize all the functions that it was going to perform, and we missed the fact that it was going to go in harm's way. So it wasn't suitable, wasn't optimal, for up-armoring, but it is what we have, so we are going to up-armor it.

Mr. COOPER. I see that my time has expired. Mr. Chairman, look forward to another round.

Mr. ANDREWS. Thank you.

With the consent of my colleagues, we are going to do another round, if that is okay with the panel as well, if it fits your schedule. Thank you.

Mr. Patterson just made a suggestion that we might have a rule that says no new requirements after milestone B, and that prompted this question. Again, this piece of data that you cite, about 33 percent of the program cost growth being attributable to these requirements changes, how many of those requirements changes happened after milestone B? Do you know?

Mr. PATTERSON. That data, as I recall, is after milestone B.

Mr. ANDREWS. It is all after milestone B.

Mr. PATTERSON. That is where the majority of the growth generally takes place.

Mr. ANDREWS. A related question: in your oral testimony, you talk about the fact that, if I read this correctly, the average increase in unit cost of the 28 MDAP programs of less than 5 years since development is only 1 percent.

Mr. PATTERSON. That is correct. That is——

Mr. ANDREWS. But it is 55 percent from years 5 to 9. How many of that in the 55 percent category, the five to nine, got a waiver through milestone B, didn't meet the requirements to get to milestone B but got waived past it? Do you know?

Mr. PATTERSON. No, I don't. I don't know exactly how many.

Mr. ANDREWS. But, I mean, would it be accurate to say it is probably most of the 55 percent cost overrun comes from that?

Mr. PATTERSON. I would say a significant portion of it, sure.

Mr. ANDREWS. One of the things that is in the conference report that we will be looking at in the WASTE TKO bill today is what we call intensive care, where if a program is permitted to go forward, even though it didn't achieve the milestone B criteria, if it is waived past it, there is a whole set of intensive requirements that are imposed upon that program to try to get it back under control.

I wanted to come back to, again, this bifurcation that you create between derived and customer requirements. Describe for us the process that you think ought to be instituted to determine whether a derived requirement is added to the package or not.

Let's say we are at a point—assuming for a moment that we accept your proposition that there are none after milestone B, which I assume you say there should be some exceptions, now as you said, for true safety or emergency purposes, but let's assume we are living in a world where, except for those narrow situations, there are going to be no changes in requirements after we hit milestone B.

We are now in pre-milestone B, and an "Oh, by the way" comes up, as you said earlier, "Oh, by the way, this can do this." Who should make the decision as to whether that gets added to the package, and by what criteria?

Mr. PATTERSON. Well, I think that the program manager should have the initial cut at whether or not they are going to include that into the program. But program managers generally are colonels or, in very large programs, brigadier generals who have significant oversight within the Department.

I think that if they have a set of rules that say, first of all, if it is not a safety of flight or if it is not some sort of safety issue, or if it doesn't give me a return on my investment, then I am going to have a thumbs-down, initially.

Mr. ANDREWS. How do you measure the concept of return?

Mr. PATTERSON. Well, let's take, for example, you have—again, I will turn to this C–17.

There were parts of that airplane that were originally designed for aluminum lithium, for example. Well, aluminum lithium is strong, but it is brittle.

So an engineering change was made to change that to a different alloy. We were breaking the aluminum lithium cargo floor guides at a regular pace, so changing that eliminated the problem of having to constantly replace it. That was a savings.

And those are the kinds of things that I would suggest are three-to-one. And even the suppliers were given the opportunity to do that.

Mr. ANDREWS. Got you.

It strikes me that this is really the essence of the 20 percent the secretary talks about in his 80 percent solution, that what he really is aiming to get at here is to give us an adjudicatory mechanism that draws the line between the 80 and the 20 when you get to this point, and it is your suggestion the program manager should be the first person to weigh in on this.

Who should evaluate his or her recommendation?

Mr. PATTERSON. Well, then you have an engineering change board that would provide a corporate view of it. And if it is a particularly expensive change, then you are going to go to your service acquisition executive, or if it is an ACAT 1–D, an acquisition category 1–D, then you have the Defense Department acquisition executive who would have a cut at that.

Mr. ANDREWS. And my final question, are you confident that we can quantify this concept of value sufficiently to hit the three or four? In other words, are all of the values that we want to promote—you gave a great example of saving, replacing a piece of a plane that is going to go wrong. But do all of the value concepts lend themselves to that kind of quantification that would let us say, "Well, this fails to meet three-to-one, so out?" Pretty hard?

Mr. PATTERSON. No, it is much more difficult than that. And that is why it takes a lot of research and study and to set up standards and conditions whereby you can evaluate these.

Mr. ANDREWS. Frankly, and I will just conclude with this, it is one of the reasons why we are glad we have the three of you and the institutions that you represent, because we really do turn to institutions like yours to assemble those data, analyze them and give

us a factual basis to draw the lines that my questions imply. Thank you.

Mr. Coffman, your turn.

Mr. NUSSBAUM. Mr. Chairman, is it——

Mr. ANDREWS. Sure, Doctor.

Mr. NUSSBAUM. Is it appropriate for me to make a remark, or——

Mr. ANDREWS. Sure. It is okay.

Mr. NUSSBAUM. I think it is not hard to measure the value of ideas that replace current capabilities. It is always harder to measure the value of things that represent new capabilities. They don't represent a savings for the operating and support detail that you were going to incur.

But if you are replacing a current capability, then it is pretty easy to do an estimate, but it is still an estimate, of what does it cost to invest to make this thing happen, and what do you save over time in the operating——

Mr. ANDREWS. I agree. The much more difficult proposition is where you have a new function that could be added by something that you discover. How do you measure that, and that requires trade-off analysis. It requires opportunity cost analysis. It requires a lot of broader inquiries.

Mr. NUSSBAUM. And if you have that long tail, the question then is do you do any discounting on it, the technical issue of net present value and at what rates. The Office of Management and Budget (OMB) helps us there.

Mr. ANDREWS. Not to be hyper-technical, but one of our problems is then matching up the federal credit scoring and net present value rules with the real-world ones, that very often a decision—a classic example is in energy. The Department has guidance to hit 25 percent alternative fuels by 2020. And in order for them to do that, they need to do multi-year contracts. But to do multi-year contracts, the Congressional Budget Office (CBO) scores that as putting the whole net present value into one year, which makes it almost impossible to do, which means we don't do much of it, which means we are falling backwards. So marrying the CBO criteria with the real-world criteria is a bit of a challenge, too.

Mr. NUSSBAUM. Yes, sir. And so the devil really is in the details on this, and——

Mr. ANDREWS. Well, the devil is in the CBO in this case. Now, don't tell Mr. Elmendorf I said that, okay?

Mr. NUSSBAUM. And one other comment, and that is, when you go to the Configuration Control Board or your Service Acquisition Executive (SAE), you are proposing to spend investment dollars to make this thing happen, and the promise is that you will return operation and support (O&S) dollars later on. That is a nice conversation, but it doesn't accord with the budgeting realities.

Mr. ANDREWS. And it doesn't score in our—nor should it.

Mr. Fitch, do you want to add one thing, then I am going to go to my friend from Colorado?

Mr. FITCH. If I could. I just wanted to say, again, that I think it is useful to talk about the operation requirements, the derived requirements, but to say again that, when we get the requirement

from the user, it is stated usually in operational terms, okay, the results they wanted to see.

Mr. ANDREWS. Yes.

Mr. FITCH. To deal with industry, and for industry to build something, those need to be translated into technical terms. We also use the term "derived requirements" for that process. So the derived requirements are really—there are a couple types we are talking about here, that which are a part of the normal system that you have to do.

The other one I would just say is your question is how do we know we get value. As a program manager, I had an acquisition program baseline. That was my contract. The way I viewed it, it was my contract with my—decision authority and with the American taxpayer to produce a capability at such a cost with certain milestones.

And I think that is what most of us take and go back to. And as we do these questions about derived requirements and everything else, I think we keep in mind that framework.

Mr. ANDREWS. Yes. I think the panel clearly understands that some subset of derived requirements are quite legitimate, necessary and desirable. And I think the three of you have given us some interesting tools to discriminate between undesirable derived requirements and desirable ones, which is what we are about.

Mr. Coffman.

Mr. COFFMAN. Thank you, Mr. Chairman.

We talked today about having discipline in terms of change requirements. But do we also have to have discipline when programs get so far out of line that they become questionable?

And I am thinking about—and I am working if you could reflect on the President's—I can't remember the nomenclature of the follow-on helicopter. Littoral Combat Ship (LCS) is in question. I wonder if you all could reflect on when a program gets so far out of line.

Mr. PATTERSON. Well, it would be helpful, I think, in the total scheme of things, if we never let them get out of line. But nonetheless, you are exactly right. They do happen. It does happen.

And one of the things that I think is difficult when you take, for example, the VH–71, the President's helicopter, and that is a perfect example of where you came in with one set of criteria as requirements and, over the course of the time, it changed dramatically.

I think that we don't have a set of standards or conditions that raise a budget flag that say, "Wait a second, I am sorry, you are red here, and you have been red three reviews in a row, and we are canceling your program." And what we do is we put ourselves in a position where it is the only game in town.

You have the President's helicopter that is arguably old, and we don't have an alternative. You chose a manufacturer and a helicopter, and there is no off-ramp. There is no plan B. And we do this rather consistently.

And I am almost of the opinion that we do it by design. And I would offer the Marines' Expeditionary Fighting Vehicle (EFV), for example. We don't have a way to walk the dog back down the path

to get an amphibious vehicle that would replace the EFV, so we need to make that work.

Mr. FITCH. I don't have the particulars on either of the programs you asked about. I was the systems engineer for the VH–3D, the current—well, it is one of the two current presidential helicopters. It is a unique mission. I think there is a desire usually if the White House says, or whatever or whoever it is, says, "I need a capability," that you find a way to do it.

Going back to it, most of the changes that I saw, and the pressures and the surprises that I got, occur in that first—traditionally, the first 12 to 15 months of a program when you go towards a Preliminary Design Review (PDR), because the contractor is off doing a lot of things. There isn't a lot of object deliverables to figure out does he get it, he doesn't get it.

I think that the competitive prototyping system to focus on doing PDRs earlier, to have effective communications with the contractor teams and oversight of the contractor teams during that period of time will do much more to get to a stable baseline at milestone B, which is the actual program initiation.

Mr. NUSSBAUM. I am going to sound like a professor on one hand. On the other hand, because there are some historical examples of things which failed, failed, failed and then were terrific. Aegis was one, and Tomahawk was another. They just took a long time to bring aboard. And for some reason, we had the fortitude to stick with them and not say, "This is an A–12 or a Gama Goat," and get rid of it.

So now we come to the category of LCS. Is it a Tomahawk or is it a Gama Goat? We don't know. But I am taken with my colleague's remark that, once you get past milestone B, if you have three reds in a row, you have got some serious explaining to do, with the presumptive answer, "You are out." It is a rule.

But the problem is knowing the future, and that is always the problem. I don't know whether LCS is a Tomahawk which is going to be absolutely terrific after a long incubation period, and the same for V–22. You just don't know, so we make decisions as people.

Mr. COFFMAN. Thank you.

Thank you, Mr. Chairman.

Mr. ANDREWS. Thank you.

Well, gentlemen, thank you very much for your expertise. Your reward for doing such a good job is we will have to call on you again. As the committee goes forward, our intention is to try to make legislative proposals for the fiscal year 2011 authorization bill that will deal with the area of the problem that the WASTE TKO legislation that we are dealing with today does not deal with.

And I think you have given us some very intriguing ways to measure the gap between what we pay and what we get. It is also heartening to hear what I have heard this morning, a consensus that this panel's contribution to the WASTE TKO bill was essentially two concepts.

The first was to add a whole series of reviews and a lot of scrutiny pre-milestone B, with particular emphasis on the requirements process. And that did make it into the conference report, and that will become the law this week, we think.

And second, the panel was very interested in much more rigorous review, what we call intensive care, of systems that pass milestone B by waiver, that have not met the requirements, or that fail Nunn-McCurdy standards and get exempted from the penalties there and go forward anyway. And I think if you look at the cost overruns, a huge majority of them fall into one of those two categories.

So what we wanted to do was to take the best practices that you very ably described this morning and engage them as intensely as we can in the systems that, again, never met the criteria to get past milestone B but get past it anyway, and those that fail Nunn-McCurdy but continue to live on.

And as Mr. Patterson said a few minutes ago—I think it was Mr. Patterson—our ultimate goal is not to have any of those cases in the future by unraveling the requirements process and looking at it more intensely to intensify that pre-milestone B analysis of what is going on.

And the other point that I would make that is more on our side of the table than yours, I think that the principal reason that we get these cost overruns is that, once something passes milestone B, an enormous political constituency develops around it. Now, there are tens of thousands of people deriving their paycheck from a project, hundreds or thousands of subcontractors, dozens or hundreds of congressional districts.

And as Secretary Gates I think can attest, making changes in those programs is very politically difficult. If you get to these flawed programs earlier when their political constituencies are smaller and weaker, the chance to do the right thing is a lot higher.

So not just for analytical reasons, but we think, given the dynamic of the way these decisions are made in the political world, the more precise we are in our measurements and the more focused we are in our evaluation, in the requirements phase and a little bit beyond that, we think the better job that we will do.

So I would say to each of the three of you we welcome your continued participation and input. We are certainly going to call upon you for your feedback as we go forward in our drafting process. And thank you very, very much for your time and attention this morning.

Members will have a period of time by contacting either majority or minority staff to supplement the record with written questions, and we would invite the witnesses to do the same thing.

And with that, the hearing is adjourned.

[Whereupon, at 9:09 a.m., the panel was adjourned.]

A P P E N D I X

May 19, 2009

PREPARED STATEMENTS SUBMITTED FOR THE RECORD

MAY 19, 2009

The Honorable Robert Andrews
Chairman, Panel on Defense Acquisition Reform
May 19, 2009

Ladies and Gentlemen welcome to today's hearing on Measuring Performance: Developing Good Acquisition Metrics. Today's hearing is the third in a series of hearings exploring how we determine if the Department of Defense is getting what it pays for in the acquisition system. We have with us today Mr. David Fitch, Director of the Acquisition Leadership Learning Center of Excellence at the Defense Acquisition University and former Dean of the Defense Systems Management College. Mr. David Patterson, Executive Director of the National Defense Business Initiative, former Deputy Under Secretary of Defense (Comptroller) and former Executive Director of the Defense Acquisition Performance Assessment, and Dr. Dan Nussbaum of the Naval Postgraduate School, former Director of Cost Analysis for the Navy.

In our previous two hearings, we've learned that there are a lot of pitfalls and shortcomings in the Department of Defense's systems for measuring performance in acquisition. The Department's current metrics are highly susceptible to error, whether it is because the baselines that serve as the basis for tracking programs are unrealistic; because we measure individual programs in isolation rather than the system as a whole; or because metrics are still in their infancy for the 80% of the acquisition system that is not major weapon systems; or some combination of all of the above. By some measures, the system is failing miserably. GAO's report that major defense acquisition programs are expected to overrun their budgets by $296 billion is definitely a failing grade. If you judge by systems in the field, you get a better grade. U.S. troops have the best equipment of any military in the world, bar none. What is perhaps most troubling to this committee, which has oversight as a primary responsibility, is that we really don't know the answer to this question. We don't have reasonable, reliable, and complete metrics that tell us the acquisition system is succeeding or failing.

The purpose of today's hearing is to try and develop a better understanding of how we might develop those metrics for the future. Our witnesses today have all studied the acquisition system deeply, and in fact, all have decades of experience as practitioners in the acquisition field, as well as their academic expertise. I would note that the House-version of the acquisition reform legislation currently pending, known as the WASTE TKO Act, directs DOD to address the question of performance assessment in a significant way. The conference committee on that bill will be meeting later today, and I look forward to bringing some of the wisdom from today's hearing into that process. Now let me recognize my colleague from Texas, Mr. Conaway for his opening remarks.

Statement of Rep. Coffman

Hearing of the

Defense Acquisition Reform Panel
on

Measuring Performance: Developing Good Acquisition Metrics

May 19, 2009

Good morning, Mr. Chairman, ladies and gentlemen. I would like to extend a welcome on behalf of Ranking Member Conaway, as well. He is sorry he could not be with us today. I would like to thank the Chairman for allowing me to make a few introductory remarks in Rep. Conaway's place.

Today's hearing is an appropriate follow-on to the Panel's two hearings, which focused on how DoD and GAO currently assesses performance on major weapons systems and service contracts. The purpose of this hearing is to think outside the box about how we should measure performance, and about what we should be measuring, and

less about the how we are doing it today. Our previous hearings revealed that current measures of performance tend to break down if the program baseline is unrealistic. We want to know if this problem can be corrected. Furthermore, are there metrics beyond cost and schedule performance that are of value, such as: how closely does the delivered system meet actual warfighter needs? Does the time of delivery of operational capability satisfy warfighter needs? How do we determine whether "optional" or "tradable" capabilities requested by the warfighter are affordable?

Mr. Chairman, we have a distinguished panel of witnesses in front of us today. I have looked at their written testimony and I look forward to their testimony. There are a couple of points I would like to highlight. Although Mr. Dillard is not testifying today he did submit a written statement that I would like to briefly comment on. He states that, "The proliferation of autonomous fiefdoms within the Department continues to increase, with each being a stovepipe of oversight

expertise imposing unique reporting requirements, assessments and reviews. He goes on to state that in regards to adding additional acquisition workforce professionals that "These new people should not be housed in the pentagon, but instead where the execution of programs occurs." Mr. Chairman, I think this is an important point that I believe we need to follow closely.

Another point or observation I would like to make is in regards to requirements and joint programs. We have many programs out there that have the word "joint" in front of them but they are joint in name only. I understand that the current requirements generation process is called the Joint Capabilities Integration System or JCIDS. It seems to me that in order to have a truly joint program that the requirements for that program must be born joint. Yet I do not believe our current system or as Mr. Dillard describes, current fiefdoms, foster such an environment. So I would be interested in hearing from our witness in this regard.

I also encourage our witnesses to share their views on existing laws and regulations that are particularly helpful or not helpful to the Department's efforts to obtain the best value and capability for our warfighters. We have heard from the Department in two separate hearings about how they currently measure performance and value on contracts. What we haven't heard enough about is how they should be measuring value. Consequently, your input will be a greatly appreciated. With that I will conclude and again thank my fellow members and you, Mr. Chairman. I look forward to the witnesses' testimony.

Testimony

of

Mr. J. David Patterson
Executive Director, National Defense Business Institute
University of Tennessee

before the

Defense Acquisition Reform Panel of the
House Committee on Armed Services

May 19, 2009

Mr. Chairman, members of the Defense Acquisition Panel, my name is Dave Patterson. I'm the Executive Director of the National Defense Business Institute at the University of Tennessee. I am very pleased to be here this morning to participate in the discussion of a question that has clearly captured the attention of the current Administration and Congress:

> How should Congress assist the Department of Defense in improving its acquisition of weapons and services so that it can meet the needs of the warfighter in the field while still being a good steward of the taxpayers' dollars?

Last week the Naval Postgraduate School sponsored a Symposium with the theme of "Defense Acquisition in Transition." I provided a paper for the proceedings of that symposium that expands on my remarks here this morning. Mr. Chairman with your approval I would submit that paper for the record and the Committee's consideration in addition to my oral statement.

The first consideration for judging the success of an acquisition program is whether it fielded a weapon system, or information system or service in time to make a positive impact for the warfighter? A system or service fielded too late to meet the need may as well have not been bought. The phrase "too little, too late" can mean lost lives.

Before we look at measures of acquisition system merit there is another consideration central to this discussion. When Secretary Gates made his budget announcement on April 6, 2009, I believe he was speaking from frustration that was as much about what has been the persistent problem of having to depend on an Acquisition System that is simply not responsive to immediate warfighter needs as much as it was about winnowing bloated, failed or unnecessary programs. Implicit in that expression of frustration is a clear lack of confidence in a system that produces program uncertainty and instability. The most dramatic improvement metric will be when the senior leadership in the Administration, Congress and the Department of Defense have seen such improvements – results, not words – that they can say they have renewed confidence in the stability, predictability and effectiveness of the Defense Acquisition System.

The Defense Acquisition Performance Assessment report contended that program stability and predictability were singularly and uniquely crucial to managing programs that were on cost, on schedule and performing. To that end in the time I have, allow me to describe two areas of improvement for measuring program effectiveness worthy of attention.

First, Major Defense Acquisition Programs or MDAPs often start at Milestone B, the beginning of Engineering and Manufacturing Development with critical staff positions vacant. Percentage of critical staff positions filled at Milestone B is an easy and important metric to be observed. It makes little difference to implement programs to raise the level of skills of the program staff if they are missing in action. Programs must have full staffing at the outset in order to have a chance of success.

Second, the acquisition strategy document that is to lay out how the weapon system is to be acquired, the initial road map, if you will, is often flawed in that it focuses more on presenting

the case for required capabilities and quantities than on laying out the reasoning for the acquisition competition methodologies. For example, both how the prime contractor participants in an MDAP competition will select subcontractors and how the winner of the competition will manage the subcontractors to gain improved efficiencies and effectiveness are generally given little consideration.

Creation of the acquisition strategy document is one of, if not the most important tasks the government acquisition program management can undertake. The strategy should establish the template for all the activities that will take place throughout the source selection process, engineering, manufacturing and development, and follow-on production and fielding. More important it establishes how the program management team is thinking about the numerous events and activities that a program will encounter. The Defense Acquisition Executive should establish a common set of strategy elements that all Military Department, Service Acquisition Executives must include in MDAP the acquisition strategy document. Additionally, a set of standards or metrics by which the strategy elements can be evaluated as effective must be part of this process.

When the lease proposal for the Air Force's first attempt at procuring a replacement for the KC-135 aerial refueling aircraft was first introduced the Single Acquisition Management Plan I saw was about six pages, unsigned. Inarguably, this was inadequate. When criticism of the program began to grow, the Air Force did not have a structured, disciplined playbook to refer to and consequently, the defense of what they proposed was made even more difficult.

In closing, I would be remiss if I didn't acknowledge the progress that has been made by the Department in improving the acquisition system over the past four years. Though it is the General Accountability Office's headline that the 96 Major Acquisition Programs have grown in cost by $296 billion that gets attention, those numbers belie an equally worthy, but over looked statistic published in the same GAO report. The average increase in unit cost of the 28 MDAP programs with less than five years since development start is only one percent. Compared with an average of 55 percent increase in acquisition unit cost of 25 programs in the group with five to nine years since program development start. There has been improvement that should be recognized.

With that, it has been by privilege to be with you this morning and I welcome your questions.

When Instructions Provide Too Much Flexibility, Establish Rules

Defense Acquisition Performance Assessment Redux: Unpredictability, Uncertainty and Program Failure: Implementing a Rule-set Can Be the Fix

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Editing Assistant: Ms. Eileen Giglio is Vice President, Acquisition and Technology for the Loch Harbour Group and provided valuable assistance in the writing of this paper as a subject-matter expert on the Defense Acquisition Performance Assessment. She has served as the Assistant Deputy Under Secretary of Defense, Strategic Plans and Initiatives—Acquisition, Technology and Logistics, Business Transformation. Ms. Giglio also served as the Deputy Director for the Defense Acquisition Performance Assessment; she provided administrative direction and management throughout the duration of the study.

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Abstract

More than three years have passed since the Defense Acquisition Performance Assessment (DAPA) project was completed and the results briefed to the study's sponsor, the Deputy Secretary of Defense. In that time, the Department of Defense has issued its fourteenth major change to the Department's Acquisition System management guidance. Combined with a shortfall of experienced and skilled acquisition business professionals, the result is a pervasive and troubling level of uncertainty and unpredictability regarding defense acquisition programs. The resulting Acquisition System including Planning, Programming, Budgeting and Execution (PPBE), Requirements and the little "a" Acquisition process lacks structure and discipline. What follows is persistent failures to meet cost, schedule and performance objectives. This paper presents a case for a mandatory set of Acquisition System rules to address this problem. Though by no means exhaustive, the recommended rules fit categories in the acquisition process, the requirements process and the PPBE process -- referred to here simply as the "Budget Rules." The premise of this paper is that the right mandatory set of rules applied to Major Defense Acquisition Programs would result in weapon systems and equipment critical to warfighter success being fielded more rapidly on cost, on schedule and performing as expected.

Introduction

More than three years have passed since the Defense Acquisition Performance Assessment (DAPA) project chaired by Lieutenant General Ronald Kadish, USAF (Ret.) was completed in November 2006 and the results briefed to the Deputy Secretary of Defense, the study's sponsor. Since that time, there have been several more attempts to describe the root cause of the flaws in the Department's Acquisition System. Most studies cover the same ground plowed by the DAPA project and previous studies, dating back to the 1985 *Packard Commission Report*. Despite these numerous evaluations of the Defense Acquisition System, none have advanced the discourse beyond what has been clear from the beginning. There is a fundamental lack of a budget process and requirements discipline that leads inexorably to programs that are over cost, behind schedule and not performing. Additionally, there is one factor that is common to serious analyses of the Department of Defense (DoD) Acquisition System.

The general discussion of reforming the Acquisition System with its many subsystems, procedures, and methodologies reveals that there is a basic failure to drive predictability regarding what the DoD can expect as a product (fielded weapon system) emerging from its acquisition process. In fact there is seldom any effort to make "predictable outcome" a program management priority. All program managers try to stay within budget or cost limits, meet schedule guidelines, and produce a weapon system or piece of equipment that performs to the level of stated requirements. But, is there any real certainty that the program manager's efforts, no matter how diligent, or adherence to the acquisition process will produce the desired result? The case presented here would answer, no. The DAPA study raised the issue of the government's inability to predict cost, schedule, and performance as a self-induced symptom of "instability" (Kadish, 2006, January). It is that instability in acquisition programs that defeats efforts to meet cost, schedule, and performance objectives.

The Problem Explained

Recent analyses of the troubles experienced in the DoD acquisition of weapons systems identify instability as a significant factor in program cost growth. A 2008 RAND Corporation study on cost growth of fixed-wing military aircraft identified the "practice of rotating officers through jobs every three to four years" as creating an unstable program management workforce (Arena, Younossi, Brancato, Blickstein & Grammich, 2008). This results in a management situation where experience gained in solving management problems is not effectively used over the term of the program and not available to those entering new to the program. The Aerospace Industries Association, in its November 2008 *Special Report, U.S. Defense Acquisition: An Agenda for Positive Reform,* raised instability as an area where the Defense Department should focus management attention. .

Two elements combine to create instability in the acquisition of weapon systems. First, there seems to be no lasting agreement on what should be the DoD Acquisition

System policy directions. Since Deputy Secretary of Defense Packard issued the first *DoD Directive 5000.1* in 1971, the regulations documents have been revised significantly about every three years: 14 times in 38 years. As Charles Cochrane (2009, January 1) so masterfully revealed in his presentation *Acquisition Management System from 1971 to 2008*, the *DoD 5000* series documents have provided direction varying from 8 pages to 840 pages of recommendations, suggestions, regulations, policy, procedures and definitions. No single Acquisition System approach has survived for more than five years, while the length of time for Major Defense Acquisition Programs to reach full operational capability is generally three times this Acquisition System regulation change cycle. For the purposes of this paper, reference to the most recent *Department of Defense Instruction 5000.02* (2008, December 8) shown in Figure 1,[1] will be used.

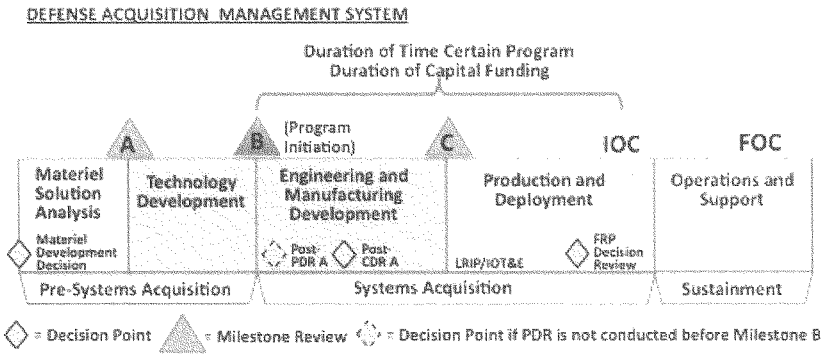

Figure 1. Defense Acquisition Management System
(used to identify where rules described later in the paper will apply)

Second, while the acquisition playing field is persistently changing, the workforce challenged with making the system successful has been reduced in numbers and experience. In the past, even though there were frequent modifications to the *5000* series Department guidance, there was also a cadre of experienced acquisition executives in the career ranks that could adjust with a modicum of disruption. The United States Senate and House Armed Services Committees, in their respective committee reports supporting the FY 2008 National Defense Authorization Act, were very concerned that the numbers, years of experience and skill levels of the professional acquisition workforce had reached unacceptably low levels (US Congress, 2008). Particularly troublesome was the major reduction in the acquisition workforce within the Department of Defense during the 1990s, the workforce on whom the Department counted to make sense of the constantly changing *5000* series Department guidance.

[1] Adapted for use in this paper from the graphic presented on page 12 of the DoDI 5000.02.

However well-intentioned and necessary the Department's changes to the *5000* series guidelines were thought to be, the consequence was instability in acquisition programs—an unfortunate result of a purposeful action by department management. Instability drives uncertainty, creating an Acquisition System environment where the program outcome is unpredictable. When the program outcome is unpredictable, program risk is increased. There is a corresponding drive to reduce risk by increasing the cost as a premium or hedge against uncertainty. When the workforce does not have the experience to deal with program risk, because every program event is being seen for the first time, there is very little chance of maintaining cost, schedule and performance. The underpinning experience necessary to work through a "tried-and-true" process does not exist.

These circumstances hold true for the Acquisition System as a whole, not just for the acquisition process—or little "a" (SECDEF, 2007, July) as it is generally understood within the acquisition community. The distinction between little "a" and big "A" is best summarized with the diagram in Figure 2. Program instability is reflective of a systemic problem inherent in the big "A" versus simply fixing a process problem in the little "a." The mythology that attends the Venn diagram with the intersecting circles is that there is integration among the elements of the Acquisition System. The implication is that each of the elements contributes to and gains from being associated with the others. The intended result is a successful program defined by being on cost and on schedule and performing as expected. The reality is more accurately represented by Figure 3,[2] in which the three elements exist independently of one another by virtue of the fact that changing regulations and vague Acquisition System direction combined with an inexperienced workforce allows the independence to persist (Kadish, 2006, January).

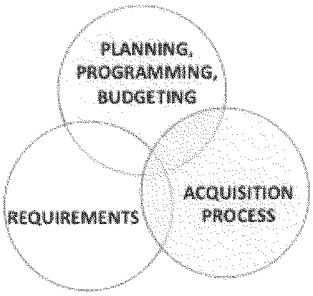

Figure 2. The Acquisition System (This includes the Planning, Programming, Budgeting and Execution process and the Requirements process in addition to the little "a" Acquisition process.)

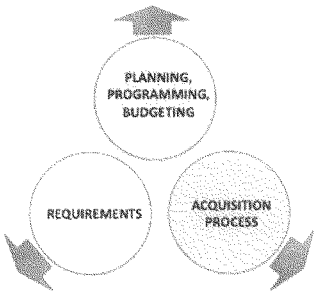

Figure 3. The Acquisition System (In reality, the System is not cohesive, but more often three independent processes creating program instability resulting in cost increases schedule slips and

[2] Both Figures 2 and 3 are adaptations of figures used in the DAPA Report, p. 4.

uncertain performance.)

What results from the combination of changing acquisition regulations and a workforce that does not have a high enough number of acquisition professionals or the experience of seeing and working through a variety of program issues, is an inability to anticipate and prevent situations that put programs in jeopardy of failing the cost, schedule and performance standards. The DAPA study found that unstable programs did have a workforce component that contributed to the instability, and though there was also recognition during the subject-matter expert briefings that changing regulations and guidance might be troublesome in establishing stable programs, the combination of these two factors was not made prominent in the final report. Numerous studies have recommended solutions to the shortcomings of the Acquisition System, but for the most part, these fixes focus on the little "a" acquisition *process*, not on the larger systemic issues.

A focus on the acquisition process ("a") fails to address the larger contextual issue of the system-driven program instability. Mandating a rule set is necessary to establish discipline and structure. "Following the rules" helps to create an acquisition program where uncertainty and the resulting program instability are reduced. The need for acquisition program discipline was emphasized by Dr. Ashton Carter, newly confirmed Under Secretary of Defense for Acquisition, Technology and Logistics. Quoted in DefenseNews.com from his written testimony presented at his confirmation hearing, Dr. Carter made clear his position: "Development, procurement and sustainment of major weapon systems require experience with the Department of Defense and the defense industry, systems engineering at every stage and iron discipline" (Bennett, 2009, March 26).

The following are a set of rules for defense acquisition programs that resulted from the DAPA panel discussions, interviews, and subject-matter expert surveys conducted during the DAPA project. This paper diverges from the DAPA project in that what the 2006 study presented as "recommendations" for consideration by the Department of Defense are offered here as "rules" to be followed. Additionally, the DAPA recommendations focused on six categories affecting the Acquisition System: organization, industry, workforce, requirements, budget and acquisition. However, only the last three categories are addressed in this paper as particularly appropriate for establishing rules to abide by for the acquisition of defense weapon systems. The list of rules is by no means exhaustive, but, rather, the list is intended to establish a foundation upon which additional rules may be considered, developed and applied. Rules that all the participants in the Acquisition System play by and are accountable to adds a level of transparency and predictability that can provide for stable programs.

Requirements Rules

For the purposes of this paper, two basic types of requirements are considered: customer requirements and derived requirements. Customer requirements are very straightforward and defined at the macro-level by approved Key Performance

Parameters (KPPs)[3] and non-Key Performance Parameters.[4] Derived requirements, on the other hand, are requirements that the customer has not specified directly as a requirement but that emerge or *derive* from the design decisions that are made (Brooksby, 2003).[5]

Derived requirements are not capabilities that the customer specifically has identified. Particularly troublesome is a subset of derived requirements that fall into the category of engineering changes—those changes that improve on "good enough" and that have a combined effect of driving up costs and missing schedule milestones. In the absence of rules that prevent pursuing this type of engineering change as a derived requirement, the guiding thought process follows this logic: "because we can, we should; because we should, we must; and because we must, we will no matter how much it costs or how long it takes." According to a recent Under Secretary of Defense, Comptroller study, prepared by Monitor Company Group, L.P. and based on Selected Acquisition report data, engineering changes account for approximately 33% of the nearly $265 billion in program cost growth from 2000 to 2007 (Monitor, 2007). No doubt, some of the engineering changes were to correct design problems. However, the engineering changes that simply improve on an otherwise sufficient, specification-compliant design while driving up costs and impacting schedule need to be reduced or eliminated.

As a result, what follows are recommended rules with appropriate rationale that should apply when considering the addition of both new customer requirements and derived requirements.

Requirements Rule One: Weapon system requirements will be fixed prior to Engineering and Manufacturing Development (EMD) or achieving Milestone B phase (see Figure 1 on page 4).

The prohibition of additional system requirements beyond the KPPs and the specific capabilities that contribute directly to them after approval for the EMD phase at

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[3] "Those attributes or characteristics of a system that are considered critical or essential to the development of an effective military capability and those attributes that make a significant contribution to the characteristics of the future joint force as defined in the Capstone Concept for Joint Operations. KPPs must be testable to enable feedback from test and evaluation efforts to the requirements process. KPPs are validated by the Joint Requirement Oversight Council (JROC) for JROC Interest documents, and by the DOD component for Joint Integration, Joint Information, or Independent documents. Capability development and capability production document KPPs are included verbatim in the acquisition program baseline" (CJCS, 2007, May 1). Occasionally, (some would say all too often) KPPs cannot be achieved with the level of technology existing now or in the foreseeable future. Approval of this category of KPP suffers from collective bad judgment, and no rule set will be a remedy. Consequently, this article does not address the development of this type of requirement.

[4] Non-Key Performance Parameters are requirements that are desired by the customer but not deemed critical or essential. Often, these requirements represent the trade-space in programs when budget constraints or program execution problems demand a de-scoping of the program.

[5] Though this reference defines requirements as they apply to software development, the relevance to weapons system program development generally is very compelling and appropriate and, therefore, is used here.

Milestone B helps to ensure that Initial Operating Capability (IOC) will be met. Fielding weapon systems on schedule simply must be a program priority. By allowing requirements to be adopted beyond those identified prior to EMD, ensures that IOC will be slipped and the weapon system will not be fielded on schedule.

Requirements Rule Two: From the start of EMD (Milestone B, program initiation) to IOC, only safety-of-flight or other safety-related engineering changes will be allowed. The only exceptions are those design changes that can be proven to produce a three-to-one savings to investment while not missing schedule.

This rule addresses the insidious nature of an ever-growing number of engineering changes that routinely skulk their way into systems development. Additionally, the rule provides a potential for incentives that produce beneficial engineering changes and cost savings. Though some will attempt to insert engineering changes using "safety" as justification, specious arguments for such justification at least will have increased scrutiny, prompted by the deviation from rule two.

Requirements Rule Three: Any and all additional system requirements that are deemed essential following the start of EMD will be developed as unique block-up grades that will be introduced as blocks or variations after Full Operational Capability (FOC) has been certified (see Figure 1 on page 4).

There is a persistent need for a disciplined and structured way of incorporating meritorious capabilities enhancements to a weapon system while not disrupting the established design, cost, schedule, or performance. By following this rule, there is the added benefit of having some level of operational experience that can inform the development and insertion of weapon system improvements.

Requirements Rule Four: Holding to an established Initial Operational Capability as a time-certain for fielding the weapon system will be a Key Performance Parameter.

Weapon systems development and fielding plans must have some consideration of time-to-need as integral to the requirement for the capability. This rule makes the time-to–need, or fielding, an essential consideration in program development and planning. If there is no fully understood and accepted time by which a weapon system must be fielded, the importance of the capability to meet a threat is called into question.

Budget Rules

According to the DAPA report (Kadish, 2006, January), budget instability is a major contributor to acquisition program instability and the failure of acquisition programs to meet cost expectations. Lack of funding discipline on the parts of Congress, the military, and the Defense Department produces acquisition programs that are targeted as bill payers for other funding priorities or that are under-funded because of poor cost estimating.

In his written confirmation statement submitted to the Senate Armed Forces Committee and reported in DefenseNews.Com, Dr. Ashton Carter emphasized the importance of having "stable funding" (Bennett, 2006, March 26). He considered stable funding a key factor in choosing whether a weapon system contract is a fixed-price type contract or cost-plus (2006, March 26).

The DAPA report offers the following solution: the establishment of a funding account for the duration of the acquisition program from the program initiation at the beginning of EMD to IOC, referred to as a "Stable Program Funding Account" (see Figure 1 on page 4). In this article, the term "Capital Funding" is used to describe a stable funding account during the period from Milestone B, EMD to IOC that is tied to specific programs and funded by the individual Services with a fixed budgeted amount. Capital funding will apply initially only to MDAPs, though other acquisition programs could be considered. The Office of the Secretary of Defense and the Services will guarantee that programs identified for capital funding will not be used to pay other bills.

Budget Rule One: All Major Defense Acquisition Programs (MDAPs) will be evaluated as candidates for capital funding.

Though not all acquisition programs are suitable for a capital funding approach, MDAPs should at least be considered since these programs—because of their size—offer the most potential for reduced cost growth based on a guaranteed stable funding profile.

Budget Rule Two: Capital funding programs will:

a. *Have a fixed-funding profile from Milestone B (EMD) to Initial Operating Capability. Capital funding programs will not be used as bill payers during that timeframe.*

The timeframe for capital funding allows for follow-on increases in the unit quantity for the acquisition program after IOC while helping to ensure that fielding the program is on time. Put another way, this rule helps to ensure that funding is not the reason for not fielding a program on time.

b. *Provide bi-annual reports to Congress on cost-schedule and performance progress.*

Congress's responsibility and right for oversight of Defense spending must be addressed. By engaging with congressional staffs and principals to keep them informed of how effectively the Defense Department is spending taxpayer dollars for acquisition programs, the needs of Congress will be addressed. Frequent, statutorily mandated program reviews will provide Congress the opportunity to assess not only the program's progress but also the effectiveness of capital funding. The program should be reviewed with Congress twice annually. This provides congressional staff and principals an early

understanding of developing trends. Failure to have a successful review (over cost, behind schedule or failing to perform) is addressed later in this paper.

c. *Have a Technology Readiness Level of at least 6 at Milestone B (EMD).*

Programs that move into EMD that do not have a Technology Readiness Level of 6 or better are destined to experience cost escalation, schedule slips, and unpredictable performance. Capital funding is predicated on the fact that costs can be controlled and schedule can be maintained. For capital funding to be effective, all aspects of an acquisition program must have as much stability as possible.

d. *Be "time-certain" programs.*

Capital funding success depends on strict adherence to a fully-agreed-to timeframe (by the government and the contractor) from Milestone B approval for EMD to IOC. This provides predictability regarding what to expect in the program in general. It also drives the government and industry program managers to be realistic in what they promise for the program and in how they propose to meet the program milestones to stay within the timeframe for system fielding.

e. *Be cancelled if the program fails to meet established cost, schedule, and performance.*

If a program fails to meet any one of the cost, schedule, and performance objectives established at program initiation after three consecutive congressional reviews, the program will be cancelled; not re-baselined or re-planned—cancelled. When government and industry program managers as well as the military departments and Defense Department program executives fully understand the consequences of program failure, the likely result will be greater management attention.

Acquisition Rules

Analysis of acquisition programs over time shows that programs generally grow about 50% in cost (Younossi et al., 2006). Larger Defense programs clearly are more prominent when analyzing program cost growth because the amounts of money are very large compared to programs managed by other Federal agencies. Though it may seem obvious, programs that have longer timeframes for EMD also experience greater cost growth (Younossi et al., 2006). Furthermore, missing from most, if not all, acquisition strategies is analysis that asks: "What does time, as an independent variable, do to the trade space defined by the minimum and optimum performance and cost?"

To address the importance of time as a consideration in developing acquisition strategies, the Special Assistant to the Deputy Secretary of Defense asked The Monitor Group (2003) to look at the value of establishing time as a boundary condition or driver in determining the desired timeframe between Milestone B and IOC. Time should be

considered an independent variable, as should cost, especially when it is critical to field a capability in time to have a positive impact on a threat.

Time is not the only factor that works against well-run acquisition programs. We have developed an acquisition-workforce culture that has adopted "flexibility" as a means to acquiring more capable weapon systems, other equipment, and services. The consequence of this culture is that there is a deliberate attempt on the part of the acquisition community to establish the broadest interpretation of what constitutes best value, desired technology, and solicitation outcome. Unfortunately, "flexibility" often comes at the expense of discipline and structure as a means to achieve cost, schedule, and performance objectives.

Successful competitive solicitations, however, depend on discipline and structure in the way that the acquisition competition is managed. Competition management begins with development of and adherence to an acquisition management/master plan or strategy. That plan or strategy should inform the Request for Proposal and is the roadmap for the subsequent competition and program management.

Acquisition Rule One: No MDAP will be considered for Milestone B certification without a comprehensive Single Acquisition Management Plan/Strategy to include at a minimum total system procurement quantity, explanation and rationale for the contracting methodology selected (i.e., prime contractor choosing subcontractors, leader-follower prime contractors, etc.), sustainment plan and how the Prime Contractor or Lead Systems Integrator will select and manage subcontractors.

Most, if not all, programs that experience significant problems with cost, schedule, and performance have inadequate or flawed acquisition strategies or management plans. Often, the focus of the acquisition strategy is on what the weapon system should do, the plans of the Military Services to field the system, and the phasing of the number of units over time that are required. This approach, while important, does not comprise an acquisition strategy or management plan. The acquisition strategy should explain how the competition will be run; what management, technical, and cost elements are most important; and whether it will be a winner-take-all (and why that is the preferred choice), split-buy, leader/follower strategy, or some combination of each. These considerations in an acquisition strategy are important and will drive necessary program decisions in the follow-on program management.

Management and acquisition strategies should consider what must be fielded and when and how block upgrades will be completed, managed, and integrated after full operating capability is achieved. The acquisition strategy must describe how the winning contractor will manage subcontractor content. An annex to the acquisition strategy must be how the weapon system competition will be financed, and consideration must be given to any subsystem's commercial value in terms of design buy-back and production rights. In the past, the Department has either retained all of the design rights or retained none of the rights. Retaining substantial design rights while keeping open the opportunity for the contractor to benefit from any commercial

markets that might emerge makes competing for the Department's business more appealing.

Acquisition Rule Two: All MDAPs will be evaluated as "time-certain" programs, where the timeframe between Milestone B and IOC (see Figure 1 on page 4) will be established with a thorough analysis, using Time as an Independent Variable (TAIV). Additionally, the criteria that describe what must be accomplished in the EMD phase of the program cannot significantly change.

When TAIV is applied to the development of an acquisition program, the importance of time in developing and defining the technology, as well as its design and production factors, are given prominence in the analysis of cost, schedule, and achieving the desired performance. Time-certain in this instance is not synonymous with schedule. Schedule is the sequential distribution of program events that, on completion, have a timeframe associated with them. We measure schedule with milestones accomplished. TAIV, on the other hand, is the analytic construct that identifies which out of a given list of performance capabilities are of marginal value when considering the amount of time necessary for a capability to be developed, incorporated into the weapon system, and fielded. The time-certain period is established with the results of the TAIV analysis. Schedule is, then, the sequence of events or program milestones that fit within the time-certain period. Though a recent Government Accountability report (GAO, 2009) points out that the DAPA report (Kadish, 2006, January, p.49) recommended that schedule be a Key Performance Parameter, this rule departs from DAPA in that the time between Milestone B and IOC be a time-certain period and that specific length of time be a Key Performance Parameter. Urgency for fielding a particular desired capability, then, has a context that can be used to describe what needs to be fielded or deployed and when.

Acquisition Rule Three: Aircraft programs will take no longer than five years from Milestone B (EMD) to Initial Operational Capability, again using TAIV as an analytic tool to validate the optimum timeframe.

Successful aircraft programs have been fielded in five years or less. The fielding of both the F-15 and F-16 were achieved in approximately five years, with the F-15E (Woods, 2008) fielded in approximately five-and-one-half years. Had management and budget attention been constant and sufficient, the C-17 cargo aircraft could have achieved IOC in five years. But after several false starts, it took almost 10 years. The complexity of the aircraft's technology demands is clearly important, but other factors seem to play roles as well. The EA-18G is planned for five years and nine months from Milestone B to IOC while the F/A-18E/F was planned for nine years and four months. It is true, however, that the EA-18G is basically an F/A-18F airframe integrated with an Improved Capability III, Airborne Electronic Attack (AEA) avionics suite (employed on the EA-6B) and should take less time to field. The accelerated development schedule (over its F/A-18E/F predecessor) probably can be attributed to the coupling of that proven, in-production airframe with an existing AEA technology.

The B-2 took 18 years from Milestone B to IOC for a variety of reasons, only some of which had to do with available technology. Budget and congressional interest played big roles in the length of time that it took for the B-2 to reach IOC. At 14 years and four months, the F-22 has taken the longest of any of the fighters to reach IOC. If the rules are followed that require capital funding and not being certified for EMD without achieving a TRL of 6, it is not a stretch for a well-managed program with stable funding that follows all of the rules described in this paper to reach IOC in five years. However, when the program becomes a bill payer for other Service needs or derived requirements are inserted before or during the EMD phase, five years will, of course, be a difficult achievement. The criteria that describe what must be accomplished in the EMD phase of the program cannot significantly change.

Acquisition Rule Four: Ship-building programs will take no longer than seven years from Milestone B (EMD) to Initial Operational Capability, again using TAIV as an analytic tool to validate the optimum timeframe.

Currently, the average time from Milestone B to IOC for US Navy ships entering the fleet is eight years, nine-and-one-half months (Costello, 2008). Size and complexity, however, do not seem to be what determines the length of time to get combat ships into the fleet. The range is from CVN21 (Gerald R. Ford Class modern aircraft carrier) taking 12-and-one-half years to strategic sealift ships taking five years, nine months. But, again, complexity or size does not seem to be the driving factor since a Supply Class Fast Combat Support Ship (AOE6) took over eight-and-one-half years to go from Milestone B to IOC while the aircraft carrier CVN74, USS John C. Stennis, took a little over eight years, four months to achieve IOC. An LPD 17 San Antonio Class amphibious docking ship took 11 years and one month to reach IOC while the Arleigh Burke Class (DDG 51) destroyer took nine years, three months to go from Milestone B to IOC. Arguably, to establish seven years as the time-certain for naval shipbuilding programs from program initiation at Milestone B to IOC will be a challenge—but a challenge that can be met if the time-certain constraint is one that both the contractor and the Department understand and capture in their Integrated Master Plan and Integrated Master Schedule. Also, the criteria that describe what must be accomplished in the EMD phase of the program cannot significantly change.

Acquisition Rule Five: Requests for Proposals (RFP) will include a competition element that asks how the competitors plan to select, manage, and evaluate their subcontractors. Subcontractor management will be an element of the Contractor Performance Assessment report and considered in determining award and incentive fees.

With regard to the issue of subcontractor management raised in Rule Four, how the winning prime contractor intends to select and manage its subcontractors and suppliers will be a prominent competition element in the Request for Proposal (RFP). The purpose of this rule is to discourage potential prime contractors from arbitrarily, and as the default position, choosing sister divisions as subcontractors. If a competitor must explain the rationale for selecting subcontractors' contributions and their cost and

design advantages compared to sister divisions or other alternatives, sister divisions may not be as appealing of a choice as a program subcontractor. Knowing that the plan for selecting and managing subcontractors will be weighted in the management section of the RFP will provide more incentive to the potential prime contractor to give very careful consideration to subcontractor selection. Profit-on-profit should become more of a competitive liability.

Acquisition Rule Six: No MDAP will be considered for Milestone B certification without a Test and Evaluation Master Plan that has been agreed to and approved.

All too often, the test and evaluation process results in new requirements that exceed contract specifications. Ensuring that a fully agreed-to and approved Test and Evaluation Master Plan that clearly bounds the limits of what can be tested, including metrics for success that all understand, is essential. This will go a long way to precluding testing the driving engineering changes and requirements that exceed the contract defined design.

Acquisition Rule Seven: Where the competitors offerings are comparable and the competition will allow, competitors for EMD will submit cost-model data and Most Probable Cost will be determined prior to final Request for Proposal release and shared with competitors. Most Probable Cost will be contract cost. Competitions will be based on technical and management risk.

A long-held view in the defense industry is that any program vice president who loses a cost competition by not having the lowest cost is fired. What exactly drives the industry to hold this point of view? If you don't count their years of experience, a winning contractor believes that there is a better than 80% probability that the contract specifications that were bid will be changing as the ink is drying on the contract. The winning contractor can then charge full price on the updated program specifications, within the cost and pricing guidelines, and make up for any risk accepted in the original winning proposal.

This approach to an acquisition program is most often prevalent when the contract is a cost-plus arrangement, though fixed-price contracts experience the same type of expanding-contract cost growth with the emergence of derived requirements and engineering changes. The problem that occurs with fixed-price contracts that have engineering changes or derived requirements is that unless the contract is amended, the cost of the changes often turns up as claims against the government. Cost-plus contracts, on the other hand, only have the added costs show up as the "plus" in cost-plus.

The excuse often heard when costs rise is that the Department and the defense contractors do not have good cost estimates. This assertion does not generally prove to be true. When competing contractors reveal the output of their cost models and compare them with the Department's estimates, there is often very little difference. As a general rule, then, all the participants in acquisition competitions have a very good

estimate of what the costs will be. Why then are competitions based on cost when everyone knows what the most likely cost will be? Cost should be taken off the table and the competition should be about which competitor has the better solution for management and technical risk, with subcontractor selection and management being prominent in that evaluation. Most Probable Cost, or the cost that the competitors and government models agree is the cost, should become the contract cost.

Acquisition Rule Eight: Competitions will be based on the motto: "the design you bid is the design you build."

A number of activities take place while the ink is drying on the contract. Not the least of these is that the government program manager and executive are saying to the winning contractor, "We know what we said we wanted, and what you proposed, but we have a few changes to the requirements we'd like you to adopt." To which the winning contractor readily replies, "Not a problem; just a few design changes, another year on the program, and an increase in cost." If both the winning contractor and the government program manager fully understand and believe that the design that was bid is the design that will be built, then their behavior will change to follow the rule.

Conclusion

The Department of Defense is now in a budget environment where it is directly competing with a formidable domestic agenda that will not be denied. In his January 2009 article A Balanced Strategy: Reprogramming The Pentagon For A New Age, published in *Foreign Affairs*, Secretary of Defense Robert Gates stated,

> *In recent years, these platforms have grown ever more baroque, have become ever more costly, are taking longer to build, and are being fielded in ever-dwindling quantities. Given that resources are not unlimited, the dynamic of exchanging numbers for capability is perhaps reaching a point of diminishing returns. A given ship or aircraft, no matter how capable or well equipped, can be in only one place at one time.* (Gates, 2009)

If Secretary Gates' message is going to be taken to heart by those charged with acquiring the "platforms" and those responsible for producing them, then far greater attention must be given to using the defense budget wisely, efficiently and effectively. Programs simply must be managed to cost, schedule and performance. A mandated set of rules that drive discipline into the Acquisition System is one answer.

This paper describes a few such rules that are worthy of implementing. They are by no means inclusive of all the rules that should be considered and established. Additionally, it should be clearly understood that for behaviors to change, all of the rules must be followed since no single rule or group of rules stands alone. For example, without a time-certain program, the discipline for capital funding will not be present and planning for funding over a well-defined time period will not be possible. The rules are

interrelated, and these rules are necessary in order to re-establish an acquisition culture that is disciplined with a clear understanding of how to bring predictability and stability to the Department of Defense Acquisition System.

The institution of rules that are clearly communicated and consistent must be enforced to reinvigorate and support the acquisition workforce's enthusiasm for meeting cost, schedule, and performance as well as establishing discipline and structure in the Acquisition System. The Department of Defense establishes and follows checklists for any number of activities from flying airplanes to mailing packages. Rules are just another form of a checklist. With 91 major Defense Acquisition Programs with a combined value of over $1.6 trillion currently being managed, the result will be getting better weapon systems into the hands of the warfighter in time to make a difference on the battlefield.

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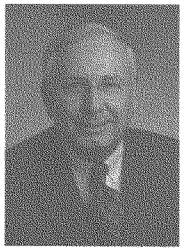
Jack D. (Dave) Patterson



Mr. Dave Patterson is the Executive Director, National Defense Business Institute where he is establishing at the University of Tennessee in the College of Business Administration an institution inspiring business innovation for both government and industry by providing practical, sound assistance in creating economically efficient and effective Defense business and acquisition programs. He is responsible for preparing funding proposals and budgets; recruiting and managing university staff, professors, other faculty members and key Subject Matter Experts engaged in relevant research and resource development tasks. Prior to his taking his current duties, he was the Principal Deputy Under Secretary of Defense (Comptroller). As the Principal Deputy, he was directly responsible for advising and assisting the Under Secretary of Defense (Comptroller) with development, execution and oversight of the DoD budget exceeding $515 billion with annual supplemental requests of more than $160 billion as well as developing legislative strategies, and developing and implementing DoD financial policy, financial management systems, and business modernization programs. In June 2005 Mr. Patterson was appointed to lead the Defense Acquisition Performance Assessment Project, a comprehensive evaluation of every aspect of the Defense Department acquisition system and decision making processes.

From August 2003 to June 2005, Mr. Patterson held duties as The Special Assistant to the Deputy Secretary of Defense. In the capacity as Special Assistant, Mr. Patterson was responsible for managing the Deputy Secretary of Defense's personal staff as well as providing direction and advice to the Office of the Secretary of Defense Staff on a wide range of national security operations and policy subjects. He contributed to the Department of Defense support to the United States' mission to establish free and economically successful societies and governments in Iraq and Afghanistan. Additionally, Mr. Patterson supported the Deputy Secretary in the areas of military commissions for detainees in the Global War on Terrorism and major defense acquisition programs.

Before returning to government service, Mr. Patterson was a founding and managing partner at Bucher, Hutchins, Kohler and Patterson, Inc. where he led the firm's commercial consulting practice developing management strategies for acquiring new business. From 1999 to 2001, he was the Vice President and Site Manager for Steven Myers and Associates' support to Lockheed Martin Corporation's winning Joint Strike Fighter competitive proposal preparation.

Between 1993 and 1999, Mr. Patterson held a variety of responsible, executive positions at McDonnell Douglas Corporation (later The Boeing Company) beginning as the Senior Manager for Market Research and Analysis on the C-17 military air cargo aircraft and later as Director, International Business Development. He was responsible for developing and executing the business capture strategy that won U.S. Government Defense Acquisition Board approval to procure 80 additional C-17s completing the first contract for 120 aircraft. Mr. Patterson led the Boeing business development team that launched the initiative to introduce a commercial version of the C-17; the BC-17.

Mr. Patterson served in the Air Force from 1970 to 1993 retiring in the rank of colonel. During that time, he held responsible leadership and management positions with assignments at the air wing level as a C-5A aircraft commander and Deputy Operations Group Commander, at major command headquarters, Headquarters, U.S. Air Force, the Office of the Chairman, Joint Chiefs of Staff and the Office of the Secretary of Defense, Inspector General. In 1986, Mr. Patterson was the Air Force Fellow at the American Enterprise Institute. He served in Vietnam flying O2As as forward air controller.

DISCLOSURE FORM FOR WITNESSES
CONCERNING FEDERAL CONTRACT AND GRANT INFORMATION

INSTRUCTION TO WITNESSES: Rule 11, clause 2(g)(4), of the Rules of the U.S. House of Representatives for the 111th Congress requires nongovernmental witnesses appearing before House committees to include in their written statements a curriculum vitae and a disclosure of the amount and source of any federal contracts or grants (including subcontracts and subgrants) received during the current and two previous fiscal years either by the witness or by an entity represented by the witness. This form is intended to assist witnesses appearing before the House Armed Services Committee in complying with the House rule.

Witness name: **Jack David Patterson** Jack D Patterson

Capacity in which appearing: (check one)

___ Individual

X Representative

If appearing in a representative capacity, name of the company, association or other entity being represented: National Defense Business Institute, University of Tennessee

FISCAL YEAR 2009

federal grant(s) / contracts	federal agency	dollar value	subject(s) of contract or grant
FA7014-06-D-0019-009	U.S. Air Force	$ 890,809	Major Defense Acquisition Program Indirect Cost Study
FA7014-06-D-0019-009	U.S. Air Force	$ 601,597	Defense Acquisition Program System Gap Analysis
FA7014-06-D-0019-009	U.S. Air Force	$1,201,806	Program & Process Controls

FISCAL YEAR 2008

federal grant(s) / contracts	federal agency	dollar value	subject(s) of contract or grant
FA7014-06-D-0019-008	U.S. Air Force	$ 1,151,082	Chief Management Officer Study
FA7014-06-D-0019-008	U.S. Air Force	$ 725,000	Major Defense Acquisition Program Indirect Cost Study

FISCAL YEAR 2007

Federal grant(s) / contracts	federal agency	dollar value	subject(s) of contract or grant
None			

Federal Contract Information: If you or the entity you represent before the Committee on Armed Services has contracts (including subcontracts) with the federal government, please provide the following information:

Number of contracts (including subcontracts) with the federal government:

Current fiscal year (2009):_____1_____;
Fiscal year 2008:_____1_____;
Fiscal year 2007:_____0_____.

Federal agencies with which federal contracts are held:

Current fiscal year (2009): United States Air Force;
Fiscal year 2008: United States Air Force;
Fiscal year 2007: _____NA_____.

List of subjects of federal contract(s) (for example, ship construction, aircraft parts manufacturing, software design, force structure consultant, architecture & engineering services, etc.):

Current fiscal year (2009): Acquisition – Research, analysis, training & tool development ;
Fiscal year 2008: Acquisition – Research, analysis, training & tool development ;
Fiscal year 2007:_____NA_____.

Aggregate dollar value of federal contracts held:

Current fiscal year (2009): $2,694,212;
Fiscal year 2008: $1,876,082;
Fiscal year 2007:____0_____.

Federal Grant Information: If you or the entity you represent before the Committee on Armed Services has grants (including subgrants) with the federal government, please provide the following information:

Number of grants (including subgrants) with the federal government:

Current fiscal year (2009 None .
Fiscal year 2008 None .
Fiscal year 2007: None .

Federal agencies with which federal grants are held:

Current fiscal year (2009):_____;
Fiscal year 2008:_____;
Fiscal year 2007:_____.

List of subjects of federal grants(s) (for example, materials research, sociological study, software design, etc.):

Current fiscal year (2009):_____;
Fiscal year 2008:_____;
Fiscal year 2007:_____.

Aggregate dollar value of federal grants held:

Current fiscal year (2009):_____;
Fiscal year 2008:_____;
Fiscal year 2007:_____.

**HOLD UNTIL RELEASED BY THE
HOUSE COMMITTEE
ON ARMED SERVICES**

STATEMENT BY

MR. DAVID P. FITCH

DIRECTOR, LEADERSHIP LEARNING CENTER OF EXCELLENCE

FORMER DEAN, DEFENSE SYSTEMS MANAGEMENT COLLEGE

(DEFENSE ACQUISITION UNIVERSITY)

BEFORE THE

PANEL ON DEFENSE ACQUISITION REFORM
COMMITTEE ON ARMED SERVICES
UNITED STATES HOUSE OF REPRESENTATIVES

**DEPARTMENT OF DEFENSE
OFFICE OF THE UNDER SECRETARY OF DEFENSE
(ACQUISITION, TECHNOLOGY & LOGISTICS)**

MEASURING PERFORMANCE:
DEVELOPING GOOD ACQUISITION METRICS

MAY 19, 2009

**HOLD UNTIL RELEASED BY THE
HOUSE COMMITTEE
ON ARMED SERVICES**

Chairman Andrews and Members of the Panel:

My name is David Fitch. I have the pleasure of serving as a member of the senior leadership team at the Defense Acquisition University (DAU). I have held various leadership positions at the University, including nearly seven years as the Dean, Defense Systems Management College—School of Program Managers. Currently, I am the Director of the university's Leadership Learning Center of Excellence. I am a retired Navy Captain and I served in acquisition or acquisition related positions for approximately 18 years of my 30-year active duty career in the Navy. I held leadership positions including squadron command, command of a Navy laboratory, Deputy to the Assistant Commander of the Naval Air Systems Command, and five years as the major program manager for a successful international and joint Major Defense Acquisition Program (ACAT 1D). After retirement from the Navy and before returning to government service, I worked in the defense industry for three years.

I want to thank you for the opportunity to appear before the panel and to participate in today's discussion. I will address the general subject of acquisition performance metrics, and your specific questions about how to increase the realism of program baselines, making trades between affordability and performance, and how to assess the value of the systems that are delivered to our warfighters. Please recognize that these are my opinions based on over thirty

years in the business and do not necessarily reflect the views of the Defense Acquisition University or, the Department of Defense, or the Administration.

THE IMPORTANCE OF STRATEGIC CHOICE

Measurement must encompass both "strategic" and "tactical" elements of acquisition. As emphasized in a recent Defense Science Board Report (Creating a DoD Strategic Acquisition Platform), what we call tactical acquisition—the management, execution and oversight of acquisition programs—is moot if we aren't spending taxpayer dollars to buy the right capabilities—strategic choice.

With respect to strategic choice, it is as important to decide what we won't buy, as well as what we will buy. The decision on how to allocate research & development and procurement dollars is a strategic issue. I believe one of the root causes of funding instability is "too many programs chasing too few dollars" -- this is a fundamental cause of overly optimistic cost estimates. The recently implemented Material Development Decision (MDD) process will bring the right players together. This will also increase collaboration and integration of the three major acquisition support systems known as: 1) requirements, 2) resources, and 3) acquisition. This should produce better informed and disciplined investment decisions. The MDD process has the potential to change the DOD culture and, in the future, to resource programs at higher confidence levels to lower programmatic risk.

Improving the requirements process is another high potential initiative focused on addressing systemic acquisition issues. Having a formal requirements, capabilities-focused definition process is not unique to DOD and we can learn important lessons by benchmarking best practices from industry. If you compare the DoD acquisition system with a commercial market example, such as the development of electronic games, there are marked similarities, as well as differences in practice. Notably, the year long process to get games on shelves for the December holiday season starts with a precise clarity of what will be developed—by when—and includes a corporate commitment to provide the resources required for the project. That level of clarity is the result of intense interaction between the people that define the capabilities of the game and the people that will develop and test the software before mass production starts.

We have recently deployed an initiative to improve the acquisition process by training of members of the Requirements Community on the fundamentals of acquisition. This initiative, supported by Congress, provides training to ensure requirements writers have a sufficient understanding of critical elements of acquisition, such as systems engineering and testing. The intent is straightforward and simple: to improve collaboration between the Department's acquisition and requirements community throughout the acquisition life cycle to better identify cost and performance trades at the right decision points to enhance opportunities for improved acquisition outcomes.

TACTICAL ACQUISITION METRICS

The most effective tools and templates incorporate metrics—both quantitative and qualitative. The question was raised, "Are there metrics beyond cost and schedule performance that are of value?" Yes, and an ongoing example is the "Probability of Program Success" (POPS) metrics that are currently being deployed across the Services and other federal agencies such as the Department of Homeland Security.

The objective of POPS is to identify a system of program metrics to alert senior leaders to situations that might require their attention and intervention. Starting with a blank sheet of paper, a group of DAU faculty, experienced program managers and other functional experts, asked themselves a series of questions: What conditions facilitate the success of programs? What metrics are leading indicators of derailment? Which of these elements are within the control or influence of the program manager and which aren't? The resulting tool, POPS, is a structured process and display that describes and assesses key elements of planning, resourcing, execution and external influences that promote or negatively impact program success.

This initiative is still evolving and is being actively used within the Army, Air Force, Navy, Marine Corps, and Coast Guard. The tool has been incorporated into DAU program manager training. Metrics in and of themselves do not produce success. However, when timely, accurate, and transparent metrics are integrated

into the management and oversight processes, better decisions and timely risk mitigation can be achieved.

Among the information that goes into POPS are earned value, integrated master schedule, and technical performance metrics. These represent the key building blocks of system capability - cost, schedule and performance. Another important "Probability of Program Success" metric is the adequacy of personnel resources—numbers and competencies—in industry and government. A highly qualified and appropriately sized workforce is vital to achieving successful program outcomes.

In addition to teaching POPS in program manager courses, we also use them when we are providing performance support to acquisition organizations in helping them solve problems.

IMPROVING ACQUISITION PROGRAM BASELINES

The question has been raised, "Can we ensure improved, realistic baselines?" We believe the answer is yes and there are several initiatives ongoing in the Department now. These include increased emphasis by the Department on assessing technology readiness and retiring risk early before starting major systems development. These will, in my opinion, result in better cost estimates, better acquisition strategies, and more realistic schedules—in short, better acquisition program baselines. In addition to retiring technical risk and producing realistic acquisition program baselines, the process of competitive

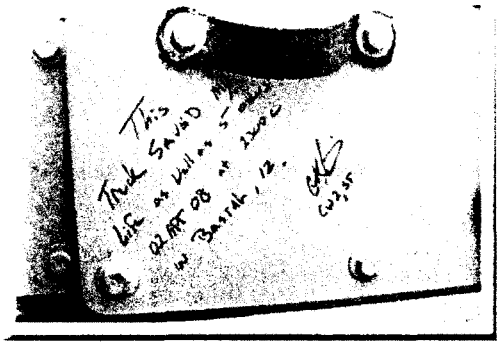
prototyping included in the new DoD 5000.02 and pending legislation increases the opportunity to appropriately address affordability and capability trades.

The competitive prototyping process allows program teams to better define technology maturity, risk, cost, and other programmatic challenges earlier. Bottom line -- this allows the government to make better decisions with actual performance data of competing industry teams before making a down select for engineering and manufacturing development. No matter how thoughtfully we plan or discipline the execution of source selections, a paper-only selection process is never as good as hard data from competing contractors. This produces actual results – not just promises. Competitive prototyping requires industry to put sufficient talent on programs or they reduce their chance of being the winner. Program performance and success is in doing, not just paper proposals.

Another important change is related to conducting preliminary design reviews (PDRs) prior to Milestone B. The intent of this change, like competitive prototyping, is to give the government and industry much greater insight into derived requirements that may drive cost and schedule. Obtaining this knowledge sooner will result in better cost and schedule estimates for engineering and manufacturing development and more realistic acquisition program baselines.

DELIVERING OPERATIONAL CAPABILITIES

The ultimate assessment of whether we have delivered value and the needed capability to the warfighter is feedback from the field.



"This truck saved my life as well as 5 others 2 Apr 08 at 2300L in Basrah (Iraq)"

Field feedback can come in different forms. The picture above is a great example of the value of the products delivered and the appreciation of the Soldiers, Sailors, Airmen, and Marines who use these products.

Before equipment is fielded, it undergoes rigorous levels of developmental and operational testing. Testing, whether at the component or system level, is the true indicator of a system's progress towards delivering the intended operational capability. The new DOD 5000.02 has increased the emphasis on oversight and analysis of developmental testing, to include earlier developmental testing and technology maturation.

CONCLUSION

Mr. Chairman, thank you for the opportunity to participate in this important discussion.

Mr. David P. Fitch

Defense Acquisition University

Mr. Fitch enlisted in the Navy in 1966. He was commissioned in 1968 after graduation from San Jose State College and Aviation Officer Candidate School in Pensacola, Florida. In 1969, after fixed and rotary wing flight training, he was designated a Naval Aviator and a Distinguished Naval Graduate. He retired from the Navy in 1998 as a Captain following a career that included three operational and major acquisition command assignments.

Mr. Fitch's acquisition career began at the Naval Air Systems Command (NAVAIR) as the Assistant Project Manager for Systems Engineering (APM, S&E) for H-3 helicopters, including the Presidential fleet of VH-3D helicopters. He managed the Navy's first helicopter Service Life Extension Program and installation of defensive counter measures on the VH-3D. Following tours on the OPNAV staff as a Requirements Officer and as Commanding Officer of an aviation training squadron (VT-2), Mr. Fitch returned to NAVAIR as the APM, S&E for three models of the SH-60 helicopter when these programs were undergoing operational testing and transition into production.

Next, Mr. Fitch was assigned as Commanding Officer, Naval Coastal Systems Center (NCSC) in Panama City, Florida, which was responsible for research, development and support of special operations, amphibious forces, and mine countermeasure units in the Persian Gulf during the Gulf War. As the CO of NCSC, he led a major reorganization of the center. Subsequently, Mr. Fitch served as the Deputy to the Assistant Commander at NAVAIR.

Mr. Fitch culminated his tour in the Navy as the major program manager for the international and joint Multifunctional Information Distribution System (MIDS)—a 1997 recipient of both the David Packard Excellence in Acquisition Award and the Department of Defense Value Engineering Award.

In 2001, after nearly three years in the defense industry, Mr. Fitch joined the faculty of the Defense Acquisition University, teaching and consulting acquisition executives in program management and other acquisition disciplines. In 2006, he led a major independent study of the Coast Guard Deepwater program. In July 2008, he assumed the position of Director, AT&L Leadership Learning Center of Excellence after nearly seven years as the Dean of the Defense Systems Management College.

Mr. Fitch holds degrees in Business and Industrial Management from San Jose State College and an MS in Education from the University of Southern California. He is a graduate "With Highest Distinction" from the Naval War College, Newport, Rhode Island.

Testimony for the House Committee on Armed Services - Panel on Defense Acquisition Reform – May 19, 2009

Statement of Dr. Daniel A. Nussbaum, Naval Postgraduate School

Chairman Andrews, distinguished members of the panel, I would like to thank you for this opportunity to discuss my thoughts on how to improve the acquisition and cost estimating processes in the Department of Defense. These ideas are mine and do not necessarily reflect the views of the Navy or the DoD.

I am Daniel A. Nussbaum, a member of the faculty at the Naval Postgraduate School, Graduate School of Operational & Information Sciences, in Monterey, California. I've spent the last thirty years mainly doing and more recently teaching and researching in the defense acquisition management system, with a focus on cost estimating. I was a previous Director of the Naval Center for Cost Analysis and past President of the Society of Cost Estimating and Analysis. In my current capacity, I educate mid-career military officers and Department of Defense civilians, as well as graduate students from many allied nations, in cost estimating, and I conduct research in cost estimating and the return on investment that the insertions of technologies offer.

All my experiences in cost estimating confirm that three things are necessary for sound cost estimating. They are 1) Acceptance of the underlying uncertainties in

predicting the future, 2) Accurate and plentiful historical data, and 3) Professionally trained and certified personnel.

First I want to discuss Uncertainty

There is uncertainty in all estimates, and this uncertainty is intrinsic to the professional practices in the Cost estimating profession. Uncertainty derives from several sources, with a major one being that we are usually designing (or building or operating) something that is substantively different from what we did before. The difference may be in the product itself (e.g., the technologies used in the system), or in the economic conditions (e.g., labor rates, or overhead rates, or material costs), or in the programmatic environment (e.g., how many we buy at a time or in total, and the manufacturing processes and technologies used).

An estimate reflects our knowledge at a point in time, when we "freeze the problem" and base the costs on the configuration and programmatics as they are understood at that moment. From that baseline, many things can change that can also change the cost estimate, including:

- Changes in labor rates, overhead rates, or schedule.
- Changes, including enhancements, to capability or quantity. While these can be controlled by mechanisms such as the Configuration Control Board (CCB) initiative. The CCB is not intended to tie the hands of the customer who may very well need these changes. For example, we would not peremptorily reject enhanced Inteligence, Surveillance and Reconnaissance (ISR) capabilities to

Global Hawk, to support the kinds of missions we're engaged in now, solely for reasons of increased cost.

- There are cost changes internal to the program when a particular technical solution to a problem does not work as planned, and an alternative technical solution becomes necessary. For example, aluminum may have been assumed to be the right material for some portion of an aircraft structure, with man-hours per pound of aluminum used as the basis of estimate. If subsequent testing or analysis shows aluminum to be inadequate, some redesign will almost surely be necessary. Redesign takes time and engineering labor) to accommodate the use of alternative materials. And, alternative materials, like titanium, cost more for materials as well as for fabrication.

Second, let us look at the impact of Historical Data

A hallmark, and necessary characteristic, of a sound cost estimate is that it is based on historical program performance (what we call "actuals") from similar or related on-going or past programs.

While the historical record is necessary, it is not sufficient, because we must take into account those processes and technologies that came into being after the dates of the historical data.

Historical data is variable. Not every aircraft costs the same as every other aircraft. Not every ship costs the same as every other ship. This variability is at the root of the "less-than-perfect fit" that characterizes our cost estimating models. The

measurement of these "less-than-perfect fits" is accomplished through statistical constructs like "standard error of the estimate" and "confidence intervals".

The general point is that we assume that the patterns of the past will repeat in the future. These patterns are almost always statistically grounded patterns, modeled with the powerful and subtle techniques known collectively as "regression". Further, we know of no alternative approach to using the past as a guide to the future, if we want a scientific (i.e., reproducible and auditable) approach.

Grounding cost estimates in historical program performance suggests that the cost estimating profession subscribes to the idea that "the Past is Prologue". That is correct. To the charge that such an approach is deficient in that it presumes that all the experiences of the past – the good and the bad – will be repeated, we in the Cost Estimating community answer that the future will not replicate the old mis-forecasts and inaccurate assumptions; rather, the future will bring with it its own, new, mis-forecasts and inaccurate assumptions. Of course, the same is true of the successes and correct assumptions of the past. That is, the historical successes and correct assumptions will not be exactly replicated; rather, new successes and correct assumptions will be achieved.

By bringing statistics and probability into the arena, we accomplish two things: we can take advantage of the full power of these powerful, subtle, mathematical disciplines; and simultaneously, we have introduced the language, the methods, and the results of these mathematical disciplines into what are invariably public discussions. In this sense, we are like meteorologists, usually right in general and occasionally not right

in particular. It is a continuing challenge for the professional cost estimator to provide a clear explanation of the basis of a cost estimate to those who use those cost estimates.

And thirdly, we need to talk about the key role of Professionally Trained and Certified Personnel.

Not all estimating is done by government employees. There are three cost estimating sub-communities: government in house estimators; employees of the large vendors who also design, develop and build what we buy (e.g., Boeing, Northrup Grumman, Lockheed Martin); and support contractors (or, consultants) that specialize in (or have divisions that specialize in) supporting the cost estimating needs of the government. Surely, we need to increase the capacity and quality, that is, the numbers and training, of the government estimators, but so do we need to enhance the professionalism of the other two communities.

Currently, there are no undergraduate curricula in cost estimating. The undergraduate classes that are closest to cost estimating are those in financial economics, which introduce the concept of net present value, but do not address the source or basis of the underlying cost estimates.

There are four educational institutions that I am aware of that teach at least one course in cost estimating. These are

- The Naval Postgraduate School (NPS, http://www.nps.edu/), located in Monterey, California, where I currently teach and do research in cost estimation.

- The Air Force Institute of Technology (AFIT, http://www.afit.edu/), located on Wright Patterson Air Force Base, in Ohio.
- The Defense Acquisition University (DAU, http://www.dau.mil/), located in diverse locations, with the DAU Capital campus on Ft. Belvoir, in Virginia.
- Massachusetts Institute of Technology (MIT, http://web.mit.edu/) in Cambridge, MA., which offers one elective course in cost estimating within its engineering curriculum.

DAU provides instruction that is required for certification in cost estimating, in the Business, Cost Estimating and Financial Management (BCEFM) Career Field, under the Defense Acquisition Workforce Improvement Act (DAWIA). The recent separation of the BCEFM career field into two separate CE and BFM tracks is a very welcome development (cf https://acc.dau.mil/CommunityBrowser.aspx?id=277653&lang=en-US for background) and should be supported. DAU is industriously tailoring its Cost Estimating courses to accommodate the separate CE track, and this too is a good evolution which should be supported. DAU support is largely limited to military and DoD employees.

The Society of Cost Estimating and Analysis (SCEA, http://www.sceaonline.net/) membership includes approximately one-third of all cost estimators supporting DoD. SCEA is a central and indispensable player in the training, initial certification and periodic recertification of cost estimators. Specifically, SCEA has collected a body of cost estimating knowledge that it provides to members of the Cost Estimating community, provides training in cost estimating, has developed and offers an

examination and experienced-based certification program that *"...promotes competency recognition based on preparation, assessment, and sustainment... it provides a professional credential that sets the standard for the entire costing estimating and analysis community. It provides the foundation for professional cost careers and offers employers and individuals a means of distinguishing and achieving excellence. Ultimately, certification offers a stamp of approval of an individual's mastery of the basic and intermediate cost knowledge and consequently strengthens the individual's and their organization's ability to produce quality cost estimates and analyses".*

Speaking from my experiences at the Naval Center for Cost Analysis, I can say that the best way to find, recruit, train, develop, and retain the next generation of cost estimating leaders is to have and support a robust Cost Estimating Intern Program. Look at the current leadership of Navy cost estimating, and you will be amazed at the number who began their careers in a Cost Estimating Intern Program.

A Cost Estimating Intern Program combines classroom training with on-the-job experience and enables DoD to cultivate skilled estimators with hands-on experience in the state-of-the-art technologies of defense weapons, platforms and support systems, the DoD planning-programming-budgeting-execution process, as well as the quantitative skills of cost estimation.

I appreciate very much what this committee seeks do accomplish, Mr. Chairman. This concludes my prepared statement.

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Synopsis: Continual involvement, over a 30-year period, supporting very senior management levels of government (US DoD and others) and commercial firms (for-profit and not-for-profit), in cost and schedule estimating and control, financial modeling, economics and operations research. Frequent speaker before professional groups and in training and educational settings.

Education

1964 BA, Mathematics and Economics, Columbia University.
1971 Ph.D., Mathematics, Michigan State University.
1973 Fellow, National Science Foundation, Econometrics and Operations Research, Washington State University.
1983 National Security Management, National Defense University.
1985 Employment of Naval Forces, US Naval War College.
1995 Senior Officials in National Security (SONS) Fellow, Harvard University, Kennedy School of Government

Employment History

2004-present: Visiting Professor, Naval Postgraduate School, Operations Research Department.

- Teach graduate level courses in cost and schedule estimating and control and other OR areas.
- Lead and conduct research supporting senior government decision makers in cost and schedule estimating and control, cost benefit analysis, and business case analysis.
- Thesis advisor and mentor for US and foreign national military officers and civilians attending NPS.
- Develop strategies and plans to establish NPS presence in the National Capitol Region.

1999-2004 Principal, Booz Allen Hamilton. Responsible for a broad range of cost, financial and economic analyses, with clients across the government and commercial spectrum. Developed new business opportunities for 500+ member team.

- Major financial and management systems projects included developing financial and management systems within US Department of Defense and for NATO aspirants.

- Led economic analyses, business case analyses, and life-cycle cost estimates to support cost-beneficial decisions for very large government systems within Air

Force, Navy, Director of Central Intelligence, and Health and Human Services Departments.

1996-1999 Director, Naval Center for Cost Analysis, Office of the Assistant Secretary of Navy (Financial Management and Comptroller), Washington, DC.

- Chief advisor to the Secretary of Navy on all aspects of cost and schedule estimating and control and single Navy point of contact for guiding, directing and strengthening cost estimating and analysis throughout the Department of Navy. Directed all Navy Independent Cost Estimates as required by Congress and senior Defense leadership on ships, aircraft, missiles, electronics, and automated information systems. Directed special, high visibility, cost and economic analyses for Secretary of Navy, Chief of Naval Operations and Commandant of Marine Corps.
- Provided cost and schedule estimating and control policy and leadership for all Department of Navy commands Navy commands. Developed and implemented cost estimating standards, models, tools, and web and database resources for Navy and OSD analysts.
- Developed first integrated cost research program to identify what needed to be done to improve cost estimating and analysis tools in the Departments of Navy and Defense.

1987-1996 Division Head, Naval Center for Cost Analysis; Washington, DC.

- Headed cost engineering, aircraft and weapons divisions. Conducted Independent Cost Estimates and cost-benefit analyses on all naval weapons, naval aircraft and aircraft systems. Developed and implemented cost estimating tools. Results provided critical and required cost estimates to the most senior levels of decision makers in the Navy and Department of Defense.
- Planned and executed the Navy's research program covering all aspects of cost and acquisition technologies. Provided products and results to senior leadership in Navy.

1982-1986 Deputy Director and Acting Director, Operations Research and Cost Analysis Divisions, Naval Air Systems Command; Washington, DC. Planned and conducted cost and cost/benefit analyses on all major naval aviation systems, including fixed and variable wing aircraft, missiles, and automated information systems. Results were furnished to senior level decision makers in the Departments of Navy and Defense and used as the analytical basis for defensible and reasoned major capital investment decisions.

1977-1981 Director, Economic Analysis and Operations Research, Headquarters, US Army, Europe; Heidelberg, Germany Directed headquarters' program of mathematical modeling in support of resolving critical operations research and resource management problems, including foreign currency fluctuations, relationship of funding to military readiness, value engineering, capital investment decisions and total cost of operations. Provided high-level operations research and econometric support to senior decision makers across the command. Created an operations research cell for the European

theater to provide civilian analysts training in real world defense issues, while providing headquarters with greater analytic talent.

1974-1976 Mathematician/Operations Research Analyst; U.S. Army Concepts Analysis Agency; Bethesda, Maryland. Designed, developed, managed and led operations research/systems analysis methodologies and studies. Conducted operations research studies in financial management, resource analysis, manpower utilization, and logistics. Studies were grounded in mathematical programming, econometric modeling, Markov processes and dynamic inventory modeling. Results were instrumental in building efficient and effective Army short term and long terms financial plans.

1969-1974 Faculty member and Chairman, Department of Mathematics and Statistics, Saginaw Valley State University; University Center, Michigan. Developed an taught courses in mathematics, statistics, computer science and economics. Built curricula to support applied engineering program and led department initiatives in budget, personnel and public affairs. Recipient of University's award for excellence.

Professional Activities

- **Society of Cost Estimating and Analysis; Arlington, VA.**
  - National President 2003-2008
  - Board of Directors 1992-present
  - Responsible for the highly regarded national training and certification program of an international professional organization. Provide oversight of content and staffing of annual training and training workshops. Responsible for designing and managing acquisition of a training tool which covers the body of knowledge in cost estimating and analysis in a single interactive, automated teaching tool. This syllabus and tool are now in the hands of over 3500 professional cost estimators around the world.
- **Washington Institute for Operations Research and Management Science.**
  - President
  - Vice President.
- **Military Operations Research Society (MORS).**
  - Board of Directors, 1988-91
  - Working Group Advisor/Chair

Major Publications: Available upon request

Testimony for the House Committee on Armed Services - Panel on Defense Acquisition Reform -

May 19, 2009

Statement of John T. Dillard, Senior Lecturer, Naval Postgraduate School

I am John T. Dillard, a member of the faculty at the Naval Postgraduate School, Graduate School of Business and Public Policy, Monterey, California. I've spent the last twenty-five years studying or participating in the defense acquisition management system. In my current capacity, I educate mid-career military officers and Department of Defense civilians in Defense Systems Acquisition Management, and I conduct research on acquisition policy and program decision-making.

Chairman Roberts, distinguished members of the panel, I would like to thank you for this opportunity to discuss my thoughts on how to improve the acquisition of materiel in the Department of Defense. These ideas are mine and do not necessarily reflect the views of the Navy or the Department of Defense.

A Complex Business Fraught With Uncertainty and Risk

The first thing we have to acknowledge is that the acquisition of major weapon systems is a very complex business. Defense programs are of very large scale, with long product cycles, integrating advancing technologies and for many stakeholders. A plethora of statutes and regulations further burdens these programs with very high transaction costs. They are conducted as highly structured projects involving research, development, testing and manufacturing of materiel in the pursuit of competitive advantage in warfighting capability. Thus, American lives and National Security depend on these high-risk project outcomes.

In projects of all types (construction, automotive, pharmaceutical, etc.), outcomes are measured against original estimates of cost, schedule and technical performance. Assessment of terminal outcomes is easy enough, but the ability to accurately forecast these three measures is critical, and is the greatest challenge for the DoD. Given DoD's project uncertainty from technical, organizational, and procedural complexity – *invention on a budget and schedule* is the current expectation. All too often, we see DoD's programs compared to those of dissimilar automotive or computer industry products, that are developed in annual business cycles and operate in completely different environments. While few would dispute the technical military superiority of fielded US equipment, it is easy to question whether development and procurement of our materiel and associated services has occurred in the most efficient and effective way. Budgets are huge, and the reports now frequently produced by the Government Accountability Office to assess major weapons programs inform us that predicted-versus-realized outcomes continue to diverge. There are instances of both success and failure.

Policy "churn" With Unclear Results

Over the last two decades, the DoD has implemented a multitude of initiatives to reform acquisition, focused upon both *how* and *what* it acquires.

- "*How*" equates to "process." Dozens of legislative and regulatory changes have encouraged process streamlining by standardizing processes, moving to electronic commerce, requiring use of commercial product specifications and data, extensive outsourcing of government services, credit card purchases and even non-traditional transaction vehicles in lieu of contracts.

- "*What* equates to "requirements." By allowing downward revisions to requirements as projects progress, the DoD attempts to hold unit "cost as an independent variable," in order to trade-off the most significant cost-drivers; and more recently, to acquire systems incrementally, incorporating only the most mature technologies in its systems, and attaining requirements in blocks.

There has yet to be a comprehensive assessment of these acquisition reform initiatives of the 1990s and early 2000s that could inform us of their individual or collective effectiveness. But we can still see the trends are worsening, evidenced in Nunn-McCurdy breaches and operational test failures cited by the GAO.

The most recent (2008) additions to the above policy thrusts include more emphasis upon the front-end of projects, requiring a Department-level decision before materiel solutions are explored, then having at least two competitive prototypes for technical demonstration before advanced development begins, and using only fixed-price contracts for the remaining development and production efforts.

I am in hearty agreement with the DoD's latest reforms with regard to shortening product cycles by limiting project scope, and orienting decision points upon progress in technology maturity, design stability, and production readiness. Shorter development cycles should reduce some inherent complexity and make it easier to more accurately estimate cost and schedule. I am also a strong proponent of planning and preparation prior to investment, and the maintenance of project discipline via configuration control, staged development, and multiple sources of critical components and prototypes. These things are already in place in DoD's most recent policy, along with use of contracting types appropriate to risk. I have seen these methods used with success firsthand to deliver major weapon systems on time, on budget, and to the satisfaction of technical and operational requirements. I am one who does not think that the acquisition processes are "broken," though indeed our requirements generation processes may be. I feel that DoD seems to be largely on the right path and in synch with the GAO's recommendations. However, there are reforms that could be made that would have a direct impact on costs.

Managing Bureaucracy Instead of Programs – and Driving Up Transaction Costs

To my continued frustration, the Department's policies have been revised too frequently, and without any analysis of the results from previous revisions. Much to the confusion of its workforce, the Department has rewritten its series of acquisition instructions four times in this decade already. The constant churn in policy has left government and industry with an array of jargon for what should have become standard terminology. Worse than this, however, has been the addition of numerous and redundant external program reviews at various levels above the program office. Specifically, these are conducted at the portfolio (Program Executive Office), service or component, and

department levels. Oversight of the services is necessary and important, but we have over done it.

My most recent collaborative research on this subject was with the National Research Council in 2008, commissioned to study options for reducing reviews of US Air Force programs to increase their cost-effectiveness and to lessen their workforce impact. We found that increasing numbers of external reviews, and the extensive preparation for them, added significantly to program transaction costs and diverted management resources from their core project management mission. Program Managers, who serve at the crucial layer of work execution, are spending less than half of their time actually managing their program. Much of it is instead reporting information up the chain of command. We counted over 88 major reviews in the typical 10-year life of a program. We heard of instances where portfolio level managers (Program Executive Officers), were assigning one Program Manager to run the program, and a twin asset dedicated to managing only the reviews. These costs of compliance are not being captured, but fellow researchers and I believe they may be as much as 10-15% of total program costs – perhaps as much as would constitute a Nunn-McCurdy breach in excess program costs.

The collective research by the GAO on defense acquisition over the period 1996 - 2008 has concluded that the DoD usually spends more time and money than originally planned on weapon systems. I feel it safe to say that increasing external program reviews in policy changes over the same period are apparently not serving to improve these outcomes. The proliferation of autonomous functional area fiefdoms within the Department continues to increase, with each being a stovepipe of oversight expertise imposing unique reporting requirements, assessments and reviews. The Department should seek to optimize its information flows with improved synergy among its staff and horizontal integration of the knowledge gained from fewer reviews. Please examine the size of the bureaucracy we have created in that five-sided building, and how many layers are imposing unnecessary and costly oversight. I am a strong proponent of program discipline, but we have staffed the Pentagon with too many "great Americans" who do not add value.

Another major challenge that has always been a Departmental constraint is the disconnect among the three major defense decision support systems. While the Requirements generation process we now call JCIDS (Joint Capabilities Integration System), and the project management processes we call the Defense Acquisition Management System are very much *event driven*, progressing along with combat contingencies, threat changes, and technological progress, etc. The funding process called the PPBE (Planning, Programming, Budgeting and Execution) system is very much *calendar driven* with the annual authorization and appropriation scheme that is used to formulate the departmental budget. And despite varying categories of funds with varying lifespans for obligation, this one disconnect results in unstable resource streams for programs, as each competes annually within the departments zero-sum pie and is subject to decrementing as priorities change, etc. Program managers cannot count upon a stable funding stream for their programs, and if they should need more time to progress than planned, they are incentivized to march toward failure rather than lose the funds that were allocated for events in the current year. The PPBE system of funds allocation prevents

agility in anticipating and fulfilling needs of the Combatant Commanders. In short, the Department can't get out of its own way here.

With further regard to people – the DoD's acquisition workforce: We have seen in recent days legislative action that will increase badly needed government workers overseeing the actual acquisition work. This will help to counter almost two decades of reductions that have hampered the Department's efforts to deliver materiel to the forces. During this same period, we have also received much less "bang for the buck" in payments to contractors for inherently governmental functions. The additions need to go beyond just the acquisition disciplines of cost estimation, systems engineering, and contracting. We need these people in logistics, test and evaluation, financial management, program management, quality assurance, etc. These new people should not be housed in the Pentagon, but instead where the execution of programs occurs. And with this ongoing institutional replenishment, we would like to see robust education and training as an integral piece of the DoD's human capital development.

With much appreciation for what this committee seeks do accomplish, Mr. Chairman, this concludes my prepared statement.

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WITNESS RESPONSES TO QUESTIONS ASKED DURING THE HEARING

MAY 19, 2009

RESPONSE TO QUESTION SUBMITTED BY MR. ANDREWS

Colonel PATTERSON. To appreciate the context in which early C–17 cost overruns occurred, some background and explanation of a methodology for arriving at an estimate of how much of the cost overruns could be attributed to derived requirements is in order. In this case engineering changes were the predominant example of what I have described as derived requirements and that appear in the public record.

The first manufactured part for the first C–17 was milled in November of 1987 and the first squadron was declared to have Initial Operating Capability in January 1995. The period between these events was one of significant turbulence for the C–17 program. The contract for the C–17 program was a fixed-price, incentive fee development contract, because the aircraft was to be designed using off-the-shelf technology and was determined to be "low" risk.

> *At the time of contract award, both the Government and MDC [McDonnell Douglas Corporation] envisioned a program based on commercial practices, minimum Government involvement and concurrent development/production effort. Consequently, a fixed price incentive contract was used to match the perceived low risk of the program.*[1]

As the program became more complex and engineering changes more frequent, MDC had no recourse to recoup investments in solving the engineering problems and meeting the cost of addressing requirements that were being added during full scale engineering and development than to make claims to the Government against the contract.[2] Though it is not feasible to determine precisely how much of the total cost overrun was attributable to derived requirements or engineering changes, it is possible to understand the relationship between the unanticipated cascade of engineering changes and increased requirements and cost overruns by virtue of the amount of the claim MDC believed justifiable.

COST OVERRUNS AND ENGINEERING CHANGES

As early as 1985 engineering changes were impacting the C–17 program costs. The Selected Acquisition Report for December 1985 described cost increase of $214.5M for engineering changes "needed for a four-pallet ramp, a combat offload rail system, and DoD standard avionics racks."[3] Though these modifications were not in 1985 referred to as "derived requirements," they do meet the definition used in the study included with the oral statement provided for the record on May 19, 2009.[4] These were the typical derived requirements not in the original contract, but identified by the program management to be necessary during development and presented as engineering changes. These changes and the corresponding cost increase occurred in the very early stages of the program, In December of 1985 the Full Scale Development contract had been signed.[5] The Government became alarmed following a 1992 Department of Defense Inspector General Report that identified a cost overrun of $700M on a $6.6B contract ceiling.[6] McDonnell Douglas was paying for costs overruns on the fixed-price contract and submitted claims for approximately $300M for what MDC asserted were changes in scope of its initial contract agreement which included "costs for engineering, development, testing and production of six C–

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[1] Report of the Defense Science Board Task Force on C–17 Review, December 1993, p 3

[2] Ibid.

[3] Selected Acquisition Report As of December 1985, p 10

[4] Derived requirements, on the other hand, are requirements that the customer has not specified directly as a requirement but that emerge or *derive* from the design decisions that are made. Derived requirements are not capabilities that the customer specifically has identified. Particularly troublesome is a subset of derived requirements that fall into the category of engineering changes—those changes that improve on "good enough" and that have a combined effect of driving up costs and missing schedule milestones.

[5] *Aeroflight, Aircraft of the World, Boeing C–17 Globemaster III,* retrieved May 27, 2009, from http://www.aeroflight.co.uk/types/usa/boeing/c-17/c-17.htm

[6] Battershell, A. L., *The DoD C–17 versus the Boeing 777, A Comparison of Acquisition and Development,* National Defense University, Washington, D.C. 1999, p 87–88

17's and three test planes."[7] In the end, after significant negotiations with the Department of Defense, McDonnell Douglas agreed to spend $456M in process improvements and the Defense Department agreed to "provide an additional $438M for the program."

A significant portion of the cost problems centered on a cascade of engineering changes that typified the years and immediate several months leading up to the negotiated settlement between MDC and the Department of Defense. The magnitude of the engineering changes occurring during this period was described clearly in the December 1993 Defense Science Board's report as it stated, "In May 1993 alone, over 1,000 changes were issued directly impacting production. The backlog of engineering changes at the end of May 1993 reveals 5,800 open work authorizations."[8] Additionally, costly changes to the program were government-imposed. A typical example is the C–17 test program which was increased from an 80 aircraft month test program to a "rebaselined test program of approximately 152 aircraft months" at the recommendation of the Defense Science Board study, with cost split evenly between the Government and MDC.[9]

SOME EDUCATED CONCLUSIONS

With the data that is immediately available from the historical record it is reasonable to conclude that the engineering changes were significant and made an impact on cost, schedule and performance on the C–17 program. Referring again to Battershell, of the $7.3B for the development costs and the first six aircraft in production Lots I and II, MDC invested approximately $1.7B of its own funds.[10] This amounts to about 26 percent of the original contract amount of $6.6B. MDC proposed a claim against the government of $1.2B in addition to the $438M it had received in the settlement[11] intended to recover what it believed to be legitimate costs associated with program changes a significant number of which were engineering changes. Though the term "significant" used above is not a precise accounting regarding "how much" of the program was "attributable" to derived requirements, it does provide a qualitative data point that is important in evaluating opportunities to improve acquisition programs in the future. [See page 11.]

[7] Adelson, A., Company News; McDonnell May Submit Big C-17 Bill, New York Times, January 14, 1993, retrieved May 27, 2009, from http://www.nytimes.com/1993/01/14/business/company-news-mcdonnell-may-submit-big-c-17-bill.html

[8] Report of the Defense Science Board Task Force on C-17 Review, December 1993, p 3

[9] Ibid. p 12

[10] Battershell, p 90

[11] Government Accountability Office Report, (GAO/NDIAD–94–141), Military Airlift C–17 Settlement Is Not a Good Deal, April, 1994, p 6